A treatise on the diseases of infancy and childhood / By J. Lewis Smith.

Contributors

Smith, J. Lewis 1827-1897.
Harvey Cushing/John Hay Whitney Medical Library

Publication/Creation

Philadelphia : H. C. Lea, 1881.

Persistent URL

https://wellcomecollection.org/works/dqcdtwyw

License and attribution

This material has been provided by This material has been provided by the Harvey Cushing/John Hay Whitney Medical Library at Yale University, through the Medical Heritage Library. The original may be consulted at the Harvey Cushing/John Hay Whitney Medical Library at Yale University. where the originals may be consulted.
This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.

wellcome collection

Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
https://wellcomecollection.org

YALE UNIVERSITY
LIBRARY

LIBRARY OF
THE SCHOOL OF
MEDICINE

Gift of
Mrs. John Timm

J. M. Benedict M.D.
Waterbury Conn.
March 1883

A TREATISE

ON THE

DISEASES

OF

INFANCY AND CHILDHOOD.

BY

J. LEWIS SMITH, M.D.,

CLINICAL PROFESSOR OF DISEASES OF CHILDREN IN BELLEVUE HOSPITAL MEDICAL COLLEGE; PHYSICIAN TO CHARITY HOSPITAL; PHYSICIAN TO THE N. Y. FOUNDLING ASYLUM; CONSULTING PHYSICIAN TO THE N. Y. INFANT ASYLUM; CONSULTING PHYSICIAN TO THE CLASS OF CHILDREN'S DISEASES, BUREAU FOR THE RELIEF OF THE OUT-DOOR POOR, BELLEVUE.

FIFTH EDITION, THOROUGHLY REVISED,

WITH ILLUSTRATIONS.



PHILADELPHIA:
HENRY C. LEA'S SON & CO.
1881.

Entered according to Act of Congress, in the year 1881, by
HENRY C. LEA'S SON & CO.,
in the Office of the Librarian of Congress. All rights reserved.

RJ45
881S

PREFACE.

THE constant endeavor of the author, as successive editions of this treatise have been called for, has been to make it more useful to the medical student and to the physician in his daily practice. He has avoided discussion of theories, except as they influence practice, while he has devoted more space to the therapeutics of the various diseases. He has been stimulated to this by constant intercourse with physicians, so as to be able to appreciate their wants, and by letters of inquiry sent by physicians, which, for the most part, relate to matters of treatment.

The text has been considerably enlarged, though, in consequence of a change of type, the bulk of the book is not materially increased. The reader familiar with the last edition will observe that a few additional diseases have been treated of; for a clear and succinct description of one of which, to wit, strumous ophthalmia, the author is indebted to Dr. O. D. Pomeroy, Surgeon to the Manhattan Eye and Ear Infirmary.

J. L. S.

No. 227 WEST 49TH STREET, NEW YORK,
September 16, 1881.

CONTENTS.

PART I.

CHAPTER I.

PAGE

INFANCY AND CHILDHOOD 17

CHAPTER II.

CARE OF THE MOTHER IN PREGNANCY 19

CHAPTER III.

MORTALITY OF EARLY LIFE—ITS CAUSES AND PREVENTION . . . 24

CHAPTER IV.

WEIGHT, GROWTH, LACTATION 29

Hindrances to Lactation and Physical Conditions rendering it Improper —Colostrum—Human Milk—Modification of the Milk in consequence of the Diet—Modification of Milk from its Retention in the Breast—Modification of Milk by Age and by Mental Impressions—Modification of Milk by the Catamenial Function and Pregnancy—Differences in Suckling Women as regards Quantity and Quality of Milk—Scantiness of Milk; its Causes and Treatment.

CHAPTER V.

SELECTION OF A WET-NURSE 48

CHAPTER VI.

COURSE OF LACTATION—WEANING 52

CHAPTER VII.

PAGE

QUANTITY OF FOOD REQUIRED IN INFANCY AND CHILDHOOD . . . 55

CHAPTER VIII.

ARTIFICIAL FEEDING 61
Composition of Milk.

CHAPTER IX.

BATHING, CLOTHING, SLEEP, EXERCISE 68
Clothing—Sleep—Exercise.

CHAPTER X.

ACCIDENTS AND AILMENTS INCIDENTAL TO THE BIRTH OF THE INFANT, AND DETACHMENT OF THE CORD 74
Apnœa (Asphyxia) Neonati—Caput Succedaneum—Cephalæmatoma.

CHAPTER XI.

OPHTHALMIA NEONATI 77
Causes—Symptoms—Treatment.

CHAPTER XII.

DISEASES OF THE UMBILICUS 83
Inflammation and Ulceration of Umbilicus—Treatment—Umbilical Granulations or Fungus—Treatment.

CHAPTER XIII.

UMBILICAL HÆMORRHAGE 85
Sex—Age—Causes—Symptoms—Prognosis—Treatment.

CHAPTER XIV.

DIAGNOSIS OF INFANTILE DISEASES 89
General Observations—Features, External Appearance of Head, Trunk, and Limbs in Disease—Attitude—Movements—The Voice—Respiratory System—Respiration in Health—Respiration in Disease—Circulatory System—Pulse in Health—Pulse in Disease—Animal Heat—Digestive System—Nervous System.

CHAPTER XV.

THERAPEUTICS 101

PART II.

CONSTITUTIONAL DISEASES.

SECTION I.

DIATHETIC DISEASES.

CHAPTER I.

PAGE

RACHITIS 103

Age—Causes—Anatomical Characters: First Stage; Second Stage—Craniotabes; Third Stage—Symptoms—Complications—Diagnosis—Prognosis—Treatment.

CHAPTER II.

SCROFULA 120

Causes—Anatomical Characters—Symptoms—Relation of Scrofulosis to Tuberculosis—Prognosis—Treatment: Prophylactic; Curative—Strumous Ophthalmia—Treatment.

CHAPTER III.

TUBERCULOSIS 143

Etiology—General Anatomical Characters of Tuberculosis—Anatomical Characters in Infancy and Childhood—Lungs—Abdominal Viscera—Stomach and Intestines—Symptoms—Encephalon—Bronchial Glands—Physical Signs—Lungs—Pleura—Stomach and Intestines—Diagnosis—Prognosis—Treatment: Prophylactic; Curative.

CHAPTER IV.

SYPHILIS 167

Etiology—Clinical History—Coryza—Mucous Patches—Roseola—Pemphigus—Acne, Impetigo, and Ecthyma—Visceral Lesions—Osseous Lesions—Prognosis—Treatment.

SECTION II.

ERUPTIVE FEVERS.

CHAPTER I.

PAGE

MEASLES 178

Symptoms—Complications—Anatomical Characters—Nature—Diagnosis—Prognosis—Treatment.

CHAPTER II.

SCARLET FEVER 187

Symptoms: Regular Form; Irregular Form; Malignant Form—Complications—A Case—Sequelæ—Otitis—Anatomical Characters—Nature—Diagnosis—Prognosis—Treatment—Prophylaxis—Care of Patients—Infected Articles.

CHAPTER III.

RÖTHELN 216

Premonitory Stage—Symptoms—Tegumentary System—The Skin—Mucous Membrane—The Respiratory System—The Digestive System—The Pulse and Temperature—Complications—Prognosis—Nature—Incubative Period—Contagiousness.

CHAPTER IV.

VARIOLA—VARIOLOID 225

Variola—Incubative Period—Stage of Invasion—Stage of Eruption—Stage of Desiccation—Varioloid—Mode of Death—Anatomical Characters—Complications—Prognosis—Diagnosis—Treatment.

CHAPTER V.

VACCINIA 236

Appearances—Symptoms—Anomalies, Complications, and Sequels—Subsequent Vaccinations—Revaccination—Selection of Virus.

CHAPTER VI.

VARICELLA 246

Symptoms—Diagnosis—Prognosis—Treatment.

SECTION III.

NON-ERUPTIVE CONTAGIOUS DISEASES.

CHAPTER I.

PAGE

DIPHTHERIA 248
Age—Incubation—Nature—Cases — Anatomical Characters — Cases—Symptoms—Diagnosis—Prognosis—Treatment—General Treatment—Stimulants—Local Treatment—Diphtheritic Croup—Preventive Measures.

PERTUSSIS 295
Age—Causes—Pathological Anatomy—Symptoms—Second Period—Complications—Diagnosis—Prognosis—Treatment—Prophylaxis.

CHAPTER II.

PAROTIDITIS 310
Nature—Diagnosis—Treatment.

SECTION IV.

OTHER GENERAL DISEASES.

CHAPTER I.

INTERMITTENT FEVER 313
Symptoms—Treatment.

CHAPTER II.

REMITTENT FEVER 318
Symptoms—Diagnosis—Treatment.

CHAPTER III.

TYPHOID FEVER 320
Causes — Anatomical Characters — Symptoms — Complications—Diagnosis—Duration—Prognosis—Treatment.

CHAPTER IV.

CEREBRO-SPINAL FEVER 328
Cause—Sex—Age—Symptoms—Mode of Commencement—Symptoms pertaining to the Nervous System—Digestive System—Pulse—Temperature—Respiratory System—Cutaneous Surface—Nature—Prognosis—Diagnosis—Anatomical Characters—Treatment: Preventive; Curative.

CHAPTER V.

PAGE

Acute Rheumatism 359
Causes—Symptoms—Duration—Prognosis—Diagnosis—Treatment.

CHAPTER VI.

Erysipelas 366
Table of Cases—Age—Point of Commencement—Causes—Premonitory Symptoms—Symptoms—Prognosis—Duration—Modes of Death—Pathological Anatomy—Treatment.

PART III.

SECTION I.

DISEASES OF THE CEREBRO-SPINAL SYSTEM.

CHAPTER I.

Acephalus—Anencephalus 377
Anatomical Characters—Symptoms—Prognosis.

CHAPTER II.

Imperfect Brain 379
Case—Symptoms—Prognosis—Microcephalus—Atrophy of Brain.

CHAPTER III.

Hypertrophy of Brain 382
Pathological Anatomy—Causes—Symptoms—Cases—Diagnosis—Prognosis—Treatment.

CHAPTER IV.

Thrombosis in the Cranial Sinuses (Phlebitis) 387
Anatomical Characters—Causes—Symptoms—Diagnosis—Prognosis—Treatment.

CHAPTER V.

Congestion of the Brain 391
Causes—Symptoms—Anatomical Characters—Prognosis—Treatment.

CHAPTER VI.

PAGE

INTRA-CRANIAL HÆMORRHAGE (MENINGEAL HÆMORRHAGE—CEREBRAL HÆMORRHAGE) 396
Causes—Anatomical Characters—Cerebral Hæmorrhage—Symptoms—Meningeal Hæmorrhage—Diagnosis—Prognosis—Treatment.

CHAPTER VII.

CONGENITAL HYDROCEPHALUS 406
Anatomical Characters — Symptoms — Diagnosis — Prognosis—Treatment.

CHAPTER VIII.

ACQUIRED HYDROCEPHALUS 413
Causes—Anatomical Characters—Symptoms—Prognosis—Treatment.

CHAPTER IX.

MENINGITIS, TUBERCULAR AND NON-TUBERCULAR 417
Age—Pathological Anatomy—Causes — Premonitory Stage — Symptoms—A Case—Diagnosis—Prognosis—Treatment.

CHAPTER X.

SPURIOUS HYDROCEPHALUS 437
Anatomical Characters—A Case—Symptoms—Cases—Diagnosis—Prognosis—Treatment.

CHAPTER XI.

ECLAMPSIA 442
Causes—Premonitory Stage—Symptoms — Anatomical Characters—Diagnosis—Prognosis—Treatment.

CHAPTER XII.

TETANUS INFANTUM 453
Fatal Cases—Favorable Cases—Period of Commencement—Frequency in Certain Localities—Causes—Symptoms—Mode of Death—Prognosis—Duration in Fatal Cases—Duration in Favorable Cases—Diagnosis—Preventive Treatment—Treatment.

CHAPTER XIII.

INTERNAL CONVULSIONS — SPASM OF THE GLOTTIS — LARYNGISMUS STRIDULUS 473
Causes—Anatomical Characters—Symptoms—A Case — Diagnosis—Prognosis—Modes of Death—Treatment.

CHAPTER XIV.

PAGE

CHOREA 481

Age—Causes—Sex—Uterine Irritation—Anæmia—Rheumatism—Microscopic Appearances: Spinal Cord; The Heart; The Lungs—Fright—Imitation—Intestinal Irritation—Lesions of Brain and Spinal Cord—Anatomical Characters—Symptoms—Prognosis—Course—Diagnosis—Treatment: Regimenal; Medicinal.

CHAPTER XV.

INFANTILE PARALYSIS 498

Symptoms—Groups—Single Muscles—Prognosis—Progress—Etiology—Anatomical Characters—Diagnosis—Prognosis—Treatment.

CHAPTER XVI.

FACIAL PARALYSIS 510

Causes—Symptoms—Prognosis—Treatment—Paralysis with Pseudo-Hypertrophy — Anatomical Characters — Causes — Prognosis — Treatment.

CHAPTER XVII.

DISEASES OF THE SPINAL CORD AND ITS COVERINGS 515

Congestion of the Spinal Cord and its Membranes—Anatomical Characters—Symptoms—Treatment.

CHAPTER XVIII.

SPINA BIFIDA 519

Diagnosis—Prognosis—Treatment.

CHAPTER XIX.

VERTEBRAL CARIES 523

Causes—Symptoms—Diagnosis—Prognosis—Treatment.

SECTION II.

DISEASES OF THE RESPIRATORY SYSTEM

CHAPTER I.

CORYZA 529

Anatomical Characters—Symptoms—Prognosis—Treatment.

CHAPTER II.

PAGE

CATARRHAL LARYNGITIS 532

Symptoms—Anatomical Characters—Treatment — Spasmodic Laryngitis—Causes—Symptoms—Anatomical Characters—Pathology—Diagnosis—Prognosis—Treatment.

CHAPTER III.

PSEUDO-MEMBRANOUS LARYNGITIS 540

Causes—Anatomical Characters—Symptoms—Pathological Characters—Diagnosis—Prognosis—Treatment.

CHAPTER IV.

BRONCHITIS 556

Causes—Anatomical Characters—Symptoms—Diagnosis—Prognosis—Treatment.

CHAPTER V.

ATELECTASIS 569

Acquired Atelectasis—Symptoms — Anatomical Characters — Treatment.

CHAPTER VI.

PNEUMONITIS 573

Catarrhal, Croupous, and Interstitial—Causes—Anatomical Characters—Cheesy Pneumonitis — Symptoms — Physical Signs — Diagnosis—Prognosis—Treatment.

CHAPTER VII.

PLEURITIS 588

Causes — Cases — Anatomical Characters — Sero-fibrinous Pleuritis—Purulent Pleuritis — Hæmorrhagic Pleuritis — Symptoms — Physical Signs—Palpation—Percussion—Auscultation — Diagnosis — Prognosis—Treatment—Nervous Cough—Treatment.

SECTION III.

DISEASES OF THE DIGESTIVE APPARATUS.

CHAPTER I.

SIMPLE STOMATITIS, ULCEROUS STOMATITIS, FOLLICULAR STOMATITIS . 632

Simple or Catarrhal Stomatitis—Causes—Symptoms—Appearances—Treatment — Ulcerous Stomatitis — Causes— Symptoms— Prognosis—Treatment—Aphthous Stomatitis—Causes—Symptoms—Diagnosis—Prognosis—Treatment.

CHAPTER II.

PAGE

THRUSH 638

Anatomical Characters—Symptoms—Causes—Diagnosis—Prognosis—Treatment.

CHAPTER III.

GANGRENE OF THE MOUTH 643

Anatomical Characters—Age—Causes—Symptoms—Diagnosis—Prognosis—Treatment.

CHAPTER IV.

DENTITION 650

Pathological Results of Dentition—Diagnosis—Treatment—Second Dentition.

CHAPTER V.

CATARRHAL PHARYNGITIS, PERI-PHARYNGEAL ABSCESS, ŒSOPHAGITIS 658

Anatomical Characters—Causes—Symptoms—Prognosis—Diagnosis—Treatment—Peri-Pharyngeal Abscess—Age—Cause—Anatomical Characters—Symptoms—Diagnosis—Prognosis—Treatment—Œsophagitis—Anatomical Characters—Treatment.

CHAPTER VI.

INDIGESTION, CONGESTION OF STOMACH, GASTRITIS, FOLLICULAR GASTRITIS, DIPHTHERITIC GASTRITIS, POST-MORTEM DIGESTION, SOFTENING 669

Causes—Symptoms—Prognosis—Treatment—Congestion of the Stomach—Gastritis—Cause—Age—A Case—Symptoms—Anatomical Characters—Diagnosis—Prognosis—Treatment—Follicular Gastritis—Diphtheritic Gastritis—Post-mortem Digestion, Softening—A Case.

CHAPTER VII.

DIARRHŒA 685

Non-Inflammatory Diarrhœa—Causes—Symptoms—Anatomical Characters—Prognosis—Treatment.

CHAPTER VIII.

INTESTINAL CATARRH OF INFANCY 690

Causes—Age—Symptoms—Anatomical Characters—Diagnosis—Prognosis—Treatment : Regimenal Measures ; Medicinal Treatment ; Enemata ; External Treatment.

CHAPTER IX.

ENTERITIS AND COLITIS IN CHILDHOOD 718

Causes—Symptoms—Diagnosis—Prognosis—Treatment.

CHAPTER X.

PAGE

CHOLERA INFANTUM 721
Causes — Symptoms — Anatomical Characters — Nature — Diagnosis— Prognosis—Treatment.

CONSTIPATION 728
Symptomatic Constipation—Causes—Case—Idiopathic Constipation—Causes—Symptoms—Treatment: Hygienic Measures; Therapeutic Measures.

CHAPTER XI.

INTESTINAL WORMS 744
Ascaris Lumbricoides—Oxyuris Vermicularis—Tænia—Bothriocephalus latus—Trichocephalus dispar—Causes—Symptoms—Diagnosis—Prognosis—Treatment.

CHAPTER XII.

GASTRO-INTESTINAL HÆMORRHAGE 762
Three Varieties—A Case—Prognosis—Treatment.

CHAPTER XIII.

INTUSSUSCEPTION 768
Intussusception without Symptoms—Intussusception with Symptoms—Previous Health—Causes—Age—Seat and Pathological Anatomy—Intussusception in the Small Intestines—Cases—Intussusception in Large Intestines—Symptoms—Diagnosis—Duration — Prognosis — Modes of Death—Treatment.

SECTION IV.

DISEASES OF THE CIRCULATORY SYSTEM.

CHAPTER I.

CYANOSIS 793
Literature of Cyanosis—Sex—Causes of the Malformations—Time of Commencement—Symptoms—Prognosis—Mode of Death—Modes of Compensation—Morbid Anatomy—Theories Relating to the Etiology of Cyanosis—Treatment.

SECTION V.

SKIN DISEASES.

CHAPTER I.

PAGE

ERYTHEMATOUS DISEASES 811

Erythema: Two Forms; Idiopathic, Symptomatic—Prognosis—Diagnosis—Treatment. Roseola: Symptoms—Causes—Prognosis—Diagnosis—Treatment. Urticaria: Causes—Prognosis—Diagnosis—Treatment.

CHAPTER II.

PAPULAR DISEASES, STROPHULUS 817

Treatment.

CHAPTER III.

ECZEMA 819

Anatomy — Etiology — Varieties — Symptoms — Course — Diagnosis—Treatment—Local Treatment—Scabies: Diagnosis—Treatment.

INDEX 829

THE

DISEASES OF CHILDREN.

PART I.

CHAPTER I.

INFANCY AND CHILDHOOD.

Infancy and childhood are in certain respects the most important and interesting periods of life. To the physiologist they are especially interesting, because they are the periods of development and of greatest functional activity ; to the pathologist, because in them many diseases occur which are rarely or never observed in the other periods, or which present in these periods peculiar features ; to the physician and vital statistician, because in them there is the greatest amount of sickness and largest number of deaths.

Infancy extends from birth to the age of two and a half years, or till the completion of first dentition. In infancy the organs are delicately organized, containing a large proportion of water, and hence are easily injured. In this period the brain is rapidly developed—more so than any other organ ; animal matter predominates in the bones ; the arteries are relatively large, the muscles small ; the superficial veins are small. Fat is absent from the interior of the body, but abundant, in well-nourished infants, underneath the integument. The skin is delicate, and its temperature not much below that of the blood. At birth it has a reddish hue, and is covered with soft, fine hairs (lanugo). The reddish hue gradually fades into the healthy tint of infancy, and the hairs fall out. In the first two months the sweat-glands have little functional activity, sensible perspiration being quite rare. Subsequently perspiration is freer, and, in certain diseased states (rachitis, etc.) is abundant. The sebaceous glands in the first half of infancy are active, particularly upon the scalp, producing often a pale yellow incrustation, consisting of sebaceous matter and epidermic cells.

The secretions from the mucous surfaces commence at an early period. At birth the surface of the digestive tube is covered with more or less

mucus, often in considerable quantity. The meconium is not considered, as formerly, to be a product of intestinal secretion. It consists of flat epithelial cells, fine hairs, oil-globules, crystals of cholesterin, and brownish or yellowish masses of coloring matter probably from the liver. It is supposed that, with the exception of the coloring matter, the meconium is derived mainly from the amniotic fluid which the fœtus has swallowed.

The most wonderful change occurring in the system at birth, through the exigencies of the new life, is that in the circulation. The flow of blood being interrupted, thrombi form in the umbilical vein, and arteries, and in the ductus arteriosus, and ductus venosus, and these vessels gradually atrophy, becoming finally shrivelled but permanent cords. I have many times at autopsies removed the plug from the ductus arteriosus when death had occurred as late as the third week. The foramen ovale closes slowly. I have ordinarily found it open till near the end of the first half year, but the valve covers fully the aperture, so that there is no detriment to the circulation. Both the pulse and respiration are more frequent during infancy than childhood, and are more accelerated by moral and physical causes.

The stomach has a smaller relative size and emesis more readily caused than in the adult. The liver is large, occupying at birth nearly half of the abdominal cavity, but it grows smaller in successive months. The appetite is good and digestion active, so that hunger, when appeased, soon returns. The thymus gland, at birth about the size of an unexpanded lung, slowly atrophies, but it does not totally disappear till after infancy.

The kidneys, distinctly lobulated at birth, gradually change their form, so as to present in the last part of infancy nearly the shape of the organ in the adult. The renal secretion commences early, even before birth. The kidneys seldom undergo degenerative changes as in the adult, but they are liable to congestions and inflammations. During the first month, and especially the first fortnight, crystals of uric acid, and the urates, are often found in the urine, in a state of apparent health, causing more or less fretfulness in their elimination, staining the diaper, and not infrequently being arrested in the tubules of the pyramids, where they can be seen as pink-colored spots or lines (uric acid infarction). These deposits of uric acid and the urates may even occur in the fœtus, producing obstruction and inflammation of the renal tubes. Congenital cystic degeneration of the kidneys is, in the opinion of Virchow, due to them. In early infancy the senses are imperfectly developed, the eyes being attracted only by bright objects, and the sense of hearing affected only by loud noises. Sleep is the normal state in the first weeks of life ; as the age of the infant increases, less and less sleep is required ; but the oldest *infants* need more than children, and several hours more than adults.

The new-born infant is apparently destitute of mental faculties. It seeks the breast by instinct, and it exhibits no perception or reflection.

The loud cries with which it commences its existence are not from anger or suffering ; they appear to be normal, like the act of nursing, and providentially designed, in order to expand the lungs. It is not till the close, or near the close, of the first month, that the gray substance of the brain begins to appear—the probable seat of the mind, and the source of all mental phenomena. Perception and curiosity are early manifested. The infant, as Edmund Burke has remarked, is constantly seeking new objects for its amusement, rejecting old playthings for such as possess more novelty. Reflection, a higher faculty of the mind, appears at a later period. The mind and the bodily organs in infancy are, in a high degree, impressionable. Anger is excited by trivial causes, but is easily appeased ; and the various functions in the system are disturbed by agencies which in youth or manhood would have no appreciable effect.

Childhood extends from infancy to the age of fifteen years or puberty. It is a period of great physical activity, and of rapid growth. The functions of the various organs are performed with more moderation than in infancy, and are less frequently deranged. The volume of the brain continues to increase rapidly, and it becomes firmer than in infancy. It is estimated that by the seventh year the weight of this organ has doubled. The mind now exerts a controlling influence over the actions of the individual. The digestive organs have changed, so that solid food is required. Most of the glandular organs are less active than in the greater part of infancy, and some of them, as the liver, are relatively smaller. The pulse and respiration gradually become less frequent as the child advances in age.

CHAPTER II.

CARE OF THE MOTHER IN PREGNANCY.

The frequency of miscarriages and still-births, and the large number of ill-formed and puny infants, born to a precarious and short existence, render imperative, on the part of the mother, a strict observance of the laws of health, and an avoidance of all exciting or perturbating influences during the time when the fœtus is being developed. The diet should be plain and easily digested, but nutritious. There is often a craving in pregnancy for unusual articles of food. These may sometimes be allowed within certain limits, provided that they are such as do not derange the stomach. Meats and animal broths, together with vegetables and farinaceous food, should constitute the ordinary diet, and should be taken at regular intervals.

Daily exercise, never violent, but moderate and gentle, is requisite. No exercise is better, none safer and more likely to contribute to cheer-

fulness and healthy functional activity of the organs, than the ordinary household duties. Lifting heavy weights, or work which, like washing and ironing, causes great and continued action of the abdominal muscles, should be avoided. Such exercise is highly injurious, and is apt to produce premature labor. Exercise in the open air, on foot, or by an easy conveyance, conduces to the health of the mother and the growth and development of the fœtus. On the other hand, rapid riding over rough roads is one of the most dangerous modes of exercise. It has been known to destroy the fœtus, which up to that time had been apparently vigorous. When such a result occurs, there is probably more or less detachment of the placenta.

It being a matter of the utmost importance that the health of the mother should continue good during gestation, any disease which she may have in this period, and which affects her nutrition or the character of her blood, should be promptly cured if practicable, and with the least possible reduction of the vital powers. Intermittent fever, occurring during gestation, should never be allowed to continue. It seriously retards fœtal development, and may produce miscarriage. Unless it be controlled by proper measures, the offspring, though born at term, is puny and emaciated. Syphilis, in the pregnant woman, also requires treatment. This disease, readily transmitted from the mother to the fœtus through the ovum or the uterine circulation, may be eradicated by anti-syphilitic treatment of the mother, or at least so modified, that the infant is born vigorous and healthy.

The pregnant woman should avoid all causes of undue mental excitement. This is almost as necessary as the avoidance of great physical exertion. There is, during pregnancy, unusual susceptibility to mental impressions, and this should be borne in mind not only by the woman herself, but by those who associate with her.

Strong emotions, whether of joy, sorrow, or anger, affect primarily the nervous system, but indirectly most of the organs of the body. Observations have long established the fact that such emotions influence the state and functions not only of the digestive and glandular, but muscular organs, as the heart and uterus. Physicians are familiar with cases in which vivid mental impressions produced uterine contractions, and even miscarriage, or have disturbed the catamenial function. Therefore, the associations and cares of pregnant women should be such as conduce to cheerfulness and equanimity.

It is the popular belief, and the belief of many physicians, that vivid mental impressions sometimes have a direct effect on the development of the fœtus. Many cases are on record in which infants were born with marks or deformities corresponding in character with objects which had been seen and had made a strong impression on the maternal mind at some period of gestation. Whether the mind of the mother exert a con-

trolling influence on the form and color of the fœtus, is a subject of great interest to the psychologist as well as the physiologist and physician, since it involves no less a question than the power and scope of the human mind. Violent emotions, it is admitted, may affect directly most of the important organs in the system. They may derange the liver, causing jaundice, accelerate, or for a moment suspend, the heart's action, stimulate the kidneys, causing diuresis, or even the intestinal follicles, causing watery evacuations. But with all these organs the brain is connected by nerves which anatomy reveals. On the other hand, the mother and fœtus have a distinct existence as regards their nervous systems, and even their blood. Still, the multitude of facts which have accumulated justify the belief that deformity, or other abnormal development of the fœtus is, at times, due to the emotions of the mother. Some of the cases related by Dr. Whitehead, in his work on hereditary diseases, are very striking and difficult to explain on the ground of coincidence. I have met the following cases. An Irish woman of strong emotions and superstitions was passing along a street in the first months of her gestation, when she was accosted by a beggar, who raised her hand, destitute of thumb and fingers, and in "God's name" asked for alms. The woman passed on; but reflecting in whose name money was asked, felt that she had committed a great sin in refusing assistance. She returned to the place where she had met the beggar, and on different days, but never afterward saw her. Harassed by the thought of her imaginary sin, so that for weeks, according to her statement, she was made wretched by it, she approached her confinement. A female infant was born, otherwise perfect, but lacking the fingers and thumb of one hand. The deformed limb was on the same side, and it seemed to the mother to resemble precisely that of the beggar. In another case which I met, a very similar malformation was attributed by the mother of the child to an accident occurring to a near relative, which necessitated amputation during the time of her gestation. I examined both of these children with defective limbs, and have no doubt of the truthfulness of the parents. In May, 1868, I removed a supernumerary thumb from an infant, whose mother, a baker's wife, gave me the following history. No one of the family, and no ancestor, to her knowledge, presented this deformity. In the early months of her gestation she sold bread from the counter, and nearly every day a child with double thumb came in for a penny roll, presenting the penny between the thumb and the finger. After the third month she left the bakery, but the malformation was so impressed upon her mind that she was not surprised to see it reproduced in her infant.

Professor William A. Hammond, of this city, in an interesting paper on the "Influence of the Maternal Mind," etc. (*Quarterly Journal of Psychological Medicine*, January, 1868), says: "The chances of these instances, and others which I have mentioned, being due to coincidence,

are infinitesimally small, and though I am careful not to reason upon the principle of POST HOC, ERGO PROPTER HOC, I cannot, nor do I think any other person can, no matter how logical may be his mind, reason fairly against the connection of cause and effect in such cases. The correctness of the facts can only be questioned ; if these be accepted, the probabilities are thousands of millions to one that the relation between the phenomena is direct." Professor Dalton also says (*Human Physiology*) : "There is now little room for doubt that various deformities and deficiencies of the fœtus, conformably to the popular belief, do really originate in certain cases from nervous impressions, such as disgust, fear, or anger, experienced by the mother." The observations on which this belief is based relate both to man and the lower animals. A very strong argument in its support is, as Professor Hammond remarks, the popular opinion, which dates back to the time of Jacob. (Genesis xxx.) An almost universal sentiment, running through centuries, is rarely wholly fallacious. It has some truth for its foundation, especially when, as in this instance, the subject is one of observation.

If maternal emotions affect the development of the exterior of the fœtus, as observations show, and physiologists admit, the presumption is strong that they may affect also the proper development and adjustment of the parts of the brain, an organ so complex and delicate, and may therefore give rise to idiocy. Dr. Seguin (*Idiocy and its Treatment, etc.*, New York, 1866) thus remarks on this point : "Impressions will, sometimes, reach the fœtus in its recess, cut off its legs or arms, or inflict large flesh wounds, before birth, . . . from which we surmise that idiocy holds unknown though certain relations to maternal impressions, as modifications to placental nutrition."

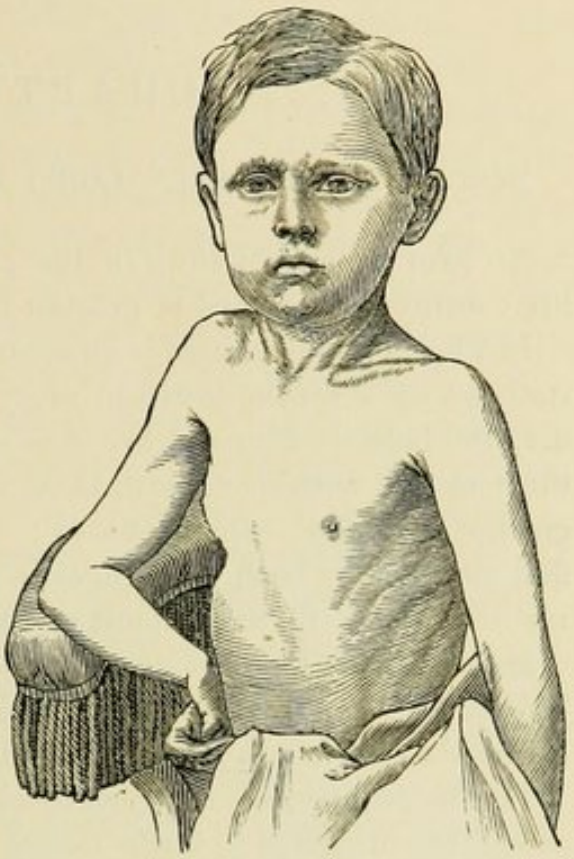
It is an interesting fact that abnormalities of structure, occurring from whatever cause, are apt to be propagated to descendants. Dr. Carpenter and others relate instances among the lower animals, and similar instances of transmission have now and then been observed in the human race. Thus, in the issue of *Nature* for March 7th, 1878, it is stated on the authority of M. Lenglen, a physician of Arras, that a certain M. Gamelon in the last century had two thumbs on each hand, and two great toes on each foot ; this peculiarity did not appear in the son, but it reappeared in the three succeeding generations, so that some of the great-great-grandchildren possessed it in as marked a degree as their ancestors.

In view of such important facts, the duty of the pregnant woman is rendered the more imperative to avoid the presence of disagreeable and unsightly objects, as well as all causes of excitement, and to remove, as soon as possible, vivid and unpleasant impressions, by quiet diversion of the mind.

The disastrous results upon the fœtus of severe injuries received by the mother are well known to the profession, for premature labor and death of the child, or feebleness from its prematurity, are common results of

such accidents. In rare instances the child may be so injured as to be deformed for life, as in the following interesting case : Richard L., aged six years, came, in January, 1877, to the children's class in the Bureau for the relief of the Out-Door Poor. The following history was obtained : On November 27th, 1870, one month before the birth of Richard, the mother fell heavily on the ice when stepping from a city car. Uterine hemorrhage resulted, which continued more or less freely, producing marked pallor, till her confinement, which occurred December 23d. The position of the child *in utero* was crosswise, but nothing untoward occurred in the delivery. Immediately after its birth, when it was being washed by the nurse, a blister, about one inch in diameter, was observed on the right side of the thorax, located about one inch below and two and a half inches externally to the nipple. A cicatrix resulted which now marks the site of the sore. When the blister healed the child seemed entirely well, and nothing more was thought of the unusual occurrence of an intra-uterine vesication, till nearly half a year had elapsed, when the thorax below the nipple and at the site of the cicatrix, was observed to be depressed, and the depression has continued to the extent indicated in the wood-cut.

FIG. 1.



The ribs at the point of depression are found to be widely separated ; the rib below being pushed downward so as to form one side of the triangle, its cartilage the second side, and the rib above the hypothenuse. The distance of the perpendicular line passing from the costo-chondral articulation of the lower rib to the upper rib, or the hypothenuse, is two and a half inches by measurement. The depression in this triangular space evidently resulted gradually from the wide separation of the ribs, and the consequent loss of resiliency in the thoracic walls in the space destitute of bony support. The child lay crosswise *in utero*, and it seems probable that the injury was produced by the pressure of its arm against the ribs during the fall. Cases like the above, and the graver cases in which fœtal life is sacrificed, or the child is born to a puny and uncertain existence from prematurity, show the very great importance of a quiet and regular life on the part of one who is about to become a mother ; for bodily injuries, like unpleasant sights, occur when least expected.

CHAPTER III.

MORTALITY OF EARLY LIFE: ITS CAUSES AND PREVENTION.

No fact is better known in the profession than that the first years of life constitute the period of greatest mortality.

In England, where there is an accurate registration of births and deaths, statistics show fifteen deaths in every hundred infants in the first year of life, and between four and five deaths in the first month. Statistics on the continent correspond with those in England, as regards the periods of greatest mortality. Quételet says: . . . . "There die during the first month after birth, four times as many children as during the second month after birth, and almost as many during the entirety of the two years that follow the first year, although even then the mortality is high. The tables of mortality prove, in fact, that one tenth of children born die before the first month has been completed."

In this country, in consequence of deficient registration of births, the percentage of deaths to births cannot be accurately ascertained. In this city, 53 per cent of the total number of deaths occur under the age of five years, and 26 per cent under the age of one year. According to the census of 1865, there were in New York city 95,020 children under the age of five years, and during the five years ending with 1865, 49,000 children five years old and under had died. Therefore, according to these statistics, more than one third of all the infants born in this city die under the age of five years. An error, however, occurs from the fact that, while the death statistics were complete, it is known there were more children in the city than were embraced in the census returns. Still it may, I think, be safely stated that one fourth of the children born in this city die before the age of five years.

In less crowded cities and the rural districts, it is known that the percentage of deaths in the first years of life to the total number of deaths is considerably less than in New York city, but it is nevertheless large.

As the child advances toward puberty, the liability to sickness and death gradually diminishes, but even the last years of childhood present a considerably larger percentage of deaths to the population than does youth or manhood.

The causes of this great mortality of infants and children, and the means of diminishing it, deserve careful consideration.

Some of the causes which conspire to produce it are to a considerable

extent unavoidable. Such are congenital vices of formation of internal organs. Many of the internal malformations necessarily occasion an early death. Cases of anencephalus, most cases of congenital hydrocephalus, of spina bifida, of cyanosis, are fatal before the close of infancy. These defects of formation we cannot detect before birth, and their causes are often obscure. Some of them seem to result from inflammation, believed to be, occasionally, syphilitic, developed at some period of fœtal existence. Other internal malformations are attributable to perturbating influences, operating temporarily on the mother during gestation. But in a large proportion of cases, we cannot assign the cause. Obviously, only partial success can attend our efforts, as regards prevention, in these cases, and almost no success, as regards the use of remedial measures.

Another obvious cause of the great mortality of early life, is natural feebleness of system, especially in infancy. The younger the patient, prior to the middle period of life, the sooner are the vital powers exhausted by disease. Hence a larger proportion of infants succumb to the same malady, than children, and a larger proportion of children, than adults. This statement is true of infancy and childhood in general. It is a law in nature, and cannot be changed by art. But there are many infants born with hereditary disease, or a strong predisposition to disease, through a fault, which is, in a degree, curable, in the system of one or both parents ; as, for example, the syphilitic, scrofulous or tubercular diathesis. Parents seriously affected by such diseases cannot, without corrective treatment, have healthy offspring. Their children are among the first to droop and die, either directly from the inherited disease, or from feebleness of constitution which such disease entails, and which renders them an easy prey to other diseases. The duty of the physician, as regards such parents, is obvious. He may, by therapeutic and hygienic measures, secure a more healthy progeny, and, so far as he can do this, he aids in diminishing the infantile mortality. He may sometimes, by timely measures directed to the infant, establish a better state of health.

The subject of hereditary disease is one of great interest and importance, especially as regards the city population. Inherited affections are less common in the country, but in the city they contribute largely to the number of deaths in early life.

Another important cause of the great mortality of children, is the fact that they are peculiarly liable to certain severe and fatal maladies. I allude particularly to the acute infectious diseases, which, as a rule, occur but once, and that in childhood. Some of them, as scarlet fever, greatly increase the number of deaths. They extend and become epidemic through the intercourse of children. We are constantly witnessing in New York the spread of the acute contagious diseases, especially of whooping-cough, measles, scarlet fever, and diphtheria, through the schools. Measures employed, thus far, by boards of health, or other local

authorities, to prevent the dissemination of these and kindred diseases, have been but partially successful except in regard to smallpox. In the large public schools especially, these maladies are most frequently contracted, and from them they radiate over the school districts. For if, as is now common, at least in New York city, a child comes to school wearing clothes which at home have lain in a room where a brother or sister was sick with measles or scarlet fever ; or if he enter the class with a mild pertussis or diphtheria, certain of his class-mates will probably return home infected with the virus of the disease. The same remarks are applicable, though with less force, to private schools. From both such schools, I have over and over again witnessed the dissemination not only of the maladies mentioned, but also of the milder infectious diseases, as mumps and varicella. The Health Board of New York city have recently, by stringent enactments regulating the schools, accomplished much in suppressing this source of the infectious diseases.

In hospitals and asylums for children, much can be done to prevent the occurrence of the infectious diseases by strict surveillance and prompt isolation of all suspicious cases. Without such care, scarcely a year passes in which these institutions are not scourged by one or more of these diseases. Much has been said of the crowding of families in tenement-houses, so common in New York and other large cities, by which a large number of children are brought under one roof ; of the uncleanliness of person and apartment to which it leads, and of the insufficient air and space which it allows to each. But one of the strongest objections, in my opinion, to the present plan of building and crowding tenement-houses is the facility which it affords to the spread of the contagious diseases of childhood ; and it is in such houses, as shown by statistics, that these maladies are the most frequent and fatal. The much-needed enactments or regulations in relation to the construction and occupancy of such houses, would, among other salutary effects, greatly diminish the death-rate from the infectious maladies.

Over the most loathsome, and formerly the most fatal, malady of mankind, namely, smallpox, we now have, or can have, complete control by statutory enactments enforcing vaccination. It is only by carelessness or the lack of sufficiently stringent regulations relating to the matter that smallpox is not "stamped out." Again, some of the most fatal inflammatory diseases of life occur chiefly in childhood, as croup and capillary bronchitis. These and kindred diseases can only be prevented by proper hygienic management on the part of families, and the circulation of tracts, or other means calculated to educate families in reference to the management of children, cannot fail to diminish the number of cases of such inflammations, and consequently of the deaths from them.

Another obvious and important cause of the mortality of early life, is the

anti-hygienic condition or state in which many children live, in consequence of the poverty or gross negligence of parents.

Residence in insalubrious localities, personal and domiciliary uncleanliness, exposure without proper protection to vicissitudes of weather, are fertile causes of sickness and death. Hence one reason for the great infantile mortality among the city poor, who live in damp and dark alleys, and in crowded and filthy tenement-houses, breathing night and day an atmosphere loaded with noxious gases. All physicians are aware how the malignant diseases, such as Asiatic cholera, cholera infantum, diphtheria, and typhus fever, seek the quarters of the city poor, and what terrible havoc they make there. All are aware, also, what wonderful recoveries result, when feeble and attenuated infants, gradually sinking with chronic diseases, induced in great measure by this malaria, are transferred from such localities to the pure air of the country.

Careless management of young children as regards dress increases greatly the liability to local diseases, such as commonly occur from exposure to cold. These are inflammatory affections, seated chiefly upon the mucous surfaces, but sometimes in parenchymatous organs. Adults, aware of the effect of sudden change of temperature from warm to cold, or of exposure to currents of air, protect themselves by additional clothing. Such precautionary measures are often lacking in the management of young children, and hence one cause of their great liability to local affections, both of the respiratory and digestive organs.

Routh, in his excellent treatise on *Infant Feeding*, says : " Among the most pernicious influences to young children, however, we may include cold ; the change of temperature from 45° to 4° or 5° below zero, as before stated, producing an increase of mortality in London alone of three to five hundred. As out of one hundred deaths, however, from all specified causes, nearly twenty-four occur to children under one, and thirty-six to children under five ; the great increase of mortality to children by cold is thus at once made obvious. Indeed, it is a household word among us, which takes its origin from the Registrar-General's returns, that a very cold week always increases the mortality of the very young and the very aged."

Lastly, a very important cause of mortality in early life is the use of improper food. In infants, artificial feeding in place of the aliment which nature has provided for them, and, in children, the use of innutritious or indigestible articles of diet, give rise to diarrhœal maladies, emaciation, and death in numerous instances. Sometimes, also, defective alimentation is the cause of scrofulous or tuberculous ailments, and sometimes it gives rise to a cachexia or feebleness of system, which, without engendering any positive disease, renders those thus affected less able to support disease induced by other causes. A committee, of which Professor Austin Flint, Jr., was chairman, appointed in 1867 to revise the " dietary table

of the Children's Nurseries on Randall's Island," states, with much truth and force : " Children . . . are not capable of resisting bad alimentation, either as regards quantity, quality, or variety. At that age the demands of the system for nourishment are in excess of the waste ; the extra quantity being required for growth and development. If the proper quantity and variety of food be not provided, full development cannot take place, and the children grow up, if they survive, into puny men and women, incapable of the ordinary amount of labor, and liable to diseases of various kinds."

Improper feeding, like other causes of mortality, is much more injurious, much more frequently the cause of death, in the city than in country. Statistics in Europe, as well as this side of the Atlantic, establish this fact. It is in infancy, and especially in the first year, that the use of unwholesome food entails the most serious consequences. No artificially prepared food is a good substitute for the mother's milk, and hence artificial feeding of the infant, unless under the most favorable circumstances, results disastrously. In the country, where salubrious air and sunlight conspire to invigorate the system, where a robust constitution is inherited, and where cow's milk, fresh and of the best quality, is readily obtained, lactation is not so necessary for the well-being of the infant ; but in the city, its importance cannot be too strongly urged.

The foundlings of the cities afford the most striking and convincing proofs of the advantages of lactation. In some cities foundlings are wet-nursed, while in others they are dry-nursed, and the result is always greatly in favor of the former. Thus, on the continent, in Lyons and Parthenay, where foundlings are wet-nursed almost from the time that they are received, the deaths are 33.7 and 35 per cent. On the other hand, in Paris, Rheims, and Aix, where the foundlings were wholly dry-nursed, at the date of the statistics their deaths were 50.3, 63.9, and 80 per cent.

In this city the foundlings, amounting to several hundred a year, were formerly dry-nursed ; and, incredible as it may appear, their mortality with this mode of alimentation, nearly reached 100 per cent. Now wet-nurses are employed for a portion of the foundlings, with a much more favorable result.

These facts, to which others might be added from the experience of European cities, show the importance of lactation as a means of reducing infantile mortality in the cities. What has been stated as regards the result of artificial feeding of foundlings, is true, in great measure, in reference to all city infants. The ill effect of artificial feeding is well known in this city, and it is the common practice in families to employ a hired wet-nurse, if, for any reason, the mother's milk is insufficient.

When the infant has reached the age at which it is proper to wean it, the digestive organs are less frequently deranged by errors of diet. More

substantial food, and considerable variety in it, may now be not only safely allowed, but are required by the wants of the system. Still, the feeding of children in health, and much more in sickness, is a subject of great importance. Therefore lactation, and the diet of infancy and childhood, will occupy our attention in the following pages.

CHAPTER IV.

WEIGHT, GROWTH, LACTATION.

Dr. Kate Parker, resident physician of the N. Y. Infant Asylum, weighed immediately after birth 170 infants, 89 male and 81 female, born consecutively, and at term, with the following result :

Average male weight	7 lbs. 11 oz.
" female "	7 lbs. 4 oz.

Fifty of these, who were wet-nursed, and apparently well taken care of, were weighed when one week old, with the following result :

Increase of weight in	32 cases.
Loss of weight in	13 "
Average gain	$4\frac{8}{10}$ oz.
" loss	$3\frac{1}{3}$ oz.
Greatest gain	12 oz.
" loss	6 oz.

AVERAGE GAIN.

From birth to age of 3 months (25 cases)	4 lbs. $8\frac{3}{4}$ oz.
" 3 to 6 months (6 cases)	3 lbs. $3\frac{1}{6}$ oz.
" 6 to 9 " "	2 lbs. $7\frac{1}{6}$ oz.
" 9 to 12 " "	1 lb. $15\frac{1}{2}$ oz.

It is desirable that the infant, as soon as it requires nutriment, should receive breast-milk. If it be fed, for a few days, with the bottle or spoon, it may be difficult finally to induce it to take the breast ; therefore it is well to determine early whether the mother will be able to wet-nurse her infant, so that, if unable, suitable provision may be made.

The matter of determining, beforehand, the capability of the mother for wet-nursing has been investigated by Dr. Donné, of Paris, and in his treatise on Mothers and Infants he describes the mode in which it may be ascertained. The desired information, in his opinion, may be acquired by examining the colostrum, which is secreted in small quantity, in the last months of gestation, and which can be squeezed from the breast in sufficient quantity for inspection.

In some women, according to Dr. Donné, the colostrum is so scanty that only a drop, or half a drop, can be obtained from the nipple by careful pressure. This will be found by the microscope to contain but few milk-globules, ill-formed, and a few granular bodies, such as the colostrum ordinarily contains. Such women almost invariably furnish poor milk, and in small quantity. In other women the colostrum is abundant but thin, resembling gum-water ; it lacks the yellow streaks and viscous character of ordinary colostrum, and it flows readily from the nipple. The milk of such women is sometimes scanty, sometimes abundant, but it is watery and deficient in nutritive principles. In a third class of women, the colostrum is pretty abundant, and it contains yellowish streaks, of more or less consistence, which are found to be rich in milk-globules of good size. Women furnishing such colostrum in the last weeks of gestation will have sufficient milk and of good quality. These latter women make the best wet-nurses.

Hindrances to Lactation and Physical Conditions rendering it Improper.

The primipara often experiences difficulty in wet-nursing in consequence of a depressed state of the nipple. It is not sufficiently prominent to be readily grasped by the mouth, and after ineffectual attempts, the infant becomes fretful when applied to the breast, and perhaps for a time refuses it altogether. Multiparæ occasionally experience the same inconvenience, but it is not common when there has once been successful lactation. By calmness and perseverance on the part of the mother, the nursling can usually be made to seize the nipple in the course of a week.

Depression of the nipple is, to a certain extent, the result of pressure upon it by the dress during gestation. The state of the nipples should, indeed, in those who have never suckled, receive early attention, even before the birth of the infant. Tightness of dress around the breast, as also upon every part of the body, should be avoided, and from time to time gentle traction should be made upon the nipple, if it be depressed. It may be drawn out by the fingers of the mother several times each day, or by a common breast-pump, or by suction with a tobacco pipe, the edge of the bowl having been smoothed. Occasionally, in these cases of depressed nipple, the mother, fatigued and discouraged by her frequent ineffectual attempts to induce the infant to nurse, becomes feverish and excited, so that the quantity of her milk is sensibly diminished. The physician should assure her, as he usually can with confidence, that in a few days, as the baby becomes a little stronger, there will be no difficulty in its nursing. Some women are unremitting in their endeavors to procure nursing. This should be forbidden, since the lack of sleep, and the nervousness which such constant endeavor produces, tend to defeat the object which they have in view, by diminishing the secretion of milk.

Sufficient sleep, freedom from anxiety, and no more frequent application of the infant to the breast than is required in successful lactation should be enjoined. Occasionally we can best succeed in procuring lactation under these circumstances of discouragement by the aid of another infant, older, more vigorous, and better able to seize the nipple. An exchange of infants for a few times may remedy the difficulty.

Occasionally suckling is rendered difficult and painful by too long delay before applying the infant to the breast. When the mother has rested a few hours after her confinement, about six in ordinary cases, lactation may commence. There is, at first, but very little milk, often only a few drops, but the secretion is promoted by nursing, so that the requisite amount is sooner obtained than when the infant is kept from the breast till the second or third day. If, as some physicians advise, suckling is deferred till the breasts are full and tender, and if, as is often the case with primiparæ, the nipples are also tender, many mothers lack the fortitude required to allow their infants to obtain a sufficient amount of milk. Excoriated and fissured nipples constitute a serious impediment to lactation. They are very sensitive on pressure, and are long in healing. They are fully described in works which relate to female diseases, and their treatment pointed out. Occasionally fissured nipples do harm to the infant by the blood which escapes and is swallowed with the milk. A case is related in which positive indigestion was caused in this way; the infant vomiting, after each nursing, milk mixed with blood. The local hindrances to lactation described above can, in most instances, be relieved in the course of a few weeks. To what extent menstruation and pregnancy are detrimental to the nursing, and therefore contra-indicate lactation, will be considered in another section.

There is, occasionally, a constitutional state of the mother which necessitates either the employment of a hired wet-nurse or weaning. This is the case when there is a strong tendency to tuberculosis. If the complexion be pallid, the system at all emaciated, and suckling be attended by more or less exhaustion, and if with fair trial of wine and tonics no improvement follow, the physician is justified in forbidding farther attempts at wet-nursing. If, under such circumstances, an hereditary tendency to tuberculosis exist, it is his duty to positively interdict nursing. The opinion of the physician, in such a matter, should be formed after mature deliberation. There are many women who, suffering temporarily from illness, and discouraged, are ready at once to abandon their infants to the care of others, with the least encouragement on the part of the physician to do so, but who, by attention to their own health, and especially by taking more sleep, soon recover from their depression, and become good wet-nurses. On the other hand, night-sweats, a cough, and progressive decline in health, show the need of immediate suspension of wet-nursing.

Sometimes women, prior to pregnancy, present indubitable evidence of tuberculosis, but by the improved general health which attends pregnancy, the disease is temporarily arrested. Such women should never suckle their infants. If they do, they soon lose all that was gained, and the disease advances rapidly. These objections to wet-nursing in such a state of health apply to the mother. There are also objections as regards the infant. The milk of those in decidedly infirm health, is deficient in nutritive principles. Their infants, therefore, are ill-nourished, and, if they have inherited a predisposition to tuberculosis, there is great danger that this disease will be developed in them ; whereas with healthy wet-nursing, even a strong predisposition may remain latent. M. Donné relates the following instructive cases, which show the danger which sometimes attends suckling, and the imperative necessity which may arise of discontinuing it. "A very light-complexioned young mother, in very good health, and of a good constitution, though somewhat delicate, was nursing for the third time, and, as regarded the child, successfully. All at once this young woman experienced a feeling of exhaustion. Her skin became constantly hot ; there were cough, oppression, night-sweats ; her strength visibly declined, and in less than a fortnight she presented the ordinary symptoms of consumption. The nursing was immediately abandoned, and from the moment the secretion of milk had ceased, all the troubles disappeared." "A woman of forty years of age . . having lost, one after another, several children, all of whom she had put out to nurse, determined to nurse the last one herself. . . . This woman, being vigorous and well built, was eager for the work and, filled with devotion and spirit, she gave herself up to the nursing of her child with a sort of fury. At nine months she still nursed him from fifteen to twenty times a day. Having become extremely emaciated, she fell all at once into a state of weakness, from which nothing could raise her, and two days after the poor woman died of exhaustion."

A very similar case recently occurred in my practice. A young and healthy woman from the country, suckling her second infant, on coming to the city, lived in a dark and very imperfectly-ventilated room on the first floor, and in the rear of a crowded tenement house. She soon lost her appetite, but continued suckling for three months, when she became so anæmic and feeble that she was compelled to seek medical advice. She died without local disease, notwithstanding the most nutritious diet and the free use of stimulants and tonics.

Constitutional syphilis in the mother does not contra-indicate lactation. It is probable that the infant also has it. The mother should take anti-syphilitic remedies, which will eradicate the disease in herself, and also, if it be present, in the infant. Febrile affections, also, do not in general contra-indicate lactation. They may, however, for a time, diminish the quantity of milk or impair its quality. If, however, the mother be in a

critical state, or much reduced, whatever the disease, suckling should cease. Whether or not the infant should be taken from the breast, if the mother be suffering from one of the essential fevers, depends on the severity of the malady, and the degree of her exhaustion. Twice I have known newly-born infants to be suckled by mothers, while the latter had scarlet fever, without contracting it, but suffering immediately afterward from severe and protracted eczema. In the country, where artificially fed infants as a rule do well, it might be best to wean if the mother be affected with such a disease, but in the city eczema is less dangerous than the diarrhœal affections which early weaning is apt to entail. In most cases of typhus and typhoid fevers, weaning or procuring a wet-nurse is necessary, on account of the depression of the vital powers which these diseases produce.

Inflammatory affections, unless of a dangerous character, do not ordinarily interfere with lactation, except that the quantity of milk be somewhat diminished. In severe inflammation, it may be so necessary to husband the strength, or to keep the patient perfectly quiet, that suckling her infant would be injudicious. It should then be transferred to a wet-nurse or weaned. Inflammation of the breast often presents an impediment to lactation. It is a common and painful affection, suspending, or greatly diminishing the secretion of milk in the affected gland. Nursing should cease as soon as there are evident signs of inflammation, unless it be limited to a small part of the gland. General heat of the breast, with tenderness and induration extending over a considerable part of it, indicate the need of the immediate removal of the infant from it. Lactation must be restricted to the unaffected side. It is often the case that the volume of the inflamed gland is considerably increased from the afflux of blood to it, and from the interstitial exudation, while it contains little or no milk, and attempts at lactation, under such circumstances, are injurious to the mother as well as to the infant. The cause of the swelling should be explained to the mother, who commonly attributes it to the accumulation of milk, and worries herself and the infant, by attempts to make it nurse. As the inflammation abates, by resolution, or more commonly by suppuration, and the normal secretion returns, the first milk, which is apt to be thick and stringy, should be rejected, after which the infant may nurse as usual. Occasionally, the abscess which has formed in the breast connects with a lactiferous tube, so that pus may, on suction, escape from the nipple. If this occur, of course lactation should be interdicted until pure milk is obtained. Pus in the milk can sometimes be detected by the naked eye. It presents a yellowish or greenish color, occurring in streaks, when not intimately mixed with the milk. When it is intimately mixed, and in small quantity, it cannot be detected by the naked eye, but the microscope reveals the pus-globules. M. Donné relates a case in which he discovered these globules by the microscope,

although there were at first no other evidences of an abscess, and doubts were expressed in reference to the accuracy of his observation. Finally, an abscess pointed and discharged.

Sometimes, when the inflammation abates, the secretion does not return, and, worse still, occasionally the inflammation has occurred so near the nipple that the lactiferous tubes are permanently closed by it, so that, though milk form in the breast, there is no escape for it. Thenceforth lactation must be entirely from one breast.

If erysipelas occur in the mother, the infant should be immediately taken from her breast and from her arms. If this disease should not be communicated to the infant through the milk, or through fissures in the nipple, of which there is danger, still the milk is apt to undergo such change in consequence of the erysipelas as to endanger the health of the child. Thus, one of the wet-nurses in the New York Infant Asylum sickened with severe facial erysipelas on the 24th of April, 1875, eight days after the death of her baby. She was wet-nursing a foundling, aged seven weeks, at the time of the commencement of the erysipelas, and as it was very important that her milk should be preserved for the coming hot months, it was deemed best to allow the nursing to continue, the infant being placed in a crib at a little distance as soon as it dropped the nipple. On the 27th, diarrhœa commenced in the baby. April 28th, its morning temperature was 101°, and that of the evening 103°, the diarrhœa continuing. It was now removed entirely from the breast, and was given artificial food. On the 29th there was a decided general icteric hue of the infant's surface, which continued till its death on May 1st. The stools numbered about eight daily till April 30th, when they ceased. The record which I preserved does not state whether there was vomiting, but it had probably been slight on account of the speedy prostration. Death occurred from exhaustion. At the autopsy, from half an ounce to one ounce of pus was found in the peritoneal cavity, newly formed fibrin was observed upon the spleen and liver, and the peritoneum generally had lost much of its lustre ; a careful microscopic examination of the liver and its ducts, made by Dr. Heitzmann, revealed no anatomical change which would explain the icteric hue, and it seemed probable that this was due to the altered state of the blood. The mucous membrane of the intestines exhibited vascular streaks, and its follicles were distinct. The lesions therefore indicated intestinal catarrh. Nothing unusual was observed in the heart and lungs of the infant. Its life had apparently been sacrificed by the unhealthy nursing.

Colostrum.

The milk secreted during gestation, and immediately after the birth of the infant, differs in its gross appearance, as well as chemical and microscopical characters, from that which is ordinarily secreted during lactation.

It is termed Colostrum. It has a turbid and yellowish appearance, and is somewhat viscid. It is decidedly alkaline, and undergoes lactic-acid fermentation more readily than common milk, and it also contains more solid matter. It has an excess of fat, of salts, and, according to Simon, also of sugar. It appears, from Simon's analysis, that the solid matter of colostrum is about seventeen per cent, while that of the ordinary breast-milk is about eleven per cent.

Examined by the microscope, the colostrum is seen to contain oil-globules and a viscid substance, which often assumes an ovoid or globular form, but which also exists in irregular masses of considerable size. This substance has been thought by some to be mucus, but it is dissolved by acetic acid and potash, and is tinged yellow by a watery solution of iodine. It is, therefore, to be regarded as albuminous. Imbedded in this substance are oil-globules, which are for the most part of small size, while the free

Fig. 2.



Milk-globules.

Fig. 3.



Colostrum-corpuscles.

oil-globules of colostrum are larger than those occurring in healthy milk. This viscid substance, with the imprisoned oil-globules, constitutes what has been designated the "colostrum-corpuscles." Some have erroneously considered the "colostrum-corpuscles" to be compound granular cells. The compound granular cell, or corpuscle, is a cell which has undergone fatty degeneration. It is distended with oil-globules to perhaps twice or thrice its normal size. On the other hand, examination of the "colostrum-corpuscles" fails to detect a cell-wall, and the large and irregular size of some of these corpuscles negatives the idea that they are cells. The oil-globules contained in the viscid substance are more readily acted on by ether than are the free oil-globules.

The colostrum is replaced by milk of the normal character in six to eight days: sometimes as early as the third or fourth day after delivery. In exceptional instances, the colostrum does not disappear for several weeks, and it may reappear at any time during lactation, as a consequence of derangement of the system, or from disease. It is assimilated with difficulty by the digestive organs of the infant, producing usually a laxative effect. It, therefore, aids in the removal of the meconium, and being

a normal secretion in the first week of lactation, it is to be regarded as beneficial. Continuing longer than the first week, its effect is deleterious. It produces evident derangement of the digestive organs, and the infant that habitually nurses it never thrives. It has diarrhœa or vomiting, becomes more or less emaciated, and suffers from colicky pains. Sometimes an extreme degree of exhaustion is reached before the cause is suspected, for, if the milk be pretty abundant, the admixture of colostrum with it cannot be detected by the naked eye. The microscope alone reveals it. The following is an interesting example of this fact. In 1868, an infant six weeks old was brought to me, with the following history : The mother had for several years been troubled with dyspeptic symptoms, but had otherwise been in good health. The infant at birth was fleshy and strong, but after the first week it had never thriven like other infants. It nursed regularly, and the quantity of milk was apparently sufficient, but it vomited as soon as it ceased nursing, it was much emaciated, and the bowels were habitually constipated. The digestive organs of the infant had been in this unhealthy state, with little variation, from the first week, and it was very evident, from the emaciation and exhaustion, that it must soon perish, unless some change were effected. The milk of the mother presented the usual appearance to the naked eye, but under the microscope, colostrum-corpuscles were observed. A wet-nurse was immediately obtained, and from that moment the gastro-intestinal symptoms disappeared, with a rapid recovery. This case shows at once the evil effects of the colostrum, and the need of a microscopic examination of the milk whenever the nursling suffers from lactation.

Human Milk.

The specific gravity of human milk is about 1032. It has been carefully analyzed by different chemists, with nearly the same result. The following table, prepared by MM. Vernois and Becquerel, gives the proportion of the various ingredients in 1000 parts :

Water,	889.08
Sugar,	43.64
Casein and extractive,	39.24
Butter,	26.66
Salts (ash),	1.38
	1000.00

Milk, being the sole food of early infancy, contains all the nutritive principles which are required for the growth and repair of the different tissues. The casein is an albuminous principle, the butter and sugar are combustible substances, and most of the salts which occur in the different tissues exist primarily in the milk. Phosphate of lime, phosphate of magnesium, phosphate of the peroxide of iron, chloride of potassium,

and chloride of sodium, known to exist in cow's milk, are believed to occur also in human milk. Epithelial cells are sometimes present, derived from the lining membrane of the lactiferous tubes.

Modification of the Milk in consequence of the Diet.

Fresh milk should give an alkaline reaction, but in certain states of ill-health, or after the use of certain articles of food, the reaction is acid. Mothers are well aware of the ill effects, as regards the infant, which follow their use of indigestible or acescent food ; and, if prudent, they avoid it. The milk, if the diet of the mother be improper, may become so strongly acid as to cause colicky pains and diarrhœa. The following observations in reference to cow's milk are instructive. We may infer from them that the regimen of the mother exerts a decided influence on the alkalinity of her milk. According to Routh (*Infant Feeding*, page 285), stall-fed cows almost always give acid milk. Dr. Mayer, of Berlin, examined the milk from a considerable number of cows, with the following result :—

(*a.*) Of cows fed with brewers' lees, red potatoes, rye bran, and wild hay, in five instances the milk was slightly acid ; in one very much so.

(*b.*) Of forty cows fed with potato mash, barley husk, and clover and barley straw, in ten, which were examined, the milk was acid ; in three, very acid.

(*c.*) From among fifty cows fed on potato mash, barley husks, and wild hay, five were examined, and in all the fresh milk was acid.

(*d.*) From forty-two cows fed on potato mash, husks, wild hay, and rye straw, out of twelve selected for examination, the fresh milk of all was acid.

(*e.*) From six cows fed by a chief gardener on coarse beet-root, red potatoes, bran mash, and hay, the fresh milk was slightly acid.

(*f.*) From five cows fed by a cow-feeder on lukewarm bran mash and hay, in four the fresh milk was quite neutral, in one it was decidedly alkaline. (*Routh.*)

The above observations of Dr. Mayer were made in the winter season, and it is possible that the acidity may have been partly due to the confinement of the cows in stalls. But that it was mainly due to the food is evident from the fact that it was greater with some kinds of food than others. Cows' milk is not as alkaline as human milk, and is therefore more readily rendered acid. Still, what Dr. Mayer observed in reference to the cow exemplified a fact of general applicability, namely, that certain kinds of food may affect the alkalinity of the milk, whether human milk or that of animals.

The relative proportion of the different ingredients of the milk varies according to the diet. If the diet be poor, the amount of water increases,

and that of butter and casein diminishes. Lehmann says (*Phys. Chemistry*, vol. ii., p. 65) : "From experiments made on bitches, it would appear that a vegetable diet renders the milk richer in butter and sugar ; while the solid constituents are augmented when a sufficient quantity of mixed food is given. Peligot found the milk of an ass most rich in casein when the animal had been fed on beet-root ; while it was richest in butter when the food had consisted of oats and lucerne. Fat food increases the quantity of the butter. Boussingault found the milk of a cow richer in casein when the animal had been fed on potatoes than when other food was taken. Reiset found that the milk of cows which were at grass was much richer in butter than when the animals had stood all night in their stall without food ; but Playfair found, on the contrary, that the quantity of butter in the milk increased during the night as much as during their stall-feeding, but that the quantity of butter in the milk was considerably diminished by the motion of the animals in the fields." * Simon made the following analyses of the milk of a poor woman. She was suddenly, during the period of lactation, deprived of the means of support, so that her food was insufficient in quantity, and of poor quality. The amount of her milk was not diminished by privation, but the solid constituents were reduced to 86 parts in 1000. After this, for a time her diet was nutritious and abundant, the quantity of milk was increased, and the solid constituents amounted to 119 parts in 1000. Her diet was again reduced, with a reduction of the solid elements to 98 in 1000, and, at a later period, the diet was again nutritious, with an increase of the solid elements to 126. The chief variation observed in the milk of this woman was in the amount of butter.

Modification of Milk from its Retention in the Breast.

M. Peligot has clearly demonstrated that the longer milk is retained in the breast the more watery it becomes. This is explained on the supposition that the solid portion is first absorbed. Therefore, the milk is richer the more frequently it is removed from the breast. A similar fact, which has the same explanation, has long been known, namely, that the first milk taken from the breast is thinnest, while that which flows last is richest. That first removed has remained longest in the gland, while that which comes last is but recently secreted.

A knowledge of this fact is of considerable practical importance. The milk, as M. Donné has shown, may be too rich, so as to cause indigestion, with more or less enteralgia, in the infant. Some nurslings, if the milk be too rich and abundant, reject a part of it by vomiting, but others do not, and suffer the consequence in derangement of the digestive organs. For such cases the remedy is, to give the breast less frequently, by which

* Animal Chem., Sydenham Soc.'s Trans., vol. ii., p. 55.

a less amount of milk is taken, and milk of a poorer quality. On the other hand, if there be poverty of the milk, and the infant be insufficiently nourished, the milk is more nutritious, if the nursing be at short intervals.

Modification of Milk by Age and by Mental Impressions.

The composition of the milk varies, also, according to the age of the infant. Simon analyzed the milk of a woman at intervals for the period of about six months. In this case the amount of casein at first was small, but the quantity increased during the two months succeeding delivery, after which it was nearly stationary. A similar increase was observed in reference to the saline substances. The sugar, on the other hand, diminished in quantity as the infant grew older, its maximum amount being in the first and second months. The quantity of butter in the milk varies from day to day more than the other elements.

Many observations have been published which show that the composition of the milk may be materially changed by mental impressions. The infant has died suddenly in the act of nursing, after his mother had been violently excited. Such a case is related by Tourtnal. The infant ceased nursing, gasped, and died in the mother's lap. In other cases convulsions have occurred. MM. Becquerel and Vernois made the chemical analysis of the milk of a woman in a state of nervous excitement, and found that the solid constituents were diminished to 91 parts in 1000, the most marked diminution being in the butter, which was only about 5 parts. In a case related by Parmentier and Deyeux the milk became watery and viscid, and remained so till the nervous attacks, from which the patient suffered, had ceased. Dairymen are well aware how ill-treatment and the separation of the calf from the cow diminishes the milk which she yields. A new milkman seldom obtains as much milk as one with whom the cow is familiar. Bouchut, alluding to the influence of the moral affections on the secretion of milk, makes the following remark, the truth of which most mothers will acknowledge : " It is also a fact, that the sight of the nursling, the idea of seeing it at the breast, and the joy which certain mothers thence experience, exercise a moral influence over the secretion of the milk entirely independent of their will. They feel the draught of milk as soon as they behold their child, or think of it too deeply ; and in a woman who saw her child fall to the ground, the flow of milk ceased, and did not reappear until the child, having quite recovered, attempted to take the breast."

Modification of Milk by the Catamenial Function and Pregnancy.

The catamenia reappear in most women before the close of lactation, often by the fifth or sixth month after delivery. If this function be re-established in the normal manner, that is, without any derangement of

the system, without pain or undue profuseness, no unfavorable result ordinarily occurs with the infant. On the other hand, if the mother suffer any disturbance of the system, or if the menses are profuse, the lacteal secretion may be so changed that the infant is injuriously affected by it. The symptoms produced are those of indigestion, such as abdominal pains, more or less vomiting, and diarrhœa. This result is, however, in my experience, quite exceptional. In rare instances, more dangerous symptoms occur in the infant. A case has been reported to me in which, at each catamenial period, the nursling was seized with convulsions.

Charles Marchand found in three chemical analyses of the milk during menstruation, a diminution of two to four parts in the butter, of two to five parts in the sugar, and a diminution in the casein and albumen of two to five parts. This seems but a trifling change when we recollect that human milk in the state of health contains, according to the analysis of M. Robin and others, 25 to 37 parts of butter, 37 to 49 parts of sugar, and 29 to 39 parts of casein, in 1000 of milk. If the menses reappear with regularity, when the infant has attained the age of ten or twelve months, they should be considered as designed to supersede the secretion of milk, which, indeed, usually begins to diminish. Weaning is then proper. If the menses return early in the period of lactation, and give rise to symptoms in the infant in consequence of the altered quality of the milk, it is advisable to allow but little nursing during the catamenia, and to employ artificial feeding instead, till the flow of blood ceases.

The change produced in the milk by pregnancy is, in general, more injurious to the nursling than that caused by the reappearance of the menses. The milk of the pregnant woman is apt to contain more or less of that viscid substance which characterizes colostrum. Still, the milk of pregnancy does not, ordinarily, derange the digestive function as much as colostrum, in the first weeks of lactation, for pregnancy rarely occurs till after the infant is five or six months old, when the organs of digestion are less readily disturbed. The injurious effect of pregnancy on the infant is shown by vomiting or diarrhœa, by restlessness and occasional abdominal pains, in fine, by symptoms of indigestion. In many cases, however, these symptoms do not occur, and the infant, though nursing regularly, continues to thrive. No doubt, as a rule, the nursling should be weaned when there are clear evidences of pregnancy, but under certain circumstances, weaning is injudicious. I have, on different occasions, been called to infants, in midsummer, dangerously sick with diarrhœal attacks induced by this cause. These infants were, perhaps, doing well, or suffering but little from indigestion, when the mothers, suspecting themselves pregnant, at once withdrew them from the breast, and cholera infantum or a kindred disease was the result. No infant in the city should be weaned in the hot months. It is much safer, though there

be indubitable signs of pregnancy, that it continue nursing till the cold weather. The better method is, however, under such circumstances, to employ a wet-nurse, or to remove the infant to the country, and wean it there. In cold weather, it is usually safe to wean an infant in the city after it has reached the age of five or six months.

The milk frequently contains other ingredients in addition to those which have been mentioned. Thus a large number of medicinal substances, taken by the mother, may enter the milk, so as to produce their characteristic effect on the infant. It is a well-known fact, that the peculiar flavor of certain vegetables, taken as food, may be noticed in the milk. It is admitted, also, that the specific virus of the contagious diseases, at least certain of them, may enter the milk, so as to give rise to the same diseases in the infant.

Differences in Suckling Women as regards Quantity and Quality of Milk.

There is, however, a great difference, in different women, as regards the quantity and quality of their milk, and even the mode in which it is secreted. The best wet-nurses are usually robust without being corpulent. Their appetite is good, and their breasts are distended from the number and large size of the bloodvessels and milk-ducts. There is but a moderate amount of fat around the gland, and tortuous veins are observed passing over it. Such nurses do not experience a feeling of exhaustion and do not suffer from lactation.

The nutriment which they consume is equally expended in their own sustenance and the supply of milk. There are other good wet-nurses who have the physical condition which I have described, but whose breasts are small. Still, the infant continues to nurse till it is satisfied, and it thrives. The milk is of good quality, and it appears to be secreted, mainly, during the time of suckling. Other mothers evidently decline in health during the time of lactation. They furnish milk of good quality and in abundance, and their infants thrive, but it is at their own expense. They themselves say, and with truth, that what they eat goes to milk. They become thinner and paler, are perhaps troubled with palpitation, and are easily exhausted. They often find it necessary to wean before the end of the usual period of lactation. There is another class whose health is habitually poor, but who furnish the usual quantity of milk without the exhaustion experienced by the class which I have just described. The milk of these women is of poor quality. It is abundant, but watery. Their infants are pallid, having soft and flabby fibre. All these kinds of wet-nurses are met in practice.

Occasionally, a considerable part of the milk is lost by oozing from the breast. This sometimes occurs in robust women, but is more frequently associated with weakness. It is then due to a relaxed state of the orifices

of the milk-ducts. Galactorrhœa, as the excessive secretion and flow of milk is designated, is said to be often associated with a menorrhagic diathesis : that is, women whose menses have been profuse are apt to have too abundant a flow of milk, corresponding with the menorrhagia. It is said that galactorrhœa is also apt to occur in those who are subject to discharges from parts which sustain no immediate relation to the breast, as in cases of hæmorrhoidal flux, diabetes insipidus, etc. Excitement, or irritation of the uterus or ovaries, may serve as an exciting cause of galactorrhœa in those predisposed to it, and excessive suckling may have the same effect.

Scantiness of Milk; its Causes and Treatment.

Though the amount of breast-milk which the infant requires is less than was estimated by Cumming, still insufficiency of this secretion is not uncommon, especially in the cities. According to the statistics of Drs. Merei and Whitehead, among healthy mothers there is insufficiency in 16.5 per cent, while among mothers in feeble health the percentage is 46.6. In treating of this subject in the following pages, reference is not had to those cases in which there is temporary diminution of milk from acute disease or other perturbating causes, but to those cases in which there is habitual scantiness.

One cause of scanty secretion of milk is a life of privation or of daily work, which necessitates separation from the infant. Insufficient food may render the milk more watery, as has already been stated, or it may cause diminution in its quantity. The mother thus situated is pallid. She is subject to palpitation and attacks of faintness. Her condition, indeed, is that of anæmia. Working women have scantiness of milk, not only in consequence of hardships, but also because they are usually separated for hours from their infants. Age is also a cause of scantiness of milk. Mothers at the age of forty years ordinarily furnish less milk than between twenty and thirty. Those who have not borne children till late in life, and whose mammary glands have therefore long been inactive, have less milk than those who commence bearing children at the usual period.

Routh speaks of hyperæmia as a cause of defective lactation. "This is a variety," says he, "which I have chiefly observed among hired wet-nurses, selected from the poorer classes, and admitted into wealthier families. . . . When feeding at the expense of a master or mistress, the amount they devour often surpasses all moderate imagination. They, in fact, gormandize. If in such instances a wet-nurse be given all she asks for, she will be found often to eat quite as much as any two men with large appetites ; and, as a result, she becomes gross, turgid, often covered with blotches or pimples, and generally too plethoric to fulfil the duties of her position. The plethora, as first induced, is of the sthenic variety,

but it soon assumes an asthenic character, and, as the immediate result, the breast no longer secretes its quantum of milk. There may be good milk secreted, but it is in small quantity, and this quantity diminishes daily. The breast may also enlarge, but it is from a deposition of fatty tissue in and about it, as in other parts of the body. The veins on the surface become less apparent, always a bad feature in a suckling breast, till finally the flow of milk ceases altogether."

Atrophy of the breast from the employment of iodine, or from long disuse, is also a cause of insufficiency of milk.

It is so necessary for the health and development of the infant that the milk should be in proper quantity as well as quality, that it is best in a work of this kind to consider the treatment of insufficient secretion, and, on the other hand, of excessive secretion and loss of milk, or galactorrhœa, and first of insufficient or scanty secretion.

The most efficient mode of increasing the lacteal secretion is that which is also natural, namely, suction from the nipple. There are many cases on record in which this has produced the flow of milk in women who have never borne children, and even in men. Baudelocque mentions the case of a girl, eight years old, who suckled her brother for a month, and cases at the opposite extreme of life have been reported ; one of a woman of seventy years, who wet-nursed a grandchild twenty years after her last confinement.

The following case, which was under my observation, is interesting in this connection : Lizzie S. was confined with her first child on May 30th, 1876. When the baby was a few days old, and before she had left the bed, she had inflammatory symptoms which proved to be due to pelvic cellulitis. Its course was tedious ; her milk diminished, and its secretion soon ceased. On or about the first of August she began to sit up, and on August 11th she was admitted into the Sixty-first Street branch of the Infant Asylum, pale and wasted, but with returning appetite. She had had no mammary secretion for eleven weeks, and her breasts were small and flabby. She had two fistulous openings, one vaginal, and the other low down in the back, near the lower end of the sacrum or the coccyx. The baby was in a fair condition, having been suckled by other women. Experiences in this and other institutions show that infants having breast milk do far better and are much more apt to live than those without breast milk, and the mother was therefore advised by one of the managers —himself a physician—to suckle her baby, although there was not a drop of milk in her breast, and nursing had been suspended eleven weeks. To the surprise of the mother, and of the nurses in the house—to whom the procedure seemed very ridiculous—milk began to appear in a few days. The mother left the institution October 8th ; but before her departure she was able to furnish, perhaps, two-thirds the quantity of milk which her infant required. This case affords practical illustration of the fact that

frequent nursing is the most efficient galactagogue. Mothers sometimes, having little breast milk, suckle their babies at long intervals, and finally, discouraged at the unproductive state of their breasts, resort to weaning, when, by patience and more frequent lactation, they might become good wet-nurses. In the cities, and during the summer season, in which breast milk is so much required, the history of cases like the above, and the more remarkable cases in which men and grandparents have had secretion of milk and have suckled infants, should induce the physician to withhold his consent to premature weaning, which the disheartened mother is apt to suggest, unless indeed he perceive other reasons for weaning apart from scantiness of milk.

Travellers among barbarous nations or tribes have often observed these cases of unnatural lactation. Humboldt saw a man, thirty-two years old, who gave the breast to his child for five months, and Captain Franklin, in the Arctic regions, met a similar case. Dr. Livingstone, in his African travels, says that he has examined several cases in which a grandchild has been suckled by a grandmother, and equally remarkable instances of lactation occur among the negroes of the Southern and Middle States. Professor Hall presented to his class in Baltimore, a male negro, fifty-five years old, who wet-nursed all the children of his mistress. In these cases of abnormal lactation, so far as we have accurate records of them, it is ascertained that the breasts were torpid, and even sometimes, as in old people, atrophied till the nursing commenced. Titillation, or pressing of the nipple, caused an afflux of blood to the gland, and developed its functional activity, so that milk was produced for the sustenance of the nursling. Therefore, in case of scanty secretion of milk, the mother may increase the quantity by applying the infant often to the breast. If, dissatisfied with the small amount of nutriment which it receives, it refuse to make the necessary suction, any other mode of gentle traction or pressure may be employed in addition. The occasional employment of another infant, or a pup, milking the breast with the thumb and fingers, or the gentle suction of a breast-pump, aids in stimulating the secretion. One of the best breast-pumps kept in the shops is that to which the name The Mother's Blessing has been applied. Forcible rubbing or traction of the breast defeats the purpose for which it is employed. It produces too much irritation and tenderness. The best mode of stimulation is by nursing, as it is the natural mode, and the moral effect of the infant at the breast aids in promoting the secretion.

Another mode of increasing the functional activity of the mammary glands is by the electrical current. The fact is established by physiological experiments, that glandular organs can be made to secrete more actively by the stimulus of electricity, and, accordingly, this agent has been successfully employed to promote the secretion of milk. In Routh's *Infant Feeding* several cases are related which show the beneficial effects

of this agent (page 149 et seq.). Among them are six reported by Dr. Skinner, of Liverpool. In all these, one or two applications of the electrical current sufficed to restore the secretion. The following is Dr. Skinner's mode of employing this treatment :

"1. *Direct.*—Both poles must terminate in cylinders, with sponges well moistened in tepid water. The positive pole is pressed deep into the axilla, while the negative is lightly applied to the nipple and the areola ; the current being no stronger than is agreeable to the patient's feelings. The poles are kept in this position for about two minutes.

"2. *Intramammary.*—The poles are to be, as it were, imbedded in the mamma, and moved about, raising and depressing both poles at once in and around the organ for the space of another two minutes. The same is to be done to both breasts daily, until the secretion is properly established. Hitherto one or two sittings have always sufficed in my hands." (*Communication of Dr. Skinner to Dr. Routh.*)

In all cases of scanty secretion of milk, the regimen of the mother is a matter of importance. Personal and domiciliary cleanliness is essential for successful wet-nursing. A certain amount of exercise in the open air is conducive to the health of the mother, and to the secretion of abundant and healthy milk. A case is related to show the effect of fresh air and outdoor exercise on the lacteal secretion. A lady of cleanly habits, living in London, had a very scanty supply of milk. She removed to the pure air of the seashore, and immediately the quantity became abundant, and continued so for months. Such cases are not infrequent. A mode of life that contributes to the general health of the mother will not fail to augment the quantity of her milk, if it be scanty, and to improve its quality.

Much has been written in reference to the diet of women who suckle. It is a popular belief that certain articles of food promote the secretion of milk much more than other articles, though equally nutritious. No doubt, writers have erred in recommending exclusively this or that kind of food, as most likely to produce milk. The exact kind of food which is preferable, in a certain case, depends partly on the physique of the individual, and partly on the character of the food to which she has been accustomed. A mixed diet contributes most to the sustenance of the mother, and to an abundant secretion of milk. Animal substances which furnish a due supply of nitrogenous aliment should be given with the farinaceous. Mothers pallid, and inclining to an anæmic condition, require a larger proportion of animal diet than those in good general health. On the other hand, plethoric women, such as Routh describes, who with excellent appetite consume large quantities of food, and who become more and more full-blooded and corpulent while the milk diminishes, require a more restricted animal diet, in connection with more exercise, especially in the open air.

There are certain kinds of food which do appear to have a galactogogue effect with most wet-nurses. Oatmeal gruel is one of these. Wet-nurses often remark, after taking a bowl of this, that they feel the flow of milk. Cow's milk with some has a similar effect. Porter or ale, taken once or twice a day, also promotes the secretion of milk, especially in those who have poor appetite, and whose systems are somewhat reduced.

A great variety of medicines have been used for their supposed galactogogue effect. Medicines which improve the general health are, no doubt, sometimes useful for this purpose, such as the vegetable and ferruginous tonics and, perhaps, cod-liver oil. But there are other medicines which it is claimed have a specific effect on the mammary gland, promoting its secretion. Lettuce, winter-green, fennel, the broom tops (scoparius), and marsh-mallow, have been used for this purpose. There can be no doubt that the aromatic stimulants, as fennel, anise, and caraway seeds, given in soups, sometimes stimulate the lacteal secretion. Another medicine which of late has been recommended to the profession, as a galactogogue, is castor oil and the plant from which it is derived.

The galactogogue effect of the leaves of the castor-oil plant has been long known to the Spaniards in South America. At least as long ago as the commencement of the last century, the ricinus communis was applied by them externally to the breast to promote the secretion of milk. It is now about twenty-five years since this use of the plant was brought prominently to the notice of the profession in this country and in Europe. In the London *Journal of Medicine*, 1857, Dr. Tyler Smith relates the results of his experiments with the castor-oil plant. He applied the bruised leaves over the breasts, and witnessed, as he thinks, an evident galactogogue effect. Dr. Routh has also made pretty extensive use of the plant, both externally and internally. He was led, he says, to employ it internally, from noticing in suckling women an increase of milk after taking a dose of castor oil. He prescribed a decoction of the leaves and stalks, and says : "I have not been disappointed. The flow has been remarkably increased. Four objections against its use, however, should be mentioned." These are, first a peculiar sensation in the eyes, with dimness of sight, an effect which he has observed only in weak women ; secondly, the necessity of increasing the dose as the patient becomes accustomed to it ; thirdly, scarcity of the plant ; fourthly, an occasional diuretic, sometimes without galactogogue, effect, and sometimes with it. The cases in which diuresis occurred were in the practice of other physicians, and Dr. Routh conjectures that this effect was produced by not keeping the breast warm during the time that the decoction was being employed. The breasts should, at the time of its use, be covered with a fomentation of leaves, or an extract of the leaves should be rubbed over the breasts in the same way in which extract of belladonna is used, and over this a warm poultice applied of the ordinary material. Dr. Routh

remarks : " When the castor-oil leaves are given as an infusion to women who are not suckling, I have observed two effects, both of which seem to denote its specific action. First, it produces internal pain in the breasts, which lasts for three or four days. Then, secondly, a copious leucorrhœal discharge takes place, after which the effect on the breasts entirely disappears."

Dr. Gilfillan, of Brooklyn, has also employed the ricinus communis successfully as a galactogogue. He employed a poultice of the pulverized leaves, and gave internally the fluid extract of the leaves, a teaspoonful three times daily. The patient had been confined the year before with her first child, but had no milk for it, though her health was good, and measures were employed, as friction and fomentations, to stimulate the secretion. The ricinus was prescribed the fourth day after her confinement with the second child, when there were no signs of secretion, and the breasts were small. " About two hours after the poultice was applied, and the first dose taken, she experienced a strange sensation in the breasts, and this increased after each dose of the medicine. The poultice was not renewed, but the extract was continued for three days, after which lactation was perfectly successful." So far, then, observations appear to show that ricinus is one of the most efficient galactogogues which we possess among medicinal agents ; but all other modes of increasing the milk are probably less effectual than that which is natural, namely, suckling.

In the treatment of galactorrhœa, the object to be attained should be kept in view. There are medicines which cure this affection by diminishing the amount of milk. Belladonna, iodide of potassium, and colchicum are antigalactics. It is proper to use them in case of weaning or of death of the infant. They not only reduce the quantity of milk, but, continued, may prevent its secretion. They are employed not to benefit the infant, but the mother.

On the other hand, if it be our purpose to prevent the oozing of milk in order to save it for the infant, or, if it be abundant and watery, to diminish somewhat its quantity and improve its quality, the treatment should be different. Iron, in cases of galactorrhœa, in which the condition of the system appears to indicate the need of it, will diminish the quantity of milk and render it richer. It is by many regarded as an antigalactic, and, given long, it might reduce too much the amount of the secretion, and even necessitate weaning. Its use should be discontinued if no more than the normal amount of milk be secreted.

In most cases of true galactorrhœa, the pathological state is that of weakness and relaxation of the tissues. The fault is not excessive secretion of milk so much as its non-retention, and the medicines which are he most useful to correct this state of the system and of the breasts are the vegetable tonics and astringents. If galactorrhœa occur in those who

have an habitual discharge, and it appear to be due to the same cause which produces that discharge, and there be no evidences of weakness, laxative medicines and other derivatives may be employed. But such cases are not common. Nux vomica has been recommended in galactorrhœa, in the belief that it diminishes the relaxation of the orifices of the lactiferous tubes.

Local treatment in this affection is important. A cloth wrung out of cold water should be occasionally applied around the nipple, and removed as it becomes warm. Solutions of tannin or alum are likewise useful. Collodion applied around the nipple, by the contraction which it produces, diminishes the orifices of the ducts, and thus aids in the retention of the milk.

CHAPTER V.

SELECTION OF A WET-NURSE.

In the cities, cases are frequent in which mothers, with all possible care or endeavor, find themselves unable to suckle their infants. Their health is too poor, or the milk possesses the properties of colostrum, or it is no longer secreted, on account of nervous excitement, or exhaustion, or inflammation of the breasts. The number of such cases in the city would surprise physicians who are familiar only with the healthy and robust mothers of the country. The infant thus deprived of the mother's milk should, if practicable, be furnished with a wet-nurse.

The selection of a wet-nurse often devolves upon the physician, and is a duty of great responsibility. It is better to select one between the ages of twenty and thirty years, and one who has suckled an infant previously. A wet-nurse between the ages of twenty and thirty is usually more active, cheerful, and conciliatory than one of a more advanced age, and her milk is more apt to be abundant and nutritious. Those who have previously suckled and had charge of infants, are obviously more competent to serve as wet-nurse than are primiparæ. The milk of a wet-nurse whose infant is under the age of six months, will ordinarily agree with a newborn infant. If above that age, it sometimes agrees, but often does not.

The most difficult and responsible task imposed on the physician in the selection of a nurse, is to ascertain the exact condition of her health, and the quantity and quality of her milk. Constitutional syphilis is common in the class of women who present themselves for wet-nursing ; it is often latent, or its symptoms are easily concealed, and it is communicable by lactation. The virus may be received by the infant from fissures or excoriations of the nipple. The nursling tainted by syphilis may, on the other hand, communicate the disease to the nurse through the same

source. It is not fully ascertained whether the syphilitic virus may be conveyed to the infant by the milk. But the cases which have accumulated in the records of medicine are numerous, in which infants, born of healthy parents, have been fully syphilized by lactation from diseased nurses (see article Syphilis). These infants have sometimes led a short and miserable existence, and have occasionally increased the misery of the household by imparting the disease to others. The duty is, therefore, imperative on the part of the physician to examine carefully the wet-nurse, in reference to any evidences of the syphilitic taint. Acquainted with the symptoms of syphilis, he may usually, by shrewd questioning and by careful examination of the present appearance and condition of the woman, ascertain with considerable certainty whether her system has ever been infected. References should also be obtained and consulted, and, if practicable, the physician who has attended her be communicated with.

It is safer to employ a wet-nurse, two months after her confinement than previously, for if she have the syphilitic taint it will by this time show itself in the innutrition, coryza, and anal sores of her infant.

There are, also, among the women who present themselves for wet-nursing in the cities, many of a scrofulous habit, and many who possess an hereditary tendency to tuberculosis, if indeed they do not already have the incipient disease. Such applicants should be rejected, on account of the poverty of their milk and the probability that they will not be able to endure the debilitating effect of lactation.

The milk should be examined, in order to ascertain its richness and quantity, and whether it contain colostrum. If there be colostrum after the eighth day, it is probable that there is some fault in the health or digestion of the wet-nurse, and that her milk may disagree with the infant. It is not necessary that the breast should be large, in order to furnish a sufficient quantity of milk, since, as has been already stated, in some the secretory function is active during the time of each nursing, so that, although the breasts are of moderate size, a sufficient amount of milk is furnished. The nipples should be well formed and prominent, and preference is to be given to those wet-nurses in whom bloodvessels are seen ramifying over the breasts.

By examination of the milk, its degree of richness can be readily ascertained. A quantity of it should be placed in a test-tube, and the cream which rises to the top indicates, approximately, the character of the milk. Good milk furnishes three per cent. of cream, and the casein and sugar usually correspond in quantity with the cream. An instrument has been invented, called the lactometer, by which the exact amount of the cream can be ascertained. It is simply a tube graded into 100 divisions. It is placed upright and filled with milk, and the number of divisions occupied by the cream indicates its proportion in 100 parts. The lacto-

scope is another instrument employed for the purpose of ascertaining the richness of the milk. It consists of two concentric tubes, which move upon each other. Milk which we wish to examine is poured within the tubes sufficient to obscure a light viewed through it, three feet distant. The column of milk is then diminished, till the light begins to be visible. The size of the column indicates the degree of opacity and the richness. The lactoscope was invented by M. Donné, and is described by him.

Dr. Minchin recommends a simple mode of determining the richness of cow's milk, and it would equally answer for the breast-milk. A vessel holding about one ounce, and containing a graduated enamel slab, passing diagonally from above downward, is filled with milk. It is then covered with a glass slide carried over it in such a way as to exclude bubbles. The number of degrees which can be read, indicates the character of the milk, as regards its richness.

Examination of the milk with the microscope not only enables us to determine whether there are abnormal corpuscles or granular elements, but also its richness. It should be examined before the cream has separated. Oil-globules of small size, and few, indicate poverty of the milk; very large oil-globules are said to indicate milk which is apt to be indigestible, especially in feeble infants. Such are the free globules of the colostrum. Numerous oil-globules of medium size indicate nutritious milk. Vogel, in 1850, made the discovery of vibriones in human milk. The fact is established that these animalcules may be generated in the milk within the breast, though such cases are not frequent. Dr. Gibb describes a case which he met. (*Ranking's Abstract*, vol. xxxiv.) An infant, seven weeks old, wet-nursed by its mother, who had the appearance of perfect health, was, nevertheless, ill-nourished and emaciated. It had no diarrhœa or other apparent disease, and the milk was therefore examined. Vibriones baculi were found in the milk immediately after it was obtained from the breast. The milk had the usual amount of cream, and seemed, to the naked eye, of good quality. According to Dr. Gibb, two genera of microscopic organisms occur in the milk, namely, vibriones and monads. It is believed that the monads occur in consequence of fermentation of the sugar and the production of lactic acid. Vogel also attributed the production of the vibriones to fermentation occurring in consequence of heat and congestion of the breast, connected with sexual excitement. This explanation is probably not correct, because vibriones sometimes occur when there is no unusual heat of breast, and no evidence of fermentation. The fact that such organisms may be found in milk which seems of good quality to the naked eye, affords additional proof of the usefulness of the microscope in the selection of a wet-nurse.

Many wet-nurses have a return of the menses as early as the fourth or fifth month after delivery. The re-establishment of this function in some women impairs the quality of the milk, so as to render it less nutritious,

and perhaps less digestible during the time of the catamenial flow, as we have stated in a preceding paragraph. In the selection of a wet-nurse, then, preference should be given to one who does not have the periodical sickness, but if she be already employed, and give satisfaction, the reappearance of the catamenia does not indicate the need of the change of nurse, unless the digestion of the infant be disordered, or its nutrition be impaired.

In the selection of a wet-nurse, attention should also be given to her mental and moral traits. Cheerfulness, affection, veracity, and a proper appreciation of the responsibility of her situation, enhance greatly the value of a wet-nurse. Not less important are habits of temperance and cleanliness. I could cite cases of the most melancholy results from the absence of these traits. In one case, idiocy resulted from an infant falling upon the pavement from the arms of a reckless or intemperate wet-nurse.

In most cases, the mode of examination indicated above suffices to show the character of a wet-nurse, so far as her health and milk are concerned. It should be borne in mind, however, that the microscope does not always reveal deleterious properties in the milk. Elements which are in a state of solution, and are invisible, may occur in excess, so as to impair the quality of the milk and render it indigestible. The following case, in which the saline ingredients seem to have been in excess, is related by Dr. Hartmann (*British and Foreign Medical Review*, vol. xii.) : "An infant, whose mother was in good health and had borne several children, exhibited a healthy appearance for the first five weeks after birth. The alvine evacuations then became copious, fluid, and discolored, and the child lost flesh and strength. After the usual remedies had been vainly administered for a fortnight, the mother remarked that the child did not take the right breast willingly, and so much did the unwillingness increase, that at length the mere application of the nipple to the child's lips occasioned loud crying. On examination it was found that the milk of the right breast had a distinctly saline taste ; whereas the milk of the opposite breast was of the ordinary sweetness ; no difference of consistence or color was discoverable. From that time the child was only allowed to nurse the left breast, and in a few days all diarrhœa and sickliness of appearance vanished." In this case there was no appreciable disease of the breast, although its secretion was perverted. The deleterious character of the milk was discovered, not by any change in its appearance, but by the taste.

It is obviously very necessary, before recommending a wet-nurse, to ascertain whether she will probably furnish sufficient milk ; for however excellent she may otherwise be, if she do not satisfy the wants of the infant she obviously should not be employed. The only certain way of ascertaining whether she have or have not sufficient milk is by weighing

the baby before and after the nursing, and observing whether the difference in the two weights corresponds with that given in the tables in Chapter VII.

CHAPTER VI.

COURSE OF LACTATION—WEANING.

After the birth of the infant, the mother needs rest a few hours—four or five, or a little longer in tedious and exhaustive cases—and then it should be applied to the breast. There is frequently a little milk at this time, and the act of nursing promotes the secretion, and increases the quantity. The full secretion is not, however, established before the third day, and though the infant be applied to the breast often, it obtains but little milk. Infants are so constituted that they require but little food until it is naturally provided for them, and the common practice of feeding them to repletion with various sweetened mixtures almost as soon as life begins, because they obtain little breast milk, is to be deprecated. Filling their stomachs in this way has a tendency to prevent their drawing upon the nipples with the avidity, which is required to stimulate a free flow of milk. Besides, as I have many times observed, indigestion, diarrhœa and sprue, are common results of this injudicious feeding. If, therefore, the infant be applied to the breast every second hour when the mother is awake till the third day, and be fed nothing besides, there need be no anxiety as regards its nutrition. If on the third day the breasts do not begin to fill, and the secretion be delayed, a little fresh cow's milk, diluted with double its quantity of warm water, and slightly sweetened, should be given every fourth hour, but should be withheld as soon as the flow of milk occurs.

Infants under the age of one month should nurse about every hour and a half by day and at longer intervals by night, or about ten times in twenty-four hours, for the stomach of the new born holds but little, and therefore receives but little at each nursing, and its digestion is active. The interval should be longer at night than in the daytime, so as to allow the mother more sleep. In the second month the interval should be about two hours, and it should be gradually lengthened as the age increases, so that after the fourth month nursing should be about every third hour, and after the sixth month, when the use of some artificial food is proper, every fourth hour.

The infant should be habituated to nursing at regular intervals, and when it is, it will ordinarily awaken at about the proper time. The practice on the part of the mother of applying the babe to the breast whenever it frets, and as a means of quieting it, although it have but just nursed,

is pernicious and should be forbidden. Giving the stomach no time to rest or filling it to repletion, tends to produce indigestion and diarrhœa, and to increase the fretfulness. The cause of the fretfulness should be sought for that the proper measures may be applied. In ignorance of the cause, it is better to quiet the restlessness by carrying the child, or even by rocking it, than to increase the task of the digestive function. Fretfulness of infants is often due to colic or griping in the bowels from gas or food that has not fully digested, and the addition of more food has a tendency to increase rather than to diminish it.

While regularity in nursing is required, still, as M. Donné has said, mathematical exactness in this matter would be ridiculous. Quiet natural sleep of a well-nourished infant should not be interrupted, in order to give it the breast, unless the sleep be unusually protracted. It will usually awaken when the system requires more nutriment. Ill-nourished infants often sleep but little, making known their want by crying and fretfulness, until they become wasted and prostrated, when they are drowsy in consequence of passive congestion of the brain. This drowsiness is evidently a pathological symptom. It shows the need of increased nutrition. It is due to scantiness of milk or milk of poor quality, and the infant should be aroused frequently for the purpose of giving it nutriment or even stimulants. The breast milk is sufficient for its nutrition till the age of six or eight months, provided it is abundant and of good quality. Therefore, if the mother be strong, and experience no exhaustion from suckling, no other nutriment need be given till that age.

Many mothers, however, by the third or fourth month of lactation, find that they have not sufficient milk to meet the wants of the infant. The constant drain upon their systems sensibly impairs their health. In such cases it is proper to commence with a little feeding from the spoon or bottle, and increase the quantity given as the infant grows older. Great care is, however, requisite in the preparation of food for so young an infant, whose digestive organs are still feeble and easily deranged. In the country, where diarrhœal affections and the so-called gastric derangements are not frequent, the danger from artificial feeding is less than in the city, and in the cool months in the city the danger is less than in the summer season. Infants of the city, between the months of May and October, have a strong predisposition to diarrhœal attacks, the result of anti-hygienic influences which surround them. Errors of diet in their case readily provoke disease or derangement of the digestive organs, often of a severe and dangerous form. Moreover, experience has shown that artificial feeding, during the period when nature designed that they should be nourished by lactation, very commonly produces in the hot months more or less vomiting and diarrhœa, followed by emaciation and other evidences of mal-nutrition. Therefore an exception must be made, in case of the city infant, as regards the commencement of artificial feed-

ing. If it be under the age of one year, it should be nourished exclusively, or almost exclusively, at the breast during the hot months, when practicable, even if the mother suffer somewhat in her health from the constant drain upon her system. It should, however, receive the amount of nutriment which it requires, and, if there be not sufficient breast-milk, it will be necessary to supply the deficiency by artificial feeding. The reader is referred to Chapter VIII., for facts relating to the subject of artificial feeding.

No fixed rule can be stated in regard to the time when it is proper to allow artificial food in addition to the breast-milk. While robust mothers with abundant milk can satisfy their infants till the age of six or seven months, many begin to feel the drain upon their systems and have an insufficient supply by the third or fourth month, and it is necessary to supplement the nursing by the use of artificial food, a smaller or larger quantity, as the case may require. The deficiency may be supplied by the use of cow's milk, either employed alone or with barley or rice-flour, Liebig's or Ridge's food, or wheat flour prepared by long boiling, as recommended in Chapter VIII. At six months also, or even at four or five months, if the infant appear anæmic and ill-nourished, it may be allowed, occasionally, one or two teaspoonsful of beef-juice, expressed from slightly boiled beef, two or three times daily. At the age of eight months, semi-liquid food may be given. Pap, prepared with stale bread or a rolled soda-cracker, may also be given once or twice daily, between the times of nursing, and occasionally beef-tea or chicken-broth, thickened with cracker or bread, is taken with relish, and if well prepared and given no oftener than once or twice a day, it is commonly readily digested, while it is highly nutritious. If the quantity of breast-milk diminish, as it often does, toward the close of the first year, artificial food should be given oftener, so as to supply the deficiency. Solid food requires considerable development of the digestive organs for its ready assimilation. It should not, therefore, be given till the close, or near the close of the first year.

Weaning ought to take place, as a rule, between the ages of ten and twelve months. It is well, if the mother's health be good and her milk sufficient, to defer weaning till the canine teeth appear. The infant then, possessing sixteen teeth, is able to masticate the softer kinds of solid food. Weaning should be gradual. Mothers often speak of weaning on a certain day. They have given but little artificial food, and have suckled at regular intervals, till at a fixed time they have denied the breast altogether. This abrupt change of diet should be discouraged. It should only be recommended under peculiar circumstances. It is apt to derange the digestive organs, and it causes fretfulness and sleeplessness on the part of the infant for a week or more. Weaning should commence by feeding with the spoon, a little oftener through the day, and nursing less, and

by discontinuing the practice of suckling at night. The infant tolerates this gradual change of diet, while it rebels against sudden weaning, and by its fretfulness increases greatly the care and trouble of the mother. Nurslings in the city should not be weaned in warm weather, nor within a month immediately preceding it. If the mother's health fail, or her milk become deficient in the summer months, so that she cannot continue suckling, the infant should be sent immediately to the country, or a wet-nurse be employed. Many lives are sacrificed in consequence of ignorance of the danger of weaning under the circumstances mentioned. Severe diarrhœa, inflammatory or non-inflammatory, is apt to result. This subject will be considered elsewhere.

CHAPTER VII.

QUANTITY OF FOOD REQUIRED IN INFANCY AND CHILDHOOD.

There is no subject in the hygiene of infancy and childhood in regard to which so much ignorance prevails as the kind and quantity of food which is required at different ages. Physicians are frequently consulted in regard to the diet, and are expected to give full information in regard to the quantity as well as kind. As stated in a previous chapter, the only correct way of determining whether the mother or wet-nurse have sufficient breast-milk is by weighing the baby before and after the nursing, and comparing the difference with a correct standard.

A striking example, showing the need of more accurate information in regard to the dietetic requirements of children, occurred, not long since, in one of the New York criminal courts. The superintendent of a charitable institution was tried and sentenced to imprisonment for not furnishing proper and sufficient food to the children under his charge, and yet none of the summoned experts could state, except in a vague and general way, how much food a child of a given age needed. Impressed with the belief of the importance to the profession of more accurate information in regard to the quantity of food required by children to insure normal and healthy growth, I have prepared the following tables.

The belief that children on account of being so much smaller, require much less nutriment than adults, leads many astray. The following statistics, while showing how much food children need to do well and how much they receive in the large and well conducted institutions of New York city, will surprise such. The fact is, the digestion of children is more active than that of adults, and they suffer more from hunger if their meals be delayed beyond the usual time. Their tissues undergo more active molecular change than those of adults, so that they need more

nutriment for the waste, and they require additional nutriment for the purposes of growth.

It will be seen from the statistics that new-born infants require less milk than those who are older, and that, after the first month, the amount required is pretty uniform during the period of lactation.

For the purpose of procuring accuracy in the observations, I obtained Fairbanks' scales, weighing to the half drachm. The infants were accurately weighed before and after each nursing, and the artificial food was weighed before and after each feeding. In this way the quantity taken at each meal was determined. The weights used were avoirdupois. The observations were made, at my request, by Dr. Kate Parker, resident physician of the New York Infant Asylum, and by Dr. Chadbourne, resident physician of the New York Foundling Asylum, and I can vouch for their accuracy. The avoirdupois ounce contains 437.5 grains, and Dr. Chadbourne ascertained, by very careful weight and measurement, employing the metric system for its greater accuracy, that one fluid ounce of human milk, with a specific gravity of 1.031, weighed 451.9 grains. With these data it was easy to determine the quantity in bulk of the milk from its weight. The observations in each case extended through twenty-four hours.

TABLE I.—*Age; under Five Weeks.*

No.	Name.	Age.	No. of Nursings.	Milk Nursed in 24 Hours.		
				Quantity in Weight.		Quantity in Fluid Ounces.
				Oz.	*Dr.*	
1	Josephine Foley	17 d.	11	10	½	9.75
2	Henry Cunningham	16 d.	9	13	5	13.24
3	Henry Jackson	19 d.	9	10	3	10.07
4	—— Rake	5 d.	12	22	7	22.22
5	Henry Benton	6 d.	12	15	5½	15.25
6	Wm. Fletcher	5 d.	12	10	1½	9.88
7	Nora Hastie	14 d.	12	17	3	16.85
8	Carl Flask	5 d.	12	5	4	5.37
9	Clarence Humphrey	1 m. 5 d.	8	11	1½	10.84
10	Frederick Dighle	7 d.	12	14	4	14.08
11	Edward Stace	6 d.	12	8	1	7.74
12	Rosa Brown	3 w.	12	14	1	13.68

From these statistics it is seen that each of these infants, who were all under the age of five weeks, and all but two under that of twenty days, nursed in the average 12.41 fluid ounces of breast milk in twenty-four hours, and, as the average number of nursings for each during the day was 11.0, the quantity of milk received at each nursing averaged only a

little more than one fluid ounce (1.12), or, to state the result of these observations in a different way, in 133 nursings of 12 infants in the twelve hours of day and twelve of night, the total quantity of milk received was 148.97 fluid ounces with a daily average of 12.41 ounces for each infant, and 1.12 fluid ounce for each nursing. These infants were selected on account of their healthy condition, none of them showing symptoms of imperfect nutrition. They were selected as fair examples of healthy infants under the age of five weeks. The practical benefit from these observations is apparent. We can do no better than imitate what is natural in the feeding of infants, and if, for any cause, lactation of a newborn infant be prevented, it should not be fed more than one and one fourth ounces, each two and a half hours, of cow's milk, prepared as directed above, so as to resemble, as closely as possible, human milk. Newborn infants, deprived of the natural mode of feeding, are apt to be over-fed by anxious mothers, with the inevitable result of indigestion, diarrhœa, and unhealthy stools, colic and sprue. Statistics like the above may assist in correcting such error.

The average quantity of milk which these infants, who were all well-nourished, received in the twenty-four hours, was 24.65 fluid ounces. The quantity received at each nursing was 2.73 fluid ounces in the average. Comparing the statistics in the two tables, we find that infants in the first month require only half the nutriment which is needed in the subsequent months of the first year. In other words, the nursling, after the first three or four weeks, requires about one ounce of milk, for each hour between the nursings. If therefore it be bottle-fed, every third hour, with cow's milk, or other food, so prepared as to have about the same amount of nutriment as breast milk, three or three and a half ounces would be sufficient for each feeding.

TABLE II.—*Ages; from Five Weeks to Ten Months.*

No.	Name.	Age.	No. of Nursings.	Milk Nursed in 24 Hours.		
				Quantity in Weight.		Quantity in Fluid Ounces.
				Oz.	*Dr.*	
1	Agnes Sunkle	6 m.	8	26	1½	25.3
2	Jessie Bradley	4 m.	9	38	½	36.8
3	Walter Gorman	3½ m.	8	24	2	23.5
4	Lottie Brooks	7 m.	10	27	3½	26.6
5	Willie Leonard	5½ m.	11	28	7	28.0
6	John Clay	5 m.	10	29	7	29.0
7	Agnes West	3½ m.	8	19	2	18.6
8	Freddy Van Buren	2 m. 10 d.	7	24	4	23.7
9	Eddie Wilson	6 m.	10	12	4½	12.2

TABLE II.—*Continued.*

No.	Name.	Age.	No. of Nursings.	Milk Nursed in 24 Hours.		
				Quantity in Weight.		Quantity in Fluid Ounces.
				Oz.	*Dr.*	
10	Frank Smith	3½ m.	8	26	7	26.1
11	Sarah White	4 m.	8	23	5	22.9
12	John Gafney	9 m.	8	24	1½	23.4
13	Bernhard Joseph	7 m.	8	27	4	26.6
14	Thomas Cole	6 m.	10	26	6½	26.0
15	Astie Russell	6 m.	10	21	6	21.1

The following observations, relating to the diet of children who have passed beyond the age of lactation, were made in the New York Foundling Asylum, with all possible care in order to avoid errors. In this institution children are not stinted in their eating, but those who eat little are reminded of their remissness, and are urged to eat more, so that no one leaves the table hungry. On the day in which Dr. Chadbourne made the observations, vegetables, except potatoes, were withheld, so that computation of the quantity of food consumed would be more accurate.

TABLE III. — *Observations Relating to the Diet during Twenty-four Hours, of Twenty-eight Healthy Children, between the ages of Two and Three Years, with an Average Age of Two Years Eight Months.*

	Total Amount.	Average for each.
BREAKFAST.		
Bread	6 lbs. 4 oz. 1 dr.	3.5 oz.
Butter	13 oz. 5 dr.	.45 oz.
Milk	22 lbs. 14 oz. 2 dr.*	12.7 fl. oz.
DINNER.		
Meat	8 lbs. 0 oz. 5 dr.	4.6 oz.
Potatoes	6 lbs. 13 oz. 7 dr.	3.9 oz.
Milk	17 lbs. 9 oz. 7 dr.	9.4 fl. oz.
SUPPER.		
Milk	19 lbs. 12 oz. 1 dr.	10.5 fl. oz.
Bread	7 lbs. 1 oz. 2 dr.	4.0 oz.
Butter	14 oz. 7 dr.	.53 oz.

* 354.6 fluid ounces.

AVERAGE FOR EACH CHILD PER DAY.

Bread,	7.5 oz. avoir.
Butter,	.98 oz. "
Meat (beef),	4.6 oz. "
Potatoes,	3.9 oz. "
Milk,	32.6 fl. oz.

TABLE IV.— *Observations upon Twelve Children between the Ages of Three and Six Years: Average Age, Four Years Ten Months.*

	Total Amount.	Average for each.
BREAKFAST.		
Bread	4 lbs. 6 oz. 3½ dr.	5.86 oz.
Butter	5 oz. 2 dr.	.427 oz.
Milk	280 fl. oz.	23.3 fl. oz.
DINNER.		
Beef	9 lbs. 1 oz. 3 dr.	12.1 oz.
Bread	1 lb. 0 oz. 1 dr.	1.6 oz.
Rice	9 lbs. 12 oz. 7 dr.	13.0 oz.
Milk	112 fl. oz.	9.3 fl. oz.
Butter	2 oz. 2½ dr.	—
SUPPER.		
Bread	2 lbs. 4 oz. 1½ dr.	3.0 oz.
Butter	5 oz. 5½ dr.	—
Milk	192 fl. oz.	16.0 fl. oz.

AVERAGE PER DAY FOR EACH CHILD.

Milk,	48.6 fl. oz.
Beef,	12.1 oz. avoir.
Rice,	13.0 oz. "
Bread,	10.3 oz. "
Butter,	1.08 oz. "

TABLE V.—*Observations relating to the Diet of Twenty-four Children, Twelve Boys, Twelve Girls, between the Ages of Four Years and Ten Years: Average, Six Years Ten Months.*

	Total Amount.	Average for each.
BREAKFAST.		
Bread	7 lbs. 13 oz. 3 dr.	5.21 oz.
Butter	12 oz. 3½ dr.	.51 oz.
Milk	348 fl. oz.	14.5 fl. oz.

TABLE V.—*Continued.*

	Total Amount.	Average for each.
DINNER.		
Roast Beef	18 lbs. 11 oz. 0 dr.	12.46 oz.
Potatoes	15 lbs. 8 oz. 3 dr.	10.30 oz.
Bread	1 lb. 6 oz. ½ dr.	.92 oz.
Milk	192 fl. oz.	8.0 fl. oz.
Butter	4½ dr.	.012 oz.
SUPPER.		
Bread	6 lbs. 2 oz. 3½ dr.	4.1 oz.
Milk	384 fl. oz.	16.0 fl. oz.
Butter	11 oz. 5½ dr.	.16 oz.

AVERAGE PER DAY FOR EACH CHILD.

Roast beef,	12.46 oz.
Bread,	10.23 oz.
Potatoes,	10.3 oz.
Butter,	.99 oz.
Milk,	38.5 fl. oz.

Compare the above observations with those of Professor Dalton, who estimates that a healthy adult taking active exercise requires each day—

Meat,	16 oz.
Bread,	19 oz.
Butter,	3½ oz.
Water,	52 oz.

while one leading a sedentary life needs considerably less.

It will be seen by the above tables, that even more food appears to be needed during the period of childhood than in adult life. We would suppose this to be so without statistical evidence, for the active exercise, and rapid and progressive growth of this period would necessarily require a large amount of nutriment. Moreover while adults do well with solid food and water, statistics show that the best diet for children who have passed beyond infancy, is one of milk with solid food, for at least breakfast and supper.

Although we are able, by observations, to determine the average amount of food required in twenty-four hours, by children of various ages, it would be wrong to limit the diet to a fixed quantity, for some need more than others. A child should never go hungry after a meal. In some of the best conducted institutions of New York, the children eat of plain food all that they desire at each meal, while in other institu-

tions the food at supper is limited, but is abundant at the other meals. As children go to bed so soon after supper, it is proper to have this meal light, and of such food as is easily digested.

CHAPTER VIII.

ARTIFICIAL FEEDING.

Occasionally the mother is unable to suckle her infant, and a hired wet-nurse cannot be or is not obtained. Artificial feeding is then necessary. In the large cities, if I may judge from our New York experience, this mode of alimentation for young infants should always be discouraged. It generally ends in death, preceded by evidences of faulty nutrition. A considerable proportion of those nourished in this manner thrive during the cool months, but on the approach of the warm season they are the first to be affected with diarrhœa and other symptoms indicating derangement of the digestive function. In my opinion, based on a pretty extended observation, in New York city more than half of the artificially fed infants, who enter the summer months, die before the return of cool weather, unless saved by removal to the country. In the country, and in the small inland cities, the results of artificial feeding are much more favorable. The majority live, and in elevated farming sections, on account of the salubrity of the air, and the facility with which milk, fresh and of the best quality, is obtained, artificial feeding is attended by little risk.

Young infants, fed by the hand, obviously require food prepared so as to resemble as closely as possible the human milk. The basis of such food must, therefore, be the milk of some animal. The following table, prepared by MM. Vernois and Becquerel, gives the proportion of the ingredients of human milk, and the milk of the four domestic animals which is most easily obtained, and most frequently employed as food :

Composition of Milk.

	Specific Gravity.	100 parts contain		The solid components consist of			
		Fluids.	Solids.	Sugar.	Butter.	Casein and extractive matters.	Salts.
Human.....	1032.67	889.08	110.92	43.64	26.66	39.24	1.38
Cow.....	1033.38	864.06	135.94	38.03	36.12	55.15	6.64
Ass.....	1034.57	890.12	109.88	50.46	18.53	35.65	5.24
Goat.....	1033.53	844.90	155.10	36.91	56.87	55.14	6.18
Ewe.....	1040.98	832.32	167.68	39.43	54.31	69.78	7.16

Cow's milk is most readily obtained, and is commonly used as a substitute for human milk, compared with which it contains less water and sugar, but more butter, casein, and salts. Its composition, however, varies considerably, according to the food of the cow and other circumstances. The variations in the milk of the cow, according to the nature of its food, have been considered in a preceding chapter. It has been stated, also, that the milk first obtained in milking is most watery, since it is longer secreted than the last milk, or the "stripping." The stall-fed cow gives acid milk, while the cow grazing in a pasture gives milk that is alkaline. Again, the milk in the first months after calving is richer than after the lapse of several months.

It is obvious from the above facts, that the analyses of different specimens of cow's milk must differ greatly, and the same is true of the milk of the goat and ass, and probably of the ewe. In fact, different samples of the milk of the same animal may differ more from each other, in their chemical character, than the average milk of one animal from that of another.

The milk of the goat and that of the ass have been recommended as food for infants in preference to cow's milk, on the ground, as is alleged, that they more nearly resemble human milk. But by reference to the foregoing table, it will be seen that more importance has been attached to this supposed resemblance than the facts justified. Neither the milk of the ass nor goat, so far as its chemical character is concerned, would seem to possess any advantages over cow's milk. The ass's milk is procured with difficulty, and is seldom used. An objection to goat's milk is the unpleasant odor which it often possesses, due to the presence of hircic acid. It is stated, however, by Parmentier, that this odor is only noticed in the milk of goats that have horns. An important advantage, in the city, in the use of goat's milk, is that the animal can be kept at little expense, so that even poor families who are not able to purchase and feed a cow, can generally possess a goat from which fresh milk can be obtained at any time. Preference is to be given to goat's milk, when fresh, over cow's milk brought from the country, perhaps watered on the way, and several hours old when received. If, however, as both chemical analysis and experience show, goat's milk is no better as food for infants than cow's milk when fresh and from healthy cows, the latter must continue in common use for this purpose.

Milk used for infants should be alkaline or neutral. If it be decidedly acid, as shown by the proper test, it should be rejected; or, if there be none better, should be rendered alkaline by the addition of lime-water or carbonate of sodium. The nurse should test the milk at different periods through the day, and be taught to make the necessary addition. We often hear parents say with satisfaction that they obtain one cow's milk, but milk from several cows is, in my opinion, preferable, as a rule, as it is apt to give a better and more uniform average in its ingredients.

Milk should always be given at a uniform temperature, namely a little warmer than the body. Employed habitually too hot or too cold, it is apt to cause stomatitis, if not a more serious disease of the digestive organs. Infants sometimes take the milk more readily if a little sugar be added. Pulverized sugar of milk, kept in the shops, may be added, one teaspoonful to five or six ounces of milk, or cane sugar may be employed. In case of constipation cane sugar is preferable, as it is more laxative. If the milk produce symptoms of indigestion, the addition of a little salt is sometimes useful.

Infants under the age of six months should take food through the nursing-bottle at the temperature of about 98½°, and the bottle as soon as used should, with the India rubber tip and attachment, be put in a quart or two-quart bowl of cold water, to which a teaspoonful of bicarbonate of sodium has been added ; and this water should be drawn through the tube and nipple by suction with the mouth. As the infant under the age of one month, when in the normal state, nurses the breast about ten times in twenty-four hours, it should have the bottle about every two and a half hours. The stomach during the first six weeks of life is very small, resembling more a dilatation of the intestines than a separate organ, not receiving more than one or two ounces of liquid without distension. Therefore, while it is fed so often, it is evident that the quantity given each time should be small, and such as will be quickly digested and absorbed. In the first month after birth the cow's milk should be diluted with half its quantity or sometimes an equal quantity of water ; from the second to the fifth month, with one-third to one-fourth its quantity ; and after the sixth month it should be employed without dilution.

The shops contain many substitutes for human milk, but cow's milk, if it can be obtained fresh from healthy grass-fed or hay-fed cows, is to be preferred to any of them for ordinary feeding. Condensed milk possesses no advantages which render it superior to ordinary milk, if the latter can be obtained directly from the animal and sufficiently often.

When shall other food be allowed in addition to cow's milk, and what kind of food ? Cow's milk given unmixed with other kind of food, does not always agree with the infant. Possessing nearly the same chemical constitution as human milk, it nevertheless behaves differently, in some respects, in its digestion. The casein of human milk coagulates in light flocculi in the stomach of the infant, so as to be readily acted on by the digestive fluids, while that in cow's milk is apt to form large and firm coagula, which are with difficulty digested, and which, therefore, may cause colic and fever and make the infant restless, or cause vomiting, by which the mass is expelled ; or it may pass the bowels only partially digested, and appear in the stools as whitish masses.

An alkali taken with the cow's milk retards the coagulation of casein, and tends to prevent the formation of large and thick curds.

If therefore the child vomits curds, or passes fragments of them in the stools, or if the stools be acid, lime water may be added, or the carbonate of sodium as recommended by Vogel, who dissolves one drachm of the carbonate in six ounces of water, and adds a teaspoonful to the milk at each meal. A more effectual way to prevent the formation of large and firm caseous coagula, is to mix with the milk some bland and easily digested farinaceous food which, by mechanically separating the caseous particles, prevents the formation of large masses; and which, while it has nutritive properties, dilutes the milk and enables the digestive fluids to act more readily upon it, the desired effect is attained of facilitating digestion without impairing the nutritive properties of the milk.

The belief has prevailed in the profession, that infants prior to the third or fourth month can digest only a very small amount of starch, since the salivary and pancreatic glands, whose secretions convert starch into glucose, a necessary change in digestion, are almost rudimentary in the first months of infancy. In a monograph relating to *Infant Diet* written by Professor A. Jacobi, and revised, enlarged, and adapted to popular reading by Dr. Mary Putnam Jacobi, it is stated that the parotid glands which, together, weigh 80 grains at fifteen months, and 120 grains at two years, weigh but 34 grains at the age of one month. In several instances we weighed the pancreas taken from the bodies of infants who had died under the age of six months in the New York Infant Asylum. Its weight was very different in those whose ages were about the same; in several under the age of four months it was less than one drachm and in some more than one drachm; but in no instance did it reach two drachms. The submaxillary and sublingual glands, which also secrete a liquid that is designed to convert starch into glucose, are comparatively insignificant in young infants, so that the combined action of the parotid, submaxillary, sublingual and pancreatic secretions, must be inadequate for the saccharification of the starch which ordinary farinaceous food contains, during the first three or four months of infancy.

But it is now ascertained that the salivary and pancreatic secretions are not the only agents by which starch is digested. The mucous surface furnishes an "epithelial ferment, which assists in the change, so that the secretions from the buccal and intestinal surfaces materially aid in the digestion." (*Revue des Sciences Med.*, 1879, by Charles Richert); also remarks by Professor Flint Jr., in *Physiol. of Man.*

It appears, therefore, that young infants are able to digest a certain amount of starch, but a much smaller proportion than those who are older and the preparation of a farinaceous food in which saccharification of the starch is effected by a chemical process, and the delicate and easily deranged digestive organs of the infant relieved of the task, has long been a desideratum.

The late Baron Liebig, who devoted considerable time in the last years

of his life to the study of the food of infants, prepared such an article, widely and favorably known on both continents as Liebig's food. Hawley's Liebig's food, made by Dr. Hawley, of Brooklyn, has been in the shops for some years. More recently, Liebig's food made by Mr. Horlick, of Chicago, and that by Mr. Mellin, of London, which are nearly identical, have come into use. Being carefully prepared according to Liebig's formula, by chemists fully competent, they possess certain advantages, such as quick and easy preparation and a pleasant flavor, and are, therefore, highly esteemed by those who have employed them.

The accompanying statements show us the nature of Liebig's food, and the way in which it is prepared. Starch is transformed into sugar and dextrin, a change which, when farinaceous substances are used in the usual way, is effected in the system, and thus the digestive organs are relieved from a part of the burden of digestion.

"The following is the best way of preparing this food: Half an ounce of wheaten flour, and an equal quantity of malt flour, seven grains and a quarter of bicarbonate of potassium, and one ounce of water are to be well mixed; five ounces of cow's milk are then to be added, and the whole put on a gentle fire. When the mixture begins to thicken, it is removed from the fire, stirred during five minutes, heated and stirred again, till it becomes quite fluid, and finally made to boil. After the separation of the bran by a sieve, it is ready for use. By boiling it for a few minutes, it loses all taste of the flour." (London *Lancet*, January 7th, 1865; *Braithwaite's Retrospect*, July, 1865.)

This food, according to Liebig, furnishes double the amount of nutriment contained in milk; or, as he expresses it, is a "double concentration" of that secretion.

Dr. Hassell, in a communication in reference to this food to the London *Lancet* for July 29th, 1865, says: "It appears to me that the great merit of Liebig's preparation consists in the use of malt flour as a constituent of the food; this, from the diastase contained in it, exercises, when the fluid food or soup is properly prepared, a most remarkable influence upon the starch, quickly transforming it into dextrin and sugar, so that in the course of a few minutes, the food, from being thick and sugarless, becomes comparatively thin and sweet."

. . . "Correct and ingenious as are the principles upon which this food has been designed, yet the directions given for its preparation are certainly open to considerable improvement. Thus, Liebig directs that the malt should be ground in a common coffee-mill, and the coarse powder passed through a sieve. This necessitates the subsequent straining of the food, a tedious operation, in order to remove the bran and remaining particles of husk. And further, that the food should be put upon a gentle fire previous to its being finally boiled. Now, a gentle heat may mean almost any temperature nearly up to the boiling-point;

and since the action of the diastase is destroyed at about 150° F., the temperature should never be allowed to exceed that degree.

"I recommend, therefore, that the malt should be well freed from husk, and finely ground; that the wheat flour should be lightly baked; and finally, that a thermometer should be employed in the preparation of the food. Indeed, in some samples recently submitted to me by Messrs. Savory & Moore, I find that the first two points have been attended to, and that they use malt freed from husk and finely ground, and the wheat flour baked.

"The effect of baking the wheat flour is to partially cook the starch entering into its composition, so that less heat is required in the preparation of the liquid food. I find that a temperature ranging between 140° and 148° is amply sufficient to effect the complete transformation and solution of the starch-corpuscles, and, indeed, to cook the food sufficiently."

Dr. James S. Hawley, who has given much attention to the preparation of Liebig's food, and who now furnishes the market with it, says: "The principal objection which has been urged against Liebig's food is the difficulty of its preparation. This objection certainly did lie against the process recommended by its author, and against many of the directions since proposed. But . . . the simplest form of cooking is all that is requisite. This consists in mixing the dry food, properly compounded, with milk or water (better milk), and slowly bringing it to a boil with frequent stirring; or heating it until it begins to thicken, then remove it from the fire and stir until it grows thin, and repeat this process two or three times. At the close of the process it will be quite thin and sweet. No food can be cooked in a simpler manner than this. This dissolving of the thick, hydrated starch is itself the evidence of the transformation of amylum into glucose. It is not claimed, that by this simple method, *all the starch* is converted, but that its percentage is very greatly diminished, sufficiently so to afford abundant assimilable nutriment to the infant, and also to avoid the dangers and inconveniences arising from the presence of indigestible matter in the intestines."

Liebig's food if given in considerable quantity, is laxative, from the large amount of grape sugar which it contains, and therefore, while useful in a constipated habit, it cannot be recommended, unless in small quantity, for infants who have a tendency to diarrhœa.

Milk should, however, be the chief article of food during the first year, and one of the chief during the whole period of infancy, but after the age of six months, it is proper to allow some solid food. The quantity of solid food should be increased and that of milk diminished as the infant grows older, but during the second and third years as well as during the first, milk should be allowed each day at, at least, certain of the meals. At the age of twelve months the artificial food already mentioned may

be made of greater consistence, so as to be given with the spoon. Crumbs of stale bread broken up should be boiled in water sufficient to cover them, for one or two hours, then removed, and to the pulp fresh milk be added. This may be given one or more times daily in addition to the nursing, care being taken that all lumps be reduced to a pulp. Beef tea is laxative, on account of the salts which it contains, as is also chicken tea ; but a small, or moderate amount of it may be given once a day. Stale wheat bread or soda cracker should be crumbled in it and soaked, so as to be soft. If there be diarrhœa, the ordinary beef tea should not be allowed to young infants, on account of its laxative effect, but the expressed juice may be given instead. Few vegetables are proper for infants under the age of one year, but the potato, baked and mashed so as to be like flour, may be given at the tenth or twelfth month. It contains a large amount of starch, but appears to be readily digested by infants of the age mentioned, if given once a day in moderate quantity, with a little butter and salt added. In the second year a greater variety of food may be allowed, but the full diet of the table must not be given till after infancy, or the age of three years. In the beginning of the second year the infant is weaned. He has twelve teeth, eight incisors, and four molars, which, with their broad surfaces, are designed for chewing. Let him have now, each day or second day, in addition to the food which has previously been employed, a small piece of roast beef, rare done and cut very fine. Other meat, as mutton, may sometimes be given instead. After the age of eighteen months, light puddings of farinaceous substances, properly prepared, as of rice and corn meal, are proper additions to the dietary.

All the teeth of the first set have appeared at the age of two years and five months, and the time has now arrived when a more marked transition may be made from liquid to solid food. Certain fruits may be allowed, even before this period ; as also the jellies of most berries, and of fruits, which being deprived of seeds and parenchyma are for the most part readily digested, while they give a relish to the farinaceous food with which they are eaten. Pastries as ordinarily made, whatever fruits they may contain, are too rich and indigestible for young children. The following judicious rule for the preparation of fruits for children, copied in popular treatises on hygiene of infancy and childhood, is from " Murray's Modern Cookery Book." . . . " Put apples sliced, or plums, currants, gooseberries, etc., into a stone jar, and sprinkle among them as much Lisbon sugar as necessary ; set the jar in an oven or on a hearth, with a teacupful of water to prevent the fruit from burning ; or put the jar into a saucepan of water, till its contents be perfectly done. Berries and fruits thus prepared, and the fruit jellies, are best eaten spread on bread and butter, or on soda crackers."

The shops contain various dietetic preparations which under certain cir-

cumstances may be employed in place of fresh milk. Among the best of these are the condensed milk, both the American and Swiss. Next is lacteous farina, Ridge's food and imperial granum.

CHAPTER IX.

BATHING, CLOTHING, SLEEP, EXERCISE.

Bathing is now recognized in all civilized countries as one of the chief promoters of bodily comfort and health. The first bathing of the infant, which is immediately after birth, should be in water at a temperature a little below that of the blood, namely, at about 96°, after which the general bath is inadmissible until the navel string is detached. In the infant, reaction of the surface when chilled is tardy and uncertain, and therefore there is great danger of catching cold when the surface is cooled by water, and does not quickly react. It is a matter of daily observation that infants become chilly and their extremities remain cool in a medium, whether air or water, in which older children and adults would have comfortable warmth. Therefore they are liable to contract bronchitis, sore throat, intestinal catarrh, or other inflammation, from very slight exposures. This fact must be borne in mind in considering the subject of bathing.

During the first year after the detachment of the navel string, the bath should be employed daily, but not longer than three minutes; during which time thorough ablution can be performed. Different authorities disagree in regard to the proper temperature of the bath during the first months of infancy. Steiner of Prague, a high authority in children's diseases, says, "During the first nine months the infant should have a daily bath a little above blood heat," . . . but most state a temperature a little below blood heat. In my opinion it should be 92°, which is considerably below blood heat, but which communicates a moderately warm sensation to the hand. After the age of ten months, or even of eight months for vigorous children, the temperature of the bath may be reduced to 90°, and it should not be lower than this during the remainder of infancy, or if it be used a little lower, care should be taken to produce reaction by brisk rubbing and exercise, after a short bath. At the close of infancy, namely at two and a half years, the temperature may be still farther reduced, but it should not, even for the most robust children of eight or ten years, be below 78°, which is recorded on our thermometers as the temperature of summer heat, and is about that of our northern lakes during midsummer.

The rules given in the books; not to bathe or direct a child to be bathed

immediately after eating, or after much exercise, when the pores of the skin are perspiring, should be heeded. The head should first be wet with the water, and Castile soap should be applied over the surface to insure cleanliness. The strongly scented toilet soaps sometimes contain rancid fats, or other deleterious substances, and should be regarded with suspicion. In hot weather a daily bath is advisable, but in the cooler months it is sufficient if the child bathe twice or three times in the week. If from lack of conveniences, or for other reasons, general bathing be dispensed with and the surface be washed from a basin or bowl, cooler water may be used than would be proper for the general bath, and a longer time to complete bathing would evidently be required. The bath-room should be comfortably warm, and after the bath, the surface should be briskly rubbed with flannel, or in case of the older children, with a suitable coarse towel, and exercise afterward encouraged to insure full reaction. In New York, in one of the largest and best managed asylums, both boys and girls are allowed to bathe, in bath houses, in the Hudson when the water and weather are not too cool.

It may be well to add to these general remarks on bathing the recent remarkable statement of a high authority on thermometric observations and temperature, that, during hot days, a bath in hot water, employed in the hours of greatest atmospheric heat, tends to reduce the heat of body and to preserve its normal temperature during the remainder of the day. Wunderlich, says "in tropical countries and in very hot seasons, no means of cooling is so lasting as a bath or douche of very warm water."

Clothing.

One of the most important duties of the mother or nurse is the selection of clothing for children which will be suitable for their age and the season. In the matter of dress, as in that of diet, many errors are unconsciously committed. In a room of proper temperature, which during the cool months should be 70° for infants and 68° for children old enough to run about, the head should never be covered unless in case of young infants, but the sides of the head as well as the neck and shoulders may be lightly covered in sleep. It is the common practice to leave off the "belly-band" which is applied after birth, when the infant has reached the age of three or four months, but from the fact that infants so often take cold, especially at night by throwing off bed clothes, both in cool weather, when the temperature of the apartment may fall below 70°, and in summer when there are currents of air through open windows, I advise the continuance of the band during the first year or eighteen months. In the summer it should be made of light merino, and in the winter, of flannel. It should never be so thick and heavy as to be uncomfortable, or so snug as to interfere in the least with the free movements of the chest and abdomen in respiration. It should extend to and not over the ribs, and

should be secured either with safety pins or a few stitches. If excoriations or prickly heat appear on the skin under the band in hot weather, a very common eruption in infancy, the surface should be dusted with subnitrate of bismuth, or a mixture in equal parts of lycopodium and oxide of zinc, and a single layer of linen should be applied over it and under the band. If the eruption be severe, it might be best to substitute a linen or soft muslin band for a time in place of the merino.

A cardinal principle in the clothing of children is that the garments should always be so loose as not to interfere in the least with the functional activity of organs. The fitting and putting on of the dress is left too much to the discretion of the nurse, who is usually ignorant of the important facts in physiology, and unwittingly and with the best intentions, injures her charge. I have often interposed to loosen the dress of young infants, which was so tight as to sensibly embarrass respiration, and the case of a new-born infant has been reported to me in which it seemed probable that death resulted from this cause. Infants especially, who are so liable to pulmonary collapse and intestinal hernia, should have loose covering of both chest and abdomen. Pressure over the stomach always feels uncomfortable, and this organ, almost as much as the lungs, needs full expansion and free movement, in order to perform its function of digestion properly. The same is true also of the intestines, but they tolerate compression better, and their movements are less impeded than those of the stomach by too tight dressing. Another part, where too snug an application of the dress does very great harm, is the neck, since moderate pressure in this region may retard the circulation of blood through very important vessels, namely, those which supply the brain, or return blood from this organ. The dress about the neck should always be so loose that the four fingers of the nurse can be readily introduced underneath it. Skirts upon girls are sometimes supported by being tied tightly around the waist and over the stomach. This should never be allowed, but they should always be supported by shoulder straps, and be loose around the waist.

Clothing protects the body according to its thickness and the feebleness of its conducting power of heat. Woollen, fur, and feather garments have very low conducting power, and wool, from its plentiful supply and cheapness, must always be the material which is chiefly worn in the winter season, while cotton, and in still greater degree, linen, are active conductors of heat, allowing its quick escape from any part of the body which it covers, and they are therefore the proper material for summer clothing.

The color of a garment matters little as regards the escape of heat from the body, for whatever its color its surface next the body is necessarily dark from the exclusion of light ; but the color is important as regards the absorption of heat from the atmosphere and the solar rays. Black

has the highest absorptive power, while white has the least, and the mixed colors have absorptive powers which are intermediate. In experiments made of shirtings of different colors, while white received 100° F. black received 208° F. A light color is therefore the best to dress children in during the hottest weather.

The covering which is proper for the head of a child when outdoors, must evidently vary considerably in different seasons, and in different states of weather. Many a young child, with scanty growth of hair, has contracted that painful disease, inflammation of the ear, followed perhaps by a protracted discharge, and more or less impairment of hearing, in consequence of taking cold from insufficient covering of head and ears in inclement and changeable weather ; even leaving off accidentally a band or tie to which a child is accustomed will sometimes give it a cold.

In this connection, I wish to call attention to the common and dangerous practice among the poor of allowing children to go bareheaded in the sun during the season when the atmospheric heat is highest. Not a summer passes in which I do not meet cases of inflammation of the brain, which I believe to be largely due to exposure to the sun's rays. There is no better and safer covering of the head of a child, who is allowed to go in the open air during the hot weather, than the light, cool, and inexpensive straw hat.

The feet should always be warm and dry, the shoes worn in wet weather being water-proof ; and special care should be taken in the selection of shoes, that they be pliable and loose, so as to allow freedom of growth, without compression of any part. If during the period of growth proper precautions are taken in this respect, the chiropodist would have little to do in subsequent years. Corns, bunions, and in-growing toe-nails originate from shoes hard and unyielding, or too tightly fitting.

Sleep.

The new-born infant requires from fifteen to eighteen hours' sleep each day. If it do not have this, and be wakeful, it is probably not well. It sleeps therefore most of the time when not awake for nursing, bathing, and change of clothing. As it grows older, a less and less amount of sleep is required. At the age of three years, about nine hours of sleep are needed, and it is better, in my opinion, for healthy development, to allow children of this age one or two hours of sleep in the middle of the day. They indeed often take it by falling asleep on the sofa, or floor, or in places where they are liable to take cold through currents of air and scant covering, if not heeded.

Much harm has been done to children who were wakeful by nurses, and mothers too, who have given them active and dangerous drugs, as laudanum or morphine, under some enticing name as soothing syrup or cordial. A wakeful and fretful child is not well. Its ailment may be

trivial or grave, but it should never, under such circumstances, receive from mother or nurse any of those proprietary mixtures, having seductive names, which the shops contain. If it need medicine, it should be examined and prescribed for by the physician. It is scarcely necessary to call attention to some accepted and important facts regarding the dormitory of children. A free ventilation is required, either through ventilators or open windows, and a sufficient number of cubic feet of air should be allowed for each sleeper. A small room should not contain more than two children. Curtains should not as a rule be employed, and no open vessels of foul water should stand in the room, or anything else which may contaminate the air. The garments worn through the day must be entirely removed and hung up away from the bed.

In the asylums of New York, where from long and abundant experience the management of children is systematized, infants and the younger children are usually put to bed between six and seven, and the older children between seven and eight o'clock ; the last meal or supper, as I have stated elsewhere, being light and easily digested.

Exercise.

Exercise is an important hygienic requirement. Harm often results from modes of exercise which are not adapted to the age. Occasionally I meet cases of permanent bow-leg, which have manifestly resulted from attempts to make the infants stand at the age of four or five months. They should never be encouraged to walk or stand till about the age of one year, and if they do at the age of nine or ten months let it be voluntary, and not taught by standing them upon their feet. In case of infants with rachitis, which disease is common in the cities, and is characterized by a lack of lime-salts in the bones, and can be detected by great backwardness in teething, attempts to stand or walk for any length of time should be discouraged, till by the use of lime-salts and cod-liver oil, and improvement of the general health, the rachitis is cured. Much of the permanent deformity which mars the beauty and symmetry of adult life originates in rachitis and might have been prevented.

The infant before he is old enough to stand takes sufficient exercise in a way that is natural and harmless. Let him lie upon his back in the crib, or on the floor, with a blanket under his body and a pillow under his head, and all his clothes loose, so as not to restrain the free movements of his limbs. A healthy infant seems to enjoy this attitude, moving all his limbs sufficiently to give them the required exercise, and evincing his delight and exuberance of life by utterances which are as expressive as words.

In the cool months of our latitude, infants should not be taken out-doors until the age of three months, and then only for a brief time in the warmest part of the day ; but in the summer they should begin to receive

out-door air and exercise at the age of one month. In warm weather the face should never be covered by a vail or otherwise, and air and light should have free access to it. The rays of the sun, however, from a clear sky, should be excluded either by a parasol or the shade of trees or houses, or by the carriage in which the infant is carried. In cold weather, or when there is a strong wind, the protection of a vail is needed. Rude tossing of infants, which is common in families, should always be forbidden. Its effect on the cerebral circulation is likely to be bad, and it involves risk of a serious accident. In one instance to my knowledge, death resulted from injury received in this way.

Walking, as it is the natural, so it is the best, exercise for the older infants and during the period of childhood. It promotes digestion when not carried to the extent of fatigue, and gives gentle exercise to all the muscles. The baby-carriage answers a useful purpose, when combined with walking. With the ordinary hired nurse it is safer for the infant to be taken out in this vehicle than in the arms, for if the nurse in careless walking should trip, great harm might result. In one instance which came under my notice convulsions and idiocy were plainly referable to the fall of an infant from its nurse's arms upon its head.

The ordinary lawn sports of childhood, as croquet for both sexes, playing ball or quoits for boys, which are rendered more exciting by the spirit of rivalry, are also useful for muscular exercise and development, while they involve little danger. The swing affords a pleasant exercise, and with the propulsion required it gives gentle but efficient activity to most of the muscles.

Many of the gymnastic exercises are too severe, involve too much risk of ruptured tendons, sprained joints, and even of dislocated or broken limbs.

Among all the ingenious inventions to provide sports and pastimes for children, there are none better than gardening and farming, where facilities will allow it, conjoined with the ordinary household duties. The healthy and robust development of the farming population, their almost complete immunity from rachitic and scrofulous ailments, is attributable to their out-door mode of life, and the many kinds of healthful work which farm life requires. Such work is always in the highest degree beneficial for children old enough to participate in it, while it develops the habit of productive industry.

CHAPTER X.

ACCIDENTS AND AILMENTS INCIDENTAL TO THE BIRTH OF THE INFANT, AND DETACHMENT OF THE CORD.

Apnœa (Asphyxia) Neonati.

In the healthy infant, born under favorable circumstances, the two important functions of life, respiration and circulation, are established within the first minute. But it not infrequently happens, in consequence of some unfavorable circumstance, that the heart and lungs cease to act, and the infant at birth lies motionless as one dead. Sometimes in these cases an occasional pulsation of the heart can be detected when the fingers press under the left ribs, but there is no respiration. According to the nature of the cause, the surface is exsanguine or cyanotic and livid.

Causes.—These are various. The fault may be partly in the infant; it may be feeble in its development; but the common causes are compression of the cord during birth, from breech presentation or otherwise; powerful, frequent, and long-continued uterine contractions, often induced by ergot, but sometimes occurring normally, which compress the placenta, and consequently obstruct the fœtal circulation; detachment of the placenta before birth, and protracted labor, from pelvic malformation or otherwise, even when there is no unusual severity of the pains.

Treatment.—Obviously the treatment must be prompt. Mucus should be removed from the mouth and fauces with the finger, and except in those cases in which there has been placental hæmorrhage or anæmia from other causes, as exhibited by pallor of the surface, a few drops of blood should be allowed to run from the cut extremity of the cord. The flow induced, aids in establishing the circulation, and, in the large proportion of cases, in which there is congestion of the internal organs, gives partial relief to it. Brisk rubbing of the body, slapping the buttocks, blowing in the face, sprinkling water upon it, alternately transferring the body from a tub of hot to cold water, may be tried in quick succession, and, if there be no signs of returning animation, no time should be lost in resorting to artificial respiration.

The child should be placed on its side upon the edge of a table, with a blanket underneath it, and the head in such a position that the epiglottis falls forward; a towel or napkin should be placed over its face, having a hole of sufficient size to blow through, corresponding with its mouth. The physician, compressing firmly the epigastrium with his thumb, blows a full

breath through the hole. A little of the air, notwithstanding the compression, enters the stomach, some may escape by the nostrils, and the rest enters the lungs. Immediately, the hand passing from the epigastrium to the thorax, compresses it gently, though with sufficient force to produce expiration. This should be repeated six or eight times per minute. The action of the heart, previously slow, becomes quicker by the artificial respiration. I have been able to produce pulsations by this method when the heart had ceased to beat for a considerable time, and death, to all appearance, had occurred. Some recommend placing the infant on the right side, on account of the position of the valve between the auricles, but I think it is better to change it from one side to the other, in order to prevent congestions, which are so apt to occur when the circulation is imperfect. The circulation always commences sooner than respiration. The first respirations are mere gasps, not more than one or two per minute in cases of decided asphyxia, but as they become more frequent, they are also deeper.

Artificial respiration should be continued fifteen or twenty minutes in cases, in which no action of the heart can be detected, by pressing the fingers under the ribs, when, if there be no signs of returning animation, the case is hopeless. If there be any pulsation, however feeble, we should not cease in the attempt at resuscitation. Some prefer insufflation through a tube (as the segment of a catheter) introduced into the larynx, and pressure upon the thyroid cartilage so as to close the pharynx, instead of upon the epigastrium. The principle of treatment is similar, but the mode which I have recommended above I have found successful beyond expectation. Thus, in one case in my practice in which pulsation in the umbilical cord had ceased from ten to fifteen minutes before birth in consequence of its prolapse, I employed artificial respiration nearly a quarter of an hour before there was any appreciable pulsation, but by perseverance the circulatory and respiratory functions were fully re-established, and the child lived and was vigorous. When respiration commences, insufflation may cease, but it is proper to aid the respiratory movements a little longer by compressing the thorax after each inspiration. Still, the physician may be disappointed in the result. In not a small proportion of cases the respiration continues gasping, and after a few hours, perhaps even a day, death ensues. I have made post-mortem examinations of several infants who have died under such circumstances, chiefly in the Nursery and Child's Hospital, about six from recollection, and have found considerable uniformity in the appearance of the viscera. Only a small portion of the lungs, sometimes almost none at all, was found inflated, even when the cries had for a time been strong, and extravasated blood, usually in considerable quantity, lay upon the surface of the brain, evidently having escaped from the meningeal vessels, which were in a state of extreme congestion in consequence of the protracted or difficult birth.

Meningeal apoplexy, therefore, seems to me the chief cause of the ill success attending our efforts to save those who are so far resuscitated, as to be able to breathe.

Recently, Professor H. L. Byrd, of Baltimore, has recommended a simple mode of resuscitation. The physician places his hands under the middle portion of the back of the child, with their ulnar borders in contact, and at right angles to the spine. Extending his thumbs, he carries forward the two extremities of the trunk by gentle but firm pressure, so that they form with each other an angle of about 45° in the diaphragmatic region. Then the angle is reversed by carrying backward the shoulders and the nates. An assistant may aid by supporting the head. By alternating these movements, Professor Byrd has succeeded in effecting resuscitation when other methods had failed, and when so much time had elapsed that the case would seem hopeless to most practitioners. The name and position of Dr. Byrd commend this method to consideration and trial. (American Supplement of *Obstet. Journ. of Great Britain and Ireland*, 1873.)

Caput Succedaneum—Cephalæmatoma.

During the birth of the child, extravasation of blood not infrequently occurs in the part of the scalp which presents. This results from the passive congestion, more or less intense according to the duration of labor and severity of the labor-pains, which occurs in the presenting parts, whether scalp, arm, or breech. CAPUT SUCCEDANEUM is the term employed to designate the swelling thus caused. Its seat is the loose connective tissue of the scalp external to the pericranium. The tumor is soft, painless, and usually located upon the occiput. It consists partly of extravasated blood, but largely of serum which has transuded from the congested vessels before that degree of congestion was reached, required to effect the transudation of the corpuscles. I have repeatedly had an opportunity to examine this tumor in stillborn infants brought from the lying-in wards attached to the Nursery and Child's Hospital, and have found when it was slight that it consisted almost entirely of serum, but ordinarily when dissected it presented the appearance of a bruise, with a large proportion of serum, the blood and serum infiltrating the scalp to a greater or less distance beyond the appreciable limits of the tumor. Caput succedaneum requires no treatment. As it lies in the loose connective tissue of the scalp, its liquid permeates the open connective tissue in every direction, and is rapidly absorbed, while the tumor disappears. The subsidence of the swelling is usually complete within forty-eight hours.

Occasionally blood is extravasated under the pericranium, detaching it from the bone. This occurs in connection with caput succedaneum, and is observed when the latter declines. The tumor thus produced is desig-

nated cephalæmatoma. It is situated upon the occipital or parietal bone, near the posterior fontanelle. Its base, corresponding with the denuded bone, is circular or oval, and it rarely crosses a suture. In exceptional instances two cephalæmatomata occur, located upon the occipital and one parietal or upon both parietal bones. The liquid, being surrounded by the firmly attached pericranium, does not escape into the surrounding tissues, as occurs in caput succedaneum, and is therefore more permanent. The tumor flattens slowly, and does not disappear till after several weeks. At the age of six months a slight prominence can sometimes be detected, indicating the seat of the tumor. As the pericranium elevated by the blood does not lose its vitality, it soon begins to produce bone, so that after some days a ring of new bone can be detected by the finger surrounding the base of the tumor, and on the inside of the detached membrane, a layer of bone is produced, thin at first and flexible, but gradually approximating the old bone, and becoming firmer as absorption occurs.

Some time since, a specimen was presented by me to the New York Pathological Society, showing this accident and the mode of cure. The child died about two months after birth, and the blood constituting the tumor, which had been in great part absorbed, was completely incased by the old bone below and the new thin formation above. The cavity at length becomes obliterated, and there only remains some thickening of that part of the cranium which corresponds with the location of the tumor.

CHAPTER XI.

OPHTHALMIA NEONATI.

This disease occurs in two forms, namely, the catarrhal and blennorhœal, and there are many cases which are intermediate.

Causes.—These are not the same in all cases. Exposure of the infant's eyes soon after birth to a bright light, catching cold, the introduction of a little of the vernix caseosa under the eyelids in the first washing, smoke, dust, and irritating gases, coming in contact with the eyes are recognized causes. Infants living in ill-ventilated and dirty apartments, having untidy clothing, with faces and bodies seldom properly washed, and attended by dirty nurses, are more frequently affected than those in the better walks of life, and better cared for. The disease is more prevalent in asylums than in private practice, for in the former the antihygienic conditions, which conduce to it, more frequently abound.

Blennorrhœal ophthalmia has been known to occur during epidemics of puerperal fever, probably from the epidemic influence, but a common cause is the introduction of a particle of infective matter under the lids

during birth, or subsequently by careless handling. But blennorrhœal ophthalmia is in a considerable proportion of cases produced by the action of those common non-infectious causes which have been mentioned above, and which in other cases produce a simple catarrhal inflammation. Why there is this difference in the effects of these non-specific causes is not known. In most cases ophthalmia neonati begins soon after birth, namely, by the third or fourth day, but it may not begin till in the second or third week.

Symptoms. *Blennorrhœal Form.*—In the beginning the palpebral conjunctiva is observed to be red, a little swollen, and its cutaneous surface presents a faint reddish tinge. Light appears to be painful, and the child is fretful and sleeps but little ; but the eye itself has its normal appearance. The progress of the disease, however, is rapid, and in twenty-four or thirty-six hours there is so much tumefaction that the upper lid extends over the lower, and it may be impossible to separate them sufficiently to obtain a view of the eye. The tumefaction is due to œdematous infiltration. The conjunctiva, both palpebral and ocular, now presents a deep red hue, is thickened and swollen, and numerous fine granulations appear upon it ; occasionally also flakes of very delicate pseudo-membrane can be observed in addition. There is an abundant production of pus of a creamy appearance, sometimes tinged with blood, which oozes out when the lids are separated. A critical period has now arrived, one which may involve the destruction of the cornea unless the case be promptly and judiciously treated. Indeed, the gravity of the disease relates chiefly to the state of the cornea, which up to the present time, notwithstanding the severity of the inflammation and the amount of surrounding infiltration, has remained transparent and apparently unaffected. But within another twenty-four hours the cornea may lose its polish, and grayish, opaque spots of softening appear upon it. Soon perforation occurs, the aqueous humor escapes, and the iris falls forward, closing the aperture and preventing further loss of the liquids of the eye.

I have observed destruction of the cornea and loss of sight chiefly, first, in cases of true gonorrhœal infection, in which there is the maximum amount of inflammation and tumefaction, extending even over the malar bone and supraorbital ridge, with marked redness and elevation of temperature of the lids : and, secondly, with a less degree of inflammation in those who were highly scrofulous. Attention, then, to the cornea is all-important, since it can usually be saved with proper treatment, although there may be so much purulent discharge and œdema that it may be impossible to see it for several days. Occasionally the cornea, instead of sloughing, becomes infiltrated to a greater or less extent, and ulcerates, but without perforation. As the patient recovers, cicatrization occurs.

The inflammation soon begins to decline. The swelling, heat, and redness of the lids and conjunctiva, and the granulations, gradually disap-

pear, and recovery is complete, except so far as the cornea may have been injured.

Catarrhal Form.—The inflammation is from the first of a mild grade, pertaining chiefly to the palpebral conjunctiva, with but a slight discharge of purulent matter, and with little swelling or increase of heat in the lids. Attention is directed to the complaint chiefly by the secretion which collects in the angles of the lids or upon their border. There may be slight intolerance of light, and ordinarily minute granulations appear upon the inflamed mucous surface. This form of the disease may disappear within a few days, or it may be protracted.

Ophthalmia of the new-born is contagious, sometimes highly so. It commences on one side, and, without precautions, commonly within a few days extends to the other.

Treatment.—As soon as the inflammation occurs, the opposite sound eye should be covered with a compress, kept in place by strips of adhesive plaster. This eye should be examined, however, once or twice daily, in order to detect the commencement of inflammation, and the bandage reapplied.

Catarrhal ophthalmia requires very simple treatment. Frequently bathing the lids with lukewarm water, or milk and water, so as to remove the secretion from between the lids, suffices in a large proportion of cases. In the severer cases, lead-water constantly or frequently applied to the exterior of the lids is useful. Among the poor, mothers ordinarily bathe the lids with breast-milk, and by this simple treatment effect a cure. If the inflammation should not abate soon by this treatment, a mild collyrium of one fourth grain of nitrate of silver to one ounce of water should be applied between the lids and allowed to run under them.

Blennorrhœal ophthalmia, on the other hand, requires prompt and judicious management. There is scarcely a disease in which delay is more disastrous.

The frequent removing of the pus is very important, which is confined in large quantity underneath the closely compressed lids, and by its pressure and irritation increases greatly the danger of destruction of the cornea. Therefore the lids during the height of the inflammation should be pressed apart every hour, so as to allow the pus to escape, and the space between the lids be freed from pus by a camel-hair pencil or a pledget of finely picked lint. Occasionally warm water may be thrown under the lids by a small glass syringe, to wash away pus and any flakes of pseudo-membrane. Probably two or three drops of carbolic acid to each ounce of water would be beneficial, from the known good effect of this agent on suppurating surfaces, but I have never employed it.

Medicinal applications to the inflamed conjunctiva should, in most cases, be mild, but should be frequently applied. I have used, in the treatment of purulent ophthalmia, as recommended by Professor Gross, a weak

solution of corrosive sublimate applied every three hours between and under the lids, the pus, so far as practicable, having been first removed by the brush and syringe. The following is the formula, and the result has ordinarily been favorable :

℞. Hyd. chlor. corros., gr. j;
Aquæ rosæ, ℥ ij ;
Aquæ, ℥ vj. Misce.

Still the beneficial result which I have observed from this collyrium, was no doubt largely due to the frequent removal of the pus, the importance of which cannot in my opinion be too strongly urged. In blennorrhœal ophthalmia, during the active period of the inflammation, with hot and swollen lids, a single thickness, or two thicknesses of linen, squeezed out of ice-water, and renewed every two or three minutes when they begin to warm, aids materially in subduing the inflammation, every moment of which, when the lids are much swollen, involves danger to the delicate cornea. This measure, therefore, which requires diligence on the part of the nurse, should be insisted on. As long as the cornea retains its transparency and polish, the eye is safe, but, as stated above, it is often difficult to obtain a view of it for some days.

The decline of the inflammation is gradual, but generally pretty rapid, yet several weeks may elapse before there is full restoration to the normal state. When the inflammation begins to abate, and the dangerous tumefaction has to a great extent subsided, a collyrium of one fourth grain of nitrate of silver to the ounce will expedite the cure.

Occasionally granulations remain upon the lids. If they do not diminish and disappear when the purulent inflammation has ceased, I would not practice excision, as recommended by Vogel, but, having everted the lids, apply a solution of nitrate of silver, five or ten grains to the ounce, to the granulations, each second day, and immediately wash away the solution by a camel-hair pencil with salt and water, and apply a little sweet oil before the lid is returned. If the granulations do not disappear with this treatment, they may be lightly touched with the smooth surface of a crystal of sulphate of copper, followed by the application of water and sweet oil. By this mode of treatment, employed from the commencement of the inflammation, a large proportion even of the severest cases do well.

Doctor O. D. Pomeroy, the experienced oculist, has kindly favored me with the following remarks relating to the treatment of this disease :

" The first indication of treatment is thorough cleanliness. The eyes should be washed out with tepid water, and salt—a drachm to the pint. This may be done every one, two, or three hours, according to the amount of discharge. The latter never should be allowed to remain in

contact with the cornea long at a time, on account of its excoriating effect. A soft, old linen rag or a soft sponge may be used to apply the salt water : an assistant separates the lids and the water is squeezed out of the sponge into the eye. A syringe is objectionable on many accounts ; one being that the poisonous matter may be thrown against the operator's eyes. Frequently the discharge may roll into stringy masses, requiring them to be wiped away by means of the soft rag.

" If the attack be mild, I would be very slow to order astringents or stimulants. Atropine, one grain to the ounce, used three or four times daily, must always be prescribed in any case whatever, for the corneal lesions are the only ones we fear. Acid carbol., two to four grains to the ounce, may be used several times a day with a view to gently stimulate the conjunctiva and destroy the poison. Binding up the sound eye is not much practised in infants ; it is difficult to keep the dressing on, and it does not always protect the eye ; further, the second eye involved is not, as a rule, as bad as the first one. After three or four days, if the discharge become very profuse, and the tissues have a relaxed look, astringents should be prescribed, but they should never increase the irritation, and should decrease the discharge. Arg. nit., gr. ss. to the ounce, may be used from two to four times daily. Aluminii et potas. sulph., gr. iv. to the ounce, may be employed for the same purpose, very freely. Zinc. sulph., gr. j to the ounce, may be also used in a similar manner. After a week or ten days, if the lids still remain swollen, and there be a profuse discharge, the lids may then be everted and stronger applications made. Arg. nit., five to ten gr. to the ounce, may be brushed on every second day ; carefully wash with salt and water before returning the lid to its natural position. Alum in saturated solution may be used in a similar manner, or acid. tan., gr. xx. to the ounce, or cupri. sulphat. in ten gr. solutions.

" *If the remedy do good to the eyes, continue ; if not, change to something else, and do not, on any account, over-irritate the eyes.*

" *Cold may be applied* in the earlier stages with tense, red, and swollen lids, and insufficient discharge, for one, two, or three days.

" The rule is to use the cold sufficiently to keep down any excess of inflammatory action. This may be known by diminished redness, heat, and swelling, and improvement in the appearance of the discharge. Cold applied about half the time is a good rule ; for instance, keep it on from fifteen minutes to an hour, then leave it off for the same time ; be guided by the exigencies of each case. *Scarification* of either the ocular or palpebral conjunctiva may be performed if necessary in the earlier stage if there be much swelling. The source of the injury to the cornea is from interference with its nutrition in consequence of compression and retarded circulation of the conjunctival and episcleral vessels, caused by the swelling. In scarifying the ocular conjunctiva, the incision should radiate from the corneal margin outward, and should not be deep, but

enough to cause pretty free bleeding. This should be encouraged by bathing with warm water.

"*When the cornea is threatened with necrosis or sloughing*, we may meet the indication as follows: the scarification already mentioned exerts a favorable influence, but if the lids be much swollen, perhaps impossible to evert, and likely enough in a spasmodic condition pressing upon the cornea, we may perform a canthotomy, that is, pass a stout pair of scissors into the external canthus and divide the commissure by one resolute cut extending to the bone. The bleeding resulting is of service, but the power of the orbicularis to exert pressure on the eyeball is temporarily broken, which is the main indication for the operation. The cornea should be carefully observed daily to see that there is no haziness or commencing ulcer, or even any abrasion of the epithelium, for the latter is often the first sign of a commencing ulcer.

"In case the cornea be seriously involved, especially if the eyeball be too hard or tender to the touch, and the patient be suffering unusual pain, paracentesis of the cornea should be performed. Unless the operator be very skilful, a spring speculum should be used and a fixation forceps to keep the eye steady. The cornea should be pierced near its periphery, and the broad cataract needle should be passed into the anterior chamber with its point well turned forward to avoid the lens. In this position it should be gently tilted, so as to make the wound gape, when the liquid slowly escapes; hold in this position until most of the fluid is evacuated, then withdraw the needle slowly to prevent prolapsus of the iris. This operation may be repeated every day or two if necessary. In an epidemic of purulent ophthalmia in young children, at the New York Foundling Asylum, I at first had a few cases of perforated cornea, but being more on my guard, I examined subsequent cases very carefully; when on the first signs of corneal trouble I performed paracentesis and did not afterward have a single perforation. However, the most careful attention will not always prevent trouble. One day you may find the patient doing well, and on the next the cornea may be perforated. It is well to remember that this is a very fatal form of eye disease.

"*Abstraction of blood by leeches* may also be practised. As a rule, however, this is not very frequently employed in young children. One leech may be used at about one inch from the external canthus, but frequently it should be removed before wholly filling, and the resulting hæmorrhage may be stopped by pressure or styptics. Repetition of the leeching is rarely required; but the leech may be applied again in twenty-four hours if the hyperæmia return. A membrane sometimes forms on the conjunction of the lid or globe, or both, which may or may not be true diphtheritic conjunctivitis. It is an open question where membranous conjunctivitis ends, and diphtheritic conjunctivitis begins. In either event stimulating applications must be interdicted, at least until the mem-

brane becomes thrown off. In other respects the treatment is similar to what has been already laid down. In Europe diphtheritic conjunctivitis is very fatal to the eye. In this country, for some reason not well known, it does not seem to be so fatal, although in a bad case here the eye is usually destroyed. When the eyes have nearly recovered from acute attack, a chronic conjunctivitis may result, even passing into a granular conjunctivitis or a true trachoma, when stimulating applications to the lids may be used, including atropine drops as a collyrium if there should be any photophobia or corneal trouble. If the child be of good constitution, however, and the general health be carefully preserved, this latter sequel to the disease does not often occur."

CHAPTER XII.

DISEASES OF THE UMBILICUS.

When properly managed, the cord desiccates and falls off between the third and ninth days. The nurse should not be allowed to oil it, which she will sometimes do unless forbidden, as this retards desiccation. If the dressing of the cord be allowed to remain wet from the urine or otherwise, it does not desiccate, but decomposes. This is not infrequent in poor, intemperate, and slovenly families. The decaying cord is apt to produce inflammation of the navel. Some Southern physicians, prior to the late war, attributed the prevalence of trismus neonatorum among the slaves to the lesion of the navel produced by this cause, the trismus being then essentially traumatic.

Inflammation of the Umbilical Vein and Arteries.

When the cord is ligated at birth, if the child be in its normal state, clots form in the umbilical vessels from the navel inward. Atrophy of the vessels follows, and by the twenty-fifth day they are represented by small, firm, fibrous cords. Sometimes, though rarely, a true phlebitis or arteritis occurs in these vessels in the first days after birth, due either to the low vitality of the child, and decomposition of the fibrinous plugs and gelatinous substance of the cord, or to the entrance into the vessels of purulent or decaying matter from the fossa of the umbilicus. We are sometimes able, by pressing along the abdominal walls toward the umbilicus, to squeeze out a few drops of tne decaying and purulent substance. The navel itself is usually inflamed at the same time. This is a very serious disease. Pus, with particles of disintegrated fibrin, is apt to pass along the vessels and enter the circulation, and, being intercepted in distant

parts, give rise to embolismal inflammations. In this manner, probably, several distinct subcutaneous inflammations and nodules of embolismal pneumonitis occurred in a new-born infant, which I attended in 1868. The infant belonged to a family highly scrofulous and prone to scrofulous inflammations. Umbilical phlebitis and arteritis are said to occur most frequently in lying-in institutions, during epidemics of puerperal fever.

Treatment.—In the manner already indicated we should attempt to press out gently any purulent and decomposing substance from the vessels, and the infant should be placed with its abdomen dependent, so far as it can be done without rendering it uncomfortable, so as to aid in the escape of the liquids by gravitation. The umbilical fossa should be kept clean, and warm water containing a little carbolic acid may be dropped upon it several times daily. The abdomen should be covered with a soft and warm poultice.

Inflammation and Ulceration of Umbilicus.

Inflammation of the umbilicus sometimes occurs in the new-born about the time of the detachment of the cord, or soon after. It probably results from uncleanliness, or carelessness in the management of the cord, by which irritating and decomposing substances remain in the umbilical fossa. Sometimes decomposing particles from the cord are the probable irritant. This disease is also most apt to occur in cachectic infants, or those of scrofulous parentage, whose general condition renders them liable to inflammations. The umbilicus becomes red, slightly swollen, and moist by a secretion. Often the inflammation remains two or three days in this mild form, receiving no treatment except from the nurse, and disappearing by the use of the dusting-powder, as lycopodium, which she employs. In other instances, it extends over a radius of an inch or even more, the walls of the umbilicus become swollen and infiltrated, and ulceration succeeds. The ulcer is circular, occupying the site of the navel, and is attended by a purulent discharge. The inflammation may now gradually abate, and the ulcer heal with a cicatrix in place of the umbilicus. But in other instances, especially if there be decided cachexia, the ulcer extends in breadth and width, till finally, in the worst cases, the peritoneum becomes involved, and perforation or peritonitis occurs, with death.

Under unfavorable hygienic circumstances the blood of the infant being vitiated, the ulcer may become gangrenous, or the inflammation may terminate directly in mortification, without the formation of an ulcer. In either case the prognosis is unfavorable. If a dark-brown slough occupy the site of the umbilicus, and a sero-sanguineous discharge exude from underneath, the common result is perforation, peritonitis, and death in from one to two weeks.

Treatment.—Inflammation of the umbilicus, if severe, and espe-

cially if attended by destruction of the tissues involved, rapidly reduces the strength. In such cases four or five drops of brandy should be administered every hour to two hours in the breast-milk.

In the simple inflammation the navel should be bathed with lukewarm water three or four times daily, and the ointment of the oxide of zinc be constantly applied; or if there be little or no discharge, the navel may be dusted with the powdered bismuth. In case of ulceration the navel should be gently washed three or four times daily with lukewarm water, to which carbolic acid is added—three or four drops to the ounce ; and if there be much inflammation, a light poultice of pulverized slippery elm should be applied in the interval, or if the inflammation be moderate, the balsam of Peru. If gangrene supervene, the parts should be frequently bathed with the carbolic-acid-water, and a cloth soaked with it be applied over them. The slough should be detached as soon as it is so far separated that its removal causes no hæmorrhage, after which the treatment for ulceration is appropriate.

Umbilical Granulations or Fungus.

When the cord falls, granulations sometimes sprout out from the exposed raw surface, and complete cicatrization is impossible till they are removed. They form a rounded mass of a pale reddish hue, at the centre of the umbilical fossa, bleeding when rubbed, and causing constant moisture of the umbilicus. The largest which I have seen had perhaps twice the size of a large pea, and they may be of any smaller size.

Treatment.—By pressing upon the umbilical parietes the tumor rises from the fossa, so that a silk ligature can be applied around its base, when the mass can be readily removed with the scissors. If the granulations be small, they may be removed by the scissors without the ligature, and hæmorrhage prevented by touching the surface with lunar caustic.

CHAPTER XIII.

UMBILICAL HÆMORRHAGE.

The granulations which have been described above occasionally cause considerable hæmorrhage when injured. The profuse and even fatal hæmorrhage which occurs at birth, or soon after, from too loose a ligature of the umbilical cord, or from laceration or other injury, is so well known, and its cause so apparent, that it need only be alluded to in this connection. Bouchut details a case in which death occurred even before birth, from this form of hæmorrhage. The child was attached to the placenta by a very short cord, which prevented delivery till it parted by the trac-

tion of the forceps. The bleeding from the umbilical vessels was so profuse, that the child was pallid and lifeless when born.

There is another form of umbilical hæmorrhage, cases of which have been from time to time observed for more than a century (one of the first on record was reported in the *Gentleman's Magazine*, April, 1752, by Mr. Watts, a physician in Kent, England), but little was done to elucidate its nature till three American physicians made it the subject of careful study, and the monographs which they have published upon it are the best which the literature of the profession affords. Dr. Francis Minot read his paper, containing the statistics of 46 cases, before the Boston Society for Medical Improvement, in April, 1852. Prof. Stephen Smith prepared his paper, containing the statistics of 79 cases, for the New York Statistical Society, in 1855. It was published in the *New York Journal of Medicine* for that year. Dr. J. Foster Jenkins presented his monograph as a report to the United States Medical Association in 1858, and it was published in the *Transactions* of the Association for that year. This paper is very valuable on account of its statistics, as the writer succeeded in collecting the records of 178 cases from medical journals, and gentlemen of the Association. These three papers contain nearly all that is known in reference to this disease.

Sex—Age.—Females are less liable than males to this hæmorrhage. In Jenkins's cases, 34¼ per cent. were females, 65¾ males. The following table gives the age at which the hæmorrhage commenced in 99 cases :

AGE.	NOS.
Under 1 day,	5
Under 2 days,	7
Under 3 "	6
Under 4 "	3
5 to 7 " (inclusive),	32
8 " 10 " "	25
11 " 15 " "	16
16 " 21 " "	4
56 "	1
	99

Ordinarily the bleeding commenced very soon after detachment of the cord, but in not a few the cord was still adherent.

Causes.—The common proximate cause is feeble coagulability of the blood. In the normal state, when the cord is ligated, the fibrin of the blood, which now ceases to flow in the umbilical vessels, forms coagula so firm that, by the time the cord is detached, hæmorrhage is impossible. But in the majority of those affected with this disease, the clots are so soft and loose that they do not present any effectual barrier to the pressure of blood, which therefore oozes through them or presses them away. This lack of coagulability is easily demonstrated, for if a little blood, as

it escapes, be caught in a vessel, it will be found to remain liquid a long time. This dyscrasia, or morbid state of the blood, which we therefore recognize as a chief cause of the hæmorrhage, does not have the same origin in all cases. It is sometimes due to inherited syphilis. The infant affected with it may be plump, and appear well at birth, but in most instances, when the hæmorrhage is to occur, it is puny and cachectic, exhibiting also local manifestations of the disease with which it is affected. Thus, in a case in my practice, the infant, puny, and apparently born before term, was observed to have several blebs of pemphigus on the first day, from some of which blood soon began to ooze, but the fatal umbilical hæmorrhage did not commence till after two weeks.

In about one-fifth of the cases ecchymoses or petechiæ have been observed upon various parts of the surface, affording additional proof of the general blood disease.

Jaundice is another cause of impoverishment of the blood in the newborn, and therefore of umbilical hæmorrhage. The writers who have collected records of the hæmorrhage, all remark the frequent occurrence of the icteric hue, both before and during the bleeding. It is not improbable that, in certain instances, the jaundice is hæmatogenous, arising from destruction of the red corpuscles and liberation of the hæmatin, a not unusual result of a profound dyscrasia, whether syphilitic or originating from some other cause. But in other, and probably most instances, the jaundice proceeds from the liver, and is the cause of the change in the blood. Thus, in five of Jenkins's cases, there was occlusion of the hepatic or common bile-ducts, and jaundice, from the presence of biliary acids in the blood, causes diminution in the amount of fibrin and red corpuscles. In the ordinary form of icterus neonatorum, the cause of which is found in the relative fullness of the capillaries and minute bile-ducts in the acini of the liver, the coagulability of the blood must evidently be impaired in proportion to the degree and duration of the jaundice.

Poor health of the mother, and impoverishment of her blood during gestation, whether from chronic disease, as tuberculosis, or anti-hygienic conditions, also cause impoverishment and diminished coagulability of the blood of the child, and are therefore causes of the hæmorrhage. The excessive use of diluent drinks or alkalies by the mother is believed by some to have a similar effect.

In certain cases the hæmorrhage is due to an inherited hæmorrhagic diathesis. In nine of Jenkins's cases the mothers were subject to menorrhagia, and liable to bleed freely after parturition, and from injuries ; and seventeen other mothers had each lost more than one infant from umbilical hæmorrhage. Probably in those cases in which the hæmorrhage commences before detachment of the cord, and external to its point of insertion, the hæmorrhagic diathesis is the main cause of the flow.

Although the cause of umbilical hæmorrhage in the majority of cases is

the vitiated state of the blood itself, observers, among others the late Sir James Y. Simpson, have met cases in which the hæmorrhage was referable to the state of the vessels. In order that the vessels be effectually closed by the fibrinous coagula, their walls should have their normal contractility, but this is in great part lost by inflammation (arteritis or phlebitis) which sometimes occurs in these vessels, as we have already seen. Inflammation, whether of artery or vein, causes thickening and infiltration of its parietes, loss of tone on the part of the fibres of which they are composed, and therefore a patulous state of the vessel. Moreover, the inflammation is apt to be suppurative, and the presence of pus in the vessel obviously hinders the formation of a firm and effective coagulum.

Symptoms.—Ordinarily umbilical hæmorrhage occurs without any premonition, but sometimes it is preceded by jaundice. Jenkins ascertained that jaundice was a prodromic symptom in 41 out of 178 cases, and besides the icteric hue, constipation, clay-colored stools, deeply tinged urine, etc., were sometimes recorded. Rarely colicky pains and vomiting preceded the hæmorrhage. The blood may be arterial or venous, or both. It oozes slowly or rapidly, rarely escaping in a jet, even when there is reason to believe that it is arterial.

Prognosis.—This is unfavorable. Statistics show that five in every six perish. The prognosis is most unfavorable when jaundice or purpura hæmorrhagica is present. Those are most likely to recover who have a healthy parentage, no obvious dyscrasia, and in whom the hæmorrhage occurs late, and is not profuse. The average duration of the hæmorrhage in 82 fatal cases in Jenkins's collection was three and a half days, the minimum being only three hours. After the arrest of the hæmorrhage, death may occur from exhaustion or the dyscrasia.

Treatment.—The treatment should be both constitutional and local. It is important, so far as time will permit, to treat the dyscrasia, and as the stools are apt to be constipated, a laxative is ordinarily indicated. A laxative is not only useful for its effect on the hepatic circulation, but as a derivative. Both Smith and Jenkins recommend calomel for this purpose. The modes of treating the bleeding parts have been various. Those most deserving of mention are the following : injecting a styptic into the open vessels, applying a styptic by compress or sponge to the navel, covering the navel with dry or wet plaster of Paris, constant pressure with the finger, which is tedious, but which maternal solicitude willingly provides, and lastly, the use of needles with ligature. All of these methods have been more or less successful in arresting the hæmorrhage, but the last is most effectual, though painful. Two needles should be passed through the umbilicus at right angles, and a waxed thread wound around each in the form of the figure 8. In four or five days the needles should be removed, and a poultice or simple dressing applied.

CHAPTER XIV

DIAGNOSIS OF INFANTILE DISEASES.

General Observations.

Diseases in early life differ in important particulars from those occurring in maturity. Some which are common in the former age are unknown or are rare in the latter, and those which occur equally at all ages often present peculiar symptoms and a peculiar clinical history in the young. Therefore physicians who are skillful in treating adults, may be unskillful in treating children. Excellence as a physician of children can only by achieved by special and continued study of their ailments.

Again, as regards the diseases of infancy, in which period there is a great amount of sickness and a large mortality, diagnosis must evidently be made from the objective symptoms; from examining the features, attitude, utterances, the pulse, respiration, etc., and inspecting the surfaces, so far as they are accessible to view, and the eliminated products. We lack for this age the important information which speech affords. Some general remarks, therefore, in reference to the appearances and functions of the system in early life, and the changes which they undergo in various pathological states, seem requisite, in order to a clearer appreciation of the symptoms, and more ready diagnosis of individual diseases.

Features, External Appearance of Head, Trunk, and Limbs in Disease.

In the new-born, as soon as respiration and the new circulation are established, the cutaneous capillaries become distended with blood, and the skin presents a congested appearance. By the close of the first week this external hyperæmia begins to abate, and is soon replaced by the normal capillary circulation.

Icterus is common in the first and second weeks. Bouchut attributes it to mild hepatitis. A much more plausible view of its causation, and probably the correct one, is that of Frerichs, who attributes it to the effect on the hepatic circulation of ligation of the umbilical cord. By ligation the current of blood through the umbilical vein to the liver ceases, the amount of blood in the hepatic capillaries, which connect with the branches of the vein, diminishes, and then, according to Frerichs, by the law of diffusion, diversion occurs of a part of the bile from the hepatic cells into the capillaries, while the rest flows in the normal manner into the

bile-ducts. The degree of jaundice is proportionate to the amount of bile which enters the circulation. Icterus neonatorum is ordinarily not a disease of importance. If the general health remain good, it subsides without medicine in the course of one or two weeks, when the circulation through the liver becomes equalized and regular.

The surface, or portions of the surface, of the new-born often present for a few hours a livid color, due to the mode of delivery. Protracted lividity occurs from atelectasis or malformation in the heart or great vessels ; lividity induced by exertion or excitement, while the respiration is normal, indicates malformation of the heart or vessels ; temporary lividity sometimes occurs in severe acute diseases, especially those of the respiratory organs ; lividity, whether temporary or permanent, is a sign of imperfect decarbonization of the blood.

The cheeks of children are congested in febrile and inflammatory diseases, except in a cachectic or prostrated state of the system. Transient circumscribed congestion of the face, ears, or forehead constitutes a reliable sign of cerebral disease. Strabismus occurring in connection with febrile reaction, oscillation of iris, inequality of pupils, and drooping of upper eye-lids, also denotes cerebral disease. The pupils are contracted during sleep ; evenly dilated in death.

Dilatation of the alæ nasi during inspiration, with contraction of the eyebrows and a countenance indicative of suffering, attends severe inflammation of the respiratory organs. Absence of tears during the act of crying shows a severe and probably fatal form of disease in infants over the age of four months.

Rapid wasting of the features, causing deep suborbital depressions, prominence and pointedness of the cheek-bones and chin, and hollowness of the cheeks, is a sign of a severe diarrhœal malady ; the most striking examples of this sudden collapse of features are afforded by patients affected with cholera infantum. In severe cases of this disease the physiognomy, from a state of fulness and health, presents in a few hours such a wasted and senile appearance that the friends with difficulty recognize the features with which they are familiar. Muscular tonicity is also greatly impaired in this disease, that of the orbicular muscles of the lips and eye-lids to such an extent that the mouth is open and eyeballs exposed during sleep. Great emaciation occurring gradually, is a symptom of subacute or chronic disease of a grave character, often of tuberculosis or chronic entero-colitis.

Strabismus sometimes occurs in children who have no serious disease. It is then due to simple paralysis of one or more of the motor muscles of the eye. But when supervening upon other symptoms of a neuropathic character, it is a grave symptom, indicating organic disease of the encephalon, as effusion, meningitis, etc. A permanently downward direction of the axes of the eyes, with smallness of the face and great expan-

sion of the cranium, is a sign of congenital hydrocephalus. The scalp in this disease is tense, bald, or sparingly covered with hair, the fontanelles and sutures open and enlarged, and the cranial bones yield to pressure. Great expansion of the cranium above the ears, while the frontal portion is not enlarged, or but slightly, denotes hypertrophy of the brain.

The appearance of the general cutaneous surface possesses much greater diagnostic value in the diseases of infancy and childhood than in those of adult life. The eruptive fevers so common in the young, and comparatively rare in the adult, reveal themselves to us in great part by the changes which they cause in the appearance of the integument. The peculiar color of the skin in constitutional syphilis, hereafter to be described, and which is more marked in infancy and early childhood than at any other age, is a diagnostic sign of great value in obscure cases. In the infant the cold stage of intermittent fever is manifested, not by muscular tremors, but by lividity, pallor, and the goose-skin appearance of the surface.

Bulbous enlargement of the fingers and incurvation of the nails are signs of cyanosis, and therefore of malformation at the centre of the circulatory apparatus, or of tuberculosis, or chronic pulmonary disease attended by malnutrition. Enlargement of the spongy portions of bones, causing prominences, softness, and bending of the bones, and consequent deformity of the limbs, patency of the fontanelles, a large and square shape of the head from calcareous deposit external to the cranium, and delayed dentition, are among the signs of rachitis.

In early infancy the glands of the skin and mucous surfaces, or which connect by their orifices with these surfaces, are slightly developed. Therefore sensible perspiration and lachrymation are rare under the age of three months. A thick Meibomian secretion of a puriform appearance collecting between the eyelids is an unfavorable prognostic sign ; it indicates a state of great depression ; it is observed most frequently in cerebral and intestinal maladies shortly before death. Passive congestion of the vessels of the conjunctiva sometimes occurs under the same circumstances, due to feebleness of the heart's action, and imperfect capillary circulation. It indicates the near approach of death.

Attitude—Movements—The Voice.

A sharp, piercing cry, head firmly retracted, flexure of the limbs with a degree of rigidity, adduction of the great toe, clonic or tonic spasm of the muscles, irregular movements of one or more limbs, with consciousness impaired, or with mental hallucinations, are symptoms of grave disease of the cerebro-spinal system. Irregular muscular movements partly controlled by the will, and occurring during full consciousness, are symptoms of chorea, a disease nearly always ending favorably in children, though incurable in the adult. Contraction of the eyebrows, turning of

the eyes and face from light, avoidance of noises, as if painful, are signs of headache. Frequent carrying of the hand to the ear, and pressing with the ear against the breast of the mother or nurse, are symptoms of otalgia. Frequent carrying of the fingers to the mouth, in connection with fretfulness or other symptoms of suffering, indicates stomatitis, gingivitis whether from difficult dentition or other causes, painful pharyngitis, or some obstructive disease of the larynx. Frequent rubbing or pressing the nose may be due to intestinal worms or intestinal irritation from other causes. It may be due to coryza or headache. Frequent forcible rubbing or striking the nose should lead to a careful examination and perhaps guarded prognosis. It often indicates grave cerebral disease, and may be a precursor of convulsions.

In severe obstructive disease of the larynx the child is restless, moving from side to side. In most inflammations of the respiratory organs, a semi-erect position gives most relief. The voice in severe laryngitis is often hoarse or indistinct, and is usually so in the pseudo-membranous form ; in pleuritis or pneumonitis it is restrained and abrupt, since the movements of the walls of the chest give pain.

The voice in severe diseases of the abdominal organs is feeble and plaintive. It is sometimes short and restrained in acute dyspepsia, in peritonitis, and in cases of great abdominal distension. The horizontal position gives most relief in abdominal diseases. In case of abdominal pain the patient often presses his hand upon the abdomen and flexes his thigh over it. Perfect quietude, with features sunken, and unchanged by smile or crying, is a symptom of severe and exhausting diarrhœal affections.

Respiratory System.

The respiration of the infant under the age of six months is very irregular, and it is more irregular the nearer the time to birth. If the newborn infant be closely observed, it will be seen to sigh often ; it breathes pretty uniformly and regularly for a moment, and then, without appreciable cause, the respiration is intermitted ; it holds its breath when it smiles or moves its head, or even its limbs ; it is very subject to hiccups ; this is more common the first week of life than at any other age. So much is the breathing of the young infant disturbed by these causes, that the number of respirations ordinarily varies in consecutive minutes. In order, therefore, to determine with accuracy the frequency of the normal respiration for this time of life, it is necessary to take the average of several observations.

At birth, while the function of the heart has for months been regularly performed, the lungs are still quiescent. The one organ has been active during the greater part of fœtal development, the other is yet untried. Hereafter, in the new order of things, so intimate is the relation between

the heart and lungs, that the proper performance of the function of the one is essential to that of the other. Therefore the commencement of respiration and the return of circulation, which is modified and temporarily arrested at birth, are nearly simultaneous. Respiration commences in the first half-minute of independent existence ; often, indeed, attempts to inspire occur before the delivery is completed. The exceptions to this early establishment of respiration are after tedious or unnatural births. The establishment of the new circulation is a moment later.

Respiration in Health.—As the air-cells at birth are closed, the establishment of respiration is difficult. The air at first penetrates a few pulmonary cells, but gradually more and more are inflated through the forcible inspirations which the crying of the infant produces, till after a variable time, respiration becomes easy and complete. If the cry be feeble, and especially if with this feebleness there be considerable congestion of the brain, the result of tedious birth, the full establishment of respiration is in a corresponding degree gradual and slow.

The frequency of the respiration in health should be ascertained, in order to determine whether, in a given case, it be abnormally accelerated. The following table embodies the result of observations which I have made, in order to determine the normal frequency of respiration in the first year of life.

Normal Infantile Respiration (*number per minute*).

	Age.										
	First half hour	From first half hour to close of first week.		From close of first week to close of first month.		From close of first month to close of third		Close of third to close of sixth month.		Close of sixth month to close of first year.	
		Awake.	Asleep.	Awake.	Asleep.	Awake.	Asleep.	Awake.	Asleep.	Awake.	Asleep.
Number of observations	29	28	14	13	13	16	10	25	7	19	6
Extreme number of respirations per minute..	25-104	32-64	40-64	40-96	28-60	32-68	28-52	36-88	24-40	28-64	24-36
Mean number of respirations per minute....	48.5	52	52	59	45	51	39	54	33	41	29

As the child advances from the age of one year, the number of respirations per minute gradually diminishes ; but through the whole period of childhood it remains greater than in the adult. At the age of five years, when the child is quiet, but awake, it is about 27 ; at the age of ten years, about 22.

Respiration in Disease.—In cerebral diseases the respiration is apt to be slow, and if somnolence occur, intermittent, and accompanied by sighing. In young infants, in the drowsiness which supervenes when the blood is imperfectly decarbonized, during severe attacks of capillary bronchitis, or broncho-pneumonia, respiration is apt to be intermittent.

In inflammatory diseases of the larynx and trachea, respiration is but slightly accelerated, and, if there be no obstruction, its rhythm is normal; if there be obstructive disease, its rhythm is altered; the inspiratory act is lengthened. In bronchitis, respiration is accelerated in proportion to the degree of extension downward of the inflammation. It is in no disease more accelerated than in severe capillary bronchitis.

In pleuritis and pneumonitis, the respiration is accelerated in proportion to the extent and acuteness of the inflammation. Inspiration ending abruptly, and succeeded by an expiratory moan, is a symptom of both pleuritis and pneumonitis in their acute stages. In certain cases of irritative or inflammatory disease of the abdominal organs, respiration presents a similar character; it is modified in this manner in consequence of the pain experienced in movements of the diaphragm. Ordinarily, however, in abdominal diseases, respiration is nearly natural.

The cough is an important diagnostic symptom. It is loud and sonorous in spasmodic croup, hoarse or harsh in true croup, clear and distinct in bronchitis, suppressed and painful in the early stages of pneumonitis and pleuritis, convulsive and with more inspirations than expirations in pertussis. A cough due to coexisting bronchitis is one of the first and most constant symptoms of measles. Typhoid and remittent fevers, difficult dentition, intestinal worms, irritating ingesta, and severe burns, sometimes give rise to a cough, which is nearly dry and painless. Occurring in such diseases, it is sometimes dependent on more or less bronchitis, to which the primary disease has given rise.

Circulatory System.

In all ages and countries the pulse has been considered an important symptom, both in diagnosis and prognosis. It aids the practitioner in determining, approximately, not only the character but the gravity of diseases. It is somewhat remarkable, from the importance which is attached to the pulse in medical practice, that its natural frequency and its character in infancy are not more accurately known. It is true that eminent observers, as Trousseau and Valleix, have published statistics relating to the infantile pulse in health, but these statistics disagree, and therefore do not afford a reliable standard with which to compare the pulse in disease. Moreover, some published statistics of the pulse possess but little value, from the small number of observations; some from the fact that records of the infantile pulse are grouped with those of older

children ; and others because the state of the infant, as regards its activity or emotions, is not mentioned.

Pulse in Health.—It is not easy to collect statistics of the healthy pulse for the period of infancy, which are entirely free from error, since there are often slight derangements of the system in the infant, which are not manifested by any marked symptoms, but which produce acceleration of pulse. In collecting the following statistics, it was my endeavor to avoid sources of error so far as possible.

In ordinary cases the movements of the heart begin about one-eighth of a minute after birth. They are at first slow, the ventricular contractions not numbering more than eight or ten by the close of the first quarter minute. In the second quarter the cries are vigorous, and the pulse now is rapidly accelerated, rising commonly above 120, and sometimes above 160 beats per minute. In fifty-seven observations of the pulse in healthy infants during the first half hour of life, after the first quarter of a minute, I found that the extremes, with one exception, were 104 and 164—average, 139.

Table of Infantile Pulse in Health.

	Age.									
	First week.		From close of first week to close of first month.		From close of first month to close of third.		From close of third month to close of sixth.		From close of sixth month to close of first year.	
	Awake. Quiet; moving slightly; nursing.	Asleep.	Awake. Quiet; moving slightly; nursing.	Asleep.	Awake. Quiet; moving slightly; nursing.	Asleep.	Awake. Quiet; moving slightly; nursing.	Asleep.	Awake. Quiet; moving slightly; nursing.	Asleep.
No. of observations.	22	16	10	10	15	17	25	6	20	3
Extremes..	104-152	108-140	124-160	104-144	112-148	104-132	112-146	104-116	112-144	....
Mean	126	122	139	118	132	118	129	108	127	109

"M. Ledéberder," says Bouchut, "could only count the pulse in the first minute of life in six children, and he has observed from 72 to 94 pulsations." Valleix estimates the pulse, between the ages of two and twenty-one days, at 87. Trousseau states that the pulse, in the first week of life, varies from 78 to 150 ; and Dr. Gorham's observations are somewhat similar to Trousseau's. My observations, as seen from the above table, do not correspond with the assertions of Ledéberder and Valleix. Indeed, if there were no conflicting testimony, there would still be a strong presumption that these authors are in error, for we would not sup-

pose that the pulse of the infant, in whom there is greater functional activity, both muscular and visceral, would fall so much below that of the fœtus. It is probable from the expression "could only count the pulse . . . in six children," that Ledéberder and perhaps Valleix counted the pulse at the wrist, which, with exceptional cases, is very difficult and often impossible in the first week of life, and that they missed some of the beats, or, not unlikely, sometimes counted their own pulse. Immediately after birth there is so little force of the ventricular systole, and the extreme arteries, therefore, of the system pulsate so feebly, that neither in the limbs nor at the anterior fontanelle can the frequency of the pulse be readily ascertained. It can be readily and accurately ascertained only by auscultation, or by placing the hand on the precordial region, or directly after birth by the pulsations in the umbilical cord.

The average pulse of the healthy infant in the first and second months is, according to Trousseau, 137 per minute, 128 from the third to the sixth month, and 120 from the sixth to the twelfth month. It is seen that his observations agree closely with mine, as regards infants who are quiet but awake. One point of interest, established by the above statistics, is the great diminution in the frequency of the pulse in sleep.

Pulse during or after Active Movements or Great Mental Excitement.

	Age.				
	First week.	Close of first week to close of first month.	Close of first to close of third month.	Close of third to close of sixth month.	Close of sixth month to close of first year.
	140	162	176	132	132
	160	156	152	148	144
	140	140	158	148	152
	152	152	144	144	182
	....	....	152	156	198
	....	....	180	156	160
Extremes...	140–160	146–162	144–180	132–156	132–198
Mean.....	148	152	160	147	156

It is seen, by the above table, that by active exercise or great mental excitement the pulse may become as rapid as in grave diseases. There is greater acceleration of pulse from the emotions and from exercise in feeble than in robust children. Obviously, in order to determine to what extent the pulse is accelerated in disease, it is necessary that it should be counted during a state of quietude. As the age increases, it is less and less influenced by the emotions and physical exertion; still, during the whole

period of childhood, such influences do have more or less effect on its frequency.

Pulse in Disease.—Febrile and inflammatory diseases produce greater acceleration of pulse in early life than in maturity. Diseases, or derangements of system, particularly those of the digestive organs, which do not materially affect the pulse in the adult, often cause acceleration of it in children. The febrile pulse of early life usually has exacerbations in its frequency. These commonly occur in the latter part of the day. Distinct and more or less regular febrile exacerbations and remissions are common in several diseases of early life, some of which are serious, while others involve little danger. Among these diseases may be mentioned difficult dentition, intestinal worms, incipient meningitis, and constipation. An intermittent and irregular pulse is common in fully developed meningitis and certain other severe organic diseases of the encephalon. It may be due also to disease of the heart, and it also occurs in some children from temporary disturbance of the digestive function. The pulse is slow in compression of the brain, and also in sclerema of the new-born.

Animal Heat.

The internal temperature of the body in a state of health is uniform. In 33 infants under the age of seven days, M. Roger found the average temperature 98.6° Fahr., while in 25, from four months to fourteen years old, it was 99°. The external temperature alone varies in a state of health, according to the temperature of the atmosphere.

Elevation of temperature above the normal standard is a sign of inflammatory and febrile affections. The increase of heat varies according to the character of the disease and its type. In favorable cases of inflammation and in simple fevers it is not ordinarily more than two or three degrees. The greater the severity and malignancy of inflammatory and febrile diseases, the greater the elevation. An elevation of more than six degrees indicates a form of disease which is likely to prove fatal. It is rare that the temperature, even in fatal cases, rises above 107°. In measles the temperature in the eruptive stage is from 101° to 103°; in scarlatina from 102° to 104°, if no complication exist. In diphtheria the temperature is elevated at first, but it is apt to fall to nearly the normal during the stage of profound toxæmia.

Reduction of the internal temperature is an unfavorable prognostic sign; it is observed, a few hours before death, in infants who are greatly reduced by certain chronic diseases, as entero-colitis. In these cases the tongue and even sometimes the breath communicate to the finger or hand a sensation of coldness.

The importance of thermometric observations, as an aid to the diagnosis of children's diseases, is within a few years more fully recognized by the

profession. Two diseases which, in their commencement, present very similar symptoms, often vary as regards the temperature. Thus, meningitis, presenting in its first stages symptoms very similar to those of typhoid fever, has a lower temperature till an advanced period, when the amount of heat increases.

Digestive System.

Inspection of the buccal and faucial surfaces discloses some of the most frequent local diseases of infancy, as the various forms of stomatitis, and others which, though not frequent, involve great danger, as gangrene of the mouth, diphtheria, and retro-pharyngeal abscess. Inspection of the tongue aids in determining in many cases whether the disease be pursuing a favorable course, or has become asthenic, and is exhausting the vital powers.

Febrile movements, even when slight, give rise to coating of the tongue, and intumescence and distinctness of its follicles. The eruptive fevers are attended by changes upon the buccal and faucial surfaces which possess diagnostic and prognostic value. Hyperæmia of these surfaces appears early in rubeola and scarlatina, prior to those phenomena which are justly regarded as pathognomonic. It is, therefore, often an important sign in the initial period of these diseases when the diagnosis is obscure. The appearance of the fauces in diphtheria and croup, indicating not only the nature of the disease, but its gravity, need only be referred to in this connection.

Inspection of the buccal and faucial surfaces sometimes enables us to form a probable opinion in reference to the nature of diseases which are seated in other parts. In the infant protracted stomatitis is a common accompaniment of chronic diarrhœa, and it indicates its inflammatory nature.

Vomiting is more frequent in infancy than in childhood, and in either period than in adult life. It is common in cerebral affections, and is one of the first symptoms of scarlet fever, and is not uncommon, though less frequent, in the commencement of the other essential fevers and of acute inflammations. It is a symptom of indigestion, entero-colitis, cholera infantum, and intussusception ; it is common, also, after the paroxysmal cough of pertussis, and not infrequent in the bronchial inflammations of young infants. In both these diseases it is excited by the muco-purulent matter upon the faucial surface.

Intestinal gas is in part secreted or exhaled from the mucous membrane, as the experiments of Hunter and others have shown, and is in part the product of chemical changes in the food. A certain amount of gas in the intestines is normal ; it subserves a useful purpose. An abnormal amount of it is common in various diseases, as indigestion, chronic entero-colitis, peritonitis, typhoid fever. It is a frequent cause of gastralgia and

enteralgia in the infant. In scrofulous or feeble infants, with impaired muscular tonicity and faulty digestion, the abdomen is often habitually more or less distended with gas, which does not, under such circumstances, give rise to pain or other local symptoms; it has significance as showing the general condition of the child.

Fig. 4.



In the rachitic, whose thorax is compressed and liver often enlarged, while the vertebral column is shortened, the abdomen is commonly protuberant. In feeble children, not decidedly rachitic, whose lungs are seldom fully inflated, and whose chests are consequently depressed, the abdomen is also prominent. The accompanying wood-cut represents one of these cases, presented for treatment at the outdoor department at Bellevue.

In feeble children who have suffered from repeated and protracted attacks of bronchitis, and whose chest-walls are consequently depressed, a similar abdominal prominence occurs.

Retraction of the abdominal walls is common in meningitis, and in many exhausting diseases. Tenesmus is a symptom of intussusception in the infant, and of colitis in children.

Much light is thrown on the character of intestinal diseases by the appearance of the stools. Muco-sanguineous stools accompanied by fever, are a sign of colitis. Stools containing unmixed blood, and not accompanied by fever, may result from a rectal polypus, and from purpura hæmorrhagica. Scanty evacuations of blood, with obstinate constipation, are a symptom of intussusception in infants.

The alvine discharges of infants often present a green color; sometimes they have the normal yellow hue when passed from the bowels, but become green on exposure to the air, or from reaction of the urine. By the microscope the green coloring matter is seen to occur in small, irregular masses. This green substance has been supposed to be bile. I am convinced that, as it occurs in the stools of the infant, it is commonly produced by the action of the intestinal secretions on the contents of the intestines; perhaps the action is upon the bile, which is mingled with the contents; for I have often noticed that the contents in and above the jejunum were yellow, while in and below the ileum their color was green.

The green hue may occur from very different causes. It may be due to over-feeding, to the action of cold, to irritating ingesta, to inflammation, etc.; it may be transient, subsiding within a day or two, or it may

continue several days. All infants, at times, have green evacuations, even when they appear in good health.

In a large proportion of the cases of diarrhœal maladies occurring during infancy the stools give an acid reaction with litmus-paper. This acid, if in considerable quantity, is irritating, increasing the peristaltic movements of the intestines, and the functional activity of the intestinal follicles, causing erythema of the skin around the anus, and reacting upon and intensifying the intestinal disease. Hence the indication for the use of antacids in the diarrhœal affections of infancy.

The presence of intestinal worms and the species may be ascertained by microscopic examination of the stools of the child who is affected with these entozoa. The stools contain ova, which differ in size and shape according to the species of worm.

Nervous System.

Pain.—This symptom affords important aid to the physician in determining the seat and nature of the diseases of children. Pain in the head may occur in them from coryza involving the frontal sinuses, or from febrile movement in the commencement of an essential fever, or of inflammation of one of the organs of the trunk. Produced by such a cause, it abates in two or three days. If it be protracted, whether constant or intermittent, it is in many cases not neuralgic, as it so often is in the adult, but is due to organic disease of the brain or meninges. Complaint, therefore, of headache in a child, without any apparent general cause or local cause external to the cranium, should awaken solicitude, and, if it be protracted, the physician should examine carefully in reference to the presence of a cerebral or meningeal disease. Mild frontal headache, continuing for weeks or months, sometimes occurs in children suffering from so-called spinal irritation. In these cases pressure over the first cervical vertebra and the occiput is apt to increase the pain.

Grave thoracic or abdominal inflammations in the adult are almost always attended by a corresponding amount of pain and tenderness ; but in children these symptoms are often absent, or, when present, are often not commensurate with the amount of disease. Thus, entero-colitis of nursing infants is, in a large proportion of instances, almost free from these symptoms, and the same may be said of many cases of pneumonitis in young children ; namely, those cases produced by extension of inflammation from the bronchial tubes and from hypostasis.

Pain in the chest or abdomen, occasional or constant, continuing for weeks or months, with fever, and unattended by thoracic or abdominal disease, indicates caries of the vertebræ. Its most common seat is the epigastric, umbilical, or hypochondriac region. It is a neuralgia due to irritation of the sensitive root of one or more of the spinal nerves. It is a very important symptom to the diagnostician, showing the nature of the

disease, which in its incipiency is so obscure. Pain in the leg, especially the inside of the knee, is of a similar character, indicating disease of the hip-joint.

Children with certain acute febrile and inflammatory diseases sometimes have hyperæsthesia of portions of the surface; it is especially marked upon the anterior aspect of the trunk. The physician might be misled into the belief that the tenderness occurred over the seat of the disease and indicated an inflammation; but the pain of hyperæsthesia can be diagnosticated from that of inflammation by the fact that it is so extensive, is less on firm than light pressure, and is especially observed upon the inner surface of the thighs. The symptoms pertaining to the nervous system occurring in the various diseases treated of in this book will be fully described in connection with those diseases, and, therefore, need not detain us in this connection.

CHAPTER XV.

THERAPEUTICS.

The young practitioner is often perplexed in deciding exactly what dose of the stronger and more dangerous medicinal agents to prescribe for a child. A practical rule, which holds good for many medicines, has been proposed by Dr. Cowling, as follows: "The proportional dose for any age under adult life is represented by the number of the following birthday divided by twenty-four." This rule is inadmissible for infants under the age of six months, but will apply for those that are older, for the use of a large number of medicines. Another rule proposed by another British physician, Professor Clarke, is based on differences in weight of children and adults: The adult dose is represented by 150. The dose of a child is determined by dividing its weight in pounds by 150. But it is an interesting fact, and one of practical importance, that children bear and often require, in order to obtain the desired effect, a much larger proportionate dose of certain agents than adults. This is partly attributable to the active elimination in childhood. Belladonna is notably one of the agents which childhood tolerates; and it may be added that some children can take a much larger dose of it than others, without producing the physiological effects. Thus, recently, I increased gradually a reliable preparation of the tincture to twelve drops for a child of four years, without producing the usual efflorescence; and Farquharson says "the dose . . . I have pushed in a child of ten, suffering from incontinence of urine, to fʒij (British Pharmacop.) with good effect, and the development of mild forms of physiological disturbance."

Arsenic is also better tolerated by children than adults. An infant of six months can take two-drop doses of Fowler's solution three times daily without ill effect. Prussic acid, strychnia, iron, ipecacuanha, and alcohol are also required in larger proportionate doses in childhood than is indicated by the rule either of Dr. Cowling or Professor Clarke.

When practicable, medicines should be given in the liquid form. Those not soluble may often be given in suspension, in some vehicle which in great part disguises the taste. The best vehicle for the bitter vegetables, as the salts of quinia, with which I am acquainted, is the elixir adjuvans of Caswell and Hazard. The following is the formula for its preparation :—

℞. Cort. aurant., ℥ ij.
Pulv. semin. coriandr.
Pulv. semin. carui, āā ℥ j.
Pulv. cort. pruni Virginianæ, ℥ iv.
Pulv. rad. glycyrrhizæ, ℥ vj. Misce.
Menstruum, Alcohol, partis j.
Aquæ, part. ijss. Misce.
Percolat. O. v, et adde—
Syr. simplic.,
Aquæ, āā Oijss.

The elixir adjuvans may also be advantageously employed in the administration of many other medicines apart from those which are repulsive on account of their bitterness. It holds them in suspension so that if they have a greater specific gravity than the elixir it is necessary to shake the bottle thoroughly before using it. The elixir taraxaci comp. is another good vehicle for bitter vegetables, although, like the elixir adjuvans, not officinal. I am sure from many observations, that unpleasant doses are apt to be wasted to a greater or less extent, and the repugnance of children to medicines employed has induced many a parent to seek other and less disagreeable modes of treatment. Chemistry has greatly aided the therapeutics of childhood, in that it has enabled us, in so many instances, to prescribe the active principles in place of the large, nauseous doses formerly employed.

PART II.

CONSTITUTIONAL DISEASES.

SECTION I.

DIATHETIC DISEASES.

CHAPTER I.

RACHITIS.

Rachitis, or rickets, consists in faulty and abnormal nutrition and perverted and impaired function of the tissues from which bone is developed, namely the periosteum and epiphyseal cartilage.

Age.—This disease commences in most instances between the ages of six months and two years. Now and then we meet cases of its earlier as well as later commencement, and skeletons are preserved in museums, which seem to show that in rare instances rachitis is congenital. Virchow alludes to such a specimen in the Wurzburg Museum, and Ritter von Rittershain describes another in the museum of the Franz Joseph Hospital in Prague. In the Wood Museum of Bellevue Hospital is a similar skeleton presented by myself, and represented in the accompanying wood-cut. The infant in this case died a few hours after birth, of atelectasis, apparently produced by the contracted state of the thoracic walls. The parents are hard-working English people, whose surroundings are such as are known to predispose to rachitis.

Fig. 5.



The skeleton, as is seen in the representation, shows the rachitic deformities in a marked degree. The dissection was made by Prof. Francis Delafield. There was no suspicion of syphilitic taint in this case. Prof. A. Jacobi described a case of congenital rachitis, in which craniotabes had occurred, in an interesting monograph published in the New York *Obstetric Journal*, in 1870, and another very remarkable case of congenital rachitic craniotabes is related by Dr. Heitzman of New York. In Heitzman's case a woman

during pregnancy had for months frequently inhaled each day the fumes of lactic acid, an agent which we will see produces rachitis if introduced in quantity into the system when the bones are immature and in a state of development, and the infant, born at term, died immediately. "It exhibited the signs of congenital rachitis in a high degree. The skull bones were completely absent. In the cartilages of the bones of the extremities and of the ribs, there were scanty depositions of lime salts, and numerous infractions. The death of the child was evidently due to the absence of the skull bones, inasmuch as the pressure of the womb during delivery caused cerebral hæmorrhage. All the organs of the chest and abdomen were found in full development and healthy" (Communicated by Dr. Heitzman to the author). Whether or not we accept as genuine all the reported cases of fœtal rachitis, there can be little doubt, from the number of observations already made and carefully recorded, and from the affirmative opinion of high authorities like Virchow, that rachitis does occur during intra-uterine development. But with few exceptions this disease begins in the first months of infancy: Enlargement of the costo-chondral articulations, known as the "rachitic rosary," which is one of the earliest and most reliable signs of rachitis, has been observed, though rarely, in infants of two or three months. It should not, however, be regarded as a sign of rachitis unless the enlargement be so great that it can be readily appreciated by examination through the integument or by sight; for in young children, with the bones in the process of normal development, these joints always have a greater diameter than that of the ribs. After the age of two years the number of those affected with rachitis gradually becomes less as we pass toward manhood.

Published statistics relating to the commencement of rachitis are mostly derived from European hospitals. The following are the aggregate statistics of Brunnicke, Von Rittershain and Ritchie, giving the age at which this disease began or was first observed:

During the first half year,	99
During the second half of first year,	259
From the first to second year,	342
" " second to third "	134
" " third to fourth "	31
" " fourth to fifth "	17
" " fifth to ninth "	21
Total,	903

Is rachitis ever developed in the adult? Osteo-malacia, or mollities ossium, a rare disease of adults, occurring with few exceptions in women after childbirth, though adult males are occasionally affected, resembles rachitis, since it is attended with softening of the bones from the absorp-

tion of their calcareous element. Trousseau, and following him, Bouchut, believe in their essential identity, regarding their differences as due to the difference in age, and especially to the fact that in osteo-malacia the bone has attained its growth, whereas in rachitis it is still growing. Moreover, as arguments in favor of their close relationship, rachitis and osteo-malacia are found to require very similar treatment, and women after childbirth resemble children as regards aptitude for disease.

The two diseases evidently have a kinship, though pathologists have hesitated to regard them as identical; rachitis consisting, as we have seen, in a disturbed nutrition of the osteo-plastic tissue, so that little or no lime is deposited in the newly-formed layers of bone, while in mollities, the lime salts are absorbed from the adult and fully formed bone. Dr. Heitzman, who before his arrival in this country had established a reputation as a leading authority in regard to the etiology of rachitis, believes in the essential identity of these two diseases, as will be seen from his interesting letter on a following page. His experiments certainly afford strong evidence of their identity.

Causes.—Rachitis, as we have stated elsewhere, is entirely distinct in its nature from scrofula. The scrofulous are not likely to become rachitic, nor the rachitic scrofulous. Proneness to low grades of inflammation or to hyperplasia of the lymphatic glands which characterizes scrofula, seldom exists in connection with swelling of the bones or other manifestations of rachitis. The differences between the scrofulous and rachitic diatheses, which indeed seem to exclude each other, are marked. The scrofulous are well developed and of good height, as a rule, while the rachitic are stunted. Scrofula manifests itself not less frequently in childhood than in infancy, whereas rachitis we have seen is especially a disease of infancy. Again, as showing the difference between the two, scrofula is not infrequently associated with tuberculosis, whereas rachitis with tuberculosis is rare.

Residence in a cold and moist climate, or in dark, damp, and ill-ventilated apartments, is a cause of rachitis. Therefore it is more common in the north of Europe than in the warm and equable climate of southern Europe; in the damp and dark basements and alleys of the city, than in dry and airy country residences. In deep valleys, shut out from the solar rays, rachitis is more common than among people of the same habits and social position living in elevated and sunlit localities.

In some infants there is an undoubted hereditary predisposition to rachitis, due to disease or feebleness of one or both parents. The offspring of a tubercular or syphilitic, or otherwise enfeebled parent are more apt to become rachitic than those of healthy ancestry, and it appears that disease of the mother is more apt to entail a rachitic predisposition than that of the father. The mother presented traces of rachitis in 27 out of 71 cases observed by Ritter von Rittershain. Among the parental

causes are advanced age of the father, poverty, hardships, and defective nutrition of either parent, and exhausting discharges of the mother, as purulent, hæmorrhoidal, and uterine fluxes. Mothers in habitual ill-health, over-worked, and poorly nourished, though without actual disease, like many in the tenement houses of the cities, are liable to have rachitic children.

The most common cause, however, is the use of food not sufficiently nutritious, or if nutritious, such as is not adapted to the feeble digestive powers of the infant, as breast-milk, thin and deficient in nutritive properties, or artificial food which is not adapted to the age of the infant. Rachitis is not, therefore, caused by the use of any particular kind of food exclusively, or any particular ingredient in the food, but by the use of the most diverse alimentary substances, provided that they are not adapted to the stage of development and the condition of the digestive organs. Those prematurely weaned, and given a food which is not a proper substitute for breast-milk, those too long wet-nursed and not allowed the additional nutriment which they require, and those, too, whose digestion is feeble naturally, or through disease, are especially liable to become rachitic. We meet rachitis often in city and especially tenement house practice, as a sequel of exhausting diseases, such as the eruptive fevers, pertussis, and particularly protracted intestinal catarrh.

It might be supposed from the nature of this malady that the use of food deficient in lime and phosphoric acid is the common cause, but facts show that this is not the correct view of its etiology, as it ordinarily occurs, although in the treatment, phosphate of lime is undoubtedly useful. The altered and abnormal nutrition of the osteo-plastic tissue is the immediate cause ; and this occurs in those whose food contains a sufficient amount of lime and phosphoric acid, as well as when these substances are insufficient.

The very interesting fact has been brought to light by experiments that small repeated doses of phosphorus produce rachitis in certain lower animals by disturbing the nutritive process of the osteo-plastic tissue, and the theory now accepted by many who have given special attention to the subject is, that some substance introduced into the system in the ingesta, or, more frequently, produced in the digestive process, irritates like phosphorus the bone-producing tissues, so changing their function that true bone is no longer produced, while it probably acts as a solvent to the lime contained in the nutritive fluid ; so that instead of being deposited upon the surface of the bone, it remains in a liquid state and is eliminated from the system. Dr. Heitzman, formerly of Vienna, but now of New York, has done much to establish this theory. He has produced what seems to be true rachitis in animals by feeding them with lactic acid, and the inference is that it is an acid or acids, either the lactic, or the lactic with allied acids, which produce rachitis as it ordi-

narily occurs in children. We know that in various states of indigestion and defective assimilation acids are produced in abundance during the period of infancy, and what more natural, in view of the facts, than that they are the active agents in producing the rachitic state. The irritative agent must, in order to reach the bones and cause the phenomena of rachitis, pass through the blood. But physiologists tell us "Among the organic acids the existence of lactic acid in healthy blood is not yet entirely beyond doubt, but it has been found in the latter under abnormal conditions" (Heinrich Frey, of Zurich).

The following letter from Dr. Heitzman, bearing upon this subject, will be read with interest :

NEW YORK, May 30, 1881.

DEAR DOCTOR :—In reply to your favor, I send you an account of my experiments relating to rachitis and osteo-malacia, first published in the *Vienna Academy of Sciences*, June, 1873.

Marchand, Ragsky, Lehman, Simon, and others have found free lactic acid in the urine of persons suffering from rachitis and osteo-malacia. C. Schmidt discovered lactic acid in the liquid of malacic shaft-bones which were transformed into globular cysts. Encouraged by these chemical researches, I undertook an experimental series on the action of lactic acid, administered both by mouth and subcutaneous injection, upon the bones of living animals, which experiments were started in April, 1872, and continued until the end of October, 1873. The experiments were made upon five dogs, seven cats, two rabbits, and one squirrel. On dogs and cats under one year of age, the lactic acid, given either by mouth or injection, in combination with the restricted administration of calcareous food, produced swelling of the epiphyses of the shaft-bones and the anterior extremities of the ribs. This result was plain in the second week after the beginning of the lactic acid treatment. Up to the fourth and fifth weeks the swelling of the epiphyses and the ends of the ribs kept increasing, and they were accompanied by curvatures of the bones of the extremities. As accompanying symptoms I noticed catarrhal inflammation of the conjunctiva, the mucosa of the bronchi, the stomach, and the intestines, emaciation and convulsive movements of the extremities. The microscopic examination of the epiphyses gave an image fully identical with that of the epiphyses of ricketty children. Upon continuing the administration of the lactic acid, the swelling of the epiphyses of the shaft-bones gradually increased, and so did the curvatures of the shaft-bones. After four or five months of lactic acid treatment, under often repeated catarrhal inflammations of the above-named mucous layers, the shaft-bones became soft to such a degree that they could be bent like branches of a willow-tree. After four to eleven months of the lactic acid treatment, the microscopic examination of the bones gave a result corresponding to that of bones of women who had died of osteo-malacia. In the three herbivorous animals no swelling of the epiphyses was noticeable. One rabbit died three months, the other five months after the commencement of the administration of the lactic acid, both with the symptoms of inanition. No marked symptoms of rachitis and malacia were traceable in the bones of these animals. The squirrel, on the contrary, which died after thirteen months of treatment with lactic acid, gave all the features characteristic of osteo-malacia.

My experiments gave the result that by continuous administration of lactic acid

at first rickets, afterward osteo-malacia, could artificially be produced upon flesh-eaters, while on herbivorous animals osteo-malacia sets in without preceding symptoms of rickets.

Through these experiments I have proved the identity of rachitis and osteo-malacia. The differences observed in them are attributable to differences in the age and in the state of the bones, when the solution of the lime salts is established. Yours truly,

D. S. H.

That other experimenters have failed to produce rachitis, Dr. Heitzman attributes to the fact that the animals on which they experimented were too old.

Experimental investigations in regard to the causation of rachitis have therefore revealed the interesting fact that certain chemical agents introduced into the system produce rachitis, and from what is known of the nature of this disease and the conditions under which it is developed, it appears probable that the presence of lactic acid in the blood is the cause in certain cases, while there are other cases which we must attribute to other agencies besides the lactic acid. There are many parallel instances. Cirrhosis, for example, is often caused by alcohol, but no one attributes all cases of this malady to it.

In the New York Infant Asylum, a few years since, one in every nine, by actual count, presented marked rachitic symptoms. Some who had the disease were suffering or had recently suffered from indigestion and gastro-intestinal derangements, such as are known to generate acids; but others were wet-nursed, and gave no evidence of faulty digestion and nutrition. By a more liberal diet, by adding to the dietary, among other articles, the juice of meat, the disease became much less frequent, and now it is seldom that a case with marked symptoms occurs in that institution. Although the histories of some of the cases in the asylum lent support to the theory that an acid is the active agent in causing rachitis, others did not so readily admit of this explanation, and it seemed to us that the etiology of this disease required further elucidation. It is certain that general anti-hygienic conditions are a common predisposing cause, even if lactic acid be the direct or exciting cause.

Anatomical Characters.—For convenience of description rachitis is divided into three periods, 1st, That of altered nutrition; 2d, That of curvature and deformity; and 3d, That of reconstruction.

The growth of bone occurs from the epiphyseal cartilage, and from the periosteal or fibrous membrane which surrounds and protects bone; growth in length is from the former, in thickness from the latter. In the normal growth of bone from the epiphyseal cartilage, there is first, beginning at the distal end of the epiphyses, a white zone of cartilage, consisting of the hyaline matrix containing the usual cartilage cells. Underneath this, and nearer the bone, is the "zone of proliferation," the cartilage in which becomes softer from the formation of cells, and absorption of the

matrix. Each cartilage cell divides into two cells, and each of these cells divides into two other cells, and the division is repeated so that eight cells instead of one are inclosed in a common cavity and capsule. Each capsule is distended by this proliferation of cells and swelling of each cell. Near the bone, that is along the extremity of the diaphysis, the groups of cells inclosed in their capsules nearly touch each other, the matrix having been absorbed. The end of the bone is covered by one or two layers of these groups of cells about to undergo ossification.

In rachitis the state is different. The cells still inclosed in their capsules undergo a more frequent division, so that instead of six or eight in the average, there are as many as thirty or forty in each capsule. Besides the layers of capsules are many more than in health, so as to form a considerably deeper zone. Hence, while in the normal bone the proliferating zone appears to the naked eye as a very thin, scarcely perceptible, layer of a reddish-gray color, tipping the end of the diaphysis, it is in rachitis a broad cushion, very soft, and of a grayish, translucent appearance, with a zone of cartilage more nearly normal on the distal end, and the proximal end lying upon the extremity of the diaphysis. This exaggerated cell proliferation and corresponding absorption of the hyaline substance intervening between the groups of cells cause the well-known softening and swelling of the cartilage, and enlargement of the joint. While this occurs, the ossifying process is also arrested. We indeed observe an effort in the direction of bone-formation. The Haversian canals, surrounded by capillary loops, extend from the bone into the proliferating zone of cartilage. Their extension is effected by absorption of the basic substance, and the appropriation of the cavities containing groups of proliferating cells, which lie in their way, and which have been described above. Before the annexation of these cavities to the Haversian canals, the cells which they contain become much smaller (medullary cells) by a rapid division. We also find as farther evidence of the attempt at bone-formation granules and masses of lime scattered through the cartilage, and here and there spiculæ and nodules of true bone springing up from the bony substratum of the shaft. Some of the Haversian canals extend far into the cartilage, nearly indeed to its free surface ; but most of them extend only into its lowest portion.

The development of bone occurs from the under surface of the periosteum. In health a soft "vascular germinal tissue" springs from the periosteal surfaces, and rapidly receives lime salts, and is transformed into bone. It always remains a thin substratum, barely visible, separating the periosteum from the bone. In rachitis this germinal tissue, not undergoing, or undergoing slowly and imperfectly, the osseous transformation, becomes a thick layer. Its color and appearance are like spleen pulp, so that the older observers supposed that there was a hæmorrhagic extravasation between the periosteum and bone. There is, however, no

extravasation, unless it accidentally occur from the numerous delicate capillaries. The resemblance to extravasated blood or spleen pulp is due to the abundant growth of large and thin-walled capillaries, as shown by the microscope. This layer of germinal tissue is, for the most part, quite uniform over the diaphyses of the long bones, while upon the cranial bones it is much thicker in certain localities than in others, and over certain areas it appears nearly or quite normal.

The nisus of ossification also appears in this sub-periosteal tissue. Lime salts are scantily and loosely deposited through it, forming rather osteophytes than bone, of very loose texture, thick, vascular, and fragile.

The question is naturally suggested, how does this disease affect the bone which is already formed when the rachitic state commences? Virchow's answer is the following: "Rachitis has, as you are aware, by more accurate investigation, been shown to consist, not in a process of softening in the old bone, as it had previously generally been considered to be, but in the non-solidification of the fresh layers as they form; the old layers being consumed by the normally progressive formation of medullary cavities, and the new ones remaining soft, the bone becomes brittle." ("Cellular Pathology," Lect. 19).

But this opinion of Virchow certainly requires modification. There is more or less absorption of the lime salts independently of that which normally occurs in the development of bone, as has been shown by Heitzman's experiments. Moreover, in craniotabes, which is one of the most interesting manifestations of the rachitic disease, the calcareous absorption is so great that holes appear in the skull. In this connection it is proper to consider the pathology of rickets. What is the nature of this malady? Niemeyer, I think, expresses the correct view when he says, "It seems to me that the most probable hypothesis regarding the cause of rachitis is that which refers it to inflammation of the epiphyseal cartilage and periosteum" (Article rachitis). The increased vascularity of the periosteum, the proliferation of periosteum and cartilage, the tenderness and pain on motion, and the febrile movement in acute cases, indicate inflammation rather than any other recognized pathological state. Rachitis appears to be a chronic, subacute inflammation, presenting an analogy with certain other well-known forms of inflammation, as cirrhosis, and chronic nephritis, in which proliferation of connective tissue and sclerosis occur. The eburnation rather than ossification, which terminates the rachitic process, may be considered an osteosclerosis.

In severe cases of rachitis many bones are affected. Indeed there is no bone that is not liable to the rachitic change; but in mild cases only a few are involved, at least so as to produce deformity appreciable to the sight.

Second Stage.—The second stage is that of curvatures and deformity.

In typical cases the relative proportion of calcareous matter being greatly reduced, if an opportunity occur of examining the skeleton, the long bones can be bent and their epiphyses, as well as the flat and short bones, can be compressed, and in some instances even crushed between the thumb and fingers. "The bones in this state can be cut with a knife with as much ease," says Trousseau, "as a carrot or other soft root." In cases in which the deposition of lime salts has been almost totally arrested for a considerable time, while absorption has occurred to give passage to the newly-formed canals, if the bone removed from the cadaver be dried, it will be possible to respire through it, so great is its porosity, and its weight is from six to eight times less than that of normal bone.

The head of the rachitic child appears abnormally large; but this appearance is due in great part to the delayed growth of the facial bones. Ritter von Rittershain states that accurate measurement shows that the rachitic head is not larger than that of the healthy child. But more recent examinations show that the head of the rachitic is abnormally large. At a recent discussion in the London Pathological Society, reported in the London *Lancet*, vol. ii., p. 1017, 1880, it was stated that in seventeen rachitic cases with an average age of 4·72 years, the average circumference of the head was 21·22 inches, while in an equal number of non-rachitic, with an average age of 6·5 years, the average circumference was 19·95 inches. Shaw has shown that the proportionate size of the head to the face, which in health is as six to one, is in rachitis as seven and one thirteenth to one. If the disease commence in the first year, or the beginning of the second, the delayed ossification prevents closure of the anterior fontanelle, which in the normal state ordinarily becomes ossified by the fifteenth month. In the rachitic the fontanelle may remain open through the second or even the third year, and the sutures proceeding from it also remain open longer than in health.

The rachitic head does not always present the same shape. It may be elongated, but more frequently it approximates to a square shape. It is more or less flattened superiorly, laterally, anteriorly, and posteriorly. The sutures which are late in closing are commonly depressed, while the frontal eminences are unusually elevated. After recovery the fontanelles and sutures often remain depressed below the general level, the latter appearing as grooves.

Craniotabes.—Occasionally the cranial bones in rachitis become very much thinned, and softened in places, to which the name craniotabes has been applied. This thinning occurs most frequently in the occipital and parietal bones, and sometimes to such an extent that the dura mater and pericranium are in contact. The soft spots are yielding when pressed upon, and in the cadaver, they are seen to be translucent when held to the light. Senator says, "The thinning of the occipital bone is brought about by the contending pressure of the pillow from without, and the brain from

within, when the infant is lying on its back." This is the accepted explanation of the cause of craniotabes, since it occurs in those portions of the skull upon which the pillow presses. It occurs chiefly in infants under the age of eight months, but, as we have seen, it may be congenital, the result of deficient ossification in the fœtal state. The degree of craniotabes varies greatly in different patients. There may be simple depressions, like erosions, on the inner surface of the occipital and parietal bones, while in other cases, and such as have been particularly studied by physicians, the loss of bone is complete, producing holes or open spaces of greater or less extent, so that the brain is covered only by the meninges,

FIG. 6.



CASE IN THE NEW YORK INFANT ASYLUM.

pericranium, and scalp. In order to ascertain if craniotabes exist, the examination must be made away from the sutures, for in the rachitic the margins of the cranial bones are flexible and yielding, even when there is no thinning, but thickening from cartilaginous proliferation. Pressure should be made cautiously and lightly with the fingers, so as not to injure the unprotected brain. When the bony layer is lacking the sensation communicated to the fingers has been compared to that from pressing upon a fully distended bladder.

Pressure upon the exposed brain is badly borne. Consequently the craniotabic infant lying in the usual position does not have quiet and refreshing sleep. It wakes often and frets till it is taken in the nurse's arms, or placed over her shoulder, which relieves the pressure upon the brain. Sometimes it instinctively seeks a position for its head on the edge of the pillow with the face downward. All rachitic infants are fretful, but those with craniotabes are most so of all from the mechanical cause alluded to. But if mere fretfulness were all, craniotabes would

possess much less pathological significance than belongs to it. Since the time of Elsässer it has been known to sustain a causative relation to many cases of that neurosis which has been variously designated spasm of the glottis, internal convulsions, laryngismus stridulus, and Kopp's asthma. Disturbance of the function of the brain, consequent on its exposed state, greatly increases the liability to convulsive diseases, and laryngismus stridulus is the one to which craniotabic infants are especially liable. For further particulars relating to this dangerous neurosis the reader is referred to the chapter which treats of it.

The wood-cut on the preceding page is of a child with rachitis, now in the N. Y. Infant Asylum. It is 18 months old, has six teeth, a square head, softened and thin cranial bones, and a greatly depressed longitudinal suture. Within the last two months it has had attacks of internal convulsions, in which it holds its breath and fixes its eyes, but which pass off in probably a quarter of a minute, without any noise. This child is very fretful, and dreads to be approached. In the same institution is another child, aged 15 months, without teeth, with a less marked rachitic head, but with the rachitic rosary, and a decided enlargement of certain of the joints of the extremities.

The deformities of the trunk and limbs occurring in the second stage are interesting. There is lateral depression of the thoracic walls between the second or third and ninth ribs, accompanied by projection of the sternum. The shape of the chest resembles that of the prow of a ship, to which Glisson likened it, or the breast of a bird. This deformity is the result of atmospheric pressure, occurring externally upon the thoracic walls during inspiration, at the time when the ribs are most softened, and least elastic. Depression of the first and second ribs is partially prevented by the support which they receive from the clavicles. The length of the clavicles is, however, somewhat diminished, and their curvatures increased, so that the shoulders approach each other. Below the ninth ribs the thoracic walls are expanded ; the corresponding ribs on the two sides are more separated from each other than in their normal state. The expansion of the base of the chest diminishes the convexity of the diaphragm, and causes depression of the liver and spleen.

The abdomen in rachitis is protuberant, partly on account of the depression of the liver and spleen, partly on account of the spinal curvatures and shortening of the trunk, but chiefly on account of the fact that in this disease the intestines are distended with gas. The meteorism gives rise to tympanitic resonance on percussion, except occasionally over the lower part of the abdominal cavity, where there may be dullness from serous effusion.

Spinal curvatures, to which allusion has been made, are common in rachitis. They are due to softening of the intervertebral cartilages, and the bodies of the vertebræ, and to laxity of the intervertebral ligaments.

Their direction is commonly antero-posterior. They are distinguished from the deformity of caries by the absence of an angular projection. Moreover, except in cases of long continuance, the curvature can be removed by placing the patient in a horizontal position, and pressing with the fingers on the projecting parts. The pelvic bones also undergo change of shape. The deformities of these bones, resulting from rachitic softening, are in the female the most important of any which the skeleton undergoes. They are produced by pressure from above of the abdominal organs and the spinal column. While the brim of the pelvis may be widened by the pressure of the abdominal organs, the promontory of the sacrum is carried forward and downward by the weight of the spinal column, which supports the head and shoulders. Pressure from below of the heads of the thigh-bones in standing, and of the ischia in sitting, tends to narrow the outlet of the pelvis. Hence the marriage of the female who has been rachitic in infancy may involve serious consequences. Many of the tedious and instrumental labor cases in the families of the city poor, which severely tax the patience and endurance of young practitioners, are attributable to rickets in early life.

The bend of the humerus is such in most patients that its concavity looks inward and forward, but occasionally it is directly the opposite. The concavity upon the forearm corresponds with the palmar surface of the hand. The concavity of the thigh presents toward the median line and a little posteriorly, the natural bend of the femur being simply in-

Fig. 7.



Fig. 8.



creased. The curvatures of the tibia and fibula vary in different cases. If the infant have not walked, their concavity is sometimes directed forward and inward ; but if it have walked, outward and backward. Occasionally, the direction of the bend on one side differs from that on the other.

Third Stage.—The third stage is that of reconstruction. After a variable period, depending on the severity of the disease and the state of the constitution, the "vascular germinal tissue" becomes more consistent, and points of calcareous matter appear here and there within it. The deposit of lime-salts continues, and the newly formed bone again becomes firm and unyielding. It is generally cancellous in places where the original bone was of this character, though the extent of the new cancellous structure is apt to be different from that in the normal bone. Thus not only are the epiphyses cancellous in the new as in the original bone, but I have seen the entire medullary cavity filled with cancellous structure. The subperiosteal deposit is sometimes also transformed into cancelli. This was the character of the change occurring under the pericranium in one specimen which I examined. Where the original bone was compact, the reconstructed bone is usually of the same character, as, for example, in the shafts of the long bones. Compact portions of the reconstructed skeleton have been said to lack the elements of true bone ; they are osteoid, according to this theory, and not osseous, resulting from petrifaction of the gelatiniform substance. I have, however, found the elements of true bone in the skeletons of two individuals who had well-marked rachitic curvatures. The portions examined were removed from the concavities of the long bones, where there had been decided bending and thickening of the shafts from the large amount of rachitic deposit. In both specimens the osseous corpuscles (*lacunæ*) and Haversian canals were easily demonstrated ; but in both there had been considerable growth of the bones since the rachitic period, and perhaps the portions which were examined belonged to this subsequent growth. The deposit of lime salts which occurs during convalescence ordinarily produces a firmer and more condensed structure than normal bone. It is sometimes designated eburnation.

Such is a brief sketch of the changes which the skeleton undergoes in ordinary cases of rachitis. An extreme degree of softening may be reached in four or five months, or not till the lapse of a year or more. The third stage, or that of consolidation, lasts one or two years. While in the first and second stages there is an arrest of ossification, and a deficiency of calcareous salts in the system, there is often in the third stage, as Lebert has stated, an exuberance of ossification, and a superabundant deposit of the salts of lime, so that the reconstructed bone is firmer and stronger than normal bone.

Occasionally, in reduced states of system, the third stage does not occur. The bones remain very soft and flexible, consisting almost entirely of animal matter. This is what has been designated rachitic consumption of bones. Such cases end fatally after a variable time.

A not infrequent accident in the second period of rachitis is fracture in the shafts of the long bones. From the nature of the fracture, crepitation can rarely be produced. The callus is not generally abundant, and reunion

of the bone is slow. Many cases of rachitic fractures are partial, portions of the shaft deprived of the mineral element bending, while the part which retains this element is fractured.

Rachitis retards the evolution of the teeth. If the disease commence as early as the fifth or sixth month, no teeth commonly appear till after the age of twelve months; if certain teeth have appeared prior to the rachitic disease, an interval of several months elapses before the next are cut. Sir William Jenner states that if the child have no teeth by the ninth month, it is probably rachitic. Teeth which are developed during the rachitic state are frail, and deficient in enamel. They become black and carious early, and loosen in their sockets. If there be no tooth at the age of twelve months, the infant is probably rachitic. The fontanelles and cranial sutures remain open longer than in healthy infants. The former may not close till the third or fourth year, and the latter not till the second or third year. Patency of the anterior fontanelle after the age of twenty months indicates rachitis.

Rickets produces another important effect upon the skeleton. Its growth is stunted, with the single exception perhaps of the cranial bones, so that those who have been rachitic in childhood, unless mildly, have less stature in adult life than the average. This is evident, though ample allowance be made for curvatures. The arrest of development is greater in some bones than others. It is greatest in the bones of the face, pelvis, and lower extremities. Stunted growth of the pelvis in connection with deformity may obviously involve very serious consequences in the female. Although the prominent and characteristic lesions pertain to the skeleton, the soft tissues are also more or less implicated. The ligaments become relaxed and flabby, giving unusual mobility to the joints and unsteadiness to the movements. The fibrous bands which unite the vertebræ, as well as the ligaments of the extremities, participate in the relaxation.

In certain rachitic patients the muscles, either in consequence of malnutrition, due to indigestion, or intestinal disease, or in consequence of disuse —for the rachitic are apt to be quiet—become shrunken and flabby. The spleen is frequently enlarged, as ascertained by palpation and percussion. The enlargement is the result of cellular proliferation, which is common in diseases attended by dyscrasia. The liver in many patients undergoes no perceptible change, except that it may be crowded a little downward. In occasional cases it is enlarged from fatty infiltration, but no special significance attaches to this, for fatty liver is common in various forms of disease attended by innutrition and wasting. There can be little doubt that Sir William Jenner errs when he states that albuminoid infiltration of the liver is common in rachitis. Parry, Gee, Dickenson, and Senator agree that it is rare, and if it do occur, is a coincidence.

Symptoms.—The patient in incipient rachitis is quiet and melancholy, shunning caresses or attempts to amuse him, since movement of his body

increases his suffering. He has general tenderness, due in part to the morbid state of the periosteum, and in part to hyperæsthesia. The rachitic infant, therefore, unless very mildly affected, will evince anxiety and dread even at the approach of any one, through fear of being touched or moved. Trousseau says : "This change in the character of the infant, the fear which it experiences of seeing its sufferings return, which the pressure of another's hand causes, this habitual sadness impressed upon its features, differs from that which we observe at the commencement of other maladies, especially from that in the prodromic period of cerebral fevers. In truth, in an infant over whom this last and cruel affection is impending we are able to excite again a momentary cheerfulness ; we are able, by exciting actively its spirits, to make it turn temporarily from this melancholy languor, which constitutes its habitual state. It is not thus in the rachitic ; the more you desire to arouse it, the more you solicit its movements, the greater will be its impatience. It is indifferent to the plays which it previously loved. This . . . habitual sadness in an infant, who, with an appetite rather augmented than diminished, sensibly emaciates, who has constantly acceleration of pulse coincident with profuse perspiration, these symptoms, I repeat, have positive significance when the infant does not cough or present any of the signs which induce us to believe in the occurrence of tubercular phthisis."

Febrile movement, manifested by acceleration of pulse and increased heat of blood, sometimes occurs in the more acute cases, but in the ordinary chronic cases there is commonly no decided elevation of temperature.

A *bruit de soufflet* of greater or less intensity, synchronous with the pulse, has frequently been heard in rachitic cases, when the ear was applied over the anterior fontanelle. Drs. Fisher and Whitney, New England physicians, first called attention to this murmur, believing it to be a sign of chronic hydrocephalus. MM. Rilliet and Barthez heard it in cases of rachitis, and therefore concluded that the American observers had mistaken the rachitic for the hydrocephalic head. Later observations have established the fact that this murmur possesses little diagnostic value. It is heard in healthy as well as diseased infants. Dr. Wirthgen detected it 22 times in 52 children, all of whom, except four, were in good health. I have auscultated the anterior fontanelle in 29 infants, who were, with two exceptions, between the ages of three and thirty months. They were in good health, or with trivial ailments which would not affect the cerebral circulation. In most infants with a patent fontanelle a murmur can be distinctly heard synchronous with the respiratory act, and in 15 of the 29 cases no other *bruit* could be detected, while in the remaining 14 a *bruit* synchronous with the pulse was heard at the fontanelle.

The rachitic, as stated above, are liable to perspirations, which are profuse about the head and neck, so as to moisten the pillow on which they

lie. The respiration is more or less accelerated except in the mildest cases, in consequence of the flexibility and diminished elasticity of the ribs, and the lateral depression of the thoracic walls, which prevent full inflation of the lungs.

The urinary secretion is abundant, like the perspiration. During the first and second periods it contains a large amount of the calcareous salts, since the lime which enters the system with the ingesta, and which in the normal state is expended in the growth of bone, is eliminated from the system by the kidneys.

The appetite in the beginning of rachitis is good, sometimes even better than in health ; but it gradually diminishes, as the disease increases in severity. Diarrhœa, alternating with constipation, is common. With the continuance of febrile movement and loss of appetite the patient soon begins to lose flesh, emaciation in the second stage being a prominent symptom.

Complications.—Rachitis is often attended by certain serious complications, the most frequent of which are inflammatory affections of the respiratory apparatus. Bronchitis is one of the most common diseases during the age at which rachitis occurs, and even a mild form of it involves great danger if the ribs be soft and flexible or the thorax have the rachitic deformity. In these cases, since full inflation of the lungs is prevented, collapse, more or less complete, of certain of the lobules is apt to occur, increasing the amount of dyspnœa, and therefore, diminishing the chances of recovery ; hence bronchitis is very fatal in infants who are decidedly rachitic.

Imperfect digestion of food, and unhealthy alvine evacuations, common in rachitic children, frequently cause diarrhœa, and, after a time, intestinal inflammation. The diarrhœa, especially if it have become inflammatory, is apt to be obstinate and dangerous, the patient becoming emaciated and feeble.

Internal convulsions, the so-called laryngismus stridulus, has been observed in so large a proportion of cases, that its occurrence in rachitis, especially in craniotabes, must be considered something more than a coincidence, as has been stated above. Hypertrophy of the brain, and chronic hydrocephalus, are also occasional complications. In cases of great deformity of the chest from rachitis, in which the lungs are more or less compressed, the pulmonary circulation is retarded and imperfect. This gives rise to congestion of the right cavities of the heart, with hypertrophy of this organ, and congestion of the hepatic veins, liver, and portal system. Congestion of the portal system may be regarded as one cause of the diarrhœal attacks.

Diagnosis.—Diagnosis is easy, except in incipient or slight cases. The lesions which pertain so largely to the skeleton are readily detected. Beading of the costo-chondral articulations occurs early, and is apparent

to the sight. Enlargement of the joints of the limbs, arrested dental evolution, the state of the anterior fontanelle, the peculiar shape of the head, the sternal projection, and rachitic curvatures, indicate positively the rachitic state. Profuse perspiration upon the head and neck, and the general tenderness of the patient, as evinced by his cries when moved or disturbed, are also important diagnostic signs. Nevertheless rachitis, though not uncommon in the tenement house families of New York, is frequently overlooked by physicians, who attribute the fretfulness, perspiration, etc., to other causes. Backwardness of dentition is a notable sign of rachitis, and is therefore one of the most important for diagnosis.

Prognosis.—The prognosis is favorable, as regards life, if rachitis be recognized at an early period, and properly treated. The vicious nutritive process may be arrested, and the patient recover with but slight deformity. If curvature of the long bones have occurred, and the head and thorax be misshapen, the patient, under favorable hygienic conditions, commonly recovers from rachitis, but with permanent deformities.

If there be that degree of spinal curvature in the dorsal region, and depression of the ribs, that respiration is, habitually, more or less accelerated and embarrassed, on account of compression of the lungs, the prognosis is unfavorable, since bronchial or pulmonary inflammation, occurring in this condition, is apt to be fatal. If there be much emaciation, and especially if diarrhœa be present, or of frequent occurrence, the prognosis should be guarded. In these cases there is probably waxy degeneration of important organs, which cannot be remedied.

Treatment.—The correct treatment of rachitis is obvious when we consider its character and the nature of its causes. The indication is to restore healthy nutrition. This requires both hygienic and therapeutic measures. The apartment in which the child resides should be dry, airy, and plentifully supplied with light. He should be taken daily into the open air, in order to invigorate his system, but in such a way as not to increase his suffering, in consequence of his general tenderness. The diet should be appropriate for he age. It should be bland and easy of digestion, and, at the same time, sufficiently nutritious. Cleanliness of person and apartment, and clothing sufficient to protect from vicissitudes of temperature, are requisite. The rachitic patient of the city should, if practicable, be removed to a well-selected locality in the country.

The medicines which are of undoubted efficacy in rachitis are cod-liver oil and lime. I prefer the following formula, which agrees with most children :

℞. Ol. morrhuæ, ℥ vj ;
Syr. calcis lactophosphatis,
Aq. calcis, āā ℥ iij. Misce.

Give one to two teaspoonfuls three or four times daily. To it may be added the syrup of the iodide of iron. The ordinary ferruginous and vegetable tonics are all useful.

The compound syrup of the phosphates, the citrate of iron and quinia, wine of iron, iodide of iron, the various preparations of cinchona, columbo, etc., are the medicines which, with or without cod-liver oil, are best calculated to restore healthy nutrition. When complications arise, the treatment should be modified to meet the exigencies of the case. Most of the diseases which occur as complications, require treatment similar to that which is appropriate in their idiopathic form, but all measures of a depressing nature should be avoided.

CHAPTER II.

SCROFULA.

The term scrofula (*scrofa*, a pig, from the resemblance of the enlarged cervical glands of a scrofulous individual to a swine's neck) is applied to a diathesis which is characterized by increased vulnerability of the tissues. The nutritive process of the tissues is readily disturbed even by trifling irritants or agencies in those who possess this diathesis, and, therefore, the scrofulous are very prone to inflammations of various parts and to hyperplasia, more particularly of the lymphatic glands. Inflammations which can properly be considered as dependent upon this diathesis, or as occurring under its influence, are for the most part subacute or chronic, and they differ from ordinary inflammations in the fact of a greater cell formation, and greater liability to cheesy degeneration of inflammatory products, so that return to the healthy state by absorption is slow or impossible. Moreover, this diathesis, while it gives rise to certain inflammations, which do not occur or are rare in other states of the system, and which all physicians at once recognize as scrofulous, often modifies those common inflammations to which all persons, whether scrofulous or non-scrofulous, are liable, as coryza and bronchitis, rendering them more protracted and less amenable to the ordinary treatment.

Scrofula is a disease chiefly of infancy and childhood. Manhood, especially the first years of it, is not entirely exempt, but scrofulous manifestations after the age of twenty years are feeble and infrequent, disappearing entirely as the individual advances toward middle life. The diathesis is most active prior to the age of ten years.

Causes.—Scrofula is congenital or acquired. Parents who had scrofulous symptoms in early life, or who are in a state of decided cachexia, as from cancer, syphilis, intermittent fever, or tuberculosis, are apt to beget scrofulous children. Insufficient nourishment of the mother during a considerable part of her gestation, and advanced age, and therefore feebleness, of the father, are occasional causes. Near blood relationship of

the parents is also a recognized cause, and to this has been attributed the scrofula of royal families. Children whose father and mother are first cousins are, according to my observations, apt to be scrofulous.

Again, those born with sound constitutions may acquire scrofula though anti-hygienic influences in the first years of life. Among the poor of New York we often observe one child in the family who presents scrofulous symptoms, while the rest of the children are well, and in many cases we are able to trace back the diathesis to some depressing cause or causes, which were sufficient to effect the peculiar change in the molecular condition of the tissues which constitutes this disease. Obviously the causes of acquired scrofula are quite numerous. In the infant it is sometimes produced by insufficiency or poor quality of the breast-milk, or the use of artificial food during the period when breast-milk is required. Too protracted lactation also, especially if artificial food be almost wholly withheld, may cause it ; as may also, in those who have passed beyond the age of lactation, the continued use of a diet which is deficient in nutritive properties.

Residence in damp, dark, and filthy apartments or streets may also produce it. Hence one reason of its frequent occurrence among the city poor. Residence in a small, crowded, and imperfectly ventilated apartment has been known to produce it, even with personal cleanliness, and a diet sufficiently nutritive.

Scrofula may also be caused, in those previously robust and of sound constitution, by disease of an exhausting nature. The eruptive fevers, as smallpox, measles, and scarlet fever, if severe, occasionally produce this result ; or they render active the diathesis, which had hitherto been latent. In this city, where chronic entero-colitis of infancy is common, I have sometimes been able to trace the diathesis to it.

Can a child affected with scrofula communicate it to others ? Does scrofula possess a specific principle, a virus which produces the disease, and which is communicable to others ? There is a strong popular belief that it is contagious by contact, and some good pathologists and high authorities in children's diseases are inclined to believe that this opinion has foundation in fact. M. Bouchut, who holds that the "scrofulous and tubercular diatheses are identical," says of scrofula that it has not been shown to be inoculable. "Nevertheless, if its contagiousness have not been demonstrated, we are not able to say that it will not be some day. The facts of vaccinia followed by impetigo, by scrofulous ophthalmia, and enlargement of the cervical glands attributed to the inoculation of scrofulous vaccine virus, and those of the contagion of phthisis by constant cohabitation, demand, at least for the present, a certain reserve."

But scrofula differs widely in its nature from those diseases which are known to be communicable. It presents no analogy with them. We

would not suppose, apart from observations, that a diathesis which consists in such a state or constitution of the tissues that they are easily wounded possessed any inoculable principle, and in my opinion observations go to show that no such principle exists. How often do we observe children with scrofulous coryza, otorrhœa, or scrofulous cutaneous eruption, associating with others without communicating the diathesis ?

Vaccination, however, affords the best opportunity for determining whether scrofula is inoculable, and the very prevalent opinion of non-professional people, that it may be communicated and established through this operation, should have due weight ; for it may be stated, as a rule, that a widespread popular belief in reference to a disease which has external manifestations, does have some foundation in truth.

The following are the facts in reference to this matter :

1st. It is the almost unanimous opinion of the most experienced vaccinators that pure vaccine lymph taken from a vesicle prior to the eighth day, never communicates anything but vaccinia. When another disease, as syphilis, is communicated by the use of the lymph, it is through the blood, which has been mixed with the lymph by careless puncture of the vesicle. This opinion, so strongly established by observations, also commands assent from its reasonableness.

2d. Vaccination of those who are decidedly scrofulous with virus from a healthy child, especially if the scab be employed, not infrequently produces a sore which becomes covered with a thick and irregular crust, consisting in part of inspissated pus, and the sore is long in healing. In the scrofulous, also, impetiginous eruptions are apt to arise around the vaccine sore, and the axillary glands to become tumefied on the side corresponding with the vaccination. This gives rise to the belief on the part of friends that impure virus has been used, and scrofula communicated, while the fault is in the constitution of the child itself. The tumefaction of the glands, and the primary and secondary sores gradually disappear in most cases, leaving no ill effects, and with no subsequent manifestations of disease.

3d. The vaccine crust from a decidedly scrofulous child, as it contains more or less animal matter, and is often pale, irregular, or broken, inserted in the arm of a healthy child, not infrequently produces an immediate inflammation with suppuration, so that the vaccine vesicle, if it form, is soon broken, and an irregular sore and crust result, which present none of the appearances observed in the uncomplicated vaccine eruption. A simple inflammation, produced by the pus or other products contained in the scrofulous scab, has coexisted with and modified the specific eruption. The sore heals gradually, and impetiginous eruptions may occur around it, but no struma remains or is communicated.

4th. Scrofulous manifestations sometimes appear for the first time after vaccinia, but they appear also after those analogous but severer erup-

tive fevers, namely, measles, scarlet fever, and smallpox. Those infectious exanthematic diseases which profoundly affect the constitution, it is admitted, may be a co-operating, if not a main, cause of scrofula, and is there anything unreasonable in the supposition that vaccinia may have occasionally a similar effect, though less frequently or in a less degree, in proportion as it is milder? From my own observations, I am of opinion that vaccinia, not vaccination, may occasionally awaken to activity the scrofulous diathesis, or, in combination with other causes, may even produce it in those who previously possessed good constitutions. It is a well-established fact, in the etiology of diseases, that causes which, in themselves, are entirely inadequate, or even insignificant, frequently produce disease in a system which other agencies have already prepared for it. Thus an excoriation gives rise to erysipelas, or a slight exposure to cold produces rheumatism. In like manner in those cases in which the friends have charged the production of scrofula upon vaccination, it has seemed to me that the most that could, with truthfulness, be alleged, was that the constitutional disease, vaccinia, which had been produced by the operation was a subordinate, but, under the circumstances, a sufficient co-operating cause of the scrofulous state.

The following is the most striking case of the apparent communication of scrofula through vaccination which I have met: D——, West Fortieth Street, residing in a tenement house, had no scrofulous affection, and was considered healthy till the age of eleven years. The remaining children of the family have never exhibited scrofulous symptoms. At the age of eleven years this boy was vaccinated from a scab, the source of which was not known, but by a physician whose practice was chiefly among the city poor. The sore produced was long in healing, and, before it had healed, the axillary glands, and those of the face and neck, began to be prominent and hard. From this time to the present, a period of six years, these glands have remained so large as to constitute a deformity, and certain other groups of glands, as those in the left infra-clavicular region and right groin, have undergone a similar hyperplasia. Examination of the blood by the microscope shows the absence of leucocythæmia. This case, at first view, certainly appears to be an example of the communication of scrofula through vaccination, and, for a time, I could interpret it in no other way. But, when we recollect the facts already stated, namely, the improbability of the communicability of a diathesis of such a nature, how frequently scrofula is acquired by children of the tenement-house population, solely through the anti-hygienic conditions in which they live, the large number of scrofulous children in the crowded quarters of the poor, many of whom have external ailments, so that the conditions for communication are present in a high degree if scrofula were contagious, while the instances of its apparent communication are very infrequent, is it not probable that cases like this are to be explained in the

manner indicated above, and that scrofula is not transmissible by vaccination?

The close resemblance clinically of scrofulous affections with the ulterior lesions of syphilis, has been adduced in support of the belief that scrofula, like syphilis, is due to some undiscovered specific principle. But the parallelism, it seems to me, is more apparent than real, and the difference between the two diseases is so great as to destroy the validity of the argument. For while syphilitic manifestations result from the reception of a certain poison in the system, scrofula as certainly results from a variety of ordinary depressing agencies, affecting the system in so many distinct ways that it seems unreasonable to suppose that they produce a fixed specific principle, which, remaining in the system, causes the phenomena of scrofula. The facts then appear to justify the belief that scrofula does not possess any such principle, but that this constitutional anomaly is the direct result of the action of depressing agencies on the constitution of the tissues.

The primary scrofulous ailments, by which the diathesis is manifested, occur for the most part upon one of the free surfaces, namely, upon some part of the skin or mucous membrane. Certain standard authors attribute this to the fact that these parts are most exposed to the action of noxious agencies. The lymphatics lying in the inflamed area take up the altered lymph and carry it to the adjacent lymphatic glands, which become irritated, and undergo hyperplasia, and perhaps ultimately suppuration. This is, in a large proportion of cases, the beginning of scrofulous ailments. Nevertheless, in not a few instances, the first manifestations are in deep-seated and covered parts, as when scrofulous periostitis or osteitis occurs, without any peripheral lesion.

Anatomical Characters.—There are no ascertained anatomical changes in the blood which are peculiar to scrofula. As long as the appetite and general health remain good, and the local affections have not occurred, the composition of this fluid is, so far as known, unaltered. In the cachexia which is present when the general health is impaired, the blood becomes impoverished, the red corpuscles lose a portion of their coloring matter, and the watery element predominates.

Does the glandular hyperplasia of scrofula produce an excess of the white corpuscles? Virchow says (*Cellular Pathology*, Lect. IX.): "During the progress of an attack of scrofula, in which, if the disease run a somewhat unfavorable course, the glands are destroyed by ulceration, or cheesy thickening, calcification, etc., an increased introduction of corpuscles into the blood can only take place as long as the irritated gland is still, in some degree, capable of performing its functions, or still continues to exist; as soon, however, as the glands are withered or destroyed, the formation of lymph-cells likewise ceases, and with it the leucocytosis. In all cases, on the other hand, in which a more acute

form of disturbance prevails, connected with inflammatory tumefaction of the gland, an increase of the colorless corpuscles always takes place in the blood." Although the glandular hyperplasia occurring in scrofula increases the number of white corpuscles in the blood, scrofula cannot be regarded as sustaining any causative relation to that great and constant increase of white corpuscles which characterizes the disease leucæmia ; for this disease, as remarked by Niemeyer, does not occur in childhood, when the scrofulous diathesis is active, but in manhood, when it has ceased to exist, or has become latent.

Strumous inflammations of the cutaneous and mucous surfaces, which we have seen are the initial lesions in a large proportion of scrofulous cases, do not present any peculiar anatomical characters. Some of them are attended by an abundant formation of cells, and by dense infiltration of the inflamed tissues ; but inflammations which do not depend on the strumous diathesis may present these same characters. The most marked differences between the strumous and non-strumous inflammations are found in their origin, amount of cell-formation, and duration.

The swelling of the lymphatic glands, which is so common in the neighborhood of scrofulous ailments, and which we have seen is in most instances the result of "conducted irritation," is due to hyperplasia of the lymphatic glands, with comparatively little or no increase of the stroma. Thus hyperplasia of the cervical glands is common, resulting from eczema of the scalp or face, or from otitis, or any of the forms of stomatitis ; and so pharyngitis often gives rise to hyperplasia of the tonsils, which are lymphatic glands. The scrofulous nature of the glandular enlargement is apparent from the fact that it continues long after the primary inflammation which gave rise to it has abated. Lymphatic glands sometimes enlarge in those who are not scrofulous, either from direct injury or propagated inflammation, but the tumefaction is commonly less in degree, and in most instances it soon abates when the exciting cause is removed.

The glands which most commonly undergo scrofulous enlargement are the cervical, inguinal, bronchial, and mesenteric ; but in those who are decidedly scrofulous, the glands in the vicinity of any protracted inflammation are very prone to hyperplasia. Thus I have seen enlarged and cheesy glands in the vicinity of scrofulous ostitis, or periostitis.

Under favorable circumstances the glandular enlargement abates after a short time, by absorption of the redundant cells. But the products of hyperplastic or inflammatory action in the scrofulous individual are very apt to undergo cheesy degeneration, and the close causative relation of this cheesy substance with tubercles is now admitted. If resolution do not soon occur in the gland, it begins to undergo cheesy degeneration. It becomes firm and inelastic, its nutrient vessels narrowed and compressed, so that circulation through it ceases, and its cells, losing their liquid and

vitality, shrivel away. This necrobiotic process appears in points in the gland, which enlarge and unite, till finally the whole gland becomes a dead mass, with shriveled elements, of a whitish appearance, like cheese, the resemblance to which has suggested the name by which the degeneration is known.

In certain patients cheesy glands act as an irritant, like inorganic matter, producing suppurative inflammation, and their history thenceforth is that of an abscess. Purulent matter mixed with the cheesy débris escapes by ulceration upon the nearest surface, and scrofulous ulcers result, which slowly heal, leaving permanent cicatrices; calcification of a cheesy gland occurs in exceptional instances.

The cervical lymphatic glands, having undergone hyperplasia in the scrofulous child, not infrequently continue painless and indolent for a considerable time, producing, according to their size, an unsightly appearance, and without undergoing cheesy degeneration. Finally one or more becomes inflamed, and the broken-down gland substance softens and is expelled, mixed with pus, through an ulcerated opening in the skin.

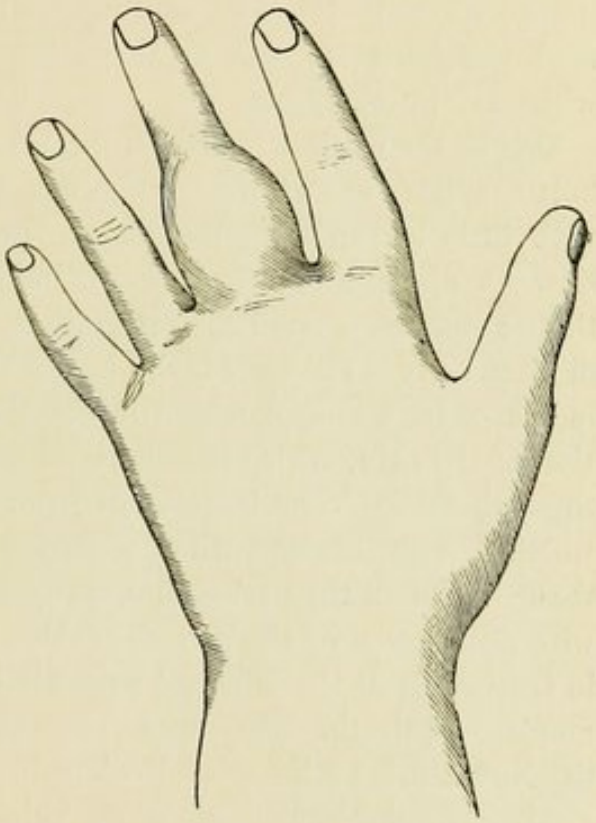
In order to complete the description of the anatomical character of scrofula, it would be necessary to describe the various inflammations to which the diathesis gives rise. Those which are most common and important occur in the skin, mucous membrane, connective tissue, the joints, the bones with their periosteal covering, and the eye and ear; eczema and coryza are very common scrofulous ailments. Phlyctenular keratitis with great intolerance of light, otitis externa, causing protracted otorrhœa, or media and interna, causing deep-seated pain, with impairment or loss of hearing, offensive purulent discharge, and, in the gravest cases, caries of the mastoid cells or caries extending along the petrous portion of the temporal bone even to the brain, causing meningitis and death, are not uncommon manifestations of scrofula, in the families of the city poor. Strumous cellulitis, occurring independently of the glandular affection, and quickly ending in suppuration, is also common. The term *cold* is applied to the abscess when the local symptoms are slight, and there is but little heat of the parts. In young children the common seat of these abscesses is directly under the skin, so that if subcutaneous cellulitis running into an abscess occur in a young child, he probably has the strumous diathesis.

The osseous system is also very prone to inflammation in the scrofulous. Periostitis, ostitis, and arthritis, rare in those with healthy constitutions, are common in the scrofulous, in whom they result, even from very slight injuries, and sometimes without the recollection of any injury, and apparently from the direct influence of the diathesis. These inflammations are more common in the lower extremities than in the upper. Periostitis often occurs in scrofulous children without ostitis, when its usual seat is upon the shafts of the long bones, and it also accompanies

inflammation of the bone, as pleurisy accompanies pneumonia. The osseous inflammations of strumous patients are of two kinds : first, the destructive, producing caries with suppuration, or necrosis ; and, secondly, the so-called *fungous*, in which there is proliferation of tissue as in white swelling. Often both these processes co-exist, granulations and new tissue springing up, while the carious or necrotic process is extending.

Dactylitis is in most instances, when occurring in young infants, a syphilitic affection, but in children of one year or more, in whom no marked syphilitic symptoms have previously occurred, it originates from the strumous cachexia, as in the following case : Charles R., aged twenty months, was admitted into the New York Infant Asylum in 1876. He had always been pallid, and had a strumous aspect. A physician acquainted with his parentage states positively that he is free from syphilitic taint, but when a few months old he had a mild form of coryza, which gradually abated under anti-strumous treatment. At the age of five months he had purpura hæmorrhagica of a severe form, but apparently not accompanied by hæmorrhage from any of the mucous surfaces. The patches of extravasated blood were quite numerous and large over the trunk and limbs, and it was nearly three months before they entirely disappeared. A few months subsequently he began to have offensive otorrhœa on one side, which did not entirely cease. In December, 1876, at the age of eighteen months, well-marked dactylitis was first observed, involving the first phalanx of the left middle finger. The swelling was somewhat tender, and the skin which covered it had a slightly reddish or pinkish tinge, indicating the inflammatory nature of the malady. Neither joint at the extremity of the phalanx was involved, so that the movements were unimpaired. The dactylitis increased somewhat after it was first discovered, and then began to decline, under treatment with the cod-liver oil and syrup of iodide of iron. The accompanying wood-cut represents the outlines, obtained by tracing the hand of the infant, when pressed on paper.

FIG. 9.



SYMPTOMS.—The scrofulous diathesis is exhibited by certain physical signs, which are present in infancy, but are more manifest in childhood. In one class of strumous children they are as follows : form, tall and

slender; quickness of movement and perception; intelligence, good; skin, thin and semi-transparent, through which the superficial veins are distinctly seen; features, delicate; cheeks, habitually pallid or florid, and flushed by slight excitement; eyes, bright, with bluish conjunctiva; muscles and bones, slender in proportion to their length. Those children who present these peculiarities are said to have the erethitic form of the diathesis.

Others have what has been designated the torpid scrofulous habit, which is characterized by softness and flabbiness of the flesh, distended abdomen, large head, broad face, slow, languid movements, and an overproduction of fat in the subcutaneous connective tissue in certain situations, especially the nose and upper lip. Though typical cases can be readily referred to one or the other of these forms, there are many which are intermediate.

One of the earliest of the scrofulous manifestations is subcutaneous cellulitis, alluded to above, giving rise to abscesses, commonly not large, with little surrounding induration, little pain, tenderness, and heat, and slow in discharging; in a word, indolent. The most frequent seat of these abscesses is upon the extremities, but they may occur upon the scalp or elsewhere. They gradually heal when the pus escapes, their site being indicated for a considerable time by the depression and reddish discoloration of the skin, which gradually returns to its normal state. Ordinarily, these abscesses do no harm apart from the reduction of the general health which they effect, but, when occurring in localities where the connective tissue lies upon the periosteum, as upon the fingers, periostitis may result, with destruction of the surface of the bone. Again, thrombi may occur in the vessels of the inflamed part, giving rise to emboli, embolismal pneumonia, and death. Specimens from such a case were presented by me to the New York Pathological Society in 1868.

The scrofulous affections of the skin often also occur at an early age, even before dentition. They are more frequent in infancy than in childhood. The most common are eczema and impetigo, and of rare occurrence, ecthyma and lupus. But all these may occur in those who are not strumous or who do not present the characteristics of the strumous diathesis.

Scrofulous affections of the mucous surfaces are scarcely less frequent than those of the skin. They present the ordinary features of mucous inflammations of a subacute and chronic character.

Sometimes they occur without obvious exciting cause; in other cases there is a cause of this kind, such as exposure to cold; but the inflammation, once established, continues on account of the diathesis. It is often doubtful whether inflammations in strumous subjects be of such a character that it is proper to designate them strumous, especially if they occur upon such surfaces as are frequently the seat of ordinary inflammation. If the

child have heretofore presented symptoms of scrofula, if the inflammation be subacute, and there be no apparent cause to originate or sustain it apart from the diathesis, it is probably of a strumous character. The diagnosis is rendered more certain by observing the effect of anti-strumous remedies. The most frequent of these scrofulous inflammations of mucous surfaces are coryza, tracheo-bronchitis, and conjunctivitis. More rarely, stomatitis, pharyngitis, vaginitis, and, according to some, entero-colitis, are of a strumous character. Coryza gives rise to snuffling respiration, the formation of crusts around and within the nares, and excoriation of the upper lip. The tracheo-bronchitis is attended by thickening of the mucous membrane, increased production of mucus and epithelial cells, and a loud tracheal râle, accompanying each inspiration.

Strumous inflammation of the mucous membrane of the trachea and bronchial tubes is not a very infrequent disease in this city. It sometimes originates in a simple inflammation from cold, or the tracheo-bronchitis of measles, or pertussis, and it is apt to continue, with its râles, cough, and scanty expectoration, for months, unless relieved by a proper course of treatment.

Among the most common of the strumous affections, are inflammation of the eyelid, designated psorophthalmia, and that of the eye itself. The former is characterized by redness and thickening of the lids, detachment of the eyelashes, and inflammation and altered secretion of the "Meibomian glands"; the latter, namely, strumous ophthalmia, by pain, lachrymation, photophobia, and a moderate degree of hyperæmia of the affected organ. One of the most common serious results of strumous inflammation affecting the eye, arises from the conjunctivitis and keratitis, namely, the formation of phlyctenulæ and ulcers on the margin of the conjunctiva and upon the cornea, fed by newly formed vessels. If not controlled by proper treatment, these may result in opacities more or less permanent, or possibly, worse still, in perforation, with its consequent ill effects.

Inflammations of the external and middle ear have their origin very generally in the strumous diathesis. Occasionally there is an exciting cause of the otitis, as an injury, or severe constitutional disease, like scarlet fever. Protracted otitis, whether external or internal, and especially that form of it which leads to ulceration, destruction of the ossicles, and caries of the petrous portion of the temporal bone, it is proper, in a large proportion of cases, to regard and treat as strumous.

I have stated that inflammations of the osseous system are common in strumous children. Some of the best observers and highest authorities, as regards the surgical diseases of children, both in this country and Europe, state that they do not consider these affections to be of a strumous nature; while others regard them as manifestations of struma. After carefully examining the reasons for this variance in opinion, I am con-

vinced that the difference of views in reference to this matter occurs from a different understanding of the nature of scrofula. Those who state that the affections alluded to are not scrofulous, believe, so far as I have been able to ascertain, that scrofula and the tubercular diathesis are identical. As tubercles are not, as a rule, present in children who suffer from these affections, it is therefore held that these affections are not scrofulous. If those holding this belief were told, or could be made to believe, that scrofula is entirely distinct from the tubercular diathesis, that it is merely a name applied to a diathetic condition in which the tissues are easily wounded, there would probably be but one opinion as regards the scrofulous nature of these inflammations; for I have often had an opportunity to observe, they occur in a large proportion of cases from very trivial injuries, showing a highly vulnerable state of the tissues.

Holmes, in his useful and eminently practical *Treatise on the Surgical Diseases of Children*, says of one of the most common of the affections alluded to, namely, morbus coxarius: "The affection in question occurs very frequently in strumous children, a circumstance which has led to its being denominated strumous. . . If by strumous be meant a state of the system which renders the subject of it prone to the deposit of tubercle in the viscera, I think that there is good reason for asserting that morbus coxarius often attacks children who are not strumous, *i.e.*, who display no such tendency to the deposit of tubercle." Still, Mr. Holmes states "that there is that condition of the system which disposes its subjects to the development of low inflammations of various kinds," which is almost the full definition of scrofula, as understood by us.

The stubbornness and frequent disastrous consequences of scrofulous inflammation of the skeleton are well known. Nearly every bone, as well as its periosteum, is liable to this form of inflammation, but some are more frequently affected than others. Inflammation of the bone may terminate by resolution, by the formation of an abscess, or, and frequently, by carious or necrotic destruction of the bone itself. Necrosis is most apt to occur in the shafts of the long bones, caries in the spongy extremities of these bones, and in the spongy portions of the short bones. If abscesses form, the pus may finally escape from the system by a tedious ulcerative process, or, retained, may undergo cheesy degeneration. Scrofulous arthritis, if early detected and properly treated, may resolve, leaving no ill effect; if otherwise, suppuration, ulceration, cartilaginous and osseous, and anchylosis, are apt to result.

Scrofulous children are perhaps no more liable to inflammation of the internal organs than other children, but the inflammatory products are more liable to cheesy degeneration, and the prognosis is therefore less favorable. The most frequent of these inflammations, and the one of chief interest, is pneumonia. Catarrhal pneumonia, so frequent in early life, whether primary or secondary, in connection with measles, pertussis,

etc., is a disease often involving grave consequences in those who are decidedly scrofulous; since, instead of resolving, the affected lung-tissue presents a strong tendency to caseous degeneration, ending in consumption of the lungs and death. I have most frequently noticed cheesy pneumonia during extensive epidemics of measles, as a complication or sequel of this disease. It may occur in those who are not scrofulous, if the vital powers be greatly reduced, but it is so much more common in the scrofulous, that some recent writers have designated this form of inflammation by the term of scrofulous, instead of cheesy, pneumonia. From the fact, however, of its sometimes occurring in the non-scrofulous, the term cheesy or caseous, especially, too, as it expresses the anatomical state, seems more appropriate.

Relation of Scrofulosis to Tuberculosis.—Tuberculosis, in a large proportion of cases, results from the substance which is produced by caseous degeneration. In a caseous mass when it softens, are found fat globules, albuminous granules, and a large amount of matter in solution. These are reabsorbed to a greater or less extent, and in them is the substance which, lodged in healthy tissue, causes the peculiar cell proliferation, by which the tubercle is produced. The theory that this agent acts as an embolus intercepted in the capillaries, has its advocates. In many instances the intimate causative relation of the substance produced by caseous degeneration to the tubercular neoplasm appears from the fact that tubercles are developed in abundance in the cheesy focus, while there are no tubercles in other parts of the system. Fungous and ulcerative inflammations occurring in the osseous system afford common examples. Now since cheesy matter in the system of a young person results, in most instances, from the products of those inflammations which we recognize as scrofulous, we see the intimate relation between scrofulosis and tuberculosis, and why for a long time the strumous and tubercular diatheses were considered identical.

Prognosis.—As scrofula may be acquired through anti-hygienic influences, so it may disappear or become latent through influences of an opposite character. Therefore the manifestations of scrofula may be limited to a brief period, or they may occur at intervals through the whole of childhood, and the first years of youth. When the diathesis is inherited, and fostered by unfavorable circumstances, the scrofulous affections appear earliest, are most varied and severe, and continue longest.

In most cases, with proper treatment, the prognosis is good, but the danger to life depends on the nature and extent of the scrofulous inflammation. The most common unfavorable result is the occurrence of pulmonary or general tuberculosis from the infection supplied by the cheesy substance, in the manner stated above. This is the usual result from cheesy pneumonia. The next most common cause of death, either directly or indirectly, is inflammation of the osseous system. Many

deaths occur from inflammation of the vertebræ, or of the hip or knee joints, when it has been allowed to continue a considerable time without proper treatment. Protracted suppurative inflammation of the bones is apt to produce amyloid degeneration of organs, which is permanent, and likely to prove fatal, or death may occur from exhaustion, with or without tuberculosis. Among the city poor meningitis is not very uncommon, consequent on long-continued otitis media and caries of the petrous portion of the temporal bone. Permanent impairment of sight and hearing often results from neglected strumous ophthalmia and otitis.

After the age of puberty the strumous affections cease, and among the most robust adults are those who in early life presented indubitable symptoms of the strumous diathesis.

Treatment. *Prophylactic.*—Measures designed to prevent scrofula are impossible without the co-operation of willing and intelligent parents. It is obvious that the prevention of congenital scrofula requires the treatment of disease or impaired health in the parent. If parents should be taught, or should remember, that good health in themselves is the necessary condition of the inheritance of a sound constitution in the child, and would adopt such therapeutic and regimenal measures as would procure this, the number of cases of inherited scrofula would be materially reduced.

As the first years of life are very important, both for correcting the diathesis when inherited, and for preventing its development in those of sound constitution, care should be taken that the regimen of the child be such as would in no way produce deterioration of the general health. The nursing infant, if the mother be in poor health, should be provided with a healthy wet-nurse, for in young children the diathesis may be acquired solely by the use of food that is scanty or of poor quality. Those old enough to be weaned should have plain and nutritious diet, with a proper admixture of animal food. More or less outdoor exercise, and residence in a salubrious locality, with sufficient air and sunlight, are requisite.

Curative.—As scrofula originates in a state of weakness existing in the parent in the congenital, and in the child in the acquired form of the disease, and is characterized by feeble resistance of the tissues to irritating agents, the inference is reasonable that all tonics have, to a certain extent, an anti-scrofulous effect upon the system. The ordinary vegetable tonics, and sometimes the ferruginous, are indeed useful in the treatment of scrofula. Employed in connection with proper regimenal measures they are sufficient, in many cases, to remove the diathesis after a time, or render it latent. Besides these medicinal agents, which tend to correct the scrofulous diathesis by their general tonic effect, there are certain others which experience has shown to be beneficial in the treatment of scrofulous affections, and which are, therefore, largely used. One of these is cod-liver oil, which contains iodine, with numerous other ingredients.

Cod-liver oil is useless or nearly so in the torpid form of the diathesis, which is characterized by an increased deposit of fat in the subcutaneous connective tissue, slow circulation, and sluggish muscular movements. On the other hand, in the treatment of the erethitic form it possesses real value. Its protracted use in such cases does so modify the molecular condition of the tissues that they are less liable to inflammation, and the diathesis is, therefore, rendered milder or removed. From one to three teaspoonfuls, according to the age, should be given three times daily. While we frequently experience so much difficulty in administering it to adults affected with tuberculosis, and sometimes find it necessary to discontinue its use on account of its nauseating effect, scrofulous children rarely refuse to take it, and it does not seem to diminish their appetite.

Iodine is justly celebrated as a remedy in the treatment of scrofulous maladies, but it is a question whether it has not been overrated as a remedy for the diathesis itself. Iodine employed internally is especially serviceable in glandular hyperplasia, and in scrofulous thickening and induration of the connective tissue and periosteum. In general, it should not be administered to children in its isolated state, on account of its irritating properties, but one of its compounds should be employed. The compounds which are chiefly prescribed in the treatment of scrofula are the iodides of starch, iron, potassium, and sodium. If, as is frequently the case, the patient be pallid, and his appetite poor, the iodide of iron should be preferred ; if not in this cachectic state, the iodide of starch. Pharmaceutists prepare syrups of both these iodides, so that they can be readily administered to the youngest child. The iodide of starch may be administered by dropping from one to five drops of the officinal tincture of iodine on a little powdered starch, and giving it in syrup. These iodides are preferable to the iodides of potassium and sodium for internal administration to children, as they are not irritating to the mucous membrane, and the iodine is readily set free. Prof. Dalton has, indeed, demonstrated that the iodide of starch is decomposed in most of the liquids of the body, and the iodine liberated.

In New York city a large proportion of the scrofulous children are cachectic, and need iron, and the iodide of iron is more frequently employed, and with good results, than any other iodine compound. The syrup of the iodide of iron, which is readily absorbed, should be given in one to two-drop doses three times daily to a child of six months, and one additional drop added for each additional year. Among the vaunted remedies of scrofula are phosphoric acid and the phosphate of lime. I have not employed these agents without at the same time using other remedies, and cannot say, therefore, to what extent they have been curative in my practice. Probably there is no better combination of remedies for the strumous diathesis than the following, which is now used in some of the institutions of New York :

℞. Ol. morrhuæ, 2 parts;
Syr. calcis lactophosphat., 1 part. Misce.

Dose, one teaspoonful to a dessertspoonful three or four times daily, to each dose of which, the syrup of the iodide of iron may be added at the time of its employment.

The internal use of mercury as an antidote for scrofula is now generally discarded. Unless, perhaps, in those cases in which the diathesis is immediately dependent on syphilis, its use for this purpose, from what we know of its therapeutic effects, would probably be more injurious than beneficial. Among the medicines which have from time to time been employed for the cure of scrofula, some of which have had considerable reputation but have nearly fallen into disuse, are walnut leaves, sarsaparilla, elecampane, conium, digitalis, horseradish, compounds of silver, gold, arsenic, baryta, and bromine. It is probable that none of these has any effect on scrofula or scrofulous ailments, except such as improve the appetite and general health, as horseradish.

The same hygienic measures are required in the treatment of scrofula as are demanded in the prophylaxis of it. The nursing infant should have healthy breast milk, and if its mother belong to a tubercular or scrofulous family, or be feeble, a healthy wet-nurse should be employed, or it should be sent to the country, where suitable cow's milk can be obtained. In the city, the infant may be fed during the cool months with porridge made of the best cow's milk and barley flour, rice flour, Ridge's or Nestle's food, or one of the preparations of Liebig's soup; but, as stated elsewhere, such food will prove disastrous to infants under the age of twelve months who are kept in the city during the hot term. Their removal to the country is indispensable, both as regards the treatment of struma, and to prevent intestinal catarrh. The expressed juice of beef slightly boiled, given several times daily in small quantity to infants, aids materially in restoring a better nutrition of the tissues. Obviously similar care is necessary in the selection and preparation of the food of children who have passed beyond the period of infancy. While the diet should be highly nutritious, it should be plain, and easily digested, and given at sufficient intervals, so as not to overtax digestion.

Fresh air, out-door exercise, daily bathing, personal and domiciliary cleanliness, are very necessary for the most successful treatment of the diathesis. Since scrofula is comparatively infrequent in farming sections, scrofulous families are greatly benefited by farm life, with all the accessories to health which pertain to it.

The local scrofulous ailments require additional and special treatment. Those located on the cutaneous and mucous surfaces are less dangerous, as a rule, than the deeper seated inflammations; still they should be promptly treated, not only for the inconvenience and annoyance which

they cause, but because they are apt to lead to hyperplasia of the neighboring glands, which sometimes proves serious. Thus a pharyngitis may cause a peripharyngeal adenitis and abscess, and a bronchitis may cause an adenitis of the bronchial glands, with the probability of their cheesy degeneration. The so-called bronchial phthisis is believed to result, in a large proportion of cases, from a strumous bronchitis, which has been allowed to run on uncontrolled by medicine, and a similar state of the mesenteric glands may result from intestinal catarrh in the strumous. Inflammations of the skin and mucous surface occurring in the strumous, require the continued use of anti-strumous remedies, conjoined with such treatment, designed to act locally, as is appropriate for individuals who are not strumous.

It is the common practice to treat the enlarged glands of struma by daily applications over them of the stronger iodine preparations. This treatment does not cause absorption of the redundant gland substance. It causes proliferation of the epidermic cells, and quickens the cell change in the gland underneath so that leucocytes are apt to form in it. Cutaneous inflammation, as eczema or impetigo, causes hyperplasia of the lymphatic glands underneath. In like manner strong applications, which irritate the skin, are apt to quicken the cell formation, so that suppuration is a common result. I once produced accidentally such an amount of vesication over an enlarged, hard, and apparently indolent gland in an infant of fourteen months, that I was very anxious lest a sore would result, which would heal with difficulty, and yet instead of dispersion of the glandular swelling the pathological processes were so promoted that suppuration and discharge of pus occurred by the time that the cuticle had reformed.

We know no better substance for the local treatment of strumous adenitis than iodine, and it should be applied, in my opinion, in such a manner that it is absorbed with the least possible irritation of the gland. The following will be found useful ointments and solutions for the treatment of these cases :

℞. Potas. iodidi, ʒ j,
Ung. stramonii, ℥ j.

To be rubbed over the gland several times daily. It should not be applied as a plaster, as it is too irritating and will vesicate. I have known a glandular swelling, which had continued about three months, to disappear in three weeks under its use in connection with internal remedies. Vaseline, in place of the stramonium ointment, makes a nicer preparation.

℞. Liq. iodinii composita,
Glycerinæ, equal parts.

To be applied as an inunction. Glycerine renders the skin soft and in a state favorable for absorption.

In *The Medical Press and Circular* for August 3d, 1870, J. Waring Curran states that he has used with great success what he designates a new iodine paint, consisting of half an ounce of iodine, the same quantity of iodide of ammonium, twenty ounces of rectified spirits, and four ounces of glycerine.

Mercurial ointments have been recommended by writers of reputation for the treatment of these glands. I have employed them, and known them to be employed, but cannot say that I have ever observed any benefit whatever from their use. In the children's class at the Out-door Department at Bellevue we have discarded them entirely for this purpose, although both the citrine and white precipitate ointments, diluted with an equal quantity of lard, have been used with apparent benefit for chronic coryza of a strumous nature, and also occasionally for external otitis of the same nature.

In a paper read at the meeting of the British Medical Association in 1870, by Mr. Jordan, the writer recommends, as attended with success, vesication, not over the gland, but at a little distance from it, as, for example, behind the neck, for treatment of the cervical glands. But a mode of treatment which seems so unlikely to be beneficial requires stronger proof of its utility than has yet been presented.

When the gland becomes actively inflamed, as indicated by increased heat and tenderness, and redness of the skin, applications of iodine are no longer proper. They increase the local disease. There is no longer any probability of resolution of the glands, and poultices should be applied.

In strumous conjunctivitis and keratitis, solution of sulphate of atropia, two grains to the ounce of water, should be dropped three times daily into the eye. It relieves the photophobia, while it exerts a curative effect on the inflammation. To remove the phlyctenula and opacities, finely powdered calomel should be dusted into the eye (see remarks by Dr. Pomeroy in the following article). For the otitis, injections of tepid water to which a little carbolic acid is added (gr. ij to iij to the ounce) should be employed, and afterward a mild astringent.

It is important that the diseases of the osseous system should receive early treatment, but, unfortunately, it is in reference to these inflammations that error of diagnosis is frequently made. Thus I have known periostitis, with the diffused redness of the skin and heat which it produces, to be mistaken for erysipelas, until the diagnosis was corrected from its persistence and non-extension. It is remarkable that strumous arthritis sometimes appears in two or more joints at once, as in the case related below. I have known it to occur nearly simultaneously in three joints, though only for a brief time in two of the joints, while it was chronic in the other. Hence, the fact that this inflammation is often mistaken for inflammatory rheumatism, and treated as such for some days, tillits nature becomes apparent ; and in like manner the febrile movement, lassitude, abdominal

pain, etc., of vertebral caries are, in a large proportion of cases, attributed to something else, and the true disease not suspected till irreparable damage has occurred, or much longer confinement and treatment required than would have been necessary with an earlier diagnosis.

The common strumous inflammations of the osseous system which involve the joints, as Pott's disease, hip-disease, and white swelling, are usually quite amenable to treatment, early applied, which insures complete rest; but, as a rule, cases neglected, or wrongly treated, go from bad to worse. There are exceptions, for a case may do well or terminate with moderate deformity without treatment, as in the following interesting instance, which also shows the difficulty which often attends diagnosis :

Fig. 10.



Anna D., aged six years, came to the children's class in the Out-door Department at Bellevue in February, 1877, with the following history : Her health was good till two years ago, when she complained of pain of a mild form in both knees. Her parents attributed it to her rapid growth, and she was always able to walk with little suffering. Slowly but steadily these joints began to swell. She has had no pain in other joints, and no member of the family has had rheumatism except a grandparent. She walks without complaint to the rooms of the Bureau. The affected joints are about equally swollen, and it is evident on examination that they contain some serous effusion. Direct pressure is not painful, but pressing the bones together with a twisting or rotating movement gives some pain. She is pale, and has a strumous aspect. A sister of fifteen years has a similar swelling of one knee, which began at the age of seven or eight years, but which has received no regular treatment, has not prevented the free use of the limb, and has given her little inconvenience.

The physicians who have examined this child, one of whom is an expert in orthopædic surgery, agree that the disease is strumous and not rheumatic, and that it did not, during two years of neglect and unrestrained motion, go on to suppuration and destruction of the joints, was probably due to her good general health.

Though the result in the above case was good, since there was little impairment in the use of the joints, and no suffering, yet delay and neglect in the treatment of all those strumous inflammations which involve the joints are exceedingly dangerous, for if left to themselves they most frequently end in suppurative inflammation and ulceration, with all the sad

consequences which these entail. Strumous inflammations of the osseous system now receive more early and correct treatment than formerly, and orthopædia, almost unknown till within the last twenty years, has become an important branch of surgery. Formerly in New York, especially in the tenement houses, we often met emaciated bed-ridden children with strumous osteitis and arthritis, their limbs swollen, and painful in motion, and offensive from the discharge, for the most part shunned by physicians, and with no prospect of relief except by amputation. Now this spectacle is comparatively infrequent. The early symptoms of these diseases being better understood and sooner recognized, the plaster of Paris or starch dressing to insure immobility, or ingeniously devised steel splints, which produce extension, and allow motion of the limb without friction of the inflamed surfaces, coming into general use, a large proportion of cases do not go beyond the first stage and are cured.

Strumous Ophthalmia.

(*Written by Dr. O. D. Pomeroy, Surgeon to the Manhattan Eye and Ear Hospital.*)

Strumous ophthalmia in young children, as described by the older writers, is simply a keratitis, or inflammation of the cornea, and is usually of the following varieties: phlyctenular or herpetic keratitis, and diffuse or parenchymatous keratitis. Perhaps it is a misnomer to designate these affections strumous. This general principle governs most cases of these inflammations, to wit, depressed vital energy, which of course is the prominent characteristic of the strumous diathesis. As is well known, the cornea is a tissue of low vital power, and any constitutional state, accompanied by depression, predisposes to an attack of keratitis. One of the commonest hospital experiences is to see a mild case of catarrhal conjunctivitis, which should be self-limiting, gradually extend to the cornea, causing an ulcerative keratitis. I believe all ophthalmic surgeons hold that the presence of corneal disease, not dependent on an obvious or specific cause, points to diminished vitality on the part of the patient.

Herpetic or phlyctenular keratitis is the most frequent variety of corneal disease in children. It is a question whether it commences with a vesicle on the cornea, or a papule; but in either case it soon becomes an ulcer. Ciliary injection probably precedes it, though this can by no means be always observed. In some patients the characteristic symptom, to wit, photophobia, may exist for a long time without injection of the eyeball, or any corneal changes whatever, but sooner or later it is probable that other characteristic signs of the disease will make their appearance. The photophobia is frequently accompanied by blepharospasm, making it well nigh impossible to separate the eyelids. When, however, this is accomplished, abundant tears gush forth, the child exhibiting signs of extreme distress. When the vesicle or papule is in a state of ulcera-

tion in the earlier stage, there may only be seen a minute loss of corneal tissue, without any opacity whatever. Soon, however, the ulcer becomes more or less opaque, perhaps seeming to be only a minute whitish spot on the cornea. This usually shows the commencement of reparative action. If the disease continue long a general conjunctivitis sets in, more especially of the ocular conjunctiva. Frequently there will be only one or not more than two or three ulcers, but, in exceptional cases, the cornea may have the periphery studded with phlyctenulæ, which, instead of promptly healing, proliferate so as to form elevated nodules, the so-called "scrofulous nodular bands." If the ulcer in any case continue long, a number of bloodvessels shoot out from the conjunctival border of the cornea, quite up to the ulcer, producing what may be termed *a vascular keratitis.* The discharge from the eye is often very acrid, causing catarrh of the lachrymal ducts, and even of the nares. Herpetic or eczematous eruptions on the cheeks, or the lip near the nostrils, are often seen, and may sometimes appear to be the cause of the disease rather than the effect. In this condition the upper lip may swell considerably, giving the patient a very "strumous" look.

The duration of phlyctenular keratitis is exceedingly variable; two or three weeks may bring it to a close, or it may continue many months. The condition of the constitution probably determines its duration as much as any other factor. Of course if an ulcer perforate the cornea staphyloma may result, rendering recovery more tedious and incomplete. *The diagnosis* of this malady is not difficult. The photophobia, so characteristic of keratitis, is present in no other disease except iritis, and the latter children rarely have; the little speck, spot, or abrasion on the cornea, together with the intolerance of light, is well nigh diagnostic. Photophobia is present in most forms of corneal disease, though not in all. *The causes* of phlyctenular keratitis are about as follows: Any condition of the system known as strumous, or whatever tends to lower the vital powers of the patient, affords a predisposing cause. I am impressed with the idea that exposure to cold or sudden change of temperature is the common exciting cause, barring any cutaneous diseases which may pass from the skin to the eye. Naturally any cause which produces a conjunctivitis may also produce this disease secondarily. The process of dentition may have something to do with the eye disturbance, or any disorder of the intestinal canal; the latter, however, being rather predisposing than exciting causes. This disease also frequently occurs in patients affected with aural or nasal catarrh, but the condition of such children trenches closely on the state designated "strumous."

The prognosis in a large number of cases is very favorable. The opacities of the cornea left after the healing of the ulcerations are the principal difficulties in the way of a good recovery. If the opacities are in the proper substance of the cornea, we are not certain that they will dis-

appear by absorption, though they may. Nothing is more difficult than to determine this point. In the epithelial and Bowman's layers, as well as the posterior layer, opacities readily disappear. When the ulcer perforates the cornea we have an anterior synechia and the appearance known as *myocephalon*, which usually disfigures the eye more or less for life.

One discouraging point about these opacities is that, though they disappear, the cornea is left with a somewhat distorted curvature, causing irregular astigmatism, and if they chance to be near the centre of the cornea, great disturbance to vision results. I have often, in fitting spectacles, noticed that the patient's vision showed an unaccountable lowering, and on investigation have found a history of an infantile keratitis which had done all the mischief. In those cases described as having "scrofulous nodular bands," the proliferative nodules are very likely to undergo a variety of degenerations which do not end in a properly restored cornea. One great difficulty in making an exact statement here is the tendency of the keratitis to recur, and there is no knowing where the process will cease, after a number of recurrences.

Treatment.—As the fifth nerve presides over the ciliary vaso-motory system of the corneal nutritive supply, it is obvious that treatment calculated to correct any of its morbid manifestations would be rational. Such is found to be the fact. Sulphate of atropia, in from one to two grain solutions, dropped into the eye three times daily, is probably superior to any other treatment. It inclines to break up the orbicular spasms, relieving the photophobia and ciliary neuralgia, diminishes vascularity, and contributes more to the relief of the patient than any other one remedy. If the pain be severe the atropine may be used six or eight times daily, or even it may be instilled every fifteen or twenty minutes, until pain is relieved. If an over-effect be reached the patient complains of dryness in the throat, possibly pain in the head, or he may have other cerebral disturbances, when the drops may be discontinued for a time. Muriate of pilocarpine in two grain solutions may be used in a similar manner and for the same purpose ; but it contracts the pupil and renders the accommodation tense, the very opposite to the atropine effect. I have not much confidence in this remedy. Powdered calomel may be dusted into the eye every second day. A small quantity only should be used, since it is apt to collect in masses, which act as foreign bodies (we desire to produce irritation for a few minutes only). A drachm of table salt to a pint of water may be used to bathe the eyes freely four or five times a day, used warm or cold according to the patient's pleasure, though warm applications are more likely to be well received. Red precipitate ointment—℞. (Vaseline, ʒj ; hyd. ox. rub. in very fine powder, gr. j to ij. M.)—placed under the eyelids every day or two, is often very beneficial. Occasionally the ulcers show a disinclination to heal, when they may be touched with Arg. nit., gr. x., Aquæ dist., ʒj. M.

Wind a bit of absorbent cotton on a probe, dip this into the solution, and touch the ulcer, but no other point. Cupri sulph., in ten grain solutions, may be used for the same purpose. A protective bandage exerting moderate pressure on the eye sometimes does good, but it should not feel uncomfortable. If there be much spasm of the orbicularis, however, it is not indicated. If the pain in the eye continue, and the orbicularis be in a state of spasm, a cantholysis may be done—that is, divide the external canthus so as to cause the lid to no longer press hardly upon the eyeball, and close the wound thus made by stitching the skin to the conjunctiva above and below the incision, and placing one stitch in the extreme outer canthus. This extends the length of the palpebral opening. The result of the operation is to temporarily break the power of the orbicularis, so as to arrest the spasm. This measure accomplishes in some cases what nothing else will.

If the eye be painful, without spasm of the lid, and there be great photophobia, whether the eyeball be too hard or not, paracentesis may be done. The mode of performance is described in the treatment of ophthalmia neonati in another place in this book. After a while the accompanying conjunctivitis may need treatment in the ordinary way. Indeed astringents may often be used quite early to obviate the irritating effects which occasionally result from the use of atropine. If an ulcer refuse to heal after the treatment already laid down, iridectomy may be done, though this is not often resorted to. Occasionally an ulcer may be cut across, by passing a narrow Graefe's knife through it, making a puncture on one side and a counter puncture on the opposite side, and then cutting out quite through the ulcer, dividing it into two equal halves. All needful treatment for the constitutional condition of the patient should be attended to. So necessary is fresh air and sunlight that I would never shut the patient in a dark room. Blue or smoke colored glasses may be worn to protect the eyes from a strong light, and in some cases the eyes may be protected by a bandage of some dark material, so that the patient may be taken for an airing without suffering. I would, however, advise to accustom the eyes to the light as much as possible without causing pain. A perforated cornea may require iridectomy.

In parenchymatous or diffuse keratitis we have quite a different array of symptoms. The margin of the cornea near the limbus may show a decided zone of injection of the conjunctival and episcleral vessels. It may be so excessive as to apparently consist of a rosy ring surrounding the cornea. These vessels after a time shoot inward, and may involve a large part, or even the whole of the cornea. In other cases, designated *non-vascular diffuse keratitis*, the injection is very slight indeed, and sometimes apparantly wanting altogether. In either case, however, the same consequences result ; the cornea becomes diffusely clouded, the process gen-

erally, but not always, commencing at the limbus. This cloudiness may be quite without lines or dots of opacity, like ground glass. Again it may appear composed of innumerable minute opaque points or lines running in various directions. At first, the corneal epithelium escapes, presenting a regular and uniform polish, but afterward it becomes opaque. Again if the process involve the whole of the cornea, minute opaque spots may be seen in Descemet's membrane, giving it some of the characteristics of keratitis punctata. In the earlier stages there may be some pain and intolerance of light, but as a rule the disease, for a corneal affection, is comparatively painless. *The duration* of this disease is never short ; it may continue for many months, and it shows a strong tendency to relapse. The most frequent *causes* are hereditary syphilis and struma. Mr. Hutchinson of London always examines the teeth of these patients to see if there be anything characteristic of hereditary syphilis. As the same or similar teeth are often noticed in strongly strumous subjects it becomes doubly interesting to make the observation. One point is apparent in most of these cases, that there are in almost every patient some signs of badly developed physique, that is, faulty tissue elaboration. As a rule both eyes sooner or later become affected, pointing to a constitutional origin of the affection.

In treatment we are often disappointed in our efforts. At the first, if there be pain or photophobia, atropine may be instilled, and the eyes bathed with warm or tepid water, several times a day. Tonics or alteratives are always indicated. One of the most useful prescriptions is the following :

℞. Hydrarg. Chlor. corros., gr. j ;
Tinc. Cinchon comp.,
Syr. Aurantii, āā, ʒiv. Misce.

Dose.—One teaspoonful three times daily after eating.

Iodide of potassium is frequently given, and may very properly alternate with the mercurial ; children will bear very large doses of the iodide, and indeed they are often necessary if we would get the curative effects of the drug ; I would suggest from three to twenty grains three times daily, well diluted with water. Both these remedies may be continued for months, but ptyalism should always be avoided. Cod-liver oil with extract of malt may be administered. Whatever tends to improve the patient's general condition is indicated. Exercise in the fresh air is good, but the pernicious effects of cold must be avoided. Paracentesis of the cornea rarely does good, but occasionally iridectomy may be of benefit. The complication of iritis or irido-choroiditis is not common, though it does occur. When the disease becomes very chronic there will be hardly vascularity enough for purposes of repair. This being the case, stimulating collyria may be used, similar to what is indicated in conjunctivitis. Olive oil and spirits of turpentine, in equal parts, may be applied to the eye every second

day. Bathing with warm water, sufficiently to congest the eye, will sometimes be serviceable. An attack of acute conjunctivitis has been known to do good. But do what we may, this affection sometimes runs on unchecked for a very long time. From some recent experiences I am inclined to believe that bichloride of mercury internally and atropine as a collyrium, are of as much value as any other agents in the treatment of this obstinate malady.

CHAPTER III.

TUBERCULOSIS.

The term tuberculosis is applied to a disease which is characterized by the formation of small nodules, developed in one or more organs.

Etiology.—The tubercular diathesis may be inherited. Hence the well-known fact of tubercular families. Cases are not infrequent in which hereditary tuberculosis proves fatal before the death of the affected parent. The offspring of a tubercular parent does not, as a rule, have tubercles at birth ; but the tubercular diathesis, at first latent, as in syphilis, manifests itself in a few weeks or months in the formation of tubercles, and in the consequent cough and emaciation. In two cases which I recall to mind, a cough from tubercles was observed, according to the statement of friends, as early as the second or third week after birth. Under good hygienic conditions, the inherited diathesis may remain latent or be removed. If both parents are tubercular, the offspring almost necessarily become so.

Tuberculosis frequently results from prolonged anti-hygienic conditions in those previously healthy and of healthy parentage. It may result from residence in damp, dark, and dirty apartments, from scanty or unwholesome food, protracted and exhausting diseases—in fine, from any agency which gives rise to great and continued impoverishment of the blood. Age is a predisposing cause. Tuberculosis is comparatively rare under the age of one year, while it is not uncommon in wasted infants between the ages of two and five years. This remark is fully substantiated by the statistics of the Nursery and Child's Hospital and Infant Asylum of this city.

Is tuberculosis propagated by infection? Most physicians would answer in the negative, though in some countries, as in Italy, it is stated that the profession have long regarded it as mildly infectious. Every physician of experience must have remarked the frequency with which tuberculosis occurs in those not predisposed to the disease, but who have been in intimate relation with consumptive patients. This has been commonly

regarded as due in no way to infection, but has been thought to be a coincidence, or has been attributed to an influence not fully understood, which the emotions or imagination exert in the causation of diseases. But recent discoveries concerning the etiology of tuberculosis, which will presently be related, afford ground for the opinion, which some of our best authorities in the pathology of tuberculosis, as Waldenburg, now hold, that minute particles exhaled or expectorated from the lungs may be the medium of infection.

In December, 1865, M. Villemin read before the Academy of Medicine of Paris and published his celebrated memoir, which contained the results of his experiments in inoculating certain lower animals with tubercular matter. Since then the fact has been established by many experiments, that tubercle may be produced in the rabbit and other animals by inserting under their skin various pathological products, whether tubercular or non-tubercular, as gray tubercles, cheesy products, thickened pus, etc., and by inserting finely divided foreign substances, not animal, as anilin blue, and also by traumatic irritations which give rise to the formation of inflammatory products under the skin, as the use of a seton. The coloring matter, whether introduced alone or in combination with a pathological substance, is found in the tubercle which results in the lungs or elsewhere. Therefore, it is inferred that tubercle in these experimental cases is produced by minute particles of the inserted substance, which enter the circulation and are deposited in the lungs or other organs. Where they are deposited, inflammation (formative irritation) occurs, with proliferation of the cellular elements of the part. This corpusculation produces the tubercle.

The importance of these discoveries is apparent. Cheesy substances produced in the system, whether in the lungs, lymphatic glands, bones—as in vertebral caries—or elsewhere, and also long retained purulent collections, as in empyema, may give rise to tuberculosis, provided that particles of the diseased substance gain admittance into the circulation.

Blood extravasated in the alveoli of the lungs, and undergoing degenerative changes, is considered a cause of tuberculosis ; but such extravasations are rare prior to the age of puberty. Protracted inflammation of the air-passages, as bronchitis or laryngitis, is stated to give rise to tubercles in certain cases, but it is not easy to see how this could occur except when the inflammation has extended to the lungs or given rise to cheesy degeneration of the contiguous glands. In infancy and childhood the common cause is a diathesis inherited, or acquired through impoverishment of the blood by previous disease or anti-hygienic conditions, or it is infection of the system from cheesy glands or purulent collections.

Post-mortem examinations in connection with these recent discoveries demonstrate that the immediate cause of the formation of tubercles in the lungs, spleen, and other viscera, in certain cases, is hyperplasia and cheesy

degeneration of the bronchial and mesenteric glands, whether or not this glandular affection is to be considered tubercular. Thus in the last two cases which I have examined there were minute transparent tubercles in the lungs, some becoming yellow, evidently of very recent formation, and also in one of the cases in the spleen, while in both cases the bronchial glands were enlarged and cheesy, and in one also the mesenteric. In another case, occurring in the Child's Hospital, the bronchial and mesenteric glands were cheesy, with all the thoracic and abdominal viscera healthy, while there were granulations nearly the size of a pin's head, due to cell proliferation, as ascertained by the microscope (tubercular), in the pia mater at the base of the brain, along its sides, and between the hemispheres.

Cases are less frequent, but are occasionally observed, in which retained purulent collections appear to be the cause of the formation of tubercles. Thus, in 1870, I presented to the New York Pathological Society the lungs, containing minute, recent tubercles, removed from an infant who had died when a few months old. The lungs were otherwise healthy, and there were no cheesy glands, for which a careful examination was instituted ; but in the left thigh was a large, deep-seated abscess, which had been detected a month before death.

Another, and probably the most frequent local cause of tuberculosis, is cheesy pneumonia. Caseous degeneration of the inflammatory products is common in young and feeble infants affected with pulmonary inflammation, and the supposition is reasonable that particles are more readily detached from a caseous mass in the lungs than in most other situations. Certainly, in this city, cases are not infrequent of young children who present the history of pneumonia, cheesy degeneration, and finally tubercles. Many such cases occur during epidemics of measles.

General Anatomical Characters of Tuberculosis.—Analysis of the blood of tubercular patients shows an increase in the water, albumen, fats, and white corpuscles, and a decrease in the number of red corpuscles. The fibrin is slightly diminished, except in cases complicated by inflammation, in which it may be in excess. The chief interest, however, as regards the anatomical characters of tuberculosis, pertains to the tubercle. The tubercle is as characteristic of tuberculosis as the eruption is of an exanthematic fever. It is produced, as already stated, by a local proliferation or corpusculation produced by the irritation of the tubercular virus in the endothelial lining of the lymphatics and bloodvessels, which is now regarded as the mother soil of tubercle, instead of the cells of the connective tissue as first taught. It is, therefore, a cell-growth, and not a deposit.

If we examine with a microscope a thin section of a recent tubercle, we will observe in its peripheral portion, in which proliferation was active at the time of death, large mother cells, spindle-shaped fibro-plastic cells,

and small round cells, which have been released from the mother cells. This zone of proliferation often has considerable extent. Passing toward the central portion of the tubercle, we find these small round cells in great abundance. They represent a more advanced stage of the tubercle, since the central part is oldest. They are the most numerous cells in the tubercle, and they have been designated the tubercle-cells. They resemble closely in appearance the smaller of the white corpuscles of the blood, and cannot be distinguished from the normal cells of the lymphatic glands, each consisting of a single large nucleus surrounded by protoplasm. They are among the most fragile of pathological cells. The cells are held together by a transparent adhesive substance, which is firm and resisting.

Every tubercle tends to undergo a molecular change by which its transparence is lost. This consists in a decay of the cells and the intercellular substance. Granules of fat are deposited within them, and the cells shrivel and disintegrate. Fragments of cells, and shrunken cells, and cell-nuclei are thus produced, which Lebert described as the tubercle-cells, and which were accepted as such by all observers till Virchow ascertained their true character. The molecular change which I have described commences in the interior of the tubercle, and extends outward till the whole tubercle becomes opaque and yellow, and at the same time so friable as to be readily crushed between the fingers. The yellow tubercle is therefore only an advanced stage of the gray semi-transparent.

It is evident that tubercle in its first period possesses vitality, and, like all neoplasms, has its bloodvessels. These are soon closed by coagula or granular fibrin, mixed with white blood-corpuscles. When the tubercle has reached the yellow transformation, its vessels are no longer pervious, but it is surrounded by a vascular zone, in which circulation continues. The subsequent history of the tubercle is well known. It is seldom, perhaps never, absorbed. It softens, and henceforth, as has been said by a German pathologist, its history is that of an abscess. It is an irritant, producing inflammation in the surrounding tissues, with thickening and induration, and abundant production of pus-cells, which mingle with the tubercle elements. Ulceration and discharge of the liquefied substance upon one of the free surfaces is the common result. In exceptional cases, instead of softening, the tubercle may undergo fibroid degeneration or cretification.

Anatomical Characters in Infancy and Childhood.—The anatomical characters of tuberculosis in the first years of life vary in certain particulars from the form which they present in the adult, but after the age of three years the differences are fewer and less pronounced than previously.

Tubercular laryngitis, so common in the adult, is absent in a large proportion of cases under the age of three years, and when present it has little intensity. Ulceration of the larynx very seldom occurs. This has been attributed to the fact that there is so little expectoration in young

children, the sputum being an irritant. Niemeyer, however, does not consider the sputum of tuberculosis sufficiently irritating to cause laryngitis and laryngeal ulceration ; but the arguments in favor of this mode of causation, in my opinion, more than counterbalance those which have been presented against it.

I have never met a case of tubercular ulceration of the larynx or trachea in the post-mortem examination of young children, nor do I recollect ever treating a case in which there was that degree of dysphonia which indicated ulceration. Rilliet and Barthez, in more than 300 necropsies of tubercular cases, found no ulcers in the larynx or trachea under the age of three years ; but met 8 cases between the ages of three and ten years, and 8 between ten and fourteen years. The ulcers, whether seated in the larynx or in the trachea—and they are in most cases in the former, since the inequalities upon the surface of the larynx favor the retention of the sputum—are commonly small, superficial, round or elongated, and with little thickening or inflammation of their borders. Occurring in the folds of the mucous membrane, as, for example, around the vocal cords, their form is usually elongated.

Bronchitis is not infrequent. This inflammation is due to, and dependent on, the pulmonary tubercles, and is therefore most intense in the part of the lung where the tubercles are most abundant and farthest advanced. Consequently it is more intense on one side than on the other, and it may be unilateral. It differs in this respect from idiopathic bronchitis, which is commonly pretty uniform on the two sides. It differs also in the fact that it is sometimes accompanied by ulcerations. The ulcers are round or elongated in the direction of the axes of the tubes, and, like those of the larynx or trachea, are superficial. Idiopathic bronchitis of infancy and childhood does not cause ulceration. Circumscribed inflammation may attack a bronchial tube, as, indeed, the trachea, and give rise to ulceration and perforation, from the presence and pressure of a diseased lymphatic gland external to the tube. This subject will be treated of hereafter.

Lungs.—It is well known that in the adult, tubercles are always present in the lungs, if they occur in any part of the system. I have met two cases in which the lungs were free from tubercles in 36 post-mortem examinations of children who died of tuberculosis. One of the two was an infant, but its exact age is not stated in the records. It had cheesy degeneration of thymus and bronchial glands, enlargement of mesenteric glands, but without cheesy degeneration, and disseminated tubercles in liver and spleen. The other, fifteen months old at death, had tubercular meningitis, with numerous granulations upon the convexity of the brain, and the other usual lesions of meningeal inflammation, with bronchial and mesenteric glands slightly enlarged and cheesy, and one of the former softened. In one case, then, in 18, the lungs had escaped the disease. Rilliet and Barthez state that they found the lungs non-tubercular in 47

cases in 312, and Hillier did in 25 cases in 160. In their cases, therefore, the lungs were exempt from tubercles in about 1 case in 7. But it is to be recollected that the statistics of these observers were prepared at the time when all cheesy degenerations were thought to be tubercular, and the bronchial and mesenteric glands are sometimes cheesy when there are no tubercles or lesions referable to tuberculosis in any other part of the system. I have records of two such cases, which I reject from my statistics of tuberculosis, as there is no evidence that the disease was anything else than cheesy inflammation. Did I include these cases, my statistics would more closely correspond with theirs.

Pulmonary tubercles in children under the age of three years are, as a rule, discrete, and disseminated through the lungs. In cases at this age, which have advanced to a fatal termination, we find yellow tubercles from the size of a pin's head to that of a shot in the different lobes ; many still semi-transparent if the disease have been of short duration, but if protracted most of them yellow, and here and there one softened and surrounded by condensed fibrous tissue. Around the semi-transparent or gray tubercles, many of which were growing, and therefore were in the state of active cell proliferation at the time of death, narrow vascular zones can often be detected by the naked eye.

Under the age of three years, tuberculosis exhibits but little tendency, perhaps none, to affect the upper lobes sooner or in greater degree than the lower.

The following are the statistics relating to the site of the tubercles in the lungs in the cases which I have examined. All, it is to be remembered, were under the age of three years :—

	Cases.
Tubercles disseminated throughout the lungs,	26
Tubercles disseminated throughout the two upper lobes,	3
Tubercles disseminated through right middle lobe and left lower lobe only,	1
Tubercles disseminated through left upper lobe only,	2
Tubercles disseminated (few and semi-transparent) in left lung only,	1
Tubercles disseminated in three points in right, and two in left lung,	1
No tubercles in lungs,	2
	36

Between the ages of three and fifteen years, statistics show that the upper lobes are more liable to tubercles than the lower ; but the difference in liability is not great. In many cases occurring in this period, the different lobes are affected nearly simultaneously, and not very infrequently the upper lobe is the last which is involved. In October, 1866, I made the post-mortem examination of a boy who died in the Children's Service of Charity Hospital, at the age of fifteen years, and small scat-

tered tubercles were found in the lower lobe of the left lung, while all other portions of these organs were healthy. Rilliet and Barthez, who include in the same statistics all cases from birth to the age of fifteen years, found gray, semi-transparent tubercles

	Cases.
In the right superior lobe in	63
In the right middle lobe in	43
In the right lower lobe in	55
In the left superior lobe in	65
In the left inferior lobe in	54

The same observers found yellow tubercles in the

Right superior lobe in	40
Right middle lobe in	28
Right inferior lobe in	39
Left superior lobe in	35
Left inferior lobe in	31

Tubercle, especially when softening commences, is itself an irritant, exciting inflammation around it. Inflammation occurring from this cause is obviously likely to be protracted, continuing for weeks or months, unless the tubercular matter be eliminated by ulceration. The highly vascular and delicate lungs of the young child are very liable to inflammation when they are the seat of tubercles, and as the tubercles are disseminated, the pneumonia is commonly more extensive than when it occurs from ordinary causes. In fifteen, or nearly one-half of my cases, there was pneumonia affecting portions of one or more lobes, or an entire lobe. From the extent and position of the solidified portions, it was obvious that in most instances the inflammation originated from the irritating effect of the tubercular matter, while in others it was due to hypostatic congestion, occurring in consequence of the long-continued recumbent position and feebleness of circulation. In these fifteen cases the seat and extent of the inflammation were as follows :

	Cases.
Nearly entire right lung,	2
Nearly entire middle and lower lobe,	1
Entire left upper lobe,	2
A considerable part of both lungs,	1
Posterior parts of both lower lobes,	4
Posterior part of left lung,	1
Left lower lobe, and right middle and lower lobes,	1
Left upper lobe (contained a large cavity) and posterior part of left lower lobe,	1
Nodules of inflamed lung around tubercles,	2

The inflammation in about one-third of the cases was due to hypostasis, as it occurred in depending portions, extended but little into the lungs and sustained no relation to the amount of tubercle. It was in the stage of red or, more rarely, of gray hepatization.

In seven of the cases there were pulmonary cavities as large in proportion as we ordinarily find in tuberculosis of the adult. The seat of one was in the right lower lobe ; of two, the left upper lobe ; of one, the right upper lobe ; of another, the right lung, its exact seat not stated ; and in the remaining case the cavity, which was the largest of all, occupied the interior of all three lobes on the right side. Some idea of the size of these cavities may be learned by the following extracts from the records : 1st Case. "A small superficial cavity communicating on one side with a bronchial tube, and on the other side with a small circumscribed collection of pus in the pleural cavity." 2d Case. "Cavity of the size of a hickory-nut." 3d Case. "Cavity of the size of a large hickory-nut." 4th Case. "Cavity three-fourths of an inch in diameter." 5th Case. "A large abscess." 6th Case. "The cavity occupied nearly the whole of the interior of the left upper lobe." 7th Case. "About half the right lung excavated into a cavity which extended through the three lobes."

Circumscribed pleuritis, produced by tubercles underneath the pleura, was observed in seven cases. It was ordinarily attended by little exudation except the fibrin, but in one case a sufficient amount of serum had been exuded to compress considerably the lung. Pus was not observed in any notable quantity.

Emphysema was present in several cases, chiefly in the upper lobes, sometimes vesicular, with fulness or bulging of the lung, an anæmic appearance of it, and doughy, inelastic feel. In other cases emphysema was interstitial, producing little bladders of air under the pleura, especially toward the root of the lung, or separating the lobules by wedge-shaped or irregular interspaces filled with air. In one case air had escaped from an emphysematous bladder into the right pleural cavity, causing pneumothorax and collapse of the lung.

Next to the lungs, the bronchial glands are more frequently diseased than any other organs, in the tuberculosis of infancy and childhood.* They undergo the successive structural changes which characterize glandular inflammations, namely, hyperplasia, and more or fewer of them cheesy degeneration and softening. In the state of hyperplasia their firmness is diminished, and they have a pale flesh-color. Cheesy degen-

* The term bronchial phthisis has long been applied to that state in which the bronchial glands are enlarged and cheesy. Now this glandular disease, we have seen, is often the result of inflammation in the strumous ; and while it may be the cause of tubercular infection, is probably not, in most instances, tubercular itself. But microscopy has not yet drawn the distinction between the cells of lymphatic glands, which cause the enlargement by proliferation when the glands are inflamed, and the cells of the tubercular neoplasm. They appear alike in the field of the microscope. Therefore it seems proper not to attempt to distinguish scrofulous glands from tubercular, when they occur in a patient affected by tuberculosis.

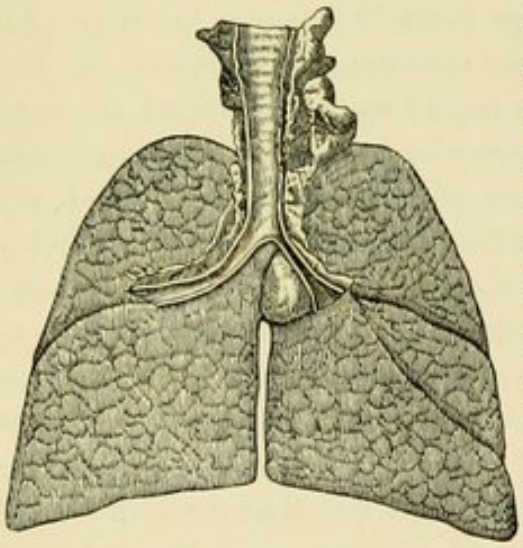
eration commences in one or more points in the gland, sometimes in the peripheral, sometimes in the central portion, and it extends till the whole gland presents the well-known cheesy appearance. When the gland softens, the thick liquid has a puriform appearance, consisting of amorphous matter, fatty particles, and the shrivelled and disintegrated cells of the gland. Soon pus-cells occur, and their number increases.

Rilliet and Barthez state that the bronchial glands were tubercular in 249 cases in children, while the lungs were tubercular in 265. All cheesy glands, it is to be recollected, they considered tubercular. In 4 of the 36 cases which I have examined, no record was preserved of the state of the bronchial glands ; in one case there was no perceptible hyperplasia and no cheesy degeneration ; in two there was hyperplasia, but no cheesy degeneration, while in the remaining twenty-nine cases there was cheesy degeneration of more or fewer of the enlarged glands, or parts of them, with occasional softening. In the fact that the bronchial glands are enlarged and caseous, we have an explanation in part of the fact, that the symptoms in the tuberculosis of young children differ from those in the adult, since Louis found the bronchial glands involved in only twenty-eight per cent. of the adult cases of tuberculosis which he examined, and Lombard in only nine per cent. A gland pressing upon the recurrent laryngeal or pneumogastric nerve, or the trachea, may give rise to dyspnœa and a cough ; or on the descending vena cava or one of the venæ innominatæ, to congestion of the brain and meninges, intracranial serous effusion, and even thrombosis in the cranial sinuses. The fact that a softened bronchial gland is not infrequently eliminated from the system, by ulceration, into a bronchial tube or the trachea, is well known. In one case which I observed the ulceration had destroyed portions of three of the cartilaginous rings of a bronchus, and the aperture was plugged by a cheesy fragment of a softened gland which protruded. Occasionally, it is stated by authors, the ulceration is into one of the large vessels of the mediastinum, or even into the œsophagus.

The following is an example of bronchial phthisis, as it commonly occurs. This case, which is not included in the foregoing statistics, was seen almost daily by me during its entire progress. On September 3d, 1874, I examined an infant in the New York Infant Asylum, who had wheezing respiration during the last eight days. The wheezing occurred both on inspiration and expiration, and also, though less pronounced, during sleep ; pulse 96, respiration 40, temperature normal. Its mother, who had charge of it, and had till recently wet-nursed it, had unequivocal symptoms of tuberculosis for several months. The child was pallid, and its flesh was soft and flabby. The fauces were perhaps a little redder than usual, but were otherwise normal, and a careful exploration of the chest revealed no cause of the embarrassed respiration. Auscultation and percussion gave a negative result. In the latter part of September a

troublesome diarrhœa occurred, which continued more or less till near death. The temperature on September 28th, October 8th, 10th, and 11th, was 100½°, 100°, 99½°, and 100°. The pulse on October 10th and 11th was 120 and 126. On October 8th the percussion-sound over the upper part of the right lung seemed somewhat duller than on the other side, though the respiration was not observed to be notably changed in the area of the dulness. There was but little cough during the entire sickness. Death occurred on October 20th. At the autopsy the bronchial glands were found enlarged and cheesy, and underneath the right bronchus, near the bifurcation, was a softened, almost diffluent gland, as large as a small hickory-nut, and compressing the bronchus. This, no doubt, had produced the wheezing respiration, which had been the chief local symptom. The lungs, spleen, and in less degree the liver, contained numerous small miliary tubercles. Certain of the mesenteric glands were also cheesy, but to less extent than the bronchial. The disease of the bronchial glands was evidently primary, the tubercles of the lungs and abdominal organs being apparently quite recent. The accompanying woodcut, from a photograph by Mr. Mason, the photographer at Bellevue Hospital, represents a posterior view of the lungs and air-passages.

FIG. 11.



In no case have I found tubercles in the heart or pericardium, though they have been observed in rare instances in the latter. The mesenteric glands were enlarged by hyperplasia, and more or less cheesy, in 30 cases, were apparently normal in two cases, while in the remaining four cases their condition was not stated. In most of the patients the mesenteric glands were small erand less cheesy than the bronchial, but in a few instances they were larger than the bronchial and more cheesy.

It is a noteworthy fact, as bearing on the causative relation of these glands to tubercles, that not infrequently the amount of hyperplasia and cheesy degeneration occurring in the former was very considerable, while the tubercles in the lungs or elsewhere were small, even minute, semi-transparent, and evidently of recent formation. It appeared as if in such cases the glandular hyperplasia and degeneration, bronchial or mesenteric, or both, preceded the general tubercular disease, and probably sustained an etiological relation to it. Since the cases which furnished the above statistics occurred, my clinical experience with tuberculosis has greatly increased, but nothing new or different has been observed at autopsies.

Abdominal Viscera.—In children, tubercles in the solid organs of the abdomen rarely give rise to appreciable symptoms, since they are small and disseminated, not impairing materially the function of the part in which they are located. On the other hand, peritoneal and intestinal tubercles, and the enlarged and cheesy mesenteric glands, give rise to symptoms which require description. The most frequent seat of peritoneal tubercles is upon the attached surface of the peritoneum, where they are formed in the connective tissue. They are distinctly seen through the peritoneum, and cause some prominence of it. Exceptionally their seat is upon its free surface. Every portion of the peritoneum, whether visceral, parietal, or omental, is liable to tubercles, but generally tuberculization of so extensive a surface does not occur in any one case. The tubercles are spherical or lenticular, and most of them small. Sometimes they are very numerous, but so minute as to be scarcely visible. They are gray or yellow, according to the age. Peritoneal tubercles often produce circumscribed peritonitis, causing adhesion of opposite surfaces. The tubercles in themselves cannot be detected by palpation ; but masses or *plaques* composed of tubercles and inflammatory products are sometimes so large that they can be felt through the abdominal walls.

The symptoms of peritoneal tuberculosis are attributable, for the most part, to the peritonitis. Among them may be enumerated abdominal tenderness or pain, meteorism, ascites—usually slight—and derangement of the bowels, commonly diarrhœa. As tubercles in this situation occur, in most cases, subsequently to tubercles elsewhere, the symptoms which have been described are associated with and are subordinate to others.

Stomach and Intestines.—The most common seat of gastro-intestinal tubercles is the small intestine, and more frequently its lower portion, near the ileo-cœcal valve, than its upper or central. They are rare in the duodenum or contiguous part of the jejunum. They are developed ordinarily in the connective tissue, either that lying under the mucous or the serous surface.

Gastro-intestinal tubercles are often accompanied by ulceration of the adjacent mucous membrane. But in a certain proportion of cases there is probably no causative relation of the tubercles to the ulcers, for ulceration of this membrane is not infrequent in the tuberculosis of children, when there are no tubercles in the walls of the stomach or intestines. The following statistics of Rilliet and Barthez, relating to this point, will aid to an understanding of the symptoms :

Tubercles in walls of stomach, 7 cases, { with ulcers, 6 cases. / without ulcers, 1 case.

Ulcers of gastric mucous membrane, without gastric tubercles, 14 cases.

Tubercles in small intestines, 82 cases, { with ulcers, 70 cases. / without ulcers, 12 cases.

Ulcers without tubercles in small intestines, 51 cases.

Tubercles in large intestine, 15 cases, { with ulcers, 10 cases. / without ulcers, 5 cases.

Ulcers in large intestine, without tubercles, 47 cases.

The ulcers have vascular, thickened, and infiltrated borders. Their diameters vary from a line to half an inch or more, and their general form is circular, or, if two or more unite, irregular. Tubercular ulcers of the stomach are mostly in the great curvature, those of the small intestines in the ileum and lower part of the jejunum, and those of the large intestine in the cœcum.

The following table exhibits the state of the principal abdominal viscera in the 36 cases embraced in my statistics :

	Liver.	Spleen.	Kidneys.
Tubercular,	12	22	1
Non-tubercular,	16	6	21
Not stated,	8	8	14
Fatty,	5	0	0

In no instance did I observe tubercular softening in the abdominal organs, and a large proportion of the tubercles in the liver, spleen, and kidneys were still in the first stage. In the five cases in which the liver was recorded fatty, this state of the organ was obvious to the sight, as it is in tuberculosis of the adult. A moderate excess of fat in the hepatic cells may have been present in some of the other cases, but it was not sufficient to be appreciable without the microscope. It is to be remarked that in the five cases in which the liver was recorded fatty, this organ contained no tubercles. The spleen is seen to have been the most frequent seat of tubercles of all the viscera, except the lungs. In fourteen cases the intestines were examined ; and in five, tubercles discovered developed in their connective tissue. The intestinal tubercles were small, and ulceration had occurred of the mucous membrane which covered them.

The brain was examined in fifteen cases. In twelve the amount of cerebro-spinal fluid varied from ʒss to ʒv, by estimation. In two others the records state that there was a considerable amount of this fluid, the exact quantity not being given, while in the remaining case congestion of the brain and meninges was noticed, but nothing was recorded in regard to the amount of cerebro-spinal liquid. The increase of the cerebro-spinal fluid in tuberculosis is attributable to wasting of the brain, a *hydrocephalus ex vacuo*, and in some cases to passive congestion and serous transudation, due to feeble circulation, or obstructed flow from the pressure of bronchial glands on the vessels within the thorax, as already stated.

Tubercles were present in the pia mater in three cases : in two with fibrinous exudation ; in the other without fibrin or other evidence of inflammation. Tubercular meningitis is described in another part of this book.

Symptoms.—The symptoms in tuberculosis of children arise in part from the diathesis, and in part from the tubercles. Before the period of tubercles, there are signs of failing health, such as loss of appetite, flabbiness of the soft parts, or emaciation, lassitude, and loss of strength. These symptoms continue after the formation of tubercles, and increase.

The features are ordinarily pallid, but during the paroxysms of fever, to which tubercular patients are subject, they may be flushed. Lividity of the features, due to imperfect decarbonization of the blood, occurs, if there be enlarged bronchial glands which compress the vessels within the thorax, or if there be extensive pulmonary tuberculization, or pulmonary tuberculization, whether extensive or not, which is complicated by capillary bronchitis or pneumonia.

The skin is nearly natural, or it loses its flexibility and softness, and becomes dry and rough. In some patients there is, at times, general or partial furfuraceous desquamation of the skin, due to exaggerated development of the epidermis. Children, like adults, notwithstanding the general dryness of the surface, are liable to perspirations at night and in sleep. This symptom is less frequent at the commencement than at an advanced period, and in acute than in chronic cases, in young, namely, those under three or four months, than in older children. It is more abundant about the head and limbs than elsewhere, and is sometimes confined to these parts.

Anasarca is not infrequent. It sometimes arises from obstructed circulation, in consequence of compression of the thoracic vessels by enlarged lymphatic glands ; in other cases it is due to diminished plasticity of the blood, a result of the tubercular cachexia. The latter is the more common cause. It is not an important symptom, on account of the small amount of serous transudation, and the character of the parts in which it occurs.

Emaciation, already alluded to, is early, constant, and progressive. Under the age of six or eight months it is less marked than in older children, many preserving considerable rotundity of features and form even in advanced tuberculosis. The failure of the strength corresponds in amount and progress with the emaciation. Slight at first, and exhibited only by a degree of lassitude, it gradually increases, till for weeks before death the little patient is fatigued by the ordinary muscular movements, and is disposed to keep quiet.

The nervous system is not ordinarily affected except in cases of intracranial tubercles. In acute tuberculosis, or tuberculosis complicated by severe inflammation, there may be agitation and delirium, especially at night.

In most patients the mucous membrane of the buccal cavity presents its normal appearance, with the exception of a moist fur upon the tongue, and a paler hue than normal of its surface generally. In acute tubercu-

losis, and in cases complicated by inflammation, the tongue is sometimes dry and brown. The appetite may be normal till the close of life, or it is poor or changeable. Occasionally it is increased, although the disease is progressing. The bowels are regular or relaxed. Diarrhœa may be a prominent symptom, even when there are no intestinal tubercles or ulceration. Meteorism and fulness of the abdomen are common.

Fever, constant, but usually with evening exacerbation, is rarely absent. It continues for weeks or months. During the exacerbation the pulse rises to 120, 140, or even to 180 beats per minute, and there is a corresponding exaltation of the temperature, which in the latter part of the day, without inflammatory complication, ranges from 100° to 102° or 103°. The febrile movement is a symptom of diagnostic value as regards the nature of the disease, though it does not indicate the seat of the tubercles.

In addition to the symptoms now described, there are *special* symptoms, due to tuberculization of the different organs. In young children, on account of the fact already referred to, to wit, the tendency to a generalization of tubercles, there is apt to be a blending of the symptoms which arise from different organs, but with care it is not difficult in most instances to isolate and refer them to their proper source. The following are the symptoms which arise from tuberculization of the more important organs.

Encephalon.—The symptoms produced by tubercles of the encephalon vary according to their seat and size, and the structural changes in surrounding parts to which they give rise. Meningeal tubercles, which are located for the most part in the meshes of the pia mater, and ordinarily along the course of the small arteries, are, as a rule, small, not more than a line in diameter, and they may remain latent for a considerable time. In the majority of cases, however, they sooner or later cause meningitis, the symptoms of which are well known and need not be described. But tubercles in this situation do sometimes give rise to symptoms when there is no meningeal inflammation. They occasion congestion of the surrounding vessels, and serous transudation, and, if developed on the under surface of the pia mater, they may produce symptoms by encroaching upon and irritating the brain ; for they are sometimes so much imbedded in the convolutions that careful examination is required in order to determine that they are meningeal, and not cerebral. Among these symptoms may be mentioned headache, frontal or occipital, sometimes intermittent, nausea, melancholy, and in certain cases the symptoms produced by serous transudation.

The symptoms of *cerebral* are in part similar to those of meningeal tubercles, but in most cases others of a neuropathic character are present, which serve for differential diagnosis. The differences as regards the symptoms of different patients affected with cerebral tubercles are attributable in part to the fact that their size and rapidity of growth vary,

but more to the difference in their seat ; for any part of the brain may be the seat of tubercles, though certain portions, as the cerebellum, are more frequently affected than others.

The child with cerebral tubercles is quiet, but irritable and easily excited. Delirium is not common, but many before the close of life exhibit a degree of mental dulness. The headache, common in cases of cerebral as well as meningeal tubercles, may be nearly general, or it is frontal, parietal, or occipital, according to the seat of the tubercles. It is often lancinating, often intermittent.

Clonic convulsions occur toward the close of life. Exceptionally they are among the earliest symptoms. Observations have failed to establish any relation between the seat of the tubercles and the localization of the convulsions. The convulsions may be unilateral, while the tubercles are in both hemispheres ; or general, while the tubercles are on one side only.

The severity and duration of the convulsive attacks, and the frequency of their occurrence in tuberculosis of the brain, vary greatly in different patients. They have been attributed to softening of the cerebral substance, which sometimes occurs immediately around the tubercles, to local congestions excited by them, and also to serous effusions in the ventricles. The convulsions, sooner or later, end in paralysis or coma.

Contraction, or tonic convulsion of certain muscles, is sometimes observed. Its most frequent seat is in the muscles of the back, and of one or both of the lower extremities. It is a late symptom. It occurs in those cases in which there is softening around the tubercles, and usually in the muscles of the opposite side.

Paralysis is also a late, but not an infrequent symptom. It is preceded by headache, and sometimes, as already stated, by convulsions. Occurring as a symptom of tuberculosis of the brain, it is due either to pressure on a cranial nerve, or to compression and perhaps softening of the cerebral substance. The paralysis may be paraplegic, commencing as feebleness of the lower extremities, and increasing until it becomes complete, or a more or less complete, hemiplegia. In paraplegia due to tubercles of the brain, the cerebellum is, as a rule, their seat ; while paralysis of one side, or of certain muscles of one side, indicates tubercles of the opposite cerebral hemisphere ; but there are exceptions. Paralysis of the third cranial nerve gives rise to ptosis, of the sixth to paralysis of the external motor nerves of the eye, and therefore to internal strabismus.

Feebleness or loss of vision, inequality, oscillation, and finally dilatation of the pupils, are not infrequent symptoms of tuberculosis of the brain, and they possess great diagnostic value. Atrophy of the optic nerve, causing amaurosis, sometimes results from tubercles as well as other tumors of the brain. Atrophy of this nerve occurs not only when the

tubercles are so located as to press on the optic tract, in which case the explanation is apparent, but also, in certain patients, when the tubercles are in other parts of the brain. In these last cases it is thought by Brown-Sèquard and others that the imperfect nutrition of the nerve is due to contraction of its nutrient vessels, produced by the tubercles through reflex action.

In tuberculosis of the brain, symptoms pertaining to the respiratory, circulatory, and digestive systems are either absent or are quite subordinate to those of a neuropathic character. Slowness of the pulse, with or without intermittence, has sometimes been observed, and it is therefore a symptom of some diagnostic value. Toward the close of life both pulse and respiration are apt to be accelerated. Vomiting, constipation, and retraction of the abdomen, which are so common in meningitis, are only occasional symptoms.

Bronchial Glands.—During the progress of tuberculosis, hyperplasia, cheesy degeneration, and softening may occur of various lymphatic glands throughout the body, but the bronchial and mesenteric are not only those which are most frequently affected, but they are the only glands, unless in exceptional instances, which materially increase the danger or give rise to special symptoms. These symptoms either have a mechanical cause, namely, the pressure exerted by the enlarged glands on contiguous parts, or they are due to softening of the glands and consecutive inflammation and ulceration.

The following are the principal symptoms due to compression. Some of them are not infrequent, others are rare. Compression of the pulmonary veins retards the flow of blood from the lungs to the left auricle, giving rise to congestion, and, in extreme cases, œdema of the lungs, with sanguineous extravasations into the lung-substance, congestion of the right cavities of the heart, hepatic veins, and of the systemic capillaries generally. Compression of the pneumogastric nerve, or of the recurrent laryngeal, which is the motor nerve of the laryngeal muscles, modifies the voice, and produces a cough which is apt to be spasmodic. The cough resembles that of pertussis, and has been mistaken for it, but it is not so violent or protracted. The voice, clear and natural at first, becomes by degrees hoarse or feeble from deficient innervation of the laryngeal muscles.

An enlarged gland, or mass of glands, lying against the trachea or one of the bronchial tubes (this may occur with tubes up to the third or fourth division), and pressing its walls inward, obviously obstructs more or less the current of air. If there be considerable obstruction, a loud, sonorous râle is produced, which is heard distinctly at a distance from the chest, obscuring other râles. It is loudest when the patient is agitated, and it sometimes intermits. Feeble respiratory murmur, dyspnœa, and a cough are not infrequent in bronchial phthisis. Diminished intensity of

the respiratory murmur is general or partial, according to the seat of the compression. It has been most frequently observed at the summit of the lungs. In certain patients this symptom is not constant, the respiration being for a time feeble and then normal. The dyspnœa may be a prominent and distressing symptom, the alæ nasi dilating, and the infra-mammary region sinking with each inspiration. The cough which occurs when a gland presses on the trachea or bronchial tube, is due to the tracheitis or bronchitis to which the pressure gives rise. If ulceration occur at the point of pressure, the cough continues as long as the ulcer remains. Compression of the large veins within the thorax, which return blood from the head and upper extremities, causes more or less congestion of these parts, with, perhaps, transudation of serum in the subcutaneous connective tissue, and within the cranium. Rarely, a softened gland by ulceration gives rise to other symptoms than those mentioned, namely, hæmorrhage by ulceration into a vessel, or pleuritis or pneumonitis if the ulceration be toward the lungs.

Improvement in the condition of the patient affected with bronchial phthisis is not unusual. It may be permanent, but in most patients it is temporary, so that in a few weeks or months the symptoms are as severe as before. The improvement is due to softening and elimination of a gland which had given rise to symptoms by its mechanical effect, or by the inflammation which it had excited.

Physical Signs.—These are absent or obscure in the incipient disease, when the glands are small, and they are most marked in those cases in which the glands are so large as to press on the thoracic walls, since they then become the medium for the transmission of sounds to the ear. The part of the thorax against which they most frequently press is the dorsal vertebræ, from the first to the sixth, and each side of the vertebræ, and less frequently the upper third of the sternum. The physical signs are dullness on percussion over the interscapular space, and perhaps, though to a less extent, over the upper part of the sternum, and bronchial respiration in the same situations. Occasionally a bruit can be detected, due to the pressure of a gland on one of the large vessels of the chest.

Lungs.—A cough is one of the earliest and most persistent of the symptoms of pulmonary tuberculosis. It is so rarely absent, that those of largest experience do not meet with more than one or two such cases. It varies in severity and frequency. If the tuberculosis be acute and its course rapid, the cough, even from its commencement, is frequent, so as weary the patient and deprive him of needed rest. But in ordinary cases, that is, when the disease is chronic, it commences gradually, attracting little attention by its infrequency, but becoming more frequent and painful as the malady advances.

Ordinarily the cough is dry in the first weeks or months, but it becomes looser in the course of the disease, from the greater amount of bron-

chial inflammation. In exceptional instances it has a spasmodic character, like that produced by pressure of an enlarged bronchial gland on the pneumogastric or recurrent laryngeal nerve. This occurs from the accumulation of viscid mucus in one or more of the bronchial tubes, usually in dilated portions of them, from which it is with difficulty expectorated.

The respiration in pulmonary tuberculosis is accelerated in proportion to the degree of tuberculization. Tuberculization of a considerable part of both lungs gives rise to dyspnœa, especially when, as is ordinarily the case, bronchial, pulmonary, or pleuritic inflammation has supervened. Pneumonitis or pleuritis gives rise to the expiratory moan, and as these inflammations, when induced by tubercles, are protracted, this symptom may continue for weeks or months.

Patients under the age of six years do not expectorate, or but rarely. After this age expectoration is not common in the commencement of pulmonary tuberculosis, but in the confirmed disease it is a pretty constant attendant of the cough. Hæmoptysis is also rare under the age of six years, and less frequent subsequently than in the adult. It is most apt to occur in those cases in which there is already passive congestion of the lungs, produced by the pressure of enlarged bronchial glands in the manner already described. Patients old enough to make known their subjective symptoms, sometimes complain of fugitive pains under the sternum or between the shoulders.

In young children the physical signs of incipient pulmonary tuberculosis are wanting, or are so obscure as not to be readily recognized. This is due to the small size and dissemination of the tubercles. In older children the physical signs appear early, and are readily recognized, because, as a rule, the tubercles are aggregated, and are more frequently at the apices of the lungs than elsewhere, as in the adult. In the advanced disease, whether in infancy or childhood, when inflammation and more or less destruction of the lung-substance have occurred, the physical signs, so far from being obscure, enable us in most cases, in connection with the history, to make an immediate and positive diagnosis.

In young children affected with pulmonary tuberculosis the irregular and imperfect expansion of the lungs produces by degrees changes in the shape of the thorax, which are apparent on inspection. In some, the lungs being habitually imperfectly inflated, the obliquity of the ribs is increased, and the thorax consequently elongated, while its antero-posterior and transverse diameters are diminished. This obviously increases the convexity or arch of the diaphragm, so that this muscle sometimes lies against the thoracic walls as high as the ninth or even eighth rib. If the costal cartilages are yielding, there is anterior flattening of the chess and depression of the sternum ; if they are firm, on account of the more advanced age, the chest remains circular.

Another shape of the thorax is not infrequent in feeble tubercular children, especially infants, who have suffered from repeated attacks of bronchitis. It occurs also in the non-tubercular, if the conditions which favor it are present. The conditions are, on the one hand, feebleness of the patient, with diminished force of respiration and impaired resiliency of the ribs ; and, on the other, obstruction by mucus of one or more of the bronchial tubes. Occlusion more or less complete, of a bronchial tube, and consequent obstruction to the current of air, produces a corresponding degree of collapse in the portion of lung to which the tube leads. The parts which collapse are, in most cases, the lower lobes, and the thin anterior margins of the upper lobes. This causes lateral depression of the lower ribs, except such as are pressed outward by the abdominal viscera, and an anterior projection of the lower part of the sternum. The shape of the thorax in these cases differs from that in rachitis, in the fact that the lateral depression does not extend to the upper ribs, nor does the upper part of the sternum project.

Certain precautions should be observed in examining the chest by percussion and auscultation. The child should sit or recline, with the arms and shoulders in the same position, and the axis of the trunk straight. Inclination of the trunk to either side, raising or depressing a shoulder, may produce an appreciable difference in the two sides as regards the physical signs. Percussion of the two sides should be practised at the same stage of respiration. A slight difference in the degree of resonance does not afford proof of disease, unless it be observed at different examinations ; for, in feeble children, it often happens that all portions of the lungs do not expand alike, so that where we have noticed slight dullness at one visit, it may by the next have disappeared, or even at the same visit, if forcible inspirations be excited.

The physical signs ascertained by palpation, auscultation, and percussion are, as in the adult, vocal fremitus, bronchial respiration, bronchophony, and dullness on percussion. In those cases in which the tubercles are mainly at the apices of the lungs, diminished expansion of the infra-clavicular region is observed during inspiration, and this part of the thoracic wall is permanently depressed, so that the clavicles are unusually prominent. If there be emphysema, this flattening does not occur, or is slight. Dullness on percussion, though more frequently observed in the infra-clavicular region than elsewhere, may be present in different isolated places. If pneumonia supervene, the dullness not infrequently extends over a considerable part of one lung. The cracked-pot sound is often observed on percussion, but it possesses no diagnostic value. It can be produced, when there is no pulmonary disease, by percussing over a bronchus.

Bronchial respiration and bronchophony are important signs, as indicating solidification of the lung, but they do not show whether the solidi-

fication be tubercular or pneumonic, or the two conjoined. This must be determined by the history of the case, the extent of surface over which these signs are heard, and their persistence. When the tubercles begin to soften, and the lung-tissue breaks up, moist râles appear, often hoarse and gurgling, obscuring the bronchial respiration. A cavity in the lung, or pneumothorax, is attended by the same physical signs as in the adult.

Pleura.—Little need be said in reference to the symptoms and physical signs of tuberculosis of the pleura, since this affection is in most instances associated with tuberculosis of the lungs, and is not distinguishable from it. But now and then the pleural tubercles are numerous and large, giving rise to symptoms, while those of the lungs are small, few, and without symptoms, or attended by symptoms which are quite subordinate. Either the costal or visceral portion of the pleura may be the seat of tubercles. They are developed directly under the pleura, or upon its free surface. They are very apt to occur in the newly formed connective tissue which results from pleuritis. Those located upon the free surface, or under the costal pleura, rarely soften, while those under the visceral pleura sometimes soften and cause ulceration. Occasionally numerous aggregated tubercles form a firm, continuous layer upon the surface of the pleura, preventing, if upon the visceral pleura, full expansion of the lung. This may give rise to a degree of dullness on percussion, and feebleness of the respiratory murmur. Ordinarily, however, in this form of tuberculosis, the symptoms and physical signs, so far as any are observed, are due to the pleuritic inflammation which the tubercles excite.

Stomach and Intestines.—The symptoms in tuberculosis of the stomach and intestines vary according to the seat and stage of the tubercles.

Tubercles, whether gastric or intestinal, are not at first accompanied by symptoms, or the symptoms are obscure and ill-defined. Symptoms arise when inflammation occurs in the adjacent tissues. Diarrhœa is one of the most common and persistent of the symptoms. The alvine discharges are brown and thin, and sometimes, in advanced cases, very offensive. They may be streaked with blood which has escaped from the ulcers. Intestinal tubercles, developed immediately underneath the peritoneal coat, sometimes cause local peritonitis, usually of little extent. This gives rise to circumscribed pain, tenderness, and more or less meteorism.

Diagnosis.—It is evident from the foregoing description of symptoms that the diagnosis of incipient tuberculosis is much more difficult in children than adults. Before commencing the examination, it is advisable to learn the hereditary tendencies of the family and the history of the patient, especially as regards antecedent diseases or debilitating agencies, and the duration of the symptoms.

Tuberculosis of the encephalon is diagnosticated with more difficulty than that of the thoracic or abdominal organs ; but certain of these organs

are ordinarily tubercular at the same time, and the knowledge of the fact that they are affected aids in the diagnosis of the disease of the brain or its meninges. Among the symptoms which possess diagnostic value may be mentioned cephalalgia and more or less fever, with exacerbations in the commencement of the disease, and, at a more advanced period, strabismus, inequality or irregular action of the pupils, impairment of vision, retraction of the head, and convulsive movements or paralysis.

In certain cases careful observation and discrimination of symptoms are requisite, in order to determine whether they arise from intra-cranial tubercles, or from congestion of the brain caused by obstruction in the venous circulation by the pressure of enlarged bronchial glands.

The diagnosis of bronchial phthisis, when the glands are still small, is necessarily uncertain, on account of the absence of symptoms. When they have increased in size and are so located as to press on the pneumogastric or recurrent laryngeal nerve, producing the spasmodic cough already described, the differential diagnosis between that disease and pertussis may be made by attention to the following facts : Bronchial phthisis occurs singly, and is non-contagious, while pertussis occurs as an epidemic, and with evidences of contagion. There are no successive stages, to wit, those of catarrh, paroxysmal cough, and decline, as in that disease, and the cough, though paroxysmal, is short, and without whoop or vomiting.

In feeble children, with inherited tubercular diathesis, emaciation, sweats, and a chronic cough, with the absence of pulmonary symptoms, should excite suspicions that the bronchial glands are involved. The evidence is almost conclusive if the cough become paroxysmal, and there be a loud, persistent, tracheal or bronchial râle.

In certain of the patients affected with this form of tuberculosis, we have seen that the prominent symptoms are due to compression of one or more of the large vessels in the chest. Compression of these vessels, and consequent retarded circulation, may be confidently referred to enlarged bronchial glands, since aneurism, carcinomatous or other tumors, which would produce a similar result, are very rare before puberty. Sometimes the diagnosis is rendered certain by the physical signs observed by auscultation, and percussion over the sternum and the interscapular space. The condition of the external glands should also be observed, as those of the axilla, neck, and groin.

The diagnosis of pulmonary, though more readily made than that of intra-cranial and bronchial tuberculosis, is often difficult and uncertain. This is, in part, explained by the fact that the tubercles are so frequently disseminated, while emaciation and a chronic cough are not infrequent from other causes than tubercles. Rachitis, intestinal worms, dentition, simple tracheal or bronchial inflammation, may be attended both by a chronic cough and emaciation. Caution is therefore requisite in order to avoid a grave error in diagnosis. Precipitancy in the diagnosis of doubt-

ful cases is worse than indecision, and it is often best to postpone an expression of opinion as to the nature of the disease, till the case has been observed for a few days.

The significance and importance of the symptoms, physical signs, and other facts on which a diagnosis must be based, have already been sufficiently pointed out. It is difficult, in fact in certain cases impossible, to discriminate between simple cheesy pneumonia and cheesy pneumonia which has ended in the formation of tubercles. The patient has an attack of catarrhal pneumonia; but, instead of absorption of the inflammatory product, cheesy infiltration occurs, and the lung in places becomes infiltrated with pus, softens, and breaks down. The patient presents the symptoms and physical signs of phthisis. He may recover after a protracted sickness, or may die. The disease may, and often does, remain a pneumonia; but this is a condition of the lungs which favors the development of tubercles, and in a certain proportion of cases tubercles do form in the last weeks of life. Though the differential diagnosis in such cases between cheesy pneumonia and tuberculosis supervening on pneumonia is impossible, practically the discrimination is unimportant, as the same treatment is required.

Advanced pulmonary tuberculosis, except when it supervenes upon pneumonia, can in most instances be readily diagnosticated by a careful examination. Still, it is to be recollected, as already pointed out, that certain of the symptoms and physical signs, which occurring in the adult would afford almost positive proof of pulmonary tuberculosis, not infrequently have a different origin in children.

The diagnosis of tubercles in the abdominal organs is facilitated by the presence of symptoms which indicate at the same time tuberculosis of the lungs. Among the chief diagnostic signs of tuberculosis of the peritoneum may be mentioned meteorism and a degree of tenderness on pressure, but there is danger of mistaking the tympanitic state of the intestines common in ill-nourished infants and the rachitic, or the fullness due to enlarged spleen or liver, for that occasioned by peritoneal tuberculization, and *vice versa*. The history of the case, and a careful examination of accompanying symptoms, and the shape and feel of the abdomen, usually suffice to establish the diagnosis. In simple gaseous distension of the abdomen there is an absence of the symptoms, general and local, which attend tuberculosis; rachitis occurs at an earlier age than peritoneal tuberculosis, and digital examination, aided by percussion, enables us to diagnosticate enlargement of the liver or spleen.

Tubercular enlargement of the mesenteric glands cannot be positively diagnosticated when they are small. When they have attained such a size that they can be felt through the abdominal walls, palpation, in connection with the history and symptoms of tuberculosis, suffices to establish the diagnosis. The glandular tumors can be diagnosticated from other

tumors by the fact that they are tender on pressure, and occupy the umbilical region, while fæcal tumors are not tender, and are located in the iliac or lumbar region. Gastro-intestinal tuberculosis cannot be positively diagnosticated. Protracted diarrhœa, or frequent attacks of diarrhœa, not readily controlled by medicine, and occurring in tubercular cases, are probably associated with intestinal ulceration ; but in only a certain proportion of cases of ulceration are there also tubercles in the walls of the intestines, as we have seen above.

Prognosis.—Death is the ordinary result of tuberculosis in the child, as it is in the adult ; but now and then one recovers. Hospital statistics show that the average duration of the disease is from three to seven months. Under favorable circumstances it is more protracted, even to two or three years. Those succumb soonest who inherit a strongly marked tubercular diathesis, live in damp, dark, and ill-ventilated apartments, and whose diet is scanty or of poor quality. Therefore in the poor quarters of the city tuberculosis presents a worse form and pursues a more rapid course than among families in better circumstances.

Favorable prognostic signs are absence of tubercular diathesis, good appetite and general health, with little emaciation, infrequency of cough, with respiration, pulse, and temperature nearly normal. Such symptoms may afford hope of recovery with judicious regimenal and therapeutic measures. On the other hand, if the symptoms be grave, death is inevitable, unless in bronchial phthisis, in which, even when there is considerable urgency of symptoms, the offending gland is sometimes eliminated by softening and ulceration, and the patient improves temporarily, if he do not ultimately recover. Complete and permanent recovery is, however, quite exceptional.

Death in tuberculosis of children may occur from exhaustion induced by the general disease, or from the local effect of the tubercles. Thus, in intra-cranial tuberculosis it may result from coma ; in pulmonary tuberculosis, from dyspnœa, though more frequently from exhaustion ; in that of the bronchial glands, from coma, dyspnœa, exhaustion, or even from hæmorrhage ; in that of the abdominal organs, from peritonitis or protracted diarrhœa.

Treatment. *Prophylactic.*—Since caseous substance occurring in some part of the system is the common cause of the development of tubercles, it is evident that measures which tend to prevent the occurrence of this substance are prophylactic of tuberculosis ; and since, in children, cheesy matter, in most instances, is a product of strumous inflammations, the anti-strumous remedies are demanded in the prophylactic as well as curative treatment of tuberculosis. Therefore, the strumous child should be watched with great care, and such measures be employed as are calculated to invigorate its system. If the mother belong to a decidedly tubercular family, or give the history of scrofula in her childhood, it

is better that she do not suckle her infant, but employ a healthy wet-nurse. Children who are weaned should have plain, but nutritious and easily digested diet, a part of which should be milk. Residence in an airy and salubrious locality, out-door life, a scrupulous avoidance of exposure by which a cold might be contracted, are important, in order to the continued latency of the diathesis.

Loss of flesh or appetite, or other evidences of failing health, indicate the need of other measures of a therapeutic character. Alcoholic stimulants should now be allowed three or four times daily in milk ; cod-liver oil, with half its quantity of syrup of the lactophosphate of lime, to which the syrup of the iodide of iron is added, will be found useful for these cases, as it is in the ordinary forms of scrofula. The various bitter preparations containing iron, as the citrate of iron and quinine, elix. calisaya bark with iron, etc., should be employed, when, for any reason, cod-liver oil is not tolerated. By the employment of such precautionary measures as soon as indicated, multitudes of children might be saved from tuberculosis who now perish.

Curative.—The medicinal agents which are required in ordinary cases have been already mentioned, namely, cod-liver oil, iron, sometimes the vegetable tonics, and alcoholic stimulants. The oil may be given in emulsion to disguise the unpleasant flavor, or, which I prefer, mixed with half its quantity of syrup of the lactophosphate of lime, as recommended for the treatment of scrofula.

If the cod-liver oil be not tolerated, or if it impair the appetite, it should be discontinued. In cases of diarrhœa it is of little or no benefit and may do harm. Under such circumstances patients sometimes do better with simple regimenal measures, aided by alcoholic stimulants, and one of the least unpleasant of the tonics, as wine of iron or the calisaya bark. The regimen already recommended for prevention is also required as a part of the curative treatment.

Certain modifications of treatment are demanded on account of the localization of the tubercles. Intra-cranial tuberculosis, as soon as diagnosticated, should be treated by pretty decided doses of iodide of potassium, though, unfortunately, there is little prospect of improvement. The glandular disease, whether bronchial or mesenteric, requires the iodide of iron, with or without that of potassium. Pneumonitis or pleuritis, so frequent a complication of pulmonary tuberculosis, requires emollient poultices, with moderate counter-irritation, and the judicious use of opiates with stimulants. The peritonitis occurring in abdominal tuberculosis, which is usually circumscribed, is best treated by fomentations and poultices, with opiates, and the diarrhœa by subnitrate of bismuth and chalk, five to ten grains of each, or the bismuth with Dover's powder, or a more active astringent.

CHAPTER IV.

SYPHILIS.

Syphilis in infancy and childhood presents itself under two forms, namely, the congenital and acquired ; the former is the more frequent.

Etiology.—Congenital syphilis may be derived from either father or mother. Either parent, having previously had syphilis, may transmit it to the offspring, although at the time free from syphilitic symptoms. The mother, healthy at the time of conception, but infected with syphilis prior to the eighth month of gestation, may communicate the disease to the fœtus ; syphilis contracted in the eighth or ninth month does not affect the fœtus. If both parents have syphilis, the infant is almost necessarily syphilitic ; on the other hand, if only one parent be affected, the infant may or may not be contaminated. Sometimes, with such parentage, a part of the children are syphilitic, and a part healthy.

Acquired syphilis in infancy and childhood may be received through primary lesions—that is, by reception of the virus from a chancre or bubo ; or it may be derived from certain of the secondary lesions. Inoculation by primary lesions may occur at the birth of the infant, from a syphilitic sore in the vagina or upon the vulva of the mother ; inoculation in this manner is, however, rare. Children may also receive the virus from primary lesions on the persons of nurses or companions. Infection in this manner is sometimes accidental, and sometimes the result of criminal conduct. A chancre on the breast of the wet-nurse not very infrequently communicates syphilis to the nursling.

The contagiousness of "secondary manifestations," for a long time doubted, is now fully established. Syphilis may be communicated by the secretion or exudation of a mucous patch, or a secondary sore. Hence the danger of lactation by unhealthy wet-nurses, though they present no symptoms of recent syphilis. Excoriations or sores upon the nipple or breast of an infected wet-nurse may communicate the disease to the nursling ; and, on the other hand, mucous tubercles or fissures upon the lips or tongue of the infected infant may be the means of contaminating a healthy wet-nurse. Many such cases are now contained in the records of medicine. Vaccination by means of the scab is also a mode by which constitutional syphilis may be communicated. For further particulars in reference to this subject the reader is referred to our remarks on vaccination.

Clinical History.—The effects of the syphilitic poison upon the development of the fœtus, and the development and health of the infant, are different in different cases. The fœtus, under the influence of the poison, often ceases to grow, shrivels, dies, and is expelled, long before term ; or it may be born alive, but prematurely, and showing clear evidences of the disease, as soon as it comes into the world ; or, again, it may be born at term, but dead. So frequently is syphilis a cause of non-viability, that, as Trousseau has remarked, this disease should be suspected as the cause, whenever a woman repeatedly aborts. Abortion from syphilis commonly occurs at or about the sixth month of gestation. In those cases in which the fœtus dies from syphilis there is often placental syphilitic disease, namely, an undue growth of cells in the villi, which, compressing the vessels, gives rise to fatty degeneration, and prevents the requisite interchange between the maternal and fœtal blood. (Herring, Frankell.) Frankell designated the change "granulation-cell hypertrophy of the placental villi." Virchow, in one case, found a gummy tumor in the maternal portion of the placenta.

When a fœtus destroyed by syphilis is expelled, it is apt to present a macerated appearance, the cuticle being detached over large patches of surface, and in other parts raised in blebs, with a thin, puriform, and offensive fluid underneath ; the liver is occasionally indurated, and abscesses with spots of inflammation are sometimes observed in the thymus gland ; the amniotic fluid is offensive, turbid, and of a greenish or greenish-brown appearance.

If the fœtus, in which syphilitic manifestations have begun to occur, have reached a viable age, and be born alive, it is small and imperfectly developed, often shriveled and senile in appearance. The skin looks unhealthy, and it may exhibit a distinct rash. Bouchut saw a seven and a half months' infant born alive, with an eruption of a copper color upon the legs and arms, and onyxis upon the fingers and toes. The bullæ of pemphigus are also not infrequent upon the skin at birth, or they appear within a few days, two or three, after birth. The smallest are about the size of a split pea ; but many are considerably larger ; the largest consist of two or more which have coalesced. They contain a thin, greenish, purulent matter, and appear most frequently upon the palms of the hands and soles of the feet, but also in severe cases upon the face and over the surface of the body. Recently I was able to diagnosticate syphilis in an infant within a day after birth, by its small size and feebleness, and the appearance of large blebs of pemphigus upon its hands, feet, fingers and toes, over which the skin soon broke, leaving troublesome and bleeding sores ; coryza commenced about the twelfth day. The parents seemed healthy, but I was enabled to trace the syphilitic taint to the mother. Non-syphilitic pemphigus, the result of cachexia, sometimes appears soon after birth, but its primary and usual seat is around the

neck, and upon the body. I have known it to appear within the first week of life, and end fatally by the close of the second week. I have not found it difficult to distinguish it from syphilitic pemphigus by the history of the family, and its absence from the palmar and plantar surfaces of the hands and feet. Condylomata, mucous patches, and stains of a copper color are the principal syphilitic affections, besides pemphigus, which have been observed at birth on the bodies of contaminated infants. It is stated that M. Cullerier, in ten years' attendance at the Hôpital de Lorraine, met only two cases of syphilitic manifestations at birth, and Victor de Meric only two cases in forty-six infants, who were affected with congenital syphilis (Bumstead); but in the practice of others a larger proportion have exhibited symptoms at birth. Ordinarily the period in which congenital syphilis is first revealed by symptoms is between the fifteenth and fortieth days. Rarely the manifestation of the disease is delayed several months. M. Diday ascertained the time of the commencement of symptoms in 158 cases as follows :

Before the completion of one month after birth, in	86
" " two " " " "	45
" " three " " " "	15
At four months,	7
" five "	1
" six "	1
" eight "	1
" one year,	1
" two years,	1

In cases of tardy commencement of syphilitic symptoms it is probable that the poison has been partially eradicated from the affected parent by appropriate treatment.

The nutrition of the infant who has inherited the syphilitic taint, but does not exhibit it at birth, is for a time good, but it begins to be impaired when the local manifestations of syphilis appear, or soon after. The system gradually wastes; the skin loses its fresh and healthy appearance, and becomes sallow, and, after a time, more or less wrinkled; the features become pinched and contracted, and wear a sad expression. M. Diday says : " Next to this look of little old men, so common in new-born children doomed to syphilis, the most characteristic sign is the color of the skin." Trousseau thus describes this discoloration of the surface : " Before the health becomes affected, the child has already a peculiar appearance; the skin, especially that of the face, loses its transparency; it becomes dull, even when there is neither puffiness nor emaciation; its rosy color disappears, and is replaced by a sooty tint, which resembles that of Asiatics. It is yellow, or like coffee mixed with milk, or looks as if it had been exposed to smoke; it has an empyreumatic color, similar to that which exists on the fingers of persons who are

in the habit of smoking cigarettes. It appears as if a layer of coloring had been laid on unequally ; it sometimes occupies the whole of the skin, but is more marked in certain favorite spots, as the forehead, eyebrows, chin, nose, eyelids—in short, the most prominent parts of the face ; the deeper parts, such as the internal angle of the orbit, the hollow of the cheek, and that which separates the lower lip from the chin, almost always remain free from it. Although the face is commonly the part most affected, the rest of the body always participates more or less in this tint. The child becomes pale and wan.''

The infant whose system is profoundly affected by syphilis rarely smiles, and its voice is feeble and plaintive ; its frequent, whimpering cry is quite characteristic.

Coryza is one of the earliest and most constant of the local affections which occur in infantile syphilis. It is slight at first, attracting little attention from the parents, who are not aware of its significance, and usually attribute it to a slight cold ; but it gradually increases. It gives rise to a secretion from the Schneiderian membrane, at first thin, but which becomes more consistent, and is attended by the formation of scabs. The thickening of the mucous membrane, in consequence of the inflammation and the presence of crusts, narrows the passage through the nostrils so as to produce snuffling respiration, and sometimes render nursing difficult. In severe cases respiration through the nostrils is almost wholly prevented, so that death may occur from inanition, unless the breast be milked into the infant's mouth, or it be fed with a spoon ; but, ordinarily, even in grave coryza, it continues to nurse, though obliged often to release its hold of the nipple to obtain breath. It is when coryza begins to interfere with lactation that it first alarms the parents. The inflammation at the same time may affect the throat and larynx, causing hoarseness of the voice. Ulceration of the Schneiderian membrane and the adjacent cartilage or bone is rare in infancy or childhood, although cases occur which are even attended with more or less flattening of the nose. Diday believes that the discharge which accompanies coryza is in great part due to mucous patches developed on the Schneiderian membrane. The upper lip, over which the discharge flows, becomes red, excoriated, and more or less incrusted. The coryza, in most cases, coexists with other local syphilitic affections. Occasionally it occurs alone, and is the only evidence of the presence of the specific taint, except such as is afforded by the mal-nutrition and general appearance of the patient.

Mucous patches occur in most patients. They are developed either upon the mucous surfaces, or upon parts of the skin which are thin and exposed to friction, and such as are moistened by secretion or transudation from the vessels underneath. The most common seat of mucous patches is at the termination of mucous canals ; but in infancy, on account

of the peculiar delicacy of the skin, they may occur upon almost any part of the cutaneous surface. They are most common, however, around the anus, upon the vulva, scrotum, umbilicus, labial commissures, in the axillæ, and behind the ears.

Mucous patches upon the skin present a rounded border, and are slightly elevated. Their color has been compared to that of the skin which has been softened by the prolonged application of a poultice. Erosions and cracks sometimes occur in the patches, from which a thin liquid exudes.

Upon mucous surfaces they are less elevated than upon the skin, and are prone to ulcerate. These ulcerations, commencing at the centre, extend, and soon the mucous patch disappears, and its site is occupied by an ulcer. The ulcer may be circular, oval, elliptical, crescentic, or irregular. The arches of the fauces are a common seat of mucous patches.

Roseola is an occasional symptom of infantile syphilis. "It is distinguished," says Diday, "by patches of a bright rose-color, circumscribed, irregularly rounded, of various sizes (most frequently about as large as one of the nails); appearing, by preference, on the belly, lower part of the chest, neck, and inner surface of the extremities." The spots do not readily and fully disappear by pressure.

Pemphigus appearing soon after birth has already been alluded to. Its most frequent seat, whether occurring after birth or as a subsequent manifestation, is, as we have stated, the palms of the hands, soles of the feet, the fingers, and toes. This eruption commences by a violet tint of the skin, and in the course of twenty-four to forty-eight hours a watery fluid collects underneath, which soon becomes turbid. The skin peels off, and sometimes an angry sore results, which bleeds readily when rubbed or pressed. In other and more favorable cases new skin takes the place of that which is lost. Pemphigus at birth is a precursor of death, but when it appears for the first time some weeks after birth, it is a less unfavorable prognostic sign. In cases of recovery it disappears, with proper treatment, in two or three weeks.

Acne, Impetigo, and Ecthyma are occasionally observed in children afflicted with syphilis. The indurated pustules of acne occur most frequently upon the shoulders, back, chest, and buttocks. The pus is sometimes absorbed, and in other cases discharged, leaving a small cicatrix, which, after a time, disappears. Impetigo appears most frequently upon the face, and occasionally upon the chest, neck, axilla, and groin. Unlike simple impetigo, the syphilitic impetiginous eruption is surrounded by a copper-colored areola. Ecthyma occurs upon the legs and buttocks chiefly. It commences as violet-colored spots, which are soon transformed into pustules. Ulcers succeed, which, in reduced states of the system, are apt to enlarge and endanger the safety of the child. Of the three pustular eruptions, acne, according to Diday, is the least serious—

indicating a "less confirmed diathesis." Ecthyma is the most serious, on account of the reduced state of system with which it is apt to be associated. Syphilitic papulæ and squamæ are rare in infants, but cases have been observed. Onychia occasionally occurs, though less frequently than in syphilis of the adult.

Visceral Lesions.—The visceral lesions which result from the syphilis of infancy and childhood are, suppuration in the thymus gland; gummy tumors in certain organs, most frequently the lungs and liver; increase of the connective tissue of the liver, known as syphilitic cirrhosis; partial perihepatitis, with depressions resembling cicatrices on the surface of the liver; peritonitis; periostitis, with thickening of the bone and exostosis.

Suppurative inflammation in the thymus gland is not common, or has not been frequently observed. When it is present the gland sometimes presents its normal appearance externally, and the abscess is only discovered by incisions. Gummy tumors are white and spheroidal; some are as small or smaller than a pin's head, while others are as large as a pea, or even a hazel-nut. I have seen a considerable number of them not as large as a pin's head, in the liver of an infant. Gummy tumors, according to Lebert, consist "of loose fibrous tissue, made up of pale, elastic fibres, inclosing in their large interspaces a homogeneous granular substance, the elements of which are less adherent to each other than in deposits of true tubercle." Lebert also, with other microscopists, discovered round granular cells in these tumors. According to Robin, gummy tumors "are made up of rounded nuclei belonging to fibro-plastic cells, or *cytoblastions;* of a finely granular, semi-transparent, and amorphous substance; and, finally, of isolated fibres of cellular tissue, a small number of elastic fibres, and a few capillary bloodvessels."

Constitutional syphilis is one of the principal causes of waxy degeneration, and the spleen and liver of infants may be enlarged from this cause. Dr. Samuel Gee has expressed the opinion that in half the cases of hereditary syphilis the spleen is enlarged. (London *Lancet*, April 13th, 1867.)

Infiltration of the liver by fibrous substance was first noticed by Gübler. It is not common in the infant. A specimen, showing this lesion, was presented to the London Pathological Society in 1866, by Dr. Samuel Wilks. The following remarks by Dr. Wilks convey a good idea of the appearance and state of the liver in syphilitic cirrhosis: "Having dissected the bodies of several infants who have died of congenital syphilis, I have found fatty livers, and an inflammation of the capsule; but in only two have I discovered adventitious products of a fibrous character. The present example, however, corresponds in every particular with the disease described by Gübler. It must be distinguished (at least as far as the naked-eye appearance reaches) from the syphilitic disease of adults,

of which many specimens have been before the Society. In these the organ is cicatrized on the surface, and contains distinct nodules of fibrous tissue ; while in the disease of children, as in the present specimen, the whole organ is infiltrated by a new material, and it consequently becomes, as described by Gübler, hypertrophied, globular, and hard, resistant to pressure, and even when torn by the fingers, its surface receives no indentation from them ; it is also elastic, and when cut, creaks slightly under the scalpel. This was the form of disease in the present specimen. It came from a syphilitic child, a month old, in whom the liver could be felt enlarged during life, and when removed weighed a pound and a half. It was smooth on the surface, and so hard that it resembled rather a fibrous tumor than a liver. It is seen that the liver in the syphilitic child is liable to three distinct pathological processes, namely, gummy tumors, cirrhosis or fibroid degeneration, and waxy degeneration."

Syphilitic perihepatitis and periostitis are more rare in infancy and childhood than in adult life, but they occasionally occur. The late Sir James Y. Simpson considered peritonitis in the fœtus one of the results of syphilis, and a cause of its death.

Osseous Lesions.—Within the last few years, important discoveries have been made in regard to the effect of syphilis upon the nutrition of the bones in children. In 1870, Dr. Wegner, of Berlin, published his observations of the state of the skeleton in twelve syphilitic children, who were either stillborn, or who died within a few days or weeks after birth. He found clear proof that the syphilitic dyscrasia very frequently disturbs the nutrition and produces anatomical changes in the skeleton of the fœtus. The following are the lesions, clearly referable to syphilis, which he observed : periostitis of long bones, including the ribs ; softening, separation, and sometimes crepitation, at the point of union of diaphysis and epiphysis ; chalky concretions and infiltrations along the line of ossification ; fatty degeneration of marrow ; irregular formation and distribution of spongy substance in the epiphysis. These lesions were not all observed in each case, but they occurred with such frequency that there could be no doubt that they were due to the syphilitic taint of system. Confirmatory observations also, in twelve cases, have since been made by Waldeyer and Köbner.*

Again, there is a syphilitic lesion of the bone in children, which is not usually present or has not usually been observed at birth, but is developed in the first weeks or months of infancy. The lesion alluded to is a circumscribed enlargement of one or more bones. This has been most frequently observed upon the long bones, including the clavicle and ribs ; but in certain children it occurs upon other bones in addition. In some

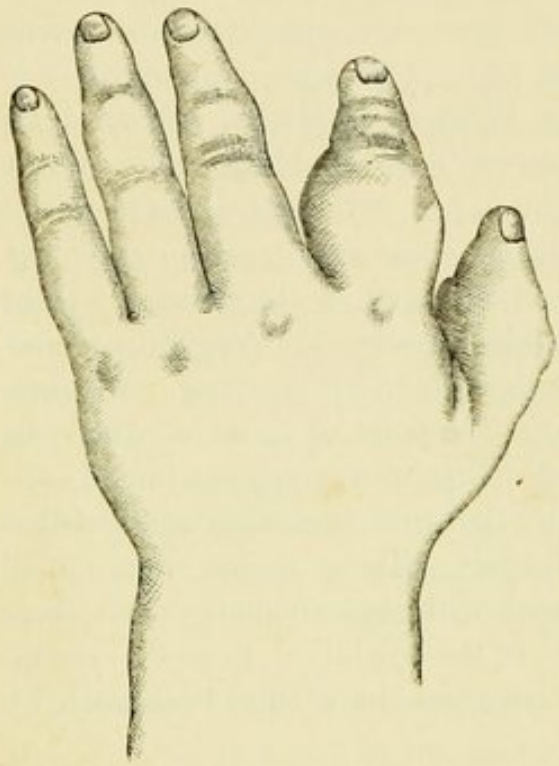
* See elaborate paper by R. W. Taylor, M.D., New York Journal of Obstetrics, etc., July, 1874.

cases it is one of the first manifestations of hereditary syphilis, occurring even sooner than the coryza, while in others several months elapse before it appears. In one case, reported by Dr. Bulkley,* of this city, it was first seen only a few days after birth, being perhaps congenital ; while in another case, in which the enlargement was upon certain phalanges, and which is represented in the accompanying figure, it appeared at the age of twelve months. When it occurs upon a phalangeal bone, it is designated *dactylitis syphilitica*.

The enlargement, if upon a long bone, ordinarily begins at or near the point of union of the diaphysis with the epiphysis. It is located upon the extremity of the shaft which it encircles, and it extends over a part or nearly the whole of the epiphysis. It has an elevation of perhaps one half or three quarters of an inch in typical cases ; its surface is smooth, or slightly undulating, and the skin over it, though distended, has its normal appearance, and is easily movable, unless ulcerations have occurred.

These enlargements, which result from the specific inflammation occurring in the periosteum and the bone, may resolve under proper treatment ; but if neglected, and the anti-hygienic conditions are bad, degenerative changes may occur, ending in ulceration and destruction of the diseased part to a greater or less extent.

FIG. 12.



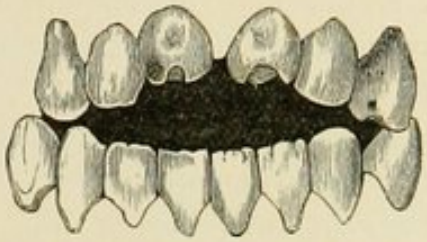
Though these bone enlargements, whenever observed, should excite suspicions of syphilis as the cause, enlargements which present the same general appearance do occur from other causes. Such a case was observed by me in the children's class in the Outdoor Department of Bellevue, and Dr. Bulkley details another case in his paper. In the case observed by me, the inflammation and enlargement seemed to be strumous. Bäumler says : " Dactylitis syphilitica does not always originate in the bone ; similar appearances may be produced through gummous formation in the sheaths of the tendons, and in the fibrous structure of the finger ;" and again, " Its outward appearance may be produced also by tuberculosis, enchondroma, or sarcoma of the bone-marrow." (Art. Syphilis, *Ziemssen's Encycl.*)

Mr. J. Hutchinson, of London, has called attention to the fact that

* Rare Cases of Congenital Syphilis, New York Med. Journal, May, 1874.

hereditary syphilis, having perhaps been manifested by the usual symptoms during infancy, and then becoming latent, may give rise to new symptoms after the fourth year. The most noticeable of these symptoms is a dwarfing of the permanent incisor teeth, which are rounded and peg-like, and their enamel notched at the free ends of the teeth. On account of the small size and shape of the teeth, there are interspaces between them. This abnormal development is most marked in the central incisors of the upper jaw, and in certain cases it is limited to them, and it never appears in the other incisors unless it does also in them. Another symptom, which only appears in hereditary syphilis, is an interstitial keratitis occurring on both sides, and attended by the deposition of fibrin in the substance of the cornea. In a few weeks the inflammation declines, but a slight opacity of the cornea remains. The cerebral nerves may become affected, usually a single pair—if the auditory, deafness resulting ; if the optic, dimness of sight. Occasionally there are other manifestations of syphilis in this period, as enlargement of spleen and liver, and nodes upon the long bones.

Fig. 13.



Prognosis.—This depends in great part on the general condition of the patient. If there be much emaciation, and the symptoms indicate a deeply-seated cachexia, a considerable proportion perish. On the other hand, if the general health be not greatly impaired, although the local affections are pretty severe, the prognosis with correct treatment is good. The younger the infant, when the symptoms of syphilis appear, the more unfavorable, as a rule, is the prognosis.

Treatment.—Parents who beget syphilitic children ought, from a due regard for their offspring, to make use of antisyphilitic remedies, although they present in their persons no evidences of syphilitic taint. A good prescription for the parents is one-sixteenth of a grain of corrosive sublimate in the compound tincture of bark, given twice or three times daily for several weeks. If the father have had syphilis, both parents should be subjected to this treatment, and it may be continued, at least on the part of the mother, during the first months of her gestation. So small a dose of the mercurial does not, in my opinion, materially increase the liability to miscarry. There is much more danger of miscarrying from allowing the syphilitic taint to remain uncontrolled. Some prefer the use of mercurial ointment in the treatment of pregnant women for syphilis, in the belief that it is less likely to produce abortion. It is used for this purpose in the proportion of one drachm to the ounce. It is equally effectual in the eradication of the syphilitic taint with the small dose of corrosive sublimate recommended above for internal administration ; but it is impossible to determine the quantity of mercury which

enters the circulation when inunction is employed, and salivation is more likely to occur.

Syphilis in the infant requires mercurial treatment as in the adult. Mercury may be employed internally or by inunction. Some prefer inunction in the treatment of ordinary cases in the manner recommended by Sir Benjamin Brodie. "I have spread," says he, "mercurial ointment, made in the proportion of a drachm to an ounce, over a flannel roller, and bound it round the child once a day. The child kicks about, and, the cuticle being thin, the mercury is absorbed. It does not either gripe or purge, nor does it make the gum sore, but it cures the disease. I have adopted this practice in a great many cases, with the most signal success." Trousseau, on the other hand, discountenances the use of inunction, as mercurial ointment applied to the skin produces irritation, and increases the suffering and restlessness of the child. He prefers the following solution, which is known as Van Swieten's, for internal treatment :

℞. Hydrarg. bichlorid., 1 part ;
Aquæ, 960 parts ;
Spts. rectific. 100 parts. Misce.

Dose, one, or at most two grammes (15.434 to 30.868 grains), in milk, daily.

In order to avoid the risk of establishing a diarrhœa, and to leave the stomach free for the employment of other medicines, as cod-liver oil and the iodide of iron, I prefer and commonly prescribe for infants inunction with the mercurial ointment diluted with eight times its quantity of lard, cold cream, or vaseline. It should not, in my opinion, be applied as a plaster, but a quantity of the size of a large chestnut should be rubbed three times daily upon the neck or breast of an infant of three or four months. For children over the age of eight or ten months, Van Swieten's, or one of the following formulæ may be employed :

℞. Hydrarg. cum cretâ, gr. iij–vj.
Sacch. alb., ʒj. Misce.

Divid. in chart. No. xii. One powder 3 times daily.

℞. Hydrarg. chlor. corros., gr. j–ij.
Syr. sarsæ comp., ℥ ij.
Aquæ, ℥ viij. Misce.

One teaspoonful 3 times daily.

℞. Hyd. chlor. corros., gr. ss.
Potas. iodid., ʒj.
Ferri et ammon. citrat., ʒj.
Syr. simplic., ℥ vj. Misce.

Dose, one teaspoonful 3 times daily for a child of 3 to 5 years.

℞. Hyd. chlor. corros., gr. j.
Potas. iodid., ʒ ij.
Syrup. simplic.,
Aquæ, āā ℥ ij. Misce.

Dose, six drops 3 times daily for a child of 3 months.

Mercury, in whatever way employed, should not be discontinued entirely till several weeks after the syphilitic symptoms have disappeared ; it is proper to continue it for a time, in diminished quantity and fewer doses, after the health seems fully restored.

When the mercurial is omitted, tonics are often required. The preparations of cinchona are useful in certain cases, as are also those of iron. If the patient remain feeble and pallid, presenting evidences of struma, cod-liver oil and syrup of the iodide of iron will be found beneficial continued for some weeks or months after the mercurial is discontinued. Attention should always be given to cleanliness and the hygienic management of the patient. In some instances direct treatment of the local affections is serviceable. To aid in the cure of syphilitic coryza, the following ointment should be applied within the nostrils by a nasal sponge three times daily :

℞. Ung. hydrarg. nitratis, ʒ ij.
Ung. zinci oxidi, ℥ ij. Misce.

Recently I have been in the habit of employing Squibb's oleate of mercury, two per cent, for syphilitic coryza of infants, and the effect has been satisfactory. It may also be employed by cutaneous inunction in the treatment of the general disease.

Condylomata or mucous patches seated upon the cutaneous surface may be dusted with calomel. At my clinique, in April, 1871, a child two years and ten months old was presented, with a large condylomatous outgrowth near the anus. The history of the child showed that in all probability the disease had been contracted within a year from syphilitic children in one of the public institutions. Within three weeks this affection disappeared by dusting upon it calomel once daily, with appropriate internal treatment.

SECTION II.

ERUPTIVE FEVERS.

CHAPTER I.

MEASLES.

The disease known in the vernacular as measles has also the names rubeola and morbilli. It is a common exanthematic affection, occurring at any age, but most frequently in childhood. It affects once the majority of mankind. Writers recognize three stages of measles : first, that of invasion, which ends with the appearance of the eruption ; secondly, the eruptive stage ; and thirdly, the stage of decline or desquamation.

Symptoms.—This disease commences with such symptoms as usually occur in mild but pretty general inflammation of the air-passages, namely, cough, fever, anorexia, and thirst. The eyes present a suffused, moderately injected, and brilliant appearance, and the buccal and faucial surfaces are injected. The Schneiderian membrane, and that lining the larnyx, trachea, and bronchial tubes, participate in the increased vascularity. The cough at first is dry, and sometimes distinctly croupy. Catarrhal or false croup, indeed, is not infrequent in the initial period of measles. The cough is attended by slight acceleration of respiration, and by little or no pain in the respiratory movements. If auscultation be practised at this early stage, we observe the vesicular murmur, somewhat harsh in character, and sometimes sonorous and sibilant râles. A little later, râles of a moist character appear.

The patient, if old enough, commonly complains of headache, and of dull pain in the epigastric region, or the centre of the sternum, due to the bronchitis. With these local symptoms febrile reaction occurs. The temperature rises to about 102° or 103°, as indicated by the thermometer in the axilla. The pulse numbers from 110 to 130 per minute. The fever is somewhat greater than in primary tracheo-bronchitis, except when the bronchitis extends to the bronchioles, but it is less than in most cases of scarlet fever.

The fever in the premonitory stage of measles after the first day is not

uniform. It is attended by remissions and exacerbations, the former occurring in the first part of the day, the latter in the evening. Sometimes two exacerbations occur in the day. The face is flushed and somewhat swollen, especially during the times of increase in the fever, and the child is drowsy or restless. Vomiting, so common a symptom in the commencement of scarlet fever, occasionally occurs in measles. While in scarlet fever this takes place in the first twenty-four hours, in measles it occurs with about equal frequency at any period previously to the eruption. It was present during the first stage, sometimes almost as late as the eruptive period, in thirteen, and was absent in twenty-three cases, in which I preserved records in reference to this symptom.

The duration of the first stage varies in different cases. It is usually from two to five days, with an average of about four. Occasionally it is more protracted on account of some disturbance in the economy, either from exposure to cold or other cause, which prevents the necessary afflux of blood toward the surface, and retards the eruption. In eighteen cases in my practice in which the duration of the cough previously to the appearance of the rash was accurately ascertained, the time varied from one to five days, with an average of three and one third ; in ten other cases it had continued, the parents stated, about a week, and in five, from one to two weeks, previously to the eruption.

The eruption commences, when the disease pursues its normal course, upon the forehead and neck, then the face, and gradually extends downward, occupying from twenty-four to thirty-six hours in passing over the trunk and limbs. It appears first as indistinct red points, not more than a line in diameter, which increase in size and become more distinct. Their borders are uneven or irregular, or they are finely notched ; their general shape is, however, circular, except as two or more unite, when they may assume any form. The crescentic form which writers describe is due to the union of two points of eruption. The largest of these spots when there is no coalescence, do not exceed a quarter of an inch in diameter, and many are much smaller. Frequently in plethoric children, if there be much fever, there is continuous redness over several inches of surface. The eruption is then confluent. This form is often observed upon parts of the surface where the capillary circulation is most active, when it is discrete elsewhere. In some of these cases, diagnosis of measles from scarlet fever is attended with difficulty.

The rubeolous eruption is slightly elevated. This is not appreciable to the sight, but can be ascertained by passing the finger slowly over the skin, when a little roughness is felt at the point of eruption. Sometimes the elevation, especially in the commencement of the efflorescence, is not appreciable, even to the touch. The eruption is broad and flat, never acuminate, never changing its form to the vesicular or pustular. It disappears by pressure, and immediately reappears when the pressure is

removed. It has been compared in appearance to flea-bites. Small, pointed, papular, vesicular, or pustular eruptions are sometimes seen in connection with those of measles, but they are accidental, occurring in other states of system, as well as in measles, if there be the same augmented temperature.

In the commencement of the eruptive period the severity of the constitutional and local symptoms increases. The pulse and temperature correspond with the character which they presented during the exacerbations of the first stage. The features are slightly swollen; the eyes still watery and sensitive to light; the conjunctiva, ocular and palpebral, and the mucous membrane of the cavity of the mouth and of the air-passages, continue injected. The tongue is covered with a moist thin fur, and its papillæ are prominent, though less so than in scarlet fever. The cough continues frequent, and is seldom attended with much expectoration, in uncomplicated cases; often there is no expectoration whatever. The appetite is lost, but drinks are readily taken on account of the thirst. Diarrhœa sometimes occurs on the first day of the eruption, but it lasts only a few hours, and, if the disease pursue its usual course, abates of itself. With the exception of this the bowels are regular, or a little constipated during the eruptive period.

On the second day of the eruption, or sixth of the fever, the symptoms begin to abate. The pulse is less accelerated, and the temperature diminishes; the cough is less frequent and is easier, and the flushed and swollen appearance of the face declines. By the close of the third or on the fourth day the rash has disappeared in the order in which it extended over the body. There only remain faint maculæ, which in the course of a day or two fade completely.

With the disappearance of the rash the fever nearly or quite ceases, but a slight and painless cough continues for several days.

Occasionally the eruption presents a livid appearance; this is the rubeola nigra of writers. From cases which I have observed, it is my opinion that this should not be considered a distinct species in the vast majority of patients, but that the dark color is due to internal inflammation, usually capillary bronchitis or pneumonia, which prevents full decarbonization of the blood. Rarely rubeola nigra is due to the vitiated state of the blood, or the malignant nature of the disease. The course of the eruption in this form of measles is somewhat different; it continues longer, fades more slowly, and does not disappear so readily on pressure. Traces of it are observed a week or more after its first appearance; it is apt to be fatal. Measles may present this form from the beginning, or, commencing as vulgaris, it may pass into rubeola nigra.

Measles may be irregular in form, but aberrations are less frequent than in scarlet fever. Writers describe measles without catarrh, and, on the other hand, with catarrh but without the rash. But positive diag-

nosis in such cases must be difficult. It is probable that simple catarrh and roseola have sometimes been mistaken for the two forms of irregularity mentioned, but when a child, in a family of children affected with measles, presents all the symptoms of that disease, except the catarrh or except the eruption, the diagnosis of irregular measles would, as a rule, be correct.

Occasionally the stage of invasion is very short, or even absent. In one case the parents informed me that the catarrhal symptoms began on the day when the eruption appeared. Convulsions sometimes occur at the commencement of measles, as well as during its progress. A single convulsive attack at the commencement of measles is usually not dangerous ; when repeated, it is more serious ; it is also more serious when it occurs in the course of measles. In certain patients the eruption appears in an irregular and partial manner, occurring, perhaps, at a late period, and indistinctly, upon the trunk alone, or upon the trunk and partially upon the legs. In many cases of deferred or partial eruption there is internal congestion or inflammation of some part, which causes withdrawal of blood from the surface, and thus prevents the normal development of the rash.

When the eruption disappears the third stage commences, that of desquamation. It is characterized by a scanty furfuraceous exfoliation of the epidermis. The desquamation is seldom as great as in scarlet fever, and it occurs most where the eruption has been thickest and the epidermis most inflamed. Exfoliation occurs between the fourth and seventh days after the commencement of the eruption, the eighth and the eleventh of the disease. In some children it does not take place, or is so slight as not to be observed.

With the disappearance of the rash, the symptoms rapidly abate. The pulse becomes more natural, the temperature is reduced, the digestive organs return to their normal state, and convalescence is established. The cough continues several days after the other symptoms abate, but it is less and less frequent, and is not painful.

Complications.—The complications of this disease are important. Much of the success of the physician in the management of measles depends upon a correct diagnosis and understanding of them. The most frequent of these complications are bronchitis and broncho-pneumonia. Slight bronchitis is common in measles, but if it increase so as to cause embarrassment of respiration, and become a source of danger, it is properly a complication. This complication, as well as pneumonia, may occur at any period of measles ; but it commences most frequently in the first stage. Occurring in the first stage, it may prevent the regular appearance of the rash ; if in the second, it often causes retrocession of it.

When bronchitis becomes really serious, it usually has invaded the minute bronchial tubes. This disease designated capillary bronchitis or

suffocative catarrh, I have elsewhere described. The clinical history of fatal bronchitis, as a complication of measles, is as follows : The respiration, at first not notably altered, becomes, by degrees, accelerated, and the patient more and more fretful. The pulse, instead of becoming less accelerated, as after the first days of simple measles, is daily more rapid, and the respiration more frequent and labored. The dyspnœa gradually increases, the infra-mammary region is depressed, during each inspiration, and the subcrepitant râle is heard on both sides of the chest. There is, probably, collapse or inflammation of some of the lobules. Finally the prolabia and fingers become livid, and death occurs from apnœa. Capillary bronchitis is diagnosticated from pneumonitis by the physical signs. It is in the young child more dangerous than that disease, unless perchance the latter be double. A large majority of those affected under the age of three years, die. The anatomical characters of fatal bronchitis occurring in connection with measles, I have had an opportunity to inspect. In an infant who died with this complication in the Infants' Hospital in the spring of 1867, there were evidences of continuous inflammation from the epiglottis to the minutest bronchial tubes.

Pneumonia as a complication does not differ materially from the idiopathic inflammation, except that it is more protracted and fatal. Its form is in most cases catarrhal, resulting from an extension downward of the bronchitis.

The next most frequent serious complication of measles is entero-colitis. This may commence at any period during the course of the disease. If the colon be more especially the seat of inflammation, the evacuations contain mucus and blood, unless in young children, in whom the stools, even in severe colitis, commonly have a green color. The anatomical character of this complication varies in different cases, like the idiopathic form of inflammation. Sometimes there is simple arborescence of the intestinal mucous membrane, with tumefaction of its follicles ; in other cases, in addition to increased vascularity, the mucous coat is softened and thickened ; and in others still, especially if the inflammatory action have been somewhat protracted, ulceration occurs, for the most part in the site of the solitary glands. Exceptionally, in fatal cases of measles attended with diarrhœa, no vascularity is observed after death, although the intestine may be somewhat thickened and softened. In these cases the diarrhœa may have been non-inflammatory or inflammatory, the injection of the vessels having disappeared after death.

Severe and obstinate diarrhœal affections occurring with measles, usually commence as the primary disease is about declining. They then become sequelæ, ending fatally in many instances several days or perhaps weeks after the disappearance of the eruption. Diarrhœal attacks, occurring in, or previously to, the eruptive stage, are, as a rule, mild and easily relieved.

In some grave cases, measles have a tendency from the first to affect the internal organs more than the surface. There then coexist bronchitis, pneumonia, and entero-colitis, with indistinctness of the eruption on the skin. Such complications render a fatal result highly probable.

Another very fatal complication and sequel is true croup, commencing when rubeola is beginning to decline ; but it is less frequent than pneumonia or entero-colitis. In catarrhal or false croup, which, as has been previously stated, is not infrequent at the commencement of measles, the cough has a loud, ringing character. In true croup, on the other hand, it is hoarse or harsh, and less distinct, on account of the presence of the pseudo-membrane in the larynx. True croup, always a grave disease, is more serious when it occurs as a complication of measles than in the idiopathic form, not only because the blood is vitiated and the system reduced by the primary affection, but because the inflammation of the mucous surface is in general more extensive, as is also, I believe, the pseudo-membrane. This membrane in the croup of measles I have seen extend so far down the air-passages, that tracheotomy could not have been attended by any decided amelioration of symptoms. This complication, though always grave, is not, however, necessarily fatal. I have known cases recover by inhalation of spray, when for days there had been dyspnœa and other evidences of a pretty firm pseudo-membrane. True croup causes continuation of the fever, which had perhaps begun to abate.

Diphtheria, when epidemic, also frequently complicates measles. Much of the mortality from measles in this city, since the year 1858, was due to this cause. In cases observed by myself, diphtheria usually began while the fauces were still inflamed, and sometimes before the eruption had begun to fade.

These are the most common complications of measles. There are others of less frequent occurrence, among which may be mentioned congestion of the brain, with or without serous effusion. Stomatitis, pharyngitis, and otitis are occasional complications. Rarely, also, purpura, attended by hæmorrhages from the different mucous surfaces, occurs in connection with measles. This complication is, however, more frequent in certain other constitutional diseases, as scarlet fever, and especially variola.

It is seen that the inflammations which are apt to occur in the course of measles are chiefly of the mucous surfaces. In scarlet fever, on the other hand, the inflammations are more frequently serous.

There are other affections, originating in measles, which are rather sequelæ than complications. Gangrene of the mouth is one which, as stated in another part of this book, is more apt to occur after measles than any other disease. After a severe epidemic of measles in the New York Foundling Asylum, in 1874, three cases of gangrenous vulvitis

occurred in those who had been affected. Ophthalmia commencing in measles often persists for weeks or months. It may give rise to granulation of the lids, and cases have been reported of violent inflammation of a purulent character, producing ulceration of the cornea, and destroying vision. The ophthalmia is sometimes very intractable. Inflammation of the Schneiderian membrane, commonly present during measles, often continues as a sequel, extending back as far as the Eustachian tube, where it may cause swelling, with impairment of hearing, and forward to the lip, where it may produce chronic eczema.

Anatomical Characters.—I have made, or witnessed, mainly in the institutions, several post-mortem examinations of those who have died in, or immediately after, an attack of measles. In all there were lesions due to complications. Indeed, death directly from measles is so rare that few have had an opportunity of studying the anatomical characters which are peculiar to this affection. In those who have died without any obvious coexisting disease, and these cases chiefly occur in the malignant form, there has been congestion of the internal organs, especially marked in the lungs, and sometimes the tissues appeared softened. The blood, also, in the malignant form, has a darker hue than natural, and ecchymotic patches have been observed upon the mucous surfaces and elsewhere, corresponding in character with the petechiæ under the skin which sometimes occur in this form of measles. In cases resulting fatally from bronchitis or pneumonia the bronchial glands are commonly tumefied in the same manner as the mesenteric glands are enlarged in enteritis, and the glands of the mesocolon in dysentery.

Nature.—Rubeola, like the other exanthematic fevers, is due to a materies morbi, the exact nature of which is unknown. It is highly contagious through the air. It has been inoculated by the serum from vesicles which sometimes occur in connection with the rubeolous eruption, and also by the blood from a patient. Inoculation does not appear to moderate the disease, and as measles, when contracted in the ordinary way, is not in itself dangerous, but dangerous only from complications, inoculation is not performed, except as a matter of scientific interest. The usual mode of propagation is through the air. It is communicated both by the breath and clothing. By fomites the virus is sometimes conveyed a long distance. The question is still undecided whether rubeola does not sometimes occur spontaneously. I have met cases, and have heard of others, one in a sparsely settled district, in which there was no evidence of exposure. Yet the immunity of certain islands for centuries, till infected through commerce, renders the doctrine of an origin *de novo* improbable.

Twelve to fourteen days elapse from the time of infection to the commencement of the eruption. In cases observed in the children's department of Charity Hospital, the incubative period was ascertained to be

about twelve days. In those who have been inoculated, this period is said to have been about one week. Rubeola prevails epidemically, like the whole class of infectious diseases, and in different epidemics the type varies somewhat, as well as the character of the complications.

Diagnosis.—The diagnosis of measles, previously to the eruption, is often difficult. The catarrhal symptoms then predominate, and these are such as may occur independently of any constitutional or blood disease. The first stage, therefore, is not infrequently mistaken for coryza, or mild bronchitis. The points of differential diagnosis are the suffused appearance of the eyes, the greater degree of fever on the first day than would be likely to arise from so moderate an amount of local disease, and morning remission and evening exacerbation of the fever. Measles in the first stage has been mistaken for remittent fever. The catarrhal symptoms should prevent such an error.

Sometimes roseola closely resembles measles in appearance, but the rash of roseola appears within a few hours after the commencement of febrile symptoms, and almost simultaneously over the whole body, and without those local symptoms referable to the mucous surfaces, which characterize measles.

Variola on the first day of the eruption has sometimes been diagnosticated measles. I recollect once being called to an infant with fatal confluent smallpox, who was said to have measles. A physician, a few days previously, observing the red points in the commencement of the eruption, had made this absurd diagnosis, and, predicting a favorable result, had not thought it necessary to repeat his visit. In case of doubt, it is the part of prudence to defer making a positive diagnosis. A few hours suffice to show the distinctive characters of the rubeolous and variolous eruptions. But the anxiety of friends often necessitates the expression of an opinion. The absence or lightness of catarrhal symptoms, the earlier appearance of the eruption, and its papular feel under the finger in smallpox, enable us to discriminate between the two diseases in the commencement of the eruptive stage. Moreover, the symptoms in the initial periods are different, as will be seen in our description of smallpox.

Prognosis.—This is favorable, provided that there is no serious complication. With internal inflammatory complication, on the other hand, the disease becomes much more grave. A large proportion thus affected die. The prognosis is also less favorable in feeble children with scanty eruption, or an eruption appearing at a late period and irregularly. Dyspnœa, persistent and great acceleration of pulse, and coma, indicate an unfavorable ending. Convulsions occur much more rarely in the course of measles than in scarlet fever, and when they occur after the initial period they usually end in coma and death.

Treatment.—Uncomplicated measles require no medicinal treatment except to palliate symptoms. The child should be kept in an airy apart-

ment, at a uniform temperature of about 70°. A temperature so elevated as to be uncomfortable to the nurse is injurious to the patient. But while the popular idea is erroneous, that he should be kept in a heated atmosphere, it is correct that currents of air and sudden reduction of temperature are dangerous. A violent and fatal attack of croup occurred in my practice in a girl of fifteen, in consequence of exposure at an open window at the close of the eruptive stage. The diet should be mild, and for the most part liquid. The patient, indeed, refuses solid food, but, on account of the thirst, takes liquids more readily. Farinaceous substances, with milk, afford sufficient nutriment in ordinary cases. If the previous health have been poor and the vital powers reduced, or if there be a complication, more sustaining diet is required. Stimulation by wine or brandy is needed in these cases. During the two or three weeks succeeding an attack of measles, care should be taken to avoid exposure to cold, or changes of temperature, since during this period there is great liability to inflammations of the mucous surfaces.

The cough ordinarily requires treatment, inasmuch as the suffering of the child and loss of sleep are largely due to this symptom. Demulcent drinks, as flaxseed tea, infusion of slippery-elm bark, or solution of gum Arabic, are useful, to which, to render them more palatable, lemon-juice may be added. A small Dover's powder, or the mistura glycyrrhizæ compositus of the pharmacopœia, given occasionally, relieves the severity and diminishes the frequency of the cough.

As the chief danger in measles is from inflammation of the respiratory organs, local treatment directed to the chest is important. The chest should be covered with oil silk, unless in the mildest cases. This increases the amount of eruption upon the surface underneath, and, I believe, tends greatly to prevent complication by bronchitis and pneumonia. If the eruption be tardy in its appearance, or indistinct, it is well to produce moderate counter-irritation by some gentle irritant underneath, as camphorated oil, to which one third part of turpentine is added.

Affections which complicate measles should receive, for the most part, such treatment as is appropriate for them when idiopathic. Secondary diseases, however, require sustaining measures more than primary. In bronchial and pulmonary inflammations, which, if they occur early in measles, prevent the regular appearance of the eruption, or, if in the eruptive stage, cause its disappearance, prompt counter-irritation over the chest by sinapisms, or otherwise, is required. Trousseau states that he has derived benefit, in these cases, from what he designates urtication. This is produced by stroking the chest two or three times daily with the nettle (urtica dioica or urtica urens). This causes a prompt and abundant eruption, and with a less amount of suffering than one would suppose. The fever abates, and the respiration becomes more natural in proportion to the amount of nettlerash. On the second day the effect is less than on

the first, and after three or four days, says Trousseau, no further irritation results from the nettle. When counter-irritation is produced, by whatever method, the chest should be covered with a warm and soft poultice, as the ground flaxseed ; derivatives to the extremities are useful in such cases. In capillary bronchitis and pneumonia stimulating expectorants are required, as carbonate of ammonium. The following I employ for a child of two or three years.

℞. Tinct ipecac. comp
(Squibb's liq. Dover's pulv.), gtt. viij–xvj.
Ammon. carbonat., gr. xvj–℥ss.
Syr. bal. tolut.,
Aquæ, āā ℥ j. Misce.
One teaspoonful every 2 or 3 hours.

Muriate of ammonium is also a good remedy in these cases, employed in double the dose of the carbonate.

Quinia to reduce the fever, and digitalis as a heart tonic, are also very useful in these inflammations, given alone or alternately with the above.

The cases of gangrenous vulvitis alluded to above were treated with a flaxseed poultice, and iodoform dusted over the surface each day or second day, with a satisfactory result. As regards the treatment of other complications, the appropriate measures are detailed elsewhere.

CHAPTER II.

SCARLET FEVER.

The terms scarlet fever, scarlet rash, and scarlatina are identical. They are employed to designate one of the most frequent and fatal of the contagious diseases, a disease which may occur at any age, but is most common in childhood, an exanthem attended with more or less pharyngitis. In this city, on account of its great frequency, and its large percentage of fatal cases, it causes more deaths than any other contagious malady. Though not more common than measles, it is attended, with us, by more than double its mortality.

There is no disease that presents a greater difference as regards character and severity of symptoms, than scarlet fever, and this has led to the recognition of different forms of it. Rilliet and Barthez describe two, the normal and abnormal ; Meigs two, the mild and grave ; and most other writers, three or more. I shall, for convenience, follow Bouchut, who makes three varieties, namely, the regular, irregular, and malignant.

Symptoms. *Regular Form.*—Scarlet fever usually begins abruptly. It is possible, often, to tell the exact time of its commencement. If there be any premonitory symptoms, they are ordinarily slight, so as scarcely to attract attention, amounting to little more than dulness, or the appearance of fatigue. In some the first symptom is chilliness and occasionally a distinct chill is experienced. This is the ordinary mode of commencement in the adult. With or without the chilliness, fever, usually intense, arises, accompanied by such symptoms as ordinarily occur in a febrile state of system, such as cephalalgia, perhaps delirium, anorexia, thirst. The pulse rises to 110, 120, or more, per minute ; the skin is hot, face flushed, the eyes bright, and the temperature is 102° to 104°. In many, there is sudden starting or twitching, with a degree of stupor, showing that the cerebro-spinal system is profoundly affected.

In most cases there occurs within the first twenty-four hours a symptom which has considerable diagnostic value, namely, vomiting. In 117 cases in which I have recorded its presence or absence, it occurred in 90, usually not at the very commencement, but within the first twelve or eighteen hours. It commonly occurred before the appearance of the rash, but not always. In a few of the cases it is recorded as a symptom of the second day. Vomiting at this period is, probably, in most cases, sympathetic, due to the irritating effect of the scarlatinous virus on the brain. It is not a severe symptom, occurring in most patients but once or twice. Great and persistent irritability of stomach indicates a serious form of scarlet fever, and is, therefore, prognostic of an unfavorable ending. When this symptom is absent or slight, or there is merely nausea, I have found the case ordinarily mild, so that, as regards the frequency of vomiting, the statistics of different epidemics vary according to the mildness or gravity of the type. The bowels are regular or somewhat constipated in this form of scarlet fever, or, if diarrhœa occur, it is slight and transient.

When the symptoms described above have continued six to eighteen hours, the rash appears. It is first observed about the ears, neck, and shoulders, in reddish indistinct patches, fading into the normal hue. These patches extend and unite, and in the course of a few hours the trunk and upper extremities, and finally the legs, are covered. The scarlatinous rash bears considerable resemblance to that produced by external heat or the redness from a sinapism, but there are numerous minute points of a deeper or duskier red than the surface generally. On passing the finger over the eruption, no distinct prominences are observed, but a sensation of roughness is sometimes imparted from engorgement of the cutaneous papillæ. The rash disappears by pressure, but in robust children, and in favorable cases, it immediately returns when the pressure is removed. Slow return of the rash is evidence of sluggish circulation, and, when marked, it indicates the malignant form of the disease. The rash gives rise to an itching or burning sensation, which adds greatly to the discomfort of the patient.

The degree of redness is not uniform over the surface, and sometimes, especially in mild cases, it is absent in places.

Early in the disease, even before the cutaneous eruption, the buccal and faucial mucous membrane presents a pretty general red appearance, and the papillæ of the tongue are elevated. Pharyngitis has already commenced, with more or less stomatitis and tonsillitis. The inflammation renders deglutition painful, so that difficulty is often experienced in giving the necessary drinks. This state of the buccal and faucial membrane continues through the disease. There is sometimes a slight fibrinous exudation over the tonsils ; the tongue is covered with a moist fur, and the secretion from the follicles of the inflamed surface is increased and mucopurulent. The Schneiderian membrane also participates in the inflammation, and, as the disease advances, a thin, irritating discharge, containing pus-cells, flows from the nostrils.

The temperature in the first days of scarlet fever is ordinarily from 102° to 105°, in grave cases even 105° to 107°. The cutaneous transpiration during this period is nearly checked, so that the skin is hot and dry. The respiration is moderately accelerated, but not so as to attract attention, unless there be a complication ; often there is slight cough from mucus in the throat or bronchial tubes. Bronchitis, common in measles, and giving rise to prominent symptoms in that disease, is either absent or slight in scarlet fever.

The symptoms pertaining to the digestive system during the initial period of scarlet fever have been sufficiently described. The subsequent symptoms do not differ materially in regular scarlet fever, except that there is no vomiting. The lips are dry and often cracked. The inflammation of the mouth and throat continues unabated, with anorexia and thirst. The urine is high-colored, and in robust children, during the first days of scarlet fever, it frequently deposits the urates on cooling.

The symptoms continue with undiminished intensity for a period of from four to six days, when the fever begins to abate, the pungent heat becomes less, and the rash fainter. There is a gradual decline of the disease, which, in its inception, was so abrupt. In mild, and even pretty severe cases, which pursue a regular and favorable course, convalescence commences by the close of the first or beginning of the second week. In the second week, the rash, becoming less and less distinct, finally disappears, as do also the redness and swelling of the buccal and faucial surfaces. The engorgement of the papillæ of the tongue and that of the tonsils subsides ; the appetite returns ; the countenance brightens and becomes natural, and the child who, during the height of the fever, scarcely noticed objects, or noticed them with indifference, or even repugnance, can be amused as before his sickness.

The period of desquamation succeeds. Exfoliation of the epidermis occurs over the whole body. This commences about the face and neck,

and it occupies several days, during which there is progressive improvement in the condition of the child. Where the skin is thin, the epidermis, as it is detached, presents a furfuraceous appearance ; where it is thick, as upon the palms of the hands and soles of the feet, it separates in a layer of considerable thickness.

Such is a brief account of scarlet fever, when it pursues its normal course, without complication or sequelæ. But there is no disease which has so many unfavorable complications and sequelæ as this. The liability to these accidents renders the prognosis in all cases doubtful, and in many instances they are the immediate cause of death. They occur both in mild and severe cases of scarlet fever.

The great difference in different cases of scarlet fever, as regards intensity of symptoms, is well known. It is sometimes so mild, its characteristic features so slight, that diagnosis is necessarily uncertain. Examples in corroboration of this statement are not infrequent. In the spring of 1866 I was called to an infant thirteen months old, who had slight pharyngitis, and an indistinct rash over a part of the surface. In two days the eruption had disappeared, and soon after the health was apparently fully restored. Diagnosis would have remained doubtful, except for sequelæ. In another instance, two children passed through the entire course of scarlet fever, playing every day in the street. Although the intelligent grandmother saw the rash upon them, its nature was not suspected till nearly two weeks afterward, when one was taken with fatal nephritis and general anasarca. In cases so mild as these, the heat of surface is not greatly increased, nor is the pulse much accelerated. There is no restlessness, nor is the digestive function materially impaired. The rash does not have so deep a color, nor is it so continuous over the surface, as in cases of ordinary gravity. The patient begins to improve in from two to four days, and is soon well. So mild a form of scarlet fever is, however, quite exceptional, but there are all varieties, from this mildness to that malignant form which I shall presently describe.

There is usually considerable faucial inflammation, even when scarlet fever pursues a regular and favorable course. If the pharyngitis be intense and protracted, many writers designate the disease scarlatina anginosa. There is, in these cases, not only general and pretty severe inflammation of the mucous membrane of the fauces, with swelling of the tonsils, and submucous infiltration, but also more or less tumefaction around the angle of the jaw, due to extension of the inflammation to the lymphatic glands, and connective tissue of the neck. In these cases the suffering of the patient is greatly increased by the amount of local disease. The adenitis and cellulitis, unless slight, do not subside with the disappearance of the rash, or they subside more slowly. They render the febrile movement more protracted. The swelling due to these inflammations often continues one or two weeks after the disappearance of the rash or even longer,

when it disappears by resolution, or frequently by suppuration, the abscess opening externally.

Irregular Form.—The irregular form of scarlet fever is commonly due to some perturbating cause. This cause is often a pre-existing or coexisting disease, or, if not actual disease, at least disordered state of system. For example, a little girl, in my practice, had the symptoms of scarlet fever, such as febrile movement and inflammation of the buccal and faucial surfaces, nearly a week before the scarlatinous eruption appeared. During this period there were symptoms of enteritis, which declined when the rash occurred. The abdominal affection was the apparent cause of the irregularity in the malady. If scarlet fever occur during an attack of entero-colitis, there is frequently no eruption. Most practitioners have met cases like the following, which I now recall to mind : In a family where scarlet fever was prevailing, a little child, early after the commencement of symptoms which seemed to be plainly referable to the exanthematic affection, was seized with vomiting and purging, and the latter continued two or perhaps three days, when death occurred. There were the symptoms and appearances of severe scarlet fever, but without the eruption. In another instance, an infant in the warm months, having protracted entero-colitis, the usual summer epidemic of this city, was apparently affected with scarlet fever, which was present in the family. There were the characteristic symptoms, but the diarrhœa continued and there was no rash.

In those that are much reduced by any antecedent disease, as phthisis, or that have a disease, chronic or acute, which produces a decided afflux of blood toward an internal organ, the eruption is commonly tardy in its appearance, indistinct, or wholly absent. The diseases which most frequently render scarlet fever irregular are those of an inflammatory nature. Some affections, occurring in connection with scarlet fever, do not change its symptoms, but themselves undergo modification. Scarlet fever occurring in a child having pertussis does not itself undergo any material change. The cough, not the fever. is sometimes modified during the coexistence of the two.

Scarlet fever may also be irregular in those that are robust and free from any other disease, assuming this form without any appreciable perturbating cause. In 1867 I attended a young lady, whose previous health was excellent, and whose brother was sick at the time with scarlet fever. This patient had considerable fever, with pretty severe pharyngitis, and, though her surface was repeatedly examined, no eruption could be discovered. Two weeks subsequently she became affected with severe nephritis, anasarca, effusion into at least one of the pleural cavities, and probably into the pericardium, the case ending fatally.

Rilliet and Barthez mention the irregular and incomplete character of the eruption in second attacks of scarlet fever, which, though uncommon,

are met from time to time. Scarlet fever, occurring a second time sometimes presents all the features of the regular disease and pursues its normal course, but it is much more apt to be incomplete and irregular than the first attack. It is more apt to be irregular if the interval between the two have been short than if several years have elapsed.

Malignant Form.—This form of scarlet fever is in some epidemics common, while in others it is rare. It usually commences with severe symptoms, those pertaining to the nervous system predominating, such as intense cephalalgia, with delirium. Many pass rapidly into coma and die within two or three days. They succumb to the virulence of the scarlatinous poison, while the disease is still in its commencement. The rash in malignant scarlet fever is dusky. It disappears by pressure, and returns slowly when the pressure is removed. There is, therefore, extreme sluggishness of the capillary circulation. In some there is great restlessness. If placed in one position on the bed they soon throw themselves, in a half-conscious or unconscious state, into another. They do not speak at all, or they mutter like those affected by the graver forms of typhus, calling the names of playmates, or talking about things which interested them when well. There is great elevation of temperature, the thermometer, placed in the axilla, rising above 103° to 105°, even to 107°, and the heat of surface is pungent, except when the case approaches a fatal termination. The pulse from the first is rapid, numbering from 130 to 160 per minute. Sometimes there is great heat of head and body, while the limbs are cool. This is an unfavorable sign.

Severe and dangerous nervous symptoms, as convulsions and coma, occur chiefly within the first three or four days. After this period the danger is mainly from exhaustion. Those who survive the onset of the disease, often have, in the course of a few days, severe pharyngitis, with inflammation of the lymphatic glands, and connective tissue around the angle of the jaw, accompanied by external swelling. The pharyngitis is attended by more or less secretion of mucus or muco-pus, which, sometimes collecting around the entrance of the larynx, causes noisy respiration, or even, if the system be greatly prostrated, embarrasses respiration by entering the larynx. The chief danger, however, from the pharyngitis, is due to the exhaustion which it causes. By rendering deglutition difficult, it interferes seriously with nutrition.

Complications.—Complications may occur in any form of scarlet fever, but they are most frequent in malignant or grave cases. The most common and serious complication, as regards the nervous system, is clonic convulsions. These occasionally occur at the commencement of the disease, before the appearance of the rash, and many then recover, but I have not seen, nor have I heard, in my intercourse with physicians, of any case which recovered when convulsions occurred after the complete development of the eruption. On the other hand, some of the physicians

of this city, of largest experience, inform me that they consider convulsions during the eruptive stage an almost certain precursor of death. Convulsive attacks in scarlatina are probably due, in part, to congestion of the nervous centres, for we sometimes find, in young children, at the time of the seizure, and immediately before it, the anterior fontanelle prominent, and forcibly pulsating. The convulsions uniformly increase the congestion, but, as the latter antedates the former, its causative relation seems to be established. But the most important element in the causation of convulsions in scarlet fever is, probably, the presence in the blood of the scarlatinous virus. This, whatever its exact nature, may, in my opinion, cause convulsions, with or without the co-operating influence of congestion, as urea gives rise to them in cases of uræmia. Convulsions occurring at the commencement of scarlet fever are usually single. If repeated, they become more serious. Convulsions after the appearance of the eruption, either end at once in coma, or they return at short intervals, with gradually increasing drowsiness, till coma supervenes.

The anginose affection in scarlet fever may be so severe, or assume such features, as to constitute a complication. It may become more serious than the primary disease itself, so as to require the chief treatment. Within the last few years diphtheria has so frequently complicated scarlet fever, that physicians have learned to make daily examinations of the fauces till convalescence is fully established. So common is this complication, that scarlet fever has been justly regarded as affording conditions which are especially favorable for the development of diphtheria. Diphtheria may occur early in scarlet fever, or not till the latter begins to decline, when it produces sudden aggravation of symptoms, and renders the case, which before was perhaps favorable, one of great gravity. As has been stated elsewhere, a pseudo-membranous formation upon the faucial surface, especially over the tonsils, is not uncommon in severe anginose scarlet fever, but is soft or pultaceous, in isolated points or patches, and easily detached. On the other hand, in the cases to which I have alluded, of diphtheritic complication, the pseudo-membrane is firm and thick, penetrating the mucous membrane so as to produce bleeding when forcibly detached, as in primary diphtheria. Besides affecting the fauces, the diphtheritic inflammation is very apt to attack the nostrils, causing swelling and exudation, so as often to embarrass respiration. This complication obviously greatly increases the severity of the case. It intensifies the febrile movement, and renders it more protracted. It produces or increases the adenitis and cellulitis around the angle of the jaw, causing within a few days, if unchecked, such tenderness and swelling of these parts as to render movements of the jaw and deglutition painful.

An occasional result of severe pharyngitis in scarlet fever is suppuration, or gangrene, occurring in the subcutaneous connective tissue of the neck. Whether suppuration occur, and an abscess form, or gangrene result, this

complication is often serious. Suppuration or gangrene indicates an intense grade of inflammation or a low vitality ; but many with this complication recover through a protracted convalescence.

If suppuration be extensive, it may so increase the debility that death occurs in consequence. Gangrene is a more serious complication ; unless slight, it renders a fatal termination highly probable. The connective tissue, subcutaneous or intermuscular, is the part which primarily sloughs. The skin over the gangrene becomes brown or dark, and separates with the slough. In the majority of cases the slough is not large. Exceptionally it extends so deeply that, when it separates, the muscles and even vessels of the neck are laid bare, and the appearance is revolting. In a case of this sort, which I saw a few years since in the practice of another physician, the cavity, after the slough had separated, was irregular, and sufficiently large to admit a hen's egg. It extended a considerable distance out of sight under the skin, and finally opened a vessel from which fatal hæmorrhage occurred.

Gangrene of the mouth also occurs in rare instances, either as a complication or sequel. I have met it in two cases, one of which recovered. In the fatal case it began while the patient was still under treatment for the fever, and was first discovered by the loss of two incisors. The one that recovered also lost two incisors, and a part of the superior maxillary bone. The one that died was scrofulous, but under good hygienic conditions ; the other lived in a tenement-house, and was ill-cared for. Rilliet and Barthez relate three cases of gangrene of the mouth, occurring, however, not as a complication, but sequel, of scarlet fever. One of these patients had, within eighteen days, varioloid, scarlet fever, and measles ; these diseases ending in fatal gangrene of the pharynx and cheek. The second child was taken, on the seventeenth day after the commencement of scarlet fever, with gangrene of the pharynx, succeeded by that of the cheek, and died on the twenty-fourth day. In the third case the gangrene was preceded by smallpox as well as scarlatina. Other observers have recorded similar cases.

Another complication, to which allusion has already been made, is enterocolitis. This may antedate the scarlet fever. In other cases, enterocolitis commences either with the scarlet fever, or during its course. Diarrhœa often occurs in connection with the vomiting, in the first hours of the fever ; and it commonly ceases during the first or second day. Occasionally it continues with greater or less severity, when it constitutes a serious complication ; it is in these cases due to intestinal inflammation. Bronchitis and pneumonia, so common in measles, do not often complicate scarlet fever.

A not infrequent complication is articular rheumatism, occurring when the fever begins to decline. Mild cases are more liable to it than those of a severe form. Attention is called to it by the complaint of the

child of pain or tenderness in the affected joints ; or, if he be too young to speak, by evidences of pain when the joints are pressed or moved. There are usually but little swelling and redness, and there are fewer joints affected than in most cases of acute primary rheumatism. In my practice, a common seat of scarlatinous rheumatism has been the areolar tissue of the wrist. The inflammation and infiltration are less than in primary acute rheumatism. This complication is not, ordinarily, serious ; nor does it, as a rule, materially retard convalescence. A physician of this city, however, informs me of two cases in which cardiac inflammation occurred in connection with the articular affection, as it frequently does in idiopathic rheumatism, and I have attended one case in which the same complication occurred with permanent crippling of the mitral valves. The urates are not so commonly present in the urine in scarlatinous as in ordinary acute rheumatism.

Serous inflammation, especially that affecting the peritoneum, pleura, or pericardium, is a common complication, independently of the rheumatic affection. It occurs during the desquamative period, and, continuing afterward, becomes a sequel. Many such cases are fatal. Pericarditis may be with difficulty diagnosticated, if it be slight, and attended by only a moderate amount of effusion, and it is, doubtless, sometimes the cause of death in those who die suddenly and unexpectedly during or soon after an attack of scarlet fever. The pleuritis is often suppurative (empyema), usually requiring thoracentesis for its cure, but recovery by ulceration is possible. Thus in 1865 I attended a little girl in a mild attack of the fever, and when the case was about being discharged, severe pleurisy began on the right side. The pleural cavity was soon half filled with liquid, and after a sickness of two months, this liquid, mainly pus, communicated with a bronchial tube, and was expectorated. She immediately began to improve. At present, with our excellent instruments, this case would have been treated by thoracentesis.

In the following case, the records of which are from my note-book, pericardial and peritoneal inflammation occurred as a complication of scarlet fever :

Case.—April 7th, 1860, C——, girl, five years and ten months old, had measles two years, and whooping-cough one year ago. With the exception of a slight cough, she has since remained well, till the present sickness. Scarlatina commenced April 4th, and on the 5th the eruption appeared. Symptoms severe, but regular ; pulse 158, full ; surface hot, and covered with the eruption ; delirium at night ; stomach irritable ; constipation. April 8th to 10th, symptoms about the same ; no delirium, however ; pulse varying from 124 to 153 per minute ; a deposit of urates in the urine.

11*th*. To-day, for the first, has severe pain in the epigastrium, accompanied by tenderness on pressure, and moderate distension at this point. The symptoms otherwise are favorable, though pretty severe ; pulse 140 ; respiration moderately accelerated, but the rhythm natural ; respiratory murmur distinctly heard in all parts of the chest, vesicular in character,

and without râles. Has taken till to-day mainly diaphoretic mixtures; to-day pulv. ipecac. comp., gr. iij., every three or four hours, is ordered; a flaxseed poultice to be applied to the epigastrium; diet nutritious, with moderate use of stimulants.

12*th*. Epigastric pain still severe; great tenderness on pressure; considerable distension at this point, and percussion elicits a dull sound; passed a restless night; when asked where she feels pain, she points to the throat and epigastric region; pulse 130 to 140 per minute; rash fading; surface warm; bowels somewhat relaxed; urine passed in usual quantity. The treatment by Dover's powder and poultices is continued, and a leech is to-day applied to the epigastrium.

13*th*. Pain less severe, but considerable tenderness on pressure; pulse about the same as yesterday; has had through her sickness a slight cough. She talks rationally, and sits much of the time in bed.

14*th*. Continued in the same state as described in yesterday's records, till 3 P.M. yesterday, when she became suddenly worse; her respiration was short and gasping; she spoke, with an effort, in a whisper, but continued conscious; and her pulse was strong. Death occurred at 5 P.M., apparently from obstructed respiration. In the last days of her sickness there was but little pharyngitis, and little or no external swelling.

Autopsy twenty-four hours after death.—Body a little emaciated; heart large for a child of five years; about one ounce of turbid serum in the pericardium; a soft deposit of lymph within the pericardial sac at the base of the heart around the origin of the great vessels, an evidence of recent circumscribed pericarditis; from four to eight ounces of transparent serum in each pleural cavity; no fibrin upon or opacity of the pleural surfaces; mucous membrane of bronchial tubes injected in streaks, and mucopus can be pressed from them; both lungs can be readily inflated, with the exception of small portions of both the lower lobes, which are hepatized, and can be but partially inflated; liver enlarged, presenting a congested appearance, and extending some four inches below the free border of the ribs; upon its convex surface in the epigastrium, corresponding with the seat of the pain, is a white, rough patch of fibrin, about one and a half inches in diameter; kidneys congested; stomach and small intestines apparently healthy; mesenteric glands moderately enlarged; mucous membrane of transverse and descending colon somewhat injected and thickened, showing mild colitis; no ulceration noticed; brain not examined

Microscopic examination was made of the blood, hepatized portions of lung, etc., but nothing of special interest in this connection was observed.

This case is instructive as showing the liability which exists in and after scarlet fever to serous inflammations, and the difficulty of diagnosticating them in certain cases on account of their circumscribed character.

Sequelæ.—The complications described above *may* occur as sequelæ, but there is another pathological state which may be a complication, and is a common and serious sequel. I refer to nephritis with albuminuria. This occasionally commences in scarlet fever, but usually not till the disappearance of the rash. There is sometimes, during the course of scarlet fever, and even subsequently, slight albuminuria due to simple congestion of the kidneys, but the albuminuria to which I allude, and which requires

treatment, is more serious. Its anatomical character is as follows : Hyperæmia, and perceptible increase in volume of the kidneys ; proliferation of the renal epithelial cells like that of the epidermis, and a granular deposit in them ; the escape of albumen from the engorged capillaries, and its appearance in the urine ; the formation of hyaline or granular casts or both, in the tubuli uriniferi, these casts often containing epithelial cells ; the escape of the casts from the kidneys with the urine ; diminution of amount of urea excreted, and, therefore, its accumulation in the blood ; and, finally, rupture of the engorged capillaries of the kidneys, and mingling of the elements of the blood with the urine.

The presence, therefore, of this renal affection can be readily ascertained by examining the urine. The quantity of albumen which this liquid contains can be approximately ascertained by adding nitric acid or applying heat. If the quantity be small, simple cloudiness is produced; if large, the urine becomes thick and white, and in extreme cases almost semi-solid from coagulation of the albumen. The character of the urine can, however, be more accurately ascertained by the microscope than by the tests which have been mentioned, since by it we discover the casts, altered epithelial cells, and blood-corpuscles.

Nephritis, with the consequent uræmia, soon gives rise to evident symptoms. Serous effusion takes place in consequence of the altered state of the blood, the most common form of which is anasarca, occurring upon the face and limbs, and sometimes in the connective tissue of the trunk. Often the effusion occurs only in the external connective tissue, and the result may then be favorable ; but in other cases it occurs, and in the order mentioned as regards frequency, in the lungs (œdema pulmonum), serous cavities, and, lastly, in the submucous connective tissue of the larynx (œdema glottidis). Obviously the danger in itself from this escape of serum depends on its location, but, whenever and wherever observed, it indicates the beginning of an unpleasant sequel, and the urine should be carefully examined, in order to ascertain the gravity of the renal disease, from the amount of albumen and casts.

Scarlatinous nephritis, with consequent uræmia, is due to the direct effect of the scarlatinous poison on the kidneys. I have known it occur in the nurse who attended a child through the fever, but did not suffer from the fever herself. It sometimes begins quite abruptly, and often when the patient has been progressively convalescing, and, perhaps, has seemed out of danger. In most cases, however, there are well-marked premonitory symptoms, as fever, restlessness, and loss of appetite. The anasarca is first observed in the face or about the ankles. Sometimes it remains inconsiderable, but in other cases it increases day by day, more or less rapidly, till the appearance of the patient is much altered. In marked cases of anasarca the features are so bloated that their natural expression is lost. The volume of the trunk and legs is augmented, and

more slowly, that of the arms. In the male child the penis and scrotum frequently attain three or four times their normal dimensions, in consequence of serous infiltration.

The duration of the anasarca or dropsy is very different in different cases. If the form be œdema pulmonum, œdema glottidis, or intracranial effusion, death is speedy. It may occur even within a day. Hydrothorax and hydropericardium are also ordinarily fatal, though not so speedily; while in ascites the prognosis is much more favorable. The duration of anasarca under the most favorable circumstances, unless it be very slight, is commonly not less than two or three weeks, and is often much longer. But the chief danger in a majority of these cases proceeds not from the dropsies, but from the poisonous effect of the retained urea on the nervous centres, so that in grave cases, nervous symptoms are common, as in Bright's disease of the adult. Headache, convulsions, and coma are apt to succeed the scanty flow of urine, and uræmic vomiting in fatal cases, even when the amount of serous effusion is moderate.

The liability to this renal malady is greatly increased, and in some cases is mainly attributable to the close relationship, as regards their functions, which exists between the skin and kidneys. A common exciting cause is exposure to vicissitudes of temperature or currents of air, by which the surface is chilled, and cutaneous transpiration checked, at the time when the old epidermis is being detached. The increased burden thrown upon the kidneys results in the pathological state which has been described. This remark does not conflict with the statement already made, that the nephritis is due to the direct effect of the scarlatinous principle on the kidneys, the disturbance of the function of the skin merely increasing the functional activity of these organs and rendering them more susceptible to the disease. All who have seen much of scarlet fever can recall to mind cases in which the patients had nearly recovered, when from some needless exposure in the streets, or by chilling of the body in a cold room, or open window, this affection occurred, with perhaps a fatal result. Elsewhere I have alluded to a case in which scarlet fever was only detected by this sequel, which began when the child was daily exposed in the open air. But many children who have been attended with the utmost care, and who, through the whole desquamative period, are kept in a uniform temperature, nevertheless become affected with albuminuria and dropsy, so that there is sufficient cause of this sequel in the state of the child and the nature of the disease through which he has passed, apart from extraneous influences. It is an interesting fact that albuminuria seems more apt to occur after mild than severe cases of scarlet fever, and observations appear to show that this difference in liability to nephritis is intrinsic: in other words, that it does not depend, as some have supposed, on a difference in the hygienic management of mild and severe scarlatina, but in the nature of the disease itself.

The *symptoms* in scarlatinous nephritis vary not only according to the degree of the inflammation, but also according to the amount and seat of the effusion. I have stated that it usually commences with languor and more or less fever. The pulse remains accelerated, the skin is hot and dry, and the appetite poor. This affection, if slight, may occur without appreciable effusion, either in the connective tissue or the cavities, but ordinarily in these mild cases a little puffiness is observed around the eyes or upon the extremities. In the majority of cases more extensive anasarca results. The skin is then pallid, distended, and pitting on pressure. The anasarca does not, in most instances, give rise to any marked symptoms. If œdema glottidis or pulmonum occur, the respiration becomes rapidly more embarrassed, till soon the blood is no longer sufficiently oxygenated for the purposes of life. The chief symptom in hydrothorax is accelerated and difficult respiration ; in hydropericardium the symptoms are such as arise from embarrassed action of the heart ; in ascites there are either no marked symptoms, or, if the amount of liquid be large, there may be more or less embarrassment of respiration from compression of the lungs.

Otitis.—Too little attention has unquestionably been given to the state of the ear in scarlet fever, and yet the middle ear, lined like the nostrils and fauces by a mucous membrane, and in direct continuity with the fauces, through the Eustachian tube, is often the seat of an inflammation which, if neglected, involves serious ulterior consequences. This inflammation commonly commences, or becomes so pronounced as to cause symptoms, in the declining stage of scarlet fever, or during convalescence. The history of the patient is somewhat as follows : The scarlet fever has probably pursued a normal course ; the naso-pharyngeal surface has been for some days inflamed, and the redness may be declining, when the child begins to complain of earache. The delicate mucous membrane lining the Eustachian tube and middle ear is injected and swollen, and the tube becomes impervious by the swelling, so that the tympanum is no longer an open, but a closed cavity. The serum, mucus, and pus produced from the inflamed tympanic surface, therefore, unable to flow away, collect, and by their presence and pressure cause the severe throbbing and aching which attend this disease. The effusion, at first largely serous, becomes more and more purulent, and, as the quantity increases, the drum is pressed outward, the mastoid cells become filled and tender to the touch, and often the collateral œdema causes tumefaction and narrowing of the external ear. After a variable time, perhaps two or three days, or not till after a week of suffering, the drum becomes thinner at one point from ulceration and bursts, and the imprisoned secretions escape into the external ear. If this terminated the history, it were well ; but, unfortunately, while in a certain proportion of cases the aperture in the drum heals kindly, and the inflammation abates without impairment of hearing or permanent injury of the auditory apparatus, there is in a large proportion of cases a subsequent

unpleasant history. The mucous membrane which lines the bony walls of the middle ear has the function of a periosteum, and, therefore, when intensely inflamed, and subject to pressure, is liable to ulcerate. As in other parts of the skeleton under similar conditions, superficial caries or necrosis of the underlying bone is apt to occur. The delicate chain of small bones stretching backward from the drum may be irreparably damaged, the aperture in the drum may be so large that it never heals, and the ossicles, becoming detached, may be lost in the discharge. Cases are not rare in which one ear has received this extent of injury, but fortunately the hearing is seldom totally destroyed in both ears. I now recollect only one such case, although I have met many whose hearing was greatly impaired on both sides, indeed nearly lost. The carious or necrotic process may extend to the mastoid cells. An offensive otorrhœa continuing for months or years indicates the persistence of the inflammatory process within the ear, which is often rendered so obstinate by the presence of dead bone.

But a more melancholy result is yet in store for certain cases. The tympanum is, in a certain part of its extent, separated from the meninges of the brain by only a thin layer of bone. The otorrhœa, after months or years, suddenly ceases, the child complains of constant severe headache, and is feverish, and in a few days death closes the scene in convulsions or coma. Fatal meningitis has supervened, produced by extension of inflammation from the bony wall of the tympanum. Strumous children are more liable than others to these serious sequelæ of scarlet fever, which originate in or proceed from the internal ear.

Anatomical Characters.—There is some difficulty in determining what are the anatomical characters of scarlet fever, since so many who die of this disease have a complication, and the lesions of this are superadded to those of the fever. The following, however, are the facts which have been ascertained in reference to this point. In many the brain, its membranes, and the lungs are congested ; often, also, the Peyerian, solitary, and mesenteric glands are enlarged, and the spleen enlarged and softened. The liver and kidneys do not present any notable alteration, though the latter are so often affected during the period of convalescence. Dr. Samuel Fenwick (London *Lancet*, July 23d, 1864) has made post-mortem examinations in sixteen cases of scarlet fever, and concludes from them that there is inflammation of the mucous membrane of the stomach and intestines like that of the skin, and that there is desquamation of the epithelial cells from these portions of the digestive tube like that of the epidermis. I have had opportunity of examining the stomach and intestines in a few instances in those who died in the eruptive stage, in the Nursery and Child's Hospital, and did not find any unusual hyperæmia of the gastro-intestinal surface, unless when gastro-intestinal inflammation had occurred as a complication. In malignant cases, in which the

cardiac systole is feeble in the last hours of life, ante-mortem coagulation of fibrin frequently occurs in the cavities of the heart, obstructing the circulation, and being the immediate cause of death. These clots are large and whitish, or yellowish-white.

NATURE.—Scarlet fever presents in a marked degree the distinguishing features of the infectious maladies. It is highly contagious, and is inoculable. Stoll, d'Amboise, and others successfully inoculated with the scarlatinous virus, using the blood, but without diminishing the intensity of the disease. Whether scarlatina ever originates spontaneously is uncertain ; but if it do so, such cases are rare. It is disseminated by exposure to patients or to fomites, but the distance to which it is contagious is short, probably not more than two or three yards. Some consider the distance to be even less than one yard. Knowledge of this fact is important, as by isolating in a family a child attacked by scarlet fever, and allowing no communication with the nurse, the other children often escape. A very common mode of communication is by clothing, so that a third person is the medium of transmission. I have noticed that when scarlet fever, as well as measles, is epidemic in this city, a large proportion of the cases, nearly all, indeed, of the first cases, can be traced to the public schools. Exposure occurs through those children who come from apartments where cases are under treatment. Physicians, and especially nurses, are sometimes the medium of communication. A medical friend of mine went directly from some children with scarlet fever, whom he was attending, to another family, where he took a little girl upon his knee. This girl in a few days became affected with scarlet fever and died. The two remaining children in the family were then attacked, and one died. Murchison alludes to similar cases (London *Lancet*, August 13, 1864). In one instance in my practice scarlet fever was communicated to an infant by a washerwoman whose own child had the disease, and who, on reaching the house where she had been engaged to work, threw her shawl over the cradle where the infant was sleeping. Six days later the infant was attacked. Mason Good cites a case in which a box of toys was the medium of communication ; and it is said that even a letter has been. The scarlatinous virus may remain for weeks and even months in apartments, clothing, or in or upon the person of one who has been affected, without any appreciable diminution in its effectiveness. A physician of this city, in whose family scarlet fever occurred, excluded a child from the room occupied by the patients, and from the patients themselves, for a month after the last case occurred, and yet although precautions had been taken in reference to clothes and bedding, this child was taken with scarlet fever soon after it was allowed to mingle with the other children. The father believes that the exposure was through the otorrhœa of one of the children. Observations, indeed, appear fully to establish the fact that the discharge from the ear or nostrils, and the particles of epidermis

which have exfoliated, may retain the virus and be the medium of communicating the malady several weeks after the fever has terminated. In a case in my practice a little girl returned home six weeks after her brother had scarlet fever, and, within a few days, took the disease. A more striking example occurred in the practice of Dr. Kearney Rogers, formerly a prominent and much-esteemed surgeon of this city, and was related to me by an intelligent friend of the family since the doctor's death. Six children in a family had scarlet fever. Three and a half months subsequently another child, living at a distance, was allowed to visit them in the apartments where they had been sick. One week from that day this child also sickened with the same malady. Dr. Elliotson states that a patient with scarlet fever was admitted into one of the wards of St. Thomas's Hospital, and, for two years subsequently, young persons who were admitted into this ward were apt to take the disease. Dr. Richardson relates the case of a family of four children, residing in the country. One died of malignant scarlet fever, and the rest, who had been removed, escaped. Some weeks subsequently one of the children returned, but within twenty-four hours took scarlet fever and died. The cottage was now thoroughly cleaned, whitewashed, and the clothing destroyed. Four months then elapsed, when the third child returned home, who also took scarlet fever in a malignant form and died. It was believed that the virus remained attached to the thatch, which extended close to the children's bed. Other similar examples might be mentioned, sufficient to establish the fact of the great permanence of the scarlatinous virus.

The period of incubation in scarlet fever varies. It is seen in the remarkable example of contagion, given above, that it was only twenty-four hours. Trousseau also relates an interesting example of short incubation. "An English gentleman with his daughter was returning from Pau to London, and was joined at Paris by another daughter, who came direct from London. Scarlet fever was prevalent in London, but there was not a case of it at Pau. The second daughter was seized with scarlet fever in crossing the Channel, and joined her relatives in Paris seven or eight hours later. She occupied the same room in the hotel as her sister, who was also attacked within twenty-four hours." The incubative period is, however, seldom so short. It is usually from three to eight days. I might cite several cases in which this was its duration. Some writers allude to cases in which two, three, or even four weeks elapsed from the time of exposure to the appearance of the disease. It is, however, a question whether in such cases there may not have been a second and more recent exposure. Rostan alludes to cases in which scarlet fever was communicated by inoculation, and in which the period of incubation was seven days.

Scarlet fever occurs most frequently between the ages of three and ten years. It is infrequent under the age of one year, and infants under the age of three months may be considered safe from an attack of it, though

fully exposed. Cases have been reported of scarlet fever occurring in the fœtus, and manifesting itself by the usual signs at birth. But a clear diagnosis in such instances is necessarily difficult, on account of the character of the scarlatinous eruption on the one hand, and the nature of the cutaneous circulation in the newly born on the other. It is probable that, in the cases alluded to, there was an error of diagnosis. Certainly in two instances I have known women immediately after their confinement (within a week) take scarlet fever, and although they communicated the disease to others, did not to their infants ; and Murchison states that he has also twice observed similar cases.

Most adults possess immunity from scarlet fever, although not protected by an attack of it in childhood. Parturient women, however, as we have stated, are liable to it, and there is considerable danger that the physicians who attend them, if at the same time visiting cases of scarlet fever, may communicate it to them.

Scarlet fever is sometimes sporadic, but, as we meet it in this country, it occurs most frequently as an epidemic. The epidemics vary greatly in type. Some are mild, and attended by few complications, so that the result of treatment is eminently satisfactory. In other epidemics the type is malignant, the complications frequent, and the percentage of deaths large. There is sometimes a succession of epidemics of one type, and then the character of the disease changes. This fact of a variable type is important as regards the value of statistics relating to treatment. Each epidemic has its prevailing character, but when the form is mild, there is now and then a case of severity, and when it is malignant, now and then one of unusual mildness. The epidemic influence is sometimes manifested in those exposed to scarlet fever by the occurrence of pharyngitis, and, as we have seen, nephritis. Professor George B. Wood, of Philadelphia, says (*Treatise on the Practice of Med.*) : "I seldom attend cases of scarlet fever without having sore throat."

Scarlatina usually occurs but once in the same individual, but a second attack after the lapse of several years is not uncommon, and there are even cases of a third attack, one of which I have witnessed. But physicians sometimes mistake roseola or erythema for scarlet fever, and, though afterward aware of their mistake, do not correct their diagnosis. Hence there is a belief in the community that second attacks are more frequent than they really are.

Diagnosis.—In the commencement of scarlet fever, prior to the eruption, there are no symptoms or appearances which will enable us to make a positive diagnosis. Positive statement in reference to the nature of the disease might better be deferred, for the credit of the physician. Still, if a child with regular bowels, and no appreciable local disease, a few days after exposure to scarlet fever, be suddenly seized with intense fever, the pulse rising to 110, 120, or more, and the temperature to 102°, 103°, or

105°, there is little doubt that the disease is scarlet fever. The diagnosis is rendered more certain if there be vomiting, and especially if, as is usual, there be redness of the fauces at this early period.

When the eruption has appeared, the nature of the malady is, in most cases, apparent. Still, roseola or erythema, due to intestinal derangement or other causes, has often, as already stated, been mistaken for scarlet fever. A day or two suffices to show the error. In scarlet fever there is more inflammation of the faucial and buccal surfaces, more continuous and persistent redness of the skin, and greater intensity and persistence of symptoms, than in those diseases. Scarlet fever is also further distinguished from them by the papular elevations upon the tongue, and the minute papulæ upon the skin. Besides, in scarlet fever, except in the mildest cases, there is from the first the aspect of serious sickness, which roseola and erythema do not present.

Scarlet fever and measles were long considered identical by the profession, and, though the ordinary forms of the two diseases can be readily distinguished from each other, there are instances in which the differential diagnosis is attended by some difficulty. Measles occurring in a robust child, with an active cutaneous circulation, sometimes presents a continuous eruption over a considerable part of the surface, like the eruption of scarlet fever. But the longer period of invasion, the coryza and bronchitis, and the absence or slight degree of pharyngitis, in connection with other symptoms, enable us to distinguish these cases from scarlatina. Moreover, in those cases of measles in which there is continuous redness of surface where the circulation is most active, as upon the face, the characteristic rubeolous eruption is present in other parts, so that, with care in examination, error of diagnosis may be avoided. Scarlet fever and measles may indeed occur together, but such a complication is rare. The diagnosis from rötheln will be considered when we treat of that disease.

The greatest difficulty of diagnosis occurs in abnormal scarlatina, especially when the rash is partial and indistinct. There is apt to be, in this form of the disease, an inflammatory complication, which causes withdrawal of blood from the surface, and it is sometimes very puzzling to decide whether this is a complication, or the sole disease. The points involved in diagnosis are numerous, but they are sometimes not sufficient to show the character of the affection. Generally, however, by observing the clinical history from day to day, the diagnosis is established. In cases of doubt it is safest to adopt such hygienic management as is appropriate for scarlet fever.

Prognosis.—The prognosis depends on the form of scarlet fever, whether mild or severe, the presence or absence of complications, and the strength of the patient. The mortality varies greatly in different epidemics, in those of a mild form not being more than one in twelve or twenty, and the ratio may be less ; while, in those of a severe form, not

more than one recovers in every two, three, or four. The hospital statistics of Rilliet and Barthez show forty-six deaths in eighty-seven cases, while in some of the mild epidemics in the New York institutions the mortality has not been more than one or two per cent. Scarlet fever, like measles, is liable to sudden changes, either from complications which may arise or other causes, so that a case which gives a favorable promise in its commencement may, in a few days, present alarming symptoms. While in measles death nearly always occurs from a complication, in scarlet fever not a few perish from the direct toxic effect of the scarlatinous poison, and not a few also from complications or sequelæ.

If the symptoms be mild, the temperature not exceeding 104°, with little or no delirium or drowsiness, and the efflorescence full, and appearing at the usual time, we may confidently predict recovery. Nevertheless, nephritis, which is one of the gravest sequelæ, is so apt to occur after the mildest cases, that families should always be warned of the danger, that they may avoid needless exposure at the time of the decline of the fever and during desquamation.

The symptoms which indicate an unfavorable ending are convulsions, except at the very commencement, great drowsiness with jactitation, a temperature exceeding 104° and especially 105°, rapid pulse, duskiness of the eruption, feeble capillary circulation, persistent vomiting, and diarrhœa. At a later period, particularly at the close of the first or in the second week, other unfavorable symptoms may occur in severe cases. The inflammation of the fauces is often so violent that it extends to the neighboring glands and connective tissue, producing severe adenitis and cellulitis. These inflammations, in proportion to their severity, increase and protract the fever, interfere with the proper use of nutriments, and, as they are apt to end in suppuration and sometimes in sloughing, they retard convalescence, and render recovery more doubtful.

As dangerous complications and sequelæ, such as have been enumerated above, are liable to occur suddenly and unexpectedly in mild as well as severe cases, it is unwise to make an unconditional favorable prognosis till the patient is well advanced in convalescence. Safety is not insured till two or three weeks after the eruption.

Some patients, who have passed through scarlet fever, die of asthenia, in consequence of the anæmic state which the fever has produced. They have not sufficient vīgor to recover, although no serious complication or sequel has occurred. Death in the desquamative stage or subsequently is more frequently due to the renal affection than to any other cause. The nephritis gives rise to dropsies, which are fatal, or to uræmic convulsions and coma. Sudden and unexpected deaths are not uncommon in scarlet fever, and although they may, sometimes, occur from uræmia, their usual immediate cause, as others and myself have had the opportunity to observe in the cadaver, is the formation of ante-mortem heart-clots.

Treatment.—It should be borne in mind that scarlet fever cannot be shortened or aborted, and that the indications are to sustain the strength, reduce excessive fever, and prevent complications. There is no known remedy which destroys the poison, when once it has obtained lodgment in the system, and begun to produce its characteristic symptoms. Those agents, as carbolic acid, salicylic acid, etc., which are most highly esteemed as disinfectants, cannot be safely used in efficient doses to antagonize the poison in the system, since such doses would seriously impair the nutrition and molecular action in the tissues. The expectations raised in the minds of many, by the employment of salicylic acid, in the treatment both of scarlet fever and diphtheria, have been disappointed, and the use of the sulpho-carbolates has not, I think, been attended by any better success.

The following is the plan of treatment which can be confidently recommended as appropriate in ordinary cases : The patient should remain in the same room till desquamation is accomplished, and he should stay in bed till the fever and the eruption have ceased. The temperature of the room during the eruptive and febrile stage should be about 60° ; during the desquamative stage, when the patient may be allowed to leave the bed for some hours, the temperature of the room should be uniformly at 70° to 75°, and the air should be constantly pure from sufficient ventilation, without exposing the patient to currents. The linen should be changed every day or second day.

The external treatment of scarlet fever by measures designed to abstract heat is important. A temperature not exceeding 103° is usually safe, so as not to require special treatment, but a temperature at or above 104° rapidly exhausts the strength and involves great danger. The high temperature can be reduced without shock or injury to the child by the judicious use of cold water externally, and by inunctions. The cold-water treatment is not required unless the temperature exceeds 103°, and it is urgently required if it exceed 105°. It has been applied in different ways. At one time in the N. Y. Foundling Asylum the patients were stripped, and placed for a short time in a bath at 80°, but it caused such fright and excitement with a portion at least of the cases, that this treatment was discontinued. A preferable way of applying this treatment is by Ziemssen's bath, in which water is employed at a temperature of 90°, and gradually cooled to 77°. In most cases, however, I prefer to reduce the temperature by the constant application to the head of cloths wrung out of ice water, or if the temperature be above 104° of a bladder containing ice, with or without a single thickness of muslin underneath. At the same time, as a potent means of reducing heat when there is great elevation of temperature, a similar application should be made from ear to ear over the neck. Cold applied over the great vessels of the neck promptly abstracts heat from the blood, while it diminishes the pharyngitis adenitis

and cellulitis, which is an important gain. At the same time it is proper to sponge frequently the hands and arms with the cool lotion, and apply around them as well as along the sides of the face, one or two thicknesses of muslin wet with the same. By such measures, which are agreeable to the patient and without any shock or perturbating effect on the system, we can reduce the temperature two or three degrees. By adding alcohol, or one of the alcoholic compounds to the water, the popular objection to the use of cold water is overcome. I seldom use the wet pack, but have seen benefit from it when other measures failed to produce sufficient reduction in temperature. The patient is placed upon a mattress protected by oil-cloth, and is covered by a sheet wrung out of water at a temperature of 70°, which is that of our Croton in midsummer. This is covered by one or two blankets. In thirty to forty minutes the patient is returned to bed, and will be found to have a temperature perhaps two or three degrees less than before the bath. If the patient be very feeble, and with sluggish circulation, reaction from the packing is sometimes tardy and incomplete. The extremities remain cold, and increased stimulation is required. There is danger under such circumstances that some internal inflammation may arise. Therefore, for most cases I prefer the other method mentioned, rather than the general bath or pack. The intelligent and observing sister who for years has had charge of the quarantine wards of the New York Foundling Asylum, tells me that the gradual but constant abstraction of heat by the rubber bags and sponging has usually operated better than the quick and great abstraction by the general bath.

Trousseau employed cold effusions in sthenic cases, which were attended by high temperature, and other grave symptoms. He employed them in the first stage of the malady, and considered them especially useful when nervous symptoms predominated. He placed the patient naked in a bathing-tub, and directed three or four pailfuls of water to be thrown over him in a space of time varying from a quarter of a minute to one minute, after which he was returned to bed, and covered with the bedclothes without being wiped. Reaction immediately occurred, often with more or less perspiration. This treatment was repeated once or twice daily according to the gravity of the symptoms. Trousseau, alluding to the affusion, says, "I have never administered it without deriving some benefit." I am sure, however, that the cautious physician, who wishes to avoid measures which excite and frighten the patient, will prefer other methods.

Inunction of the surface of the body and extremities has long been in use. An unpleasant symptom in severe cases, and one which increases the restlessness of the patient, is the pungent heat of surface. Frequent inunction reduces this, relieving the dryness of the skin, and so increasing the comfort that the patient asks for it. Leaf lard answers for this purpose, and being inexpensive, is within the means of the most destitute family.

I prefer using butter of cocoa in cake, or vaseline, to each ounce of which five or six drops of carbolic acid may be added. Not only does inunction have the local effect which has been described, but it is stated to diminish sensibly the rapidity of the pulse, and the general temperature of the body.

Scarlet fever when mild, and without complication, requires little treatment, but every case, however mild, should be kept quietly in bed. If there be restlessness, an occasional dose of bromide of potassium with a warm mustard foot-bath will give relief, and this with the inunction would suffice for most of those lightly affected. There is, however, in all cases more or less pharyngitis, and as mild cases as well as severe may become complicated with diphtheria in localities where diphtheria is endemic or epidemic, I employ the following mixture even in the mildest cases ;

℞. Tinc. ferri chloridi, ʒij ;
Potas. chlorat., ʒi-ii ;
Syr. simplic., ℥ iv.

Give one teaspoonful every hour or every second hour, to a child of four or five years. The mildest cases are not less liable to nephritis than those of a severe type, so that during the disease, and in convalescence, they require cautious management as regards exposure to currents of air, or sudden changes of temperature, for all those agencies which check cutaneous transpiration may lead to development of nephritis.

In the average cases, that is, in those in which the temperature is about 102° or 103°, and there are no dangerous symptoms, I prescribe the above potash and iron mixture, to be given as above, except that on each fourth or sixth hour I administer quinine, dissolved in the elixir adjuvans, or other convenient vehicle, two grains to a child of four or five years. If the pharyngitis begin to abate, or be mild, I often prescribe the following mixture in place of the iron and potash. In all cases it will be found useful during the declining period.

℞. Ammon. carbonat.,
Ferri et ammon. citrat., āā ʒ ss ;
Syr. simplic., ℥ iv. Misce.

Dose, one to two teaspoonfuls every second or third hour.

In severe cases, in which the pulse is quick and weak, the temperature above 104°, the capillary circulation languid, the stomach irritable, and perhaps the bowels loose, while the nervous system is profoundly affected, as shown by drowsiness, delirium, or great restlessness, the condition is one of great danger, and measures designed to give relief are urgently required. As a temperature above 104° and especially above 105° rapidly exhausts the system, the antipyretic treatment by water, recommended above, should be employed, and perhaps a large dose of sulphate of quiniæ. Aconite and veratrum viride should never be prescribed in these

cases, as they are depressing. Digitalis is preferable to them, but it is less antipyretic than quinine. Five grains of quinine may be given three times daily to a child of five years. If the stomach be irritable, and it often is in these cases, ten of the bisulphate may be given in a suppository, and repeated if needed. While all but the mildest cases require the use at regular intervals of alcohol, either in the form of wine whey or milk punch, these severe cases, which are designated malignant, require alcoholic stimulants in larger and more frequent doses. If the nervous system be profoundly affected, so as to produce great restlessness, or other symptoms precursory of convulsions, the use of the bromide of potassium is indicated. While cool water may be employed externally for its antipyretic effect, it is proper to aid in allaying the nervous symptoms by a hot mustard foot-bath. If convulsions occur, which are usually attended by the disappearance of the eruption, this bath should be employed at once, or a general warm bath.

The large antipyretic doses of quinine should in general only be employed for two or three days, as its longer use might involve danger from its toxic properties. Afterward the smaller dose should be given. Digitalis will often be found useful, as a heart tonic, when the pulse is rapid and weak. One teaspoonful of the infusion, or four or five drops of the tincture, may be given every four hours to a child of five years. In these grave cases, which are characterized by great elevation of temperature, rapid pulse, and prostration, carbonate of ammonium will also be found useful, administered in decided doses between the quinine or digitalis. I prescribe it dissolved in water, so that each teaspoonful contains from three to five grains, and direct it to be given in milk, which is the best vehicle for it.

If the patient with malignant scarlet fever live till the fifth or sixth day, the urgent nervous symptoms begin to abate, and the angina then commonly demands more attention. The treatment of the throat has of late years become very important, since so many cases are nowadays complicated with diphtheria. For external treatment I prefer the cold compress, or India-rubber bag, which I have advised above, during the first three or four days, if the case be severe, and there be much elevation of temperature. If the fever be mild, camphorated oil or a light flaxseed poultice may be preferable. The poultice appears sometimes to give more relief to the tenderness than any other application. I do not, however, consider treatment of the neck important in mild cases, and I limit its use to those who have much inflammation and febrile movement. The treatment of the faucial surface is of more importance, and for this I prefer the use of the hand atomizer. This should be used every two to four hours, and if the instrument be well constructed, as Richardson's hard-rubber, or Delano's metallic, and in good condition, six to twelve compressions of the bulb are sufficient, if the following mixture be used :

℞. Acid. carbolic., gtt. xxxij;
Potas. chlorat., ʒ iij;
Glycerinæ, ℥ ii;
Aquæ calcis, ℥ vi. Misce.

This spray should be employed at least every two hours, if any exudation adhere to the inflamed surface. For infants I dilute the mixture with an equal quantity of water. The following should be employed by the atomizer if there be diphtheritic complication, since it is a more efficient solvent of pseudo-membranes than the above:

℞. Liquor potassæ, ʒ i;
Aquæ calcis, ℥ v.

The muco-purulent discharge from the nostrils in connection with the pharnygeal swelling often so impedes respiration that it proves annoying to the patient and increases his suffering. For this, warm lime-water, with about one two hundredth part of carbolic acid, should be injected into the nostrils; or, which I prefer, thrown into them in the form of spray by the atomizer. Richardson's and some others have a cap or point designed for the nostrils. The atomizer employed for the fauces is very effectual in removing the muco-pus, which often renders the respiration noisy and embarrassed in severe cases, for it dilutes the secretion and provokes a strong cough.

The abscess along the neck, which often results from severe adenitis and cellulitis, should be opened early, since it is painful, causes protraction of the fever, loss of strength, and restlessness, and as it is apt to be diffused, endangers absorption of the elements of pus.

The renal affection is often more dangerous than the scarlet fever. A clear appreciation of its therapeutic indications is important, since by judicious treatment many recover whose lives would inevitably be sacrificed by improper measures. As there is in these cases active hyperæmia of the kidneys, having an inflammatory character, diuretics which stimulate these organs should not be given, at least till this pathological state has, in a measure, abated. As the eliminative functions of the skin and of the intestinal mucous surface are to a considerable extent vicarious with that of the kidneys, diaphoretic and purgative remedies are required. By free diaphoresis the ill effect of arrested or diminished renal secretion is, for a time, averted. Treatment to produce diaphoresis should vary somewhat in different cases. It should in most patients be commenced by the use of a warm general or foot-bath, and the patient then be covered in bed. If free perspiration be not produced, it may be promoted by surrounding the body, either with hot dry or moist air. Hot dry air may be produced by burning alcohol in a thin layer upon a plate under a chair upon which the patient sits, while he is surrounded by a blanket, or he may be covered in bed, and the hot air introduced under the bedclothes by a common small sheet-iron pipe, the further extremity of which resting

on the floor contains an alcohol-lamp. Hot moist air may be produced by placing against the patient one or more bottles of hot water, surrounded by a wet cloth. The steam arising from this, and enveloping the body and limbs, produces a prompt sudorific effect. There is in use in this city, in the treatment of these and similar cases requiring diaphoresis, a convenient apparatus for generating steam. It consists of a cylinder pierced with holes for the admission of air, and containing a spirit-lamp over which is a pan or pail holding a little water. The patient, nearly denuded, is placed in a chair, with the apparatus by his side, and is covered with a blanket so that the steam surrounds the body. This gives rise to free perspiration, which continues after the patient is placed in bed. This treatment may be repeated each day, if the patient require it, while diaphoretics and laxatives are given. The diaphoretics which have heretofore been most employed in this affection are the acetates of ammonium and potassium, the bitartrate and citrate of potassium, and spiritus ætheris nitrosi. These agents employed singly or variously combined increase the diaphoretic effect, if used in connection with the external measures described above, which are calculated to produce diaphoresis. If employed with the surface cool, they act rather as diuretics than diaphoretics.

Pilocarpin, the muriate of which is most conveniently used, as it is soluble in water, is an efficient sudorific and useful remedy for scarlatinous dropsy, if the action of the heart be strong. Ether may be employed with it, or the amount of alcoholic stimulant increased at the time of its exhibition to guard against any depressing effect. To a child of two years one-twentieth of a grain may be given every six hours, by the mouth. It may also be employed hypodermically, as one-twentieth of a grain for a child of five years. It should be given cautiously, or not at all if the heart's action be weak.

Diuretics, which do not stimulate the kidneys, are proper at an early period of the renal malady, and in my opinion digitalis is more useful than any other internal remedy. I do not hesitate to administer it from the first day, often in combination with acetate of potassium, which in addition to a diaphoretic and diuretic has a laxative action. Digitalis has the confidence of the profession of New York more than any other medicine, both for the nephritis of children and of adults. One teaspoonful of the infusion should be given every fourth hour to a child of three to five years. The following is a good formula for a child of five years in good general condition :

℞. Potas. acetat., ʒ ss ;
Infus. digital., ʒ vj. Misce.

For the older robust children with scarlatinous uræmia and serous effusions few remedies afford so much relief in the commencement as cathartics of a hydragogue nature. A mixture of jalap and cream of tartar, pulvis jalapæ compositus of the Pharmacopœia, meets the indication. Even in

children somewhat reduced medicines of this nature are often required. Cathartics are more certain in their effects than either diaphoretics or diuretics, and, therefore, they should be given in urgent cases in which it is necessary to remove the urea or serum as speedily as possible. An excellent prescription in many of these cases, and one from which I have obtained a good result, is the following :

℞. Podophyllin, gr. j ;
Sacch. alb., ʒj. Misce.
Divid. in chart. No. viii.–xii.
Dose, one powder, according to circumstances.

After the use of laxative agents, the kidneys, being less congested on account of the diversion that has occurred, often begin to excrete more freely. But if the patient be anæmic, or enfeebled, and the symptoms are not urgent, cathartic or other depressing remedy is inadmissible. Cases like the following, from my note-book, are not infrequent. A little boy, pale and scrofulous, began to have anasarca, after scarlet fever, chiefly of the scrotum, and accompanied by a moderate degree of ascites. The urine, which was passed in nearly the normal quantity, contained albumen. This patient gradually and fully recovered, with no treatment except the use of an oil-silk jacket over the kidneys and abdomen, to promote diaphoresis, and the use of iron. Such a case actively treated by eliminatives would, probably, have proved fatal. Variation in measures is therefore demanded, according to the state of the patients, but digitalis, being a heart tonic, is very useful in the asthenic as well as sthenic cases.

It is evident from what has been stated above that the condition of the ear should be closely observed in and after scarlet fever. If the patient have earache, considerable relief may be obtained in the commencement by dropping a few drops of laudanum and sweet oil into the ear, and covering the ear by some hot application, either dry or moist, which will retain the heat. A favorite popular remedy in the tenement houses of New York, is a bag of dry and hot chamomile flowers, bound over the ear. Hot water syringed into the ear is also beneficial, and sometimes a leech applied at the base of the tragus aids materially in checking the inflammation in the first day or two. In most cases, however, the otitis continues, and the drum of the ear should be inspected daily.

Dr. Albert H. Buck, of New York, in a highly instructive paper on this subject, read before the International Medical Congress in 1876, writes : " This is the time when paracentesis of the membrana tympani produces such beneficial effects. In this one slight operation, which in itself is neither dangerous nor very painful, lies the power to prevent the whole train of disagreeable and dangerous symptoms." Dr. Buck relates an instructive example. The age of the patient was three years, and the earache had been complained of only about twenty-four hours. " Towards morning," said he, " I was sent for, as the pain had become constant.

. . . An examination with the speculum and reflected light showed an œdematous and bulging membrana tympani (posterior half), the neighboring parts being very red, though as yet but little swollen. In the most prominent portion of the membrane I made an incision, scarcely three millimetres (one tenth inch) in length, and involving simply the different layers of the membrana tympani. This was almost immediately followed by a watery discharge (without the aid of inflation), which ran down over the child's cheek. At the end of three or four minutes the child had ceased crying, and in less than a quarter of an hour she was fast asleep. At first the discharge was very abundant and mainly watery in character, but it steadily diminished in quantity, and became thicker, till finally on the fourth day it ceased altogether. On the tenth day the most careful examination of the ear could not detect any trace of either the inflammation or the artificial opening." This simple operation had probably saved the ear from ulceration of the drum, long-continued suppurative otitis, and perhaps from permanent impairment of hearing. It is evident that the operation should be performed early, before the ear is irreparably injured.*

But if the otitis have continued unchecked by treatment till the pent-up secretions, after days and nights of suffering, have escaped by ulceration through the drum, the opportunity for prompt and certain cure is passed. Still the patient under these circumstances may quickly recover, or there may be the other alternative described above, in which the ear is badly damaged, and a chronic inflammation established in the walls of the tympanum, giving rise to an offensive otorrhœa. Under such conditions the

---

* Dr. O. D. Pomeroy, an experienced and skilful aurist of New York, has kindly furnished the following particulars in reference to this operation : "The forehead mirror should be worn in order to leave the hands free to operate, using either artificial or daylight. A good-sized speculum is introduced into the meatus. Then an ordinary broad needle, about one line in diameter, with a shank of about two inches, such as oculists use for puncturing the cornea, should be held between the thumb and fingers, lightly pressed, so as not to dull delicate tactile sensibility. The part being well under sight, the most bulging portion of the membrane should be lightly and quickly punctured, with a very slight amount of force. The posterior and superior portion of the membrane is most likely to bulge. The chorda tympani nerve ordinarily lies too high up to be wounded. The ossicles are avoided by selecting a posterior portion of the membrane. After puncture the ear should be inflated by an ear-bag, whose nozzle is inserted into a nostril, both nostrils being closed, so as to force the fluid from the tympanum. The puncture may need to be repeated, at intervals of a day or two, provided that the pain and bulging return. In my opinion paracentesis may frequently be rendered unnecessary by the timely use of one or two leeches applied to the meatus. Leeching employed at the right time rarely fails to subdue the pain and inflammation. The posterior face of the tragus is ordinarily the best place for applying the leech, but it may be applied in front of the ear or behind wherever the tenderness on pressure is greatest.

"New York, Dec. 13, 1878."

same internal treatment is indicated which we make use of in suppurative inflammations of bone in other parts of the system. The internal use of cod-liver oil and iodide of iron is indicated, especially for those patients who seem to have the strumous diathesis, the object being to prevent extension of inflammation, and to produce a more healthy state of system, which will facilitate the healing process. The following, or some equivalent carbolized solution, should be syringed from one to three times daily into the ear. It should be used warm with an ear syringe :

℞. Acid. carbolic., ʒ ss ;
Glycerinæ, ℥ ij ;
Aquæ, ℥ iv. Misce.

We have stated above that during convalescence precautions should be taken to prevent the patient's catching cold, so as to diminish the liability to the sequelæ, which have now been described. He should not be allowed to go in the open air in unpropitious weather till a month after the fever. An oil-silk protection, worn over the under-clothes for a month or two, from the time that the febrile symptoms begin to decline, and covering the lumbar region, affords considerable protection to the kidneys.

Prophylaxis.—Since the period of Jenner's discovery of the prophylactic power of vaccination, as regards smallpox, the attention of the profession has been frequently directed to the prevention of scarlet fever. Belladonna has been employed as a prophylactic, and recommended, but its use for this purpose has been fruitless, and is now nearly or quite discarded. The most reliable, and, indeed, the only efficient prophylactic, is isolation, and the proper employment of disinfection in the sick-room and upon the patient. There can be no doubt that most of the excretions of a child sick with this malady contain the scarlatinous virus, as do also the cells of the epidermis, which are thrown off during convalescence and minute particles of which are wafted away as motes in the air. By the proper application of washes, which contain carbolic acid, to the fauces and nostrils, the secretions from these surfaces are to a great extent disinfected. If otorrhœa occur, the ear should be syringed with warm water containing carbolic acid in the proportion of one drachm to the pint, and this should be continued after convalescence, for cases occur which show that the discharge from the ear is probably the medium by which the virus is communicated, even as late as the fourth week after the disappearance of the rash. Children in the midst of the fever usually experience a degree of relief from inunction of the surfaces, and if carbolic acid be added to the substance which is employed for this purpose, and the inunction be made twice daily over the entire surface, contamination of the air through the exhalations and exfoliations from the skin is in great part prevented. A convalescent child should not be allowed to

mingle with other children till three or four weeks have elasped, and all who are liable to take the malady should be excluded from the room in which a case has occurred for a longer period.

The New York Health Board enforce the following excellent regulations against scarlet fever as well as measles :

" *Care of Patients.*—The patient should be placed in a separate room, and no person except the physician, nurse, or mother, allowed to enter the room, or to touch the bedding or clothing used in the sick-room, until they have been thoroughly disinfected.

" *Infected Articles.*—All clothing, bedding, or other articles not absolutely necessary for the use of the patient, should be removed from the sick-room. Articles used about the patient, such as sheets, pillow-cases, blankets, or clothes, must not be removed from the sick-room until they have been disinfected, by placing them in a tub with the following disinfecting fluid : eight ounces of sulphate of zinc, one ounce of carbolic acid, three gallons of water.

" They should be soaked in this fluid for at least one hour, and then placed in boiling water for washing.

" A piece of muslin, one foot square, should be dipped in the same solution and suspended in the sick-room constantly, and the same should be done in the hallway adjoining the sick-room. . . .

" All vessels used for receiving the discharges of patients should have some of the same disinfecting fluid constantly therein, and immediately after use by the patient be emptied and cleansed with boiling water. Water-closets and privies should also be disinfected daily with the same fluid, or a solution of chloride of iron, one pound to a gallon of water, adding one or two ounces of carbolic acid.

" All straw beds should be burned. . .

" It is advised not to use handkerchiefs about the patient, but rather soft rags for cleansing the nostrils and mouth, which should be immediately thereafter burned.

" The ceilings and side walls of the sick-room after removal of the patient should be thoroughly cleaned and lime-washed, and the woodwork and floor thoroughly scrubbed with soap and water."

By such measures of prevention there can be no doubt that the number of cases of scarlet fever would be greatly reduced. Dr. William Budd, of Bristol, England, has for years recommended similar precautions in the families which he attends, and the following is his testimony in regard to the result : " The success of this method, in my own hands, has been very remarkable. For a period of nearly twenty years during which I have employed it in a very wide field, I have never known the disease to spread in a single instance beyond the sick-room, and in very few instances within it. Time after time I have treated this fever in houses crowded from attic to basement with children and others, who have

nevertheless escaped infection. The two elements in the method are, separation on the one hand, and disinfection on the other." (*British Medical Journal*, January 9, 1869.)

CHAPTER III.

RÖTHELN.

The disease known as rötheln has heretofore been rare in America. In the Eastern continent, on the other hand, it appears to have been known for many years, and American physicians frequently designate it German or French measles. Meagre and imperfect descriptions of this malady have appeared in some of the British journals, and cases quite fully detailed have been published by British physicians.

Rötheln is not entirely a new disease in this country, though most American physicians never saw a case of it until within the last decade. Cases occurring in and about Boston were described by Dr. Honans, Sr., in 1845, and at a later date, namely in 1853 and 1871, B. E. Cotting and Mr. D. Howard saw cases, and described them in papers read before local societies. (See Boston *Med. and Surg. Journal*, March 15th, 1873.) In 1874, Dr. Caleb Green, of Homer, Cortland County, New York, an accurate and intelligent observer, also witnessed an epidemic.

This hitherto rare and interesting malady occurred in New York City as an epidemic in 1873 and 1874, attaining its maximum prevalence in March and April of the latter year, after which it declined, occasional cases occurring throughout May. This, so far as I can learn, was the first occurrence of rötheln in this locality. In a general practice of more than twenty years, extending over a considerable portion of this city, I had previously seen nothing like it, and other older physicians, having a large general practice, have informed me that they consider it an entirely new disease with us. Those who believe that they have occasionally observed isolated cases of it, previously to the epidemic, probably refer to roseola.

The first case which I met with occurred in the middle of December, 1873, in West Seventy-first Street, in the northern suburbs of this city. A few weeks later cases were so numerous in the more thickly populated sections of New York as to attract the attention of many physicians. It was evident that a disease had appeared with which we were not familiar, and as the eruption occurred in points and small circumscribed patches, it was usually designated by the physicians, in want of a more accurate name, epidemic roseola, or was spoken of as a spurious measles. Physi-

cians who were familiar with foreign medical literature saw the resemblance between these cases and those of rötheln, as described by British and continental writers, but in certain at least of the foreign cases the duration of the rash was said to be seven days (Liveing, London *Lancet*, March 14th, 1874, and *Med. News and Library*, May, 1874), whereas in the cases in New York it commonly disappeared by the fourth day. This discrepancy, however, was not sufficient to invalidate the belief in the identity of the New York disease with the foreign rötheln. It was readily explained by the difference in the seasons in which the cases occurred, for Liveing observed his cases in June and July, and, as we will see, the greater the external heat, the longer the duration of the eruption.

Between the middle of December, 1873, and May 1st, 1874, I had observed and treated this malady in eighteen families. Cases occurred in three other families living in the same houses with some of those which I attended, and, as they were fully and clearly described to me, so that there could be no doubt as to their nature, I have included them in my statistics. The total number of cases in these twenty-one families was forty-eight. During May, when the epidemic was declining, I saw six additional cases, occurring singly, making a total of fifty-four. Their ages are given in the following table ;

Age.	Cases.
From eight months to one year,	2
" one year to two years,	4
" two years to five years,	16
" five " " ten "	23
" ten " " fifteen "	3
" fifteen years to thirty years,	6
Total number of cases,	54

The age of the youngest patient was eight months, and that of the oldest thirty years. Seventy-two per cent of the total number were between the ages of two and ten years ; so that rötheln is pre-eminently a disease of childhood. Individuals in and beyond the middle period of life seem to have nearly an immunity from it. The age of the oldest patient of whom I was informed in the epidemic of 1873 and 1874 was about forty years. On March 25th, 1873, during my attendance in the N. Y. Foundling Asylum, rötheln appeared in a boy of four years : in the following month about thirty more cases occurred in this institution, all children, while among the large number of female nurses and employees who were chiefly between the ages of twenty and thirty years, all but three escaped.

From 1874 to 1880 rötheln did not prevail in New York, unless now and then an isolated or sporadic case, the nature of which was not recognized and which was supposed to be roseola. On August 9th, 1880, two cases appeared in different wards of the N. Y. Foundling Asylum, when it was remembered that two weeks previously these children had been ex-

posed to a patient in the hospital, attached to the institution, who had what the physician in attendance supposed at the time to be roseola.

Commencing with these two cases an epidemic occurred in the asylum, mild in type, affecting only a few at a time, but extending over several months, until about sixty inmates, chiefly children, were attacked. Toward the close of 1880, rötheln began to appear in the northern part of the city, in which the asylum is located, and over which my practice extends. Its maximum prevalence was attained in the latter part of March and April, 1881, when it particularly attracted the attention of physicians. A large proportion of the children attending certain public and private schools were attacked. It occurred in seventeen families in my practice. The ages of the patients in these families are given in the following table:

Age.	Cases.
From one to two years,	3
" two " five "	8
" five " ten "	18
" ten " fifteen "	11
There were two cases over fifteen years, aged respectively twenty-two to forty-two years,	2
Total number of cases,	42

Premonitory Stage.—Premonitory symptoms are, in most instances, absent, or so mild as to attract but little attention. It not infrequently happened in the New York epidemics that the parents or the teachers in the schools were first made aware of the illness of the children by observing the eruption. In some instances, children were sent from school, not because they felt too ill to remain, but on account of the unusual appearance of the skin. Sometimes, however, in those old enough to express their sensations a premonitory stage of some hours or a day, or even of longer duration was present; consisting of such symptoms as usually occur when one has taken a severe cold, as languor, pain in the head, trunk, or limbs. The resident physician of the New York Foundling Asylum was so ill with rötheln that he was confined to his bed during the first day of the disease. Now and then patients experience nausea, previously to the eruption, and in the first and second days of the eruptive stage. In only one instance did I observe grave prodromic symptoms. A boy aged eight years was suddenly seized with clonic convulsions, and while in a warm bath for the relief of these, the rash appeared upon those parts of the body which were immersed in water.

Symptoms.—*Tegumentary System.* (*a*) *The Skin.*—The eruption commonly commences upon the forehead, around the ears and along the neck, as in measles. Occasionally it may appear upon the back or chest, as in the above-mentioned case, in which the hot water accelerated its appearance. Commencing above the efflorescence travels downward, appearing after

some hours upon the lower part of the trunk and on the legs, resembling in this respect the eruption of measles and scarlatina. It occurs upon all parts of the integument, except the scalp and palmar and plantar surfaces. In the majority of the cases which I have seen it gradually faded away, disappearing by the fourth day, but on children who were kept warm in bed, or in warm apartments, it remained longer than on others. In many instances traces of the rash were still visible several days after recovery when the patients were heated by exercise or excitement. It reappeared at times, though indistinctly, on a girl of thirteen years for three weeks. In most of the cases in the New York epidemics the eruption commonly occurred in points and circular spots, somewhat smaller than those of measles. These points and spots were numerous and thickly set, so that, in the aggregate, they covered at least half of the surface, while between them the skin presented nearly or quite its normal appearance. The general aspect in most cases was more like that of measles than that of scarlatina, but in exceptional instances the skin between the points and spots had a redness similar to that of erythema, and the resemblance was very like the scarlatinous efflorescence. Thus, in a boy of three years the eruption so closely resembled the scarlatinous over the trunk, that were it not that the temperature was constantly below 100° and all febrile movement ceased within three or four days, I would probably have considered the malady a mild scarlatina. In certain patients the eruption, beginning in circumscribed spots, like that of measles, becomes in two or three days confluent so as to resemble that of scarlatina, while over other parts the spots remain discrete. This was the character of the eruption upon the third and fourth days on the extremities of a little boy in the Foundling Asylum. The rash is attended by considerable itching, from which, indeed, many patients suffer more than from all other symptoms.

The eruption disappears on pressure, produces a slight roughness of the surface, as ascertained by passing the fingers gently over it, and usually fades away without desquamation. Exceptionally there is a slight branny exfoliation, and in one of my patients this was as considerable over the abdomen as in cases of scarlatina.

(*b*) *The Mucous Membrane.*—In connection with the cutaneous eruption a mild inflammation also occurs upon the mucous membrane covering the fauces, buccal cavity, and nostrils, and upon reflections of this membrane over the eyes and eyelids, *i.e.*, upon the conjunctiva. In certain patients this inflammation is scarcely appreciable, but in the majority it arrests attention at once. It produces a suffused, reddish or weak appearance of the eyes, with a moderately increased lachrymation. On everting the eyelids the palpebral conjunctiva is seen to be injected. In certain patients a moderate puriform secretion collects at the inner angle of the eyelids. In occasional cases the conjunctivitis causes œdema of the lids, usually slight and likely to be overlooked by the physician,

but in three instances which I now recall to mind the mothers of the children directed my attention to the swollen state of the lids. In one of these, an infant of twenty-three months, the tumefaction was so great, commencing about the time the eruption began to fade, that light was totally excluded from the eyes, and it was impossible to ascertain their condition. The skin over the eyelids retained nearly its normal appearance, and a puriform secretion appeared between the lids. In three or four days the œdema of the lids and the hyperæmia of the conjunctiva rapidly declined. The coryza is in most cases sufficient to cause an unpleasant sensation in the nostrils and provoke sneezing, but the flow from the nostrils, though present, was in no instance under my observation as abundant as in ordinary cases of scarlatina or even of measles. The fauces present an injected appearance, and in severe cases there is moderate swelling of the tonsils. The same catarrhal hyperæmia is also seen in spots or patches, more or less diffused, upon the buccal surfaces. Both the faucial and buccal catarrh are less in degree, however, than in cases of rubeola and scarlatina, which have an equal intensity of cutaneous eruption, and this fact has aided me in differential diagnosis.

The Respiratory System.—In both the epidemics which I have witnessed the mucous membrane of the larynx, trachea, and bronchial tubes participated only slightly in the inflammation which involved the nasal, buccal, and faucial surfaces. Many of my patients had no cough, but others had a mild cough lasting for a few days, but with normal respiration. It was due apparently to a very mild catarrh of the respiratory tract at the time when the nasal and conjunctival surfaces were the most affected. It subsided in a few days without treatment. In no case do I recollect that there was any hoarseness.

The Digestive System.—The tongue in rötheln is moist and of normal appearance or covered by a slight fur. The appetite may be impaired, but is not wanting in uncomplicated cases. The patients sometimes say that it is nearly the same as in health, the thirst is slight, and the bowels are regular.

Nausea is not infrequent, and vomiting was, in several cases in my practice, one of the initial symptoms. In certain patients it also occurred on the first or second day of the eruption. In others there was no nausea, so far as I could learn, either immediately before or during the prevalence of the disease. This symptom is less frequent in rötheln than in scarlet fever, but is as common apparently as in measles. I have never found albumen in the urine, though I have examined that passed by several patients. This secretion did not appear to be abnormal except as it contained urates, so common in febrile states.

The Pulse and Temperature.—The largest number of accurate daily observations relating to the temperature was, I think, that of Doctor Reid in the New York Foundling Asylum during the month of March,

1874. He has kindly furnished me with his statistics relating to this symptom as follows : " The number of closely observed cases in which the temperature was taken was twenty-four. In seventeen of the cases the temperature ranged from 97° to 99°, in six it reached 100°, 100¼°, and 100¾° ; in one it reached 103¼° on the second day of the eruption, but remained so elevated only one day." In certain patients Doctor Reid observed what he designates, " a tendency to the development of an ephemeral fever." These observations correspond closely with those made by myself during the same epidemic. Thus, in 16 cases I found the axillary temperature taken each day to be constantly between 98° and 100°, with a pulse under 110 , except in one case, in which it numbered 124 . In certain other patients a more decided febrile movement, lasting from one to two or three days, occurred, usually in the commencement of the malady. Thus, a girl aged three and a half years had a temperature of 101¾° and a pulse of 128 . In another instance the pulse was 124 and the temperature 102°. In another, a girl of three and a half years, there was active febrile movement occurring without apparent cause on Saturday night, but abating on the following day. She seemed well until the following Tuesday, when the febrile movement returned and the eruption appeared. On Thursday the temperature from 102° to 103° fell to 99½°, and within a day or two she was convalescent. In two other patients from two to four days after the disappearance of the eruption an accession of fever occurred, lasting about one day, and attended by pain and distress in the epigastric region, but without vomiting or diarrhœa. In one of these the temperature was 103¾°, the pulse 130 per minute. In the other case the temperature and pulse did not seem to be under these figures, but were not accurately ascertained. Occasionally the febrile movement is due more to complications than to the primary disease. Thus, in two of my patients the febrile movement was mainly attributable to diphtheritic inflammation which had attacked the fauces. But while the fever in rötheln is ordinarily of short duration, in certain patients temporary exacerbations may occur in which the temperature is as high as in scarlet fever or measles.

Complications—Prognosis.—The only complication which occurred in cases in my practice has already been alluded to, namely diphtheria, which, when prevalent, is apt to attack surfaces already inflamed. In the Foundling Asylum varicella complicated one case and pneumonia another. In a third pneumonia occurred about three days after the disappearance of the eruption. The prognosis in uncomplicated cases is always very favorable, and there is no liability to sequelæ more than in mild catarrhal inflammations of a non-specific character. The duration of rötheln is short, not ordinarily extending beyond three to five days.

Nature—Incubative Period—Contagiousness.—Is rötheln a distinct malady or one with which we are familiar, but the form and character of

which are modified by unusual meteorological conditions? Is it roseola assuming at certain periods an epidemic character, and appearing to be contagious? Or is it at all times infectious, possessing a specific principle, and, like other infectious diseases, self-propagating? Should it in nosological classification be placed among the non-contagious and local, or among the constitutional and infectious maladies? Let us consider the facts observed in the New York epidemics.

The first cases of rötheln in this city were often designated roseola by the physicians called to treat them, since they seemed to resemble more closely this disease than any other with which they were familiar. But rötheln differs widely from the peculiar form of dermatitis known as roseola. The successive occurrence of the eruption over the upper and then the lower parts of the body, but covering the whole surface, and the definite duration of three to five days, are points of difference. Moreover, roseola would not without so great change in its character as to become virtually a distinct disease, occur in the cool months without any appreciable dietetic cause, as an epidemic over a certain area and for a limited time, affecting whole households and sparing other households, as well as individuals of a certain age. We, therefore, consider it distinct from roseola.

Most of the cases in the New York epidemics bore considerable resemblance to measles, both as regards the appearance and duration of the eruption and the catarrh of the mucous surfaces. Parents often diagnosticated measles before the arrival of the physician, and the physician himself, at first glance, sometimes made the same diagnosis. But in rötheln the shortness and mildness of the stage of invasion, the absence of cough or the presence of one trivial and scarcely noticed, appetite good or but slightly impaired, in fine symptoms that are transient or slight, afford a striking contrast to the graver symptoms of measles. But the decisive proof that rötheln is not a modified measles is found in the fact that one does not prevent the other. Of the forty-eight cases observed by myself, prior to May 1st, in the epidemic of 1874, nineteen at least had had measles, and one who had rötheln took measles subsequently. I have already stated that in the New York Foundling Asylum rötheln in 1873 and 1874 closely followed an epidemic of measles. A considerable number of the children attacked by the former disease had recently recovered from the latter. During the epidemic of 1880 and 1881 the same fact was observed, namely that a previous attack of measles as well as scarlet fever afforded no protection from rötheln. Dr. Chadbourne, the resident physician, writes of the cases in the Foundling Asylum in 1880 and 1881: "Eight children had rötheln who had had both scarlet fever and measles within six months under my observation, while certain others had had these diseases at some previous time." Of the cases observed by myself in family practice in the same epidemic, it is stated in my notes that

ten had had measles. These statistics are sufficient to show that rötheln is a distinct disease from measles, however close the kinship.

That rötheln is not a form of scarlet fever is evident from the fact that as regards at least the New York epidemics the rash was in most instances quite distinct from the scarlatinous efflorescence, occurring, as we have said, in small more or less circular points and patches. Moreover, as we have remarked above, there is in rötheln a slight febrile movement and general mildness of symptoms, which contrast with the high fever and other pronounced symptoms of scarlatina, or if there be considerable febrile movement its duration is brief. But the conclusive proof of an essential difference between these two diseases is found in the fact already stated in reference to measles, that the attack of the one malady does not prevent the occurrence of the other. There are, it is true, cases in which it is difficult at first to make the differential diagnosis between rötheln and mild measles or mild scarlet fever, but when the course of the malady has been closely observed for three or four days, it will rarely happen, I think, that we will be unable to make out its character.

Those cases of an epidemic which arise when the causes or conditions from which it is developed are most strongly operative and which at this time are apt to be typical, obviously afford the best data for studying its nature. Such were the forty-eight cases which I saw in the epidemic of 1873 and 1874 and the forty-two in that of 1880 and 1881. As regards the former epidemic, in thirteen of the twenty-one families embraced in my statistics, the first cases were children, who up to the time of the seizure were attending public and private schools, and in certain instances those who were nearly simultaneously attacked, living perhaps in streets widely separated, were attending the same school. During the epidemics of 1880 and 1881, the first patients in thirteen of the eighteen families in which rötheln occurred were school children between the ages of six and twelve years, and in most, if not all, the different schools which they attended, rötheln was at the time prevailing as an epidemic, as I ascertained on inquiry. It, therefore, seemed probable that these had contracted it from others in the schools.

In both the New York epidemics during the time that rötheln was at its maximum prevalence, in most of the families containing two or more children the cases were multiple, not occurring simultaneously, but in succession, as if the malady was contracted from those first affected. This is what we daily witness in the spread of exanthematic fevers. Thus in Mr. E.'s family, a girl attending one of the public schools took rötheln in the middle of December, 1873 ; the two remaining children sickened with it one week and two weeks later. A niece visiting in the family at the time when the first child was sick, but returning home to another street, also had the eruption on December 27th. Alice R., aged ten years, a frequent visitor at Mr. E.'s, living in the same street, and several

times exposed to his children during their illness, also took rötheln about January 4th. West Seventy-first Street, where these cases occurred, is thinly settled and suburban, and I could learn of no other cases in the vicinity. A child of Mr. P., aged five and a half years, had been in the habit of playing with two children two doors away who became affected with rötheln in the beginning of April, 1881. On April 14th he was supposed to have a mild coryza from taking cold, as he sneezed often, but in a few hours the efflorescence appeared. Four days subsequently, on the 18th, an infant was affected in the same way, and thirteen days later another child in the family, aged twelve years. In a similar manner rötheln occurred in the families of two brothers living in adjoining houses in West Fifty-first Street. The first patient was a boy of twelve years. It appeared successively in the children of these two families until ten had been affected. In a family in West Forty-sixth street, the first case was a boy attending a school in which rötheln was prevalent. Within twenty days, namely, between March 31st and April 20th, four other children were attacked in succession.

These facts and cases seem to demonstrate the contagiousness of rötheln, at least during the time in which the conditions are most favorable for its development, or during the time in which the epidemic influence is most pronounced. In the declining period of both the New York epidemics, the cases which I observed occurred for the most part singly, although there was no attempt to isolate the patients, so the contagious character, if present, must have been very slight.

Rötheln is in my opinion an exanthematic fever feebly contagious. It resembles varicella in general mildness of symptoms, in the absence of dangerous complications or sequelæ, and in the uniformly favorable prognosis, while its symptoms show a resemblance to measles and scarlet fever.

If the above view be correct, rötheln must possess an incubative period which, in the cases observed in both epidemics, apparently varied between seven, or perhaps less than seven, and twenty-one days. Its incubation, therefore, resembles that of scarlet fever, which, as is well known, varies in different patients. In the cases which came under my notice, the incubative period, when it could be accurately ascertained, was more frequently about two weeks, than a longer or shorter period. The resident physician of the New York Foundling Asylum, when the epidemic was prevailing in that institution, returned to his home in the State of Maine to a locality where rötheln was unknown. Fourteen days from the date of his departure he was himself affected with the disease in its typical form. No other case occurred at his home, where probably the atmospheric conditions were unfavorable. Minnie B., attending a school in which there were many cases, had the rash on April 5th. On the 23d of the same month, eighteen days afterward, it appeared upon the servant who was frequently in Minnie's room. Elizabeth C., attending a school in which

rötheln was prevailing, had the eruption on April 17th. It commenced upon her sister thirteen days, and upon her mother fourteen days subsequently.

Other cases might be cited of an apparently shorter as well as longer incubative period. The following note from Dr. Chadbourne, of the New York Foundling Asylum, bearing upon this subject, is interesting : " I am led to believe from my observations that the period of incubation was, in the majority of the cases, from twelve to fifteen days. The disease has been very feebly contagious. In some cases one child would have rötheln while the other, nursed by the same woman, would escape. In two instances women had the disease, and though each suckled two infants the latter escaped."

Rötheln requires no treatment.

CHAPTER IV.

VARIOLA—VARIOLOID.

Variola, or smallpox, is a specific febrile affection, accompanied by a vesiculo-pustular eruption of the skin. Since the discovery of the protective power of vaccination it has been shorn of much of its terror, but it is still the most loathsome and most dreaded of all the fevers. Two forms of this disease are recognized, depending on the fact whether there have been previous vaccination. If the patient have been vaccinated at some period in his life, the disease, which is rendered milder in consequence, is designated varioloid. If there have been no vaccination, it is called variola or smallpox. Both forms are identical in nature, the one communicating the other ; they differ only in gravity.

Smallpox presents four stages : the initial, or that of invasion ; the eruptive ; that of desiccation ; and, lastly, that of desquamation. It is called discrete when the pustules remain separated from each other ; confluent when they unite. This division is made according to the character of the eruption upon the face and hands. There are parts of the surface, as the abdomen, where the pustules are always discrete, even in the confluent form.

Incubative Period.—During the last half of the last century inoculation with variolous matter was extensively practised in Great Britain and on the Continent, as it was found that smallpox thus communicated was milder than when received by infection. This operation enabled physicians to determine the period of incubation, which was found to be from eight to eleven days. When variola is communicated through the

air, the incubative period is somewhat longer, namely, from twelve to fourteen days.

Stage of Invasion.—Smallpox begins abruptly with chilliness. In children of an advanced age there is often, as in the adult, a distinct chill. This is followed by fever and such symptoms as usually accompany febrile movement, namely, lassitude, anorexia, and thirst. In addition certain symptoms arise which, though not peculiar to smallpox, are so marked in the commencement of this disease, that they possess considerable diagnostic value. These symptoms, which pertain to the nervous system and occur in the initial stage of varioloid as well as variola, are severe frontal headache, pain in the small of the back, and great drowsiness, sometimes with delirium. In many children convulsions occur, preceded and followed by a degree of stupor which is almost as profound as coma. Trousseau suggests the name rachialgia for the pain in the back, as he believes that it is located in or around the spinal cord. This belief is based on the fact which he, as well as other observers, has noticed, that there is sometimes in connection with this symptom an incomplete paraplegia, indicated by numbness of the legs, or even inability to use them, and sometimes more or less paralysis of the bladder. These paraplegic symptoms pass off in a few days. Vomiting is also a common symptom in this stage, and one also of diagnostic value. It occurs at short intervals for twenty-four to thirty-six hours. The same symptom is common in scarlet fever, and not infrequent in measles, but in both these maladies irritability of stomach is much less persistent than in smallpox, vomiting does not occur in normal rubeolous and scarlatinous cases more than once or twice.

The tongue is covered with a moist fur. If the disease is to be discrete, constipation is commonly present in the stage of invasion; if confluent, diarrhœa is a common symptom, continuing till the fourth or fifth day, or even longer. Roseola or erythema sometimes occurs in this stage, and this may lead to error of diagnosis, the disease being mistaken for one of these cutaneous affections, or even for scarlet fever. The symptoms in the stage of invasion are usually more violent in confluent than in discrete variola, but there are exceptions.

Stage of Eruption.—The eruption commences about the third day, earlier in some cases, later in others. The average duration, therefore, of the first stage is somewhat shorter than in measles, but considerably longer than in scarlet fever. Sydenham has stated, and observations show the truth of the remark, that the shorter the first stage, the more severe the disease will prove to be; and, conversely, the longer the period, the milder will be its form. Therefore, if the eruption begin on the second day, it will, as a rule, be confluent; if not till the fifth or sixth day, it will be scanty and the disease light.

The eruption commences in minute red spots, somewhat like those of

lichen, which gradually enlarge. It is first observed around the lips and upon the neck, then upon the face, scalp, upper part of chest, arms, and finally upon the lower part of the chest, the abdomen, and legs. It is sometimes, especially in young children, first observed in the folds of the skin, as about the genitals or in the groin. If the cuticle be irritated, as by a sinapism, the eruption often appears first upon this part of the surface and in greater abundance than elsewhere. Commencing in a minute reddish point, as stated above, it rapidly enlarges, and soon its central part begins to be indurated and raised. It feels round and hard to the finger, is tender, and its diameter does not ordinarily exceed two lines. This is the papular stage. The papulæ increase and become more elevated, and in twenty-four to forty-eight hours from the commencement of the eruptive stage they become vesicular. On the fifth day of the eruption, or eighth of the disease, the vesicle has attained its full size. Its diameter is then about one fourth of an inch, and its elevation is two or three lines. Its base is circular and indurated, and it is surrounded by a narrow zone of inflammation, indicated by redness and tenderness of the skin. The pock commonly, as it passes from the papular to the vesicular stage, loses its acuminate form, and becomes depressed in the centre, but in most cases, mixed with the umbilicated vesicles, are some which remain acuminate.

In proportion as the eruption becomes developed in discrete variola and in varioloid, the symptoms which accompanied the stage of invasion abate ; the fever, headache, pain in the back, and thirst cease, and the appetite returns. In the confluent form, the febrile action continues with little abatement.

Simultaneously with the eruption upon the skin, an eruption also occurs upon the buccal and faucial surfaces, and often upon that of the air-passages. It occurs sometimes, also, upon the conjunctiva, producing dangerous ophthalmia, and even ulceration, with loss of sight, and upon the mucous surface of the genital organs. The form which it presents upon mucous surfaces is somewhat different from that upon the skin. There is at first a deposit of fibrin, producing a small, round, grayish spot at the point of eruption—firm, slightly elevated, and covered, if not by the entire mucous membrane, at least by its epithelial layer. Ulceration soon occurs, as in ulcerous stomatitis, and, if the patient live, the reparative process succeeds, as in simple ulcers. The eruption upon mucous surfaces increases considerably the suffering of the patient, in consequence of the tenderness of the ulcers ; and if its seat be the surface of the larynx or trachea, it may be the immediate cause of death, especially in young children, by obstructing respiration.

The cutaneous eruption has been traced to the vesicular stage. On or about the fifth day of the eruptive period, or eighth of smallpox, the vesicles gradually change their character, their contents becoming thicker

and turbid. At the same time they increase still more in size, and the central depression disappears. This is designated the stage of maturation, or of suppuration, though it is known that the turbidity is due chiefly to another substance than pus. The pock having undergone these changes, is termed the pustule.

In discrete variola, and in varioloid, the fever returns during the pustular stage ; or, if the form of the disease be confluent, and the fever have continued, it now becomes more intense. The return of fever, or its increase, is denoted by increased frequency of pulse, elevation of temperature, dryness of skin, anorexia, and thirst. A tendency to constipation remains throughout in varioloid and discrete variola; in the confluent form diarrhœa more frequently occurs, which, if it continue, is an unfavorable prognostic sign.

Other changes occur. The pustules increase somewhat in size, and become more globular. Some of them, when most distended, break through friction of the clothes, or scratching of the child, and, their contents escaping, add to the loathsomeness of the disease. There is in the pustular stage more or less redness of the surface between the eruptions, and, except in the mildest cases, tumefaction from subcutaneous infiltration occurs. In the confluent form, at this period, the features are often so swollen that the friends would not recognize the patient. The eyelids may be so œdematous that the eyes are for a time concealed from view. This œdema of the surface is not altogether absent in the vesicular stage, but it increases during the time of maturation, after which it subsides.

Stage of Desiccation.—This immediately succeeds the full development of the pustules. The liquid portion of the contents of the pustules, which are broken, evaporates, leaving a crust. If there be no rupture, the liquid is absorbed and a scab results, which, though smaller, preserves in a measure the form of the pustule. While the pustule desiccates, the surrounding inflammation rapidly abates. The crusts occur first upon the face, and on other parts in the order in which the eruption appeared. The odor from the patient, at this time, is peculiar. In the confluent form, especially, it is very offensive, and can be noticed at a distance from the bedside. Rilliet and Barthez call it nauseous and fetid. As desiccation progresses, the symptoms, local and general, abate. The pulse and temperature, if the case be favorable, return to their normal standard. The cough, hoarseness, and thirst disappear, while the appetite returns ; the sleep is more tranquil, and the functions, generally, are more regularly performed.

The last stage is that of desquamation ; it commences between the eleventh and sixteenth days. The scabs, which present a dark or brownish appearance, are successively detached. This period lasts several days ; sometimes two or three weeks even elapse before all the crusts separate. In the mean time the patient gradually recovers his health and

former strength. After the fall of the crust, the cicatrix underneath presents a reddish appearance. This color gradually fades, and there remains an irregular depression, or pit, of a lighter color than the surrounding surface; and if there have been a full development of the eruption, disfiguring the patient for life.

Such is the clinical history of variola, when it is favorable, and its course is regular. The disease is sometimes irregular. In rare instances the eruption occurs almost at the commencement of the attack. The form is then very apt to be confluent. There are irregularities, also, in consequence of diarrhœa, hæmorrhages, or other complications. I have known the eruption appear first on the limbs, and last on the trunk and face, and the appearance of the eruption is not always the same. In the anæmic and feeble child it often presents a pale color, with some induration at its base, but without the red areola around it, or with this quite indistinct. In rare instances the vesicles have a reddish color, their contents being tinged with blood. This form of variola is designated hæmorrhagic. It indicates a profoundly altered state of the blood. The eruption in this form is of small size, and if the pock be broken, blood oozes from it.

I have met one, perhaps two cases of malignant hæmorrhagic smallpox, as described by Hebra, among the rare forms of this malady. The second case died so soon that we were undecided whether he had smallpox or scarlatina. A man aged 36 years, previously healthy, became suddenly and severely sick, in June, 1881, with fever, intense headache and backache, great depression of the vital powers, sleeplessness, and a sensation of sinking or depression in the epigastrium. He had a marked foreboding of coming evil, and begged almost constantly for relief. Within forty-eight hours a heavy and continuous dusky scarlatiniform eruption covered the whole surface, except below the knees, disappearing on pressure; fauces at first but moderately injected. On the following day, the third of his sickness, with a temperature of 104.5°, the efflorescence became a dark red, numerous small extravasations of blood had occurred under the skin, the urine contained blood, and finally seemed to consist almost entirely of dark blood; a large effusion of blood under the entire conjunctiva of either eye prevented closure of the eyelids, and probably hæmorrhages had occurred within the eyes, as the sight was nearly lost. Death occurred on the following day. In Hebra's article on smallpox is the description of precisely such cases, but the death of my patient was too early for exact diagnosis.

Varioloid.—The course of varioloid is similar to that of variola, but it is somewhat shorter. It commences with rigors, followed by fever, headache, pain in the back, vomiting, drowsiness, and sometimes delirium, or even convulsions. The symptoms in the stage of invasion are, indeed, the same in character, and often nearly as severe as in variola. With the

initial symptoms, there is also sometimes a scarlatiniform eruption, so that the disease may at first be mistaken for scarlatina. On the third or fourth day the variolous eruption commences. The number of pocks is commonly few, often not more than twelve to twenty. In the mildest form of varioloid, if the physician be not summoned in the stage of invasion, he is not apt to be called at all, so that the patient may pass through the disease in ignorance of its nature. The true character of the malady is not ascertained till others are affected, either with variola or varioloid.

The eruption pursues a more rapid course in varioloid than in the unmodified disease. By the fifth or sixth day the pustules are fully developed, though often smaller and less likely to be ruptured than in variola. Often, in varioloid, the eruption aborts. It remains papular two or three days, and then declines, or it may reach the vesicular stage, and decline without pustulation.

The constitutional symptoms in varioloid abate with the commencement of the eruptive stage. The secondary fever is slight or absent.

Such is the usual mild course of varioloid, but not always. If several years have elapsed since the vaccination, its protective power is greatly impaired, and varioloid may then exhibit as severe a form as ordinary smallpox. In some instances it is fatal.

The term varioloid is, as has been stated, applied to cases of variolous disease if there have been previous vaccination. It is also applied by writers to second attacks, whether the first occurred from infection or from variolous inoculation, but such cases are rare.

Mode of Death.—Death in smallpox occurs in several different ways. The most fatal period is the pustular. Feeble children not infrequently die from exhaustion at or about the time that the pustules attain their greatest size. The eruption appears and becomes developed as usual, but there are evidences of weakness in the patient, and suddenly the progress of the vesicle or pustule ceases. It begins to subside, and its walls shrivel. There is evidently absorption, in part, of the liquid contents. These phenomena are of the gravest character. Death is the common result, and within twenty-four hours. In other cases death occurs from apnœa. The pock increasing in size in the larynx and trachea, obstructs inspiration, or there may be the formation of a pseudomembrane, as in true croup. This is not an unusual mode of death in young children, in whom the calibre of the larynx and trachea is small. Sometimes convulsions and coma occur in the last hours of life. In other cases the stage of desquamation is reached, but convalescence does not occur. The patient each day becomes more anæmic and feeble, and finally death results from failure of the vital powers. Again, after smallpox has run its course, purpura hæmorrhagica may be developed. Hæmorrhages occur from the gums, throat, nostrils. Blood is vomited, and

evacuated in the stools. I have known death to occur in all these ways, but that from purpura is least frequent. Sometimes, as in scarlet fever, death occurs suddenly and unexpectedly in confluent, and even in discrete variola, when the previous symptoms had apparently been favorable. The patient is overpowered by the intensity of the virus.

Anatomical Characters.—In those who have died of variola, without inflammatory or other complication, the heart-clots have been found small, dark, and soft. The blood is dark and thin. The vessels of the brain and its membranes are injected, so that numerous red points appear on the cut surface of this organ. The vessels of the lungs and the abdominal organs are congested, while the muscles present a deep red color. The variolous eruption penetrates more deeply than that of any other exanthematic fever. It has been stated elsewhere that it occurs not only on the skin, but often on the surface of the mouth, fauces, and air-passages. The mucous membrane in these situations is frequently also the seat of catarrhal inflammation, being thickened and softened, and in some parts, as the larynx, a pseudo-membrane is occasionally produced, as in croup. The inflammation, whether catarrhal or pseudo-membranous, may occur without as well as with the presence of the specific eruption.

The eruption very seldom, perhaps never, appears upon the gastro-intestinal surface, but the solitary follicles and patches of Peyer are often enlarged, as in some other zymotic affections. The liver, spleen, and kidneys are commonly congested in those who have died of variola. The spleen, especially, is increased in volume and softened ; the kidneys are enlarged, as if from commencing nephritis, and sometimes softened.

The minute structure of the pock is described by Rilliet and Barthez, and others. The vesicle is multilocular, consisting of at least five or six compartments, with distinct partitions. Its centre is united by fibrous bands to the derm beneath, which union gives rise to the umbilicated appearance. The giving way of these minute bands in the pustular stage occurs when the form changes from the umbilicated to the convex. In the pustular stage also, according to some, a fibrinous formation occurs within the pustule ; according to others, this substance is of the nature of the epidermis, presenting the appearance of the cuticle when macerated. Mixed with this epidermic or fibrinous formation are pus-cells.

Complications.—There are several different complications of variola. One is salivation. This is common in the adult, but rare in the child. When it occurs in the child, it is slight, commencing with or about the time of the eruption, and disappearing in from one to four or five days. Ophthalmia is another complication. Simple conjunctivitis, often quite intense, may occur in consequence of pustules developed under the lids. This inflammation subsides without injury to the eye, as the primary disease abates. A more serious inflammation occurs at an advanced stage of variola, commencing in or near the desquamative period. This

produces more or less chemosis, and sometimes opacity or ulceration of the cornea. A similar inflammation may occur in the ear, giving rise to otorrhœa, and even in some patients, to rupture of the drum of the ear. Abscesses in the subcutaneous connective tissue have been occasionally observed, especially in the confluent form. Subcutaneous infiltration and feebleness of constitution favor their occurrence. Suppuration within the joints is a somewhat rare complication or sequel, rendering convalescence protracted, if, indeed, the case be not fatal.

M. Béraud has published a memoir to show that orchitis in the male and ovaritis in the female may complicate variola. These inflammations are believed to be accompanied by a small and imperfect variolous eruption upon the tunica vaginalis and the peritoneal covering of the ovary. Trousseau states that he has often met this complication in the male, since his attention was called to it. It is mild, and subsides with the disappearance of the eruption. Laryngitis, simple or diphtheritic, bronchitis, pneumonia, pharyngitis, purpuric hæmorrhages, gangrene of the mouth or other parts, œdema pulmonum, and œdema glottidis are occasional complications, some of which are frequent, others rare.

Prognosis.—This depends on the age, vigor of system, form of the disease, and the presence or absence of complications. The younger the child, the greater the danger. Trousseau says : " Confluent variola, and even discrete variola, are almost always fatal in individuals less than two years old." Above the age of three or four years discrete variola usually ends favorably, but the confluent form is still, as a rule, fatal. Varioloid in the child is a mild disease, terminating favorably in a large proportion of cases. It is milder at this age than in the adult, on account of the more recent period of vaccination. If varioloid be severe, and the eruption abundant in a child who has been vaccinated, it is probable that the vaccination was spurious.

It is not necessary, from what has been said, to specify the favorable prognostic signs. The unfavorable prognostics are, great violence of the initial symptoms ; early appearance of the eruption ; an abundant eruption, especially if pale, and without swelling of the surface ; rapid decline of the eruption in the vesicular or pustular stage ; hæmorrhagic eruption, or hæmorrhages from the surfaces ; fever continuing after the appearance of the eruption ; diarrhœa persisting beyond the third or fourth day ; delirium or great drowsiness ; a frequent and feeble pulse ; and, finally, obstructed respiration—if slow, indicating a pseudo-membrane or variolous eruption in the larynx or trachea ; if rapid, indicating bronchitis or pneumonia.

Diagnosis.—The diagnosis cannot be made with certainty prior to the eruptive stage. If, however, smallpox be prevalent, if the patient have not been vaccinated, and the symptoms which pertain to the period of invasion be present, as headache, pain in small of back, repeated vomiting,

drowsiness, and perhaps convulsions, there is ground for the gravest suspicion. If, in addition to these symptoms, reddish points begin to appear on the second or third day, the diagnosis may be made with confidence. At this early period, even before there is any distinct cutaneous eruption, ash-colored spots may sometimes be observed on the buccal or faucial surface, the commencement of the variolous eruption ; these possess considerable diagnostic value.

The scarlatiniform efflorescence, in the first stage of variola, sometimes leads to the belief that the disease is scarlet fever. The absence of the pharyngitis, and the appearance of the variolous eruption soon after the efflorescence, correct the diagnosis. Smallpox has, in the beginning of the eruptive period, sometimes been mistaken for measles. The points involved in the differential diagnosis have been presented in treating of that disease. After the development of the eruption, it may be mistaken for varicella. The eruption of varicella is, however, preceded by symptoms which are milder and of shorter duration, and its appearance is different. It is irregular, instead of round ; is not umbilicated, and it does not have the round, inflamed, and indurated base, which characterizes the variolous eruption. The eruption of ecthyma is sometimes umbilicated, but the symptoms of ecthyma and variola, and the progress of the eruptions in the two diseases, are very different.

Treatment.—Smallpox, like the other essential fevers, is self-limited, and therefore the constitutional treatment should be sustaining and palliative. In the first stages of the disease, the diet should be simple ; gentle laxatives and refrigerant drinks are required if there be much febrile excitement. Lemonade is a grateful drink, and may be given in moderate quantity. Spiritus Mindereri in carbonic acid water may be allowed. As the disease advances, more nutritious food should be recommended ; and in severe cases carbonate of ammonium, and even alcoholic stimulants, are required.

As confluent smallpox is nearly always, and the discrete form often fatal in infancy, the physician should carefully watch the progress of the case in the infant. By judicious treatment, some, in this period of life, may be saved, who otherwise would perish. In the infant depressing measures should be avoided. A laxative may be given, at first, if there be much fever, and the bowels are constipated ; but the diet should be nutritious, and many soon require tonics and stimulants. If the pulse become more frequent and feeble, or if, with frequency of the pulse, the face and extremities become cool ; or, in the vesicular or pustular stage, the eruption suddenly subside, alcoholic stimulants must be immediately employed, or the patient dies.

Such is an outline of the constitutional treatment required in smallpox. Sydenham inculcated a mode of treatment which experience has shown to be injurious in infancy and childhood. He had observed that the severity

of the disease was ordinarily proportionate to the amount of eruption, and concluded from this fact that measures which retarded the development of the eruption were salutary ; cold drinks, a cold apartment, scanty covering of the body, cathartics that caused derivation of blood from the surface, even sometimes the abstraction of blood, were considered, according to Sydenham's theory, to be useful as means of preventing full development of the eruption.

Sydenham's treatment, however appropriate it might sometimes be in case of robust adults, is unsuitable for children, because they do not, as a rule, tolerate, in this disease, measures which reduce the strength. Moreover smallpox is rendered more dangerous by what Rilliet and Barthez designate perturbating treatment—treatment which renders it abnormal. The regular appearance and development of the eruption are requisite in order that the case may progress favorably. On the other hand, the opposite plan of treatment, which families, if left to themselves, are apt to adopt—namely the employment of measures to promote perspiration, as hot drinks, and confinement in a heated room—is also injurious.

The patient should be kept in a temperature such as he has been accustomed to, and such as is agreeable to him ; his diet should be simple and nutritious ; laxative medicine should only be given to procure the natural evacuations. In smallpox, as in all infectious diseases, free ventilation of the apartment is required.

While the general eruption should not, as a rule, be interfered with, it is proper to endeavor to diminish, so far as possible the size of the pocks, on parts exposed to view, so as to prevent disfigurement. Professor Flint, in his *Treatise on the Practice of Medicine*, has published an excellent summary of the various measures which have been recommended for accomplishing this end. First : The opening and breaking up of the vesicle by means of a fine needle. This is tedious practice in confluent variola, but it can readily be performed in the discrete form—at least as regards the vesicles upon the face. This treatment was proposed by Rayer, and it is recommended by many who have tried it. Secondly : After the evacuation of the liquid, the cauterization of the vesicle by a pointed stick of nitrate of silver. Rilliet and Barthez say, in reference to this mode of treatment, " Individual cauterization of the pustules is, on the other hand, an almost infallible means of causing them to abort. To be successful, it is necessary to penetrate into the interior of the pustule with a pointed crayon of nitrate of silver in order to cauterize the derm. . . . It is only the first or second day of the eruption that it (cauterization) has certain success ; nevertheless, we have often seen it succeed the third or the fourth day, or even the fifth."

Thirdly : The application of tincture of iodine once or twice daily over the eruption when in the papular stage. Some writers, who have employed iodine, state that it does not prevent pitting but diminishes it. Its

favorable effects are produced by coagulating the contents of the papule. Fourthly : The exclusion of light and air by means of a plaster. A mixture containing tannate of iron has been employed for this purpose in one of our hospitals. This produces a black mask. Light and air may also be excluded by smearing the face with sweet oil, and dusting twice daily upon the oiled surface a powder containing equal parts of subnitrate of bismuth and prepared chalk. Fifthly : The application of mild mercurial ointment upon the face or other parts of the surface, where it is desirable to render the eruption abortive. This mode of treatment does diminish the size of the vesicles and the pitting, but I should not recommend it for children. I have known in the adult severe mercurialization from its employment for four or five days, and, though young children do not exhibit so readily the effects of mercury, the use of the ointment, unless for a very limited period, increases, in my opinion, their feebleness, and diminishes the chance of their recovery. Calamine made into a paste with sweet oil is said to be equally effectual with mercurial ointment, and it produces no constitutional effect. Its effect is obviously similar to that of the bismuth and chalk employed with sweet oil as stated above. Also, I have employed pulverized charcoal made into a thin paste with sweet oil or glycerine, and applied daily or twice daily to the face. It effectually excludes the light, and the result appeared to be good as regards pitting, but it is a disagreeable application. Curschmann recommends as preferable to any of these methods, the use of iced compresses to the face and hands. The pain, redness, and swelling are diminished by their use, but without change in the copiousness of the eruption. (*Ziemssen's Encyclop.*) If fissures or excoriations occur, an application may be made of oxide or carbonate of zine in glycerine, one drachm to the ounce.

The prevention of smallpox, so far as practicable, is one of the important incidental duties of the physician. Isolation of the patient, and precautions in reference to his clothes and bedding, are imperatively required, so great is the contagiousness of this disease. The only certain means of prevention is confessedly vaccination, and providentially the incubative period of the vaccine disease is much less than that of variola. Therefore, smallpox may be prevented after the virus is received in the system, by timely and successful vaccination. Vaccination, at any period between the time of exposure and the commencement of the symptoms of invasion, will either prevent the occurrence of smallpox or modify it. If the symptoms of invasion have already commenced, it is uncertain whether it produces any modifying effect.

CHAPTER V.

VACCINIA.

Vaccinia is a mild eruptive disease, which occasionally occurs among cattle, and has been propagated from them to man. It is characterized by the appearance upon the surface of one or more papules, which soon become vesicular, and then pustular. It is communicable by contact, but unlike the other eruptive fevers, it is not contagious through the air. It is inoculable, both by the liquid contained in the vesicle, which is designated vaccine lymph, and by the scab which results from the desiccation of the pustule.

To Gloucestershire, England, the honor belongs of discovering and utilizing the fact that vaccinia, a mild and comparatively harmless disease, is transmissible from the cow to man, and that it affords protection from smallpox. It appears that a vague opinion prevailed among the farmers of this dairying section, that a disease, which has since been designated vaccinia, was occasionally received from the cow in milking, the virus passing from a pustule on the teat to a sore or chap on the hand of the milker, and that those who thus contract the disease receive immunity from smallpox. As usually happens with important discoveries, so slow of apprehension is the human intellect, these people, to whom Providence had revealed a most important fact, were blind to its real value. Finally, in the year 1774, Benjamin Jesty, whom the world has not sufficiently honored, "an honest and upright man," according to his epitaph, a farmer of Gloucestershire, had the courage to vaccinate his wife and two children. His excellent moral character did not shield him. He was regarded by his neighbors as an inhuman brute, who had performed an experiment on his own family, the tendency of which might be to transform them into beasts with horns.

This first essay in vaccination appears to have been entirely successful, but the prejudice against the operation continued. A fifth of a century passed, during which there was no extension of the benefits of this great discovery. At last, toward the close of the last century, Dr. Edward Jenner, a physician of Gloucestershire, and inoculator of his district, began to investigate this disease of the cow, about which little was known, and the grounds for the belief that it afforded protection from smallpox. Fortunately for the world, Jenner had been educated under John Hunter, and had learned from his great master to study nature rather than books,

to be guided by experience and observation rather than by the dogmas of his predecessors or of the schools.

Jenner performed his first vaccination on the 14th of May, 1796, twenty-two years after Benjamin Jesty had lost his good name among his neighbors for vaccinating his own family. The popularizing of vaccination, mainly through Jenner's perseverance, affords one of the most interesting and instructive chapters in the history of medical science. How he went up to London, full of the importance of the discovery, and was there advised by his medical friends to desist from his wild schemes, lest he should injure the reputation which he had gained from a creditable paper on the habits of the cuckoo ; how he was finally allowed to vaccinate in hospital wards, and gained some adherents to the new faith among the leading physicians of the metropolis ; and, finally, how, as the claims of vaccination began to be recognized, at the close of the last century and commencement of the present, a most acrimonious discussion arose, which filled all the medical journals of that period. The opponents of vaccination resorted to every device to prevent the acceptance of Jenner's views. They attempted to prejudice the people against them by specious arguments, by ridicule, and even by caricatures. One of the leading journals contained the picture of a cow covered with sores, and devouring children, and it was urged that vaccination was a bestial operation, degrading man to the level of the brute. But the truth had gained a firm hold, and the practice of vaccination extended.

The discovery of vaccinia, and of its protective power, cannot be too highly appreciated. It has, probably, done more to relieve human suffering than any other discovery of the last one hundred years, unless we except that of anæsthetics, and more to save human life than any other instrumentality of a purely physical kind.

The fact was established in the time of Jenner that the virus of small-pox inoculated in the cow produced vaccinia, which, in its propagation back to man never returned to its original form, but always remained vaccinia. Moreover, Jenner believed that the disease known in the horse as the grease was identical in nature with vaccinia in the cow. He failed, however, in his experiments to communicate vaccinia from the horse, but other experiments have been more successful. In 1801, a Dr. Loy, of the county of York, England, met two cases of vaccinia in persons who had taken care of a horse affected with the grease, and, from the lymph which he obtained, was able to produce vaccinia in the cow. In 1805, Viborg, a Danish veterinary surgeon, after many failures, succeeded also in communicating vaccinia to the cow by means of the virus taken from a horse.

From this time little light was thrown on this subject till within the last twenty years. Although Loy and Viborg, and perhaps a few others, had recorded their success, other experimenters had failed to communicate vac-

cinia from the horse. In the absence of additional cases the profession began to question whether there might not have been some error in the observations of the gentlemen whose names I have mentioned, and whether a disease identical with vaccinia occurred in the horse, or a disease which might communicate vaccinia to the cow or to man, was still regarded as undetermined.

Observations confirmatory of those of Loy and Viborg were at length, however, made, which must be regarded as conclusive. In 1856 in the department of L'Eure-et-Loir, France, M. Pichot was consulted by a boy who had on the back of his hands vaccine pustules, which had apparently reached the eight or ninth day. He had not taken care of nor been in contact with a cow, but had a few days before taken care of a horse affected with the grease. Vaccination was performed by means of the lymph taken from these pustules, and genuine vaccinia was produced.

Again in 1860, an epidemic prevailed among the horses in Riemes and Toulouse, France. A mare sickened with the disease, and there was swelling of the hough, with discharge of sanious matter. M. Delafosse vaccinated two cows with this matter, and communicated genuine vaccinia. This epidemic was believed by the veterinary surgeons to be an eruptive fever, differing in its nature somewhat from the disease or diseases which have ordinarily been designated the grease. It has been conjectured that two or more distinct affections of the horse have the same appellation, one of which, it is now admitted, is identical with vaccinia of the cow, and may communicate it; and the reason why so many experimenters have failed to vaccinate the cow from the horse is that they have used the virus of the wrong disease, or have taken matter from horses which had been affected with the true disease, but from ulcers which had lost their specific character.

Prior to the time of Jenner variolous inoculation was practised in most civilized countries, since variola produced in this way was found to be milder than when arising from infection. This practice is now obsolete; forbidden in some places by legislative enactments. It is superseded by vaccination. Vaccination, or the introduction of vaccine lymph into the system, is quickly and conveniently performed by scarifying with a lancet, and rubbing into the incisions the lymph, or a little of the scab pulverized and dissolved in a drop of cold water. It may also be performed by scraping off the epidermis with the edge of the instrument till the blood begins to ooze; and also, though with less certainty of success, by puncturing the skin with the point of the lancet, or by an instrument called the vaccinator. The scab should never be employed when it is possible to obtain pure lymph, since it contains animal matter apart from the virus, and may be the medium through which other diseases may be communicated. Besides it is much less active than pure lymph.

If the child have a vascular nævus, this may be selected as the point of

vaccination. Unless of large size, it can usually be cured by the inflammation which vaccinia produces. Statistics collected by Simon, as well as Marson, show that of those who contract varioloid, the larger the number of vaccine cicatrices the milder the disease, and the less the proportionate number of deaths. In Simon's statistics of those who stated that they had been vaccinated, but who presented no cicatrix, 21¾ per cent died; of those who had one cicatrix, 7½ per cent died; of those who had two, 4⅛ per cent died; of those who had three, 1¾ per cent died; while of those who had four or more cicatrices, only ¾ per cent died. These statistics would seem to indicate the propriety of vaccinating in several places. But, so far as appears, when two or more cicatrices were observed, the patients may have been vaccinated at different times, at intervals, perhaps of several years, and if so, the inference would not follow that more complete protection is produced by vaccinating in several places than in one. Moreover, if vaccination be performed in the usual manner by several incisions on the arm, and the virus be fresh and active, usually two or more distinct vesicles arise, which unite in their development, and probably protect the system as much as if they were separated by a wider space.

Appearances—Symptoms.—In genuine vaccination no effect is observed, except the slight inflammation due to the operation, till the close of the third day. Then the specific inflammation commences. This is indicated by a small red point, at first scarcely visible, indurated and slightly elevated, as determined by the touch, rather than by the eye. This increases, and on the fifth day the cuticle over the inflamed part begins to be raised by a transparent and thin liquid. The vesicle increases in diameter, and by the sixth day presents an umbilicated appearance, and is surrounded by a faint and narrow red zone. At the close of the eighth day the vesicle is fully developed. Its size varies considerably. It is usually from a sixth to a third of an inch in diameter, and oval or circular. If the vaccination have been performed by incisions, the size of the matured vesicle may be considerably larger, and its shape irregular, in consequence of the union of two or more vesicles. The eruption now presents a whitish or pearl-colored appearance, due to the whiteness of the cuticle, and the transparence of the liquid underneath. If the vaccination be performed by incisions, it is not unusual to observe over the centre of the vesicle, and adhering to it, a small yellowish scab, which has resulted from the scarification, and which contains none of the virus.

The vaccine vesicle, like that of variola, consists of compartments, commonly eight or ten, with complete partitions, so that there is no intercommunication. On the ninth day the inflamed areola becomes more distinct, and its diameter rapidly increases. Its color is deep red, its temperature is considerably elevated, and it is accompanied by more or less induration of the subcutaneous tissue, and it is tender to the touch. On the tenth day the pock has reached its full development. The areola then extends

from one to two inches away from the vesicle, becoming fainter at its outer circumference, and gradually disappearing in the healthy skin. The shape of the outer circumference of the areola is irregular, projecting further at one point than another, though its general form is circular.

On the tenth day, when the inflammation has reached its maximum, the heat, itching, and tenderness in and around the pock are such that the child is often feverish and restless. Occasionally the glands of the axilla become swollen and tender. In other cases, in which there is but a moderate amount of inflammation, the constitutional disturbance is slight.

At the close of the tenth day, or on the eleventh, the inflammation begins to decline ; the areola becomes narrower and then disappears ; the induration and tenderness abate ; and with this change the pustule desiccates, its liquid is absorbed, and there results a brownish or a dark mahogany-colored scab, which is detached, ordinarily, between the fourteenth and twenty-first days. The cicatrix, at first reddish, like all recent cicatrices, gradually becomes paler, and remains whiter than the surrounding integument. It presents several minute depressions or pits, which indicate the genuineness of the vaccination.

Anomalies, Complications, and Sequels.—The vesicle is often broken, accidentally, or by the nails of the child. If the top of the vesicle be destroyed, or most of the compartments be opened, the inflammation is commonly increased, considerable suppuration occurs, and there results a large, irregular, yellowish scab, consisting of the virus mixed with desiccated pus. This scab is entirely unreliable, and unfit for the purpose of vaccination, though the protective power of the disease is not diminished by injury of the vesicle, even if it be totally destroyed. The cicatrix which results from extensive injury of the vesicle is apt to be large, and without the indented points which characterize the normal cicatrix.

In rare cases when the inflammation which surrounds the vesicle is intense and deep seated, suppuration occurs in the subjacent connective tissue, giving rise to an abscess. This abscess is commonly of small size, but it increases the fretfulness and constitutional disturbance which attend vaccinia. This subcutaneous suppuration occurs most frequently in those who have a scrofulous or vitiated state of system. Inflammation of the lymphatic glands of the axilla I have spoken of as not infrequent in vaccinia. This sometimes proceeds to suppuration, producing an unpleasant, though not serious, complication.

It sometimes happens that vesicles appear in other parts besides the points where the virus was inserted. These supernumerary vesicles commonly occur where the cuticle has been removed by scalds or injuries.

Trousseau relates the case of an infant whom he had vaccinated. On the eleventh day he was astonished to find twenty-seven vaccine pustules on the face, trunk, and limbs. This infant had, however, before the vaccination, a simple non-specific eruption over the whole body, and it was

believed that it had produced these vaccinations by transferring the lymph, with its nails, to the various parts where the cuticle was denuded.

It is not unusual, also, to observe minute papules appearing on parts of the surface simultaneously with or soon after the vesicle, and in a few days declining. These seem to be abortive vaccine eruptions.

One of the most serious complications is erysipelas. This may occur directly from the operation, or from the inflammation caused by the vesicle, when the virus possesses no deleterious property ; and, again, it may result from some unknown element in the virus. It may occur immediately after the operation, when it commonly prevents the working of the virus, or during the vesicular or pustular stage ; or, again, after desiccation and separation of the scab. I have observed it at all these periods.

Erysipelas, occurring as a complication of vaccinia, is invariably referred by the friends to the virus employed, and the physician who has had the misfortune to vaccinate is often unjustly blamed. In many of these cases there was a strong predisposition to erysipelas at the time of the vaccination, and the operation or the inflammation which accompanied the normal development of the vesicle served simply as an exciting cause. Erysipelas would occur as soon from a non-specific sore ; indeed, we not infrequently are called to cases of this disease in young children, which commence from non-specific sores upon the genitals, or on one of the limbs. That the fault is not in the virus employed, is evident from the fact that other children, vaccinated with the same, have simple uncomplicated vaccinia.

Sometimes, on the other hand, the cause of erysipelas, whatever it may be, exists in the virus. For further facts in reference to this subject, the reader is referred to our remarks on erysipelas.

The fact is established by many observations that syphilis is communicable by vaccination. The symptoms of it may not appear till vaccinia has terminated, or for a little time subsequently, but it then constitutes a very serious sequel. A physician of this city, well known in this community as skilful in the diagnosis and treatment of skin diseases, and therefore not likely to be mistaken as regards the nature of the diseases, states that he communicated syphilis to two infants by vaccinating with the same scab. Both had the characteristic syphilitic eruption. In January, 1868, an infant was brought to Prof. Alonzo Clark's clinique, in this city, having syphilitic rupia, which, in the opinion of the physicians present, was undoubtedly the result of vaccination.

Trousseau relates the case of a young woman, eighteen years old, who was vaccinated with virus taken from an infant apparently in perfect health. The vaccination was unsuccessful ; but twenty-three days subsequently his attention was called to an eruption which had appeared in two places on the woman's arm, corresponding with the points where the virus had been inserted. The eruption was that of ecthyma, which, by

the next examination, which was five days subsequently, had been transformed into rupia. The axillary lymphatic glands were tumefied and indolent, and finally roseola appeared, which removed all doubts as to the syphilitic character of the disease. There was syphilitic infection, which first manifested itself in the points where vaccination had been performed (*Article de la Vaccine*). It is not ascertained in Professor Clark's case, nor is it stated in Trousseau's, whether the lymph or scab was employed for vaccination. There can be little doubt that the pure lymph never communicates anything but vaccinia, and if by vaccination any other disease be imparted, a little blood has mingled with the lymph, or the scab has been employed.

The vesicle in genuine vaccinia is sometimes very small, not having a diameter of more than two lines. Occasionally the development of the vesicle is retarded. It does not appear till two or three days later than the usual time, or even a longer period.

Vaccinia is modified by certain diseases. It is arrested by measles and scarlet fever, pursuing its course after the subsidence of the exanthem. On the other hand, it sometimes modifies the paroxysmal cough of pertussis, but only during the time when the pock is maturing. Eczematous eruptions occasionally occur after vaccinia, as they often do after the other eruptive fevers, or, if already present, they may be aggravated

Subsequent Vaccinations.

A second vaccination, performed prior to the ninth day after the first vaccination, is successful. A genuine vaccine eruption results, which is smaller the more advanced the primary disease. This second eruption overtakes the first. On the ninth day the susceptibility to vaccinia is in most cases, lost ; so that vaccination performed on the tenth, or subsequent days, is unsuccessful.

As a rule, an acute contagious disease occurs only once in the same individual. Vaccinia is an exception. In most people, after a few years, it can be produced a second time ; and cases of a third or fourth successful vaccination, at intervals of a few years, are not uncommon. Now, subsequent cases of vaccinia differ from the first, which has been described above. The period of incubation is shorter, and the vesicular, pustular, and desiccative stages succeed each other more rapidly, so that the whole period of the disease is less. The variation from the appearance and course of the first vesicle is proportionate to the degree of protection which the first vaccination still affords, both as regards smallpox and vaccinia. If several years have elapsed since the first vaccination, and the protective power which it afforded is nearly lost, the second vaccinia differs but little from the first. If, on the other hand, the first vaccination still afford nearly complete protection, the result of the second is slight ; the eruption is insignificant, lacking the characteristic appearance

of the vaccine vesicle, resembling a common sore, and disappearing within a week. It is not accompanied by the inflamed areola, or any appreciable constitutional disturbance.

Vaccination often produces no result. This is sometimes due to the fact that the lymph or scab employed is useless. It has spoiled by keeping, or never has been good. In other cases it is due to a lack of susceptibility in the person. Some take vaccinia with difficulty, and only after several vaccinations ; just as children, though fully exposed, often fail to take measles or scarlet fever, on account of a condition of the system which prevents the reception of the virus, or antagonizes and controls its action. In some instances, after vaccination, an eruption is produced, which may or may not be genuine ; but it immediately becomes purulent, and is soon broken. A large yellow, uneven scab results, having none of the appearance and containing little or none of the vaccine virus. This scab, as well as the liquid matter which preceded the formation of the scab, is utterly useless for the purpose of vaccination, and, if so employed, will probably cause a sore from its irritating effect, but not of a specific character. If, in place of the true vaccine vesicle, the eruption present the appearance which I have described, namely, that of a pustule, soon breaking and forming a large irregular, yellowish scab, the vaccinia—if it be correct so to designate it—must be considered spurious. A sore has been produced by the animal matter which was employed in the vaccination along with the virus, which has modified the action of the virus, and probably has rendered it useless as a means of protection ; or there may have been no virus inserted with this animal matter. The physician should in such cases insist on a second vaccination.

Cases like the above are of frequent occurrence, and the parents of the child are often satisfied with the result. They see an eruption following vaccination, accompanied by considerable inflammation, and leaving a cicatrix. Unless undeceived by the physician, they are apt to remain in the belief of the child's security, until, perhaps, it takes smallpox. Such cases, obviously, tend to diminish the confidence which the public should have in vaccination as a means of protection from smallpox, and on account of their frequent occurrence it is important in every case that the physician should see the result of his vaccination. It has been proposed, as a means of determining the genuineness of vaccinia, to revaccinate when the eruption begins, and if the first be genuine, the second will overtake it. This is called Brice's test ; but it is not necessary, since the physician, familiar with the appearance of the true vesicle, can determine at once its genuineness by the sight.

Protection from Vaccination—Revaccination.

It was believed by the early advocates of vaccination that the general performance of this operation would soon eradicate smallpox from the

community, so that it would be interesting only to the medical historian as a scourge of past ages. This result, however, is not achieved. As a rule, the greater the benefit of any measure designed to ameliorate the condition of mankind, the greater and more numerous are the obstacles which diminish its effectiveness. Science is full of examples of this. Fortunately these obstacles, as regards vaccination, are not such as to impair the confidence of physicians in its protective power, and it is not too much to expect that this simple operation will yet be the means of rendering smallpox a disease almost unknown, unless in its modified form.

Vaccination should be performed in the first year of life. In rural districts, where there is little danger of exposure to smallpox, it may be deferred till the age of ten or twelve months. In the city, on the other hand, where there is constant intercourse of people, and where contagious diseases are often contracted in ignorance of the time and place of exposure, an earlier vaccination is advisable. Some physicians recommend performance of the operation as early as the age of four to six weeks. The objection to this is, that if erysipelas occur, so young an infant is apt to perish from it, whereas an infant three or four months old ordinarily recovers. For this reason I believe that the most suitable age is about four months for the city infant, in ordinary times; but if smallpox be epidemic, vaccination should be performed at an earlier age. I have vaccinated even the new-born infant when smallpox had broken out in adjoining apartments.

Vaccinia usually extinguishes, for a time, the susceptibility to smallpox. According to M. Gintrac, varioloid does not occur within two years in those who have been vaccinated. It may, however, in exceptional instances, occur in a mild form within a few months after vaccination. The protection afforded by vaccination gradually diminishes by time, but it does not probably, as a rule, cease entirely. Varioloid, however, occurring thirty or forty years after a successful vaccination, is apt to be severe, and it may even be fatal, showing that it has been but slightly modified. In other cases, even after so long an interval, the symptoms present a degree of mildness which indicates that the protective power of the vaccination is not entirely lost.

If a second vaccination be practised soon after the scab from the first vaccination has fallen, it will usually produce no result, but in other cases it gives rise to a little redness, swelling, and induration, which show that vaccinia has been reproduced, though in a very mild and insignificant form. It is probable that in these cases varioloid might also occur by exposure, though with a mildness corresponding with that of the vaccinia. The longer the period after the first vaccination, the greater the number of those in whom a second vaccination is effective, and, as has already been stated, the greater also the liability to the variolous disease, until the system is protected by a second vaccination. A second vaccination should be performed about the sixth or eighth year, and a third between the fifteenth

and twentieth year. If smallpox be epidemic, it is proper to vaccinate all who have not been vaccinated within three or four years.

Selection of Virus.

The lymph is preferable to the scab for vaccination, provided that it can be obtained fresh. The scab is more easily preserved, and, therefore, if the lymph and the scab be old, the latter is to be preferred. The lymph should be taken on the fifth day, if the vesicle be sufficiently developed. It may also be taken on the sixth, seventh, or even eighth day, provided that the areola have not formed. The lymph of the fifth day acts with greater energy, though that of the sixth or seventh day is not much inferior. Lymph obtained after the formation of the areola is less efficient, though it may communicate the genuine disease.

There is no mode of vaccination so reliable as the use of lymph, taken directly from the arm and immediately inserted—the arm to arm vaccination. Lymph can be preserved for a few days on a flattened surface of whalebone, or the segment of a quill, and if employed within a week, it will usually communicate vaccinia. Lymph may be preserved a longer period between two surfaces of glass, but the best way of preserving it is in capillary glass tubes. The end of the tube is placed within the vesicle, and the lymph ascends by capillary attraction. When a sufficient quantity is received, the ends are sealed, by holding them for a moment in a flame. Care is requisite in doing this, so as not to heat the lymph, as it is spoiled by a temperature much above the body. When the lymph is used, the ends of the tube are broken, and by blowing gently through it, a sufficient quantity is received on the point of a lancet.

If the scab be genuine, it presents a dark-brown or mahogany color, and has a circular, oval, or at least a rounded form ; it is firm, or compact, and has a lustre. Soft, yellowish, and irregular scabs are not genuine, and those of a dull appearance, or without lustre, have usually spoiled in the keeping. The scab is best preserved in soft beeswax, which excludes the air, and it should be kept in a cool place. It is the belief of many that the vaccine virus gradually becomes weaker by passing successively through the human system (Condie, *American Journal of the Medical Sciences*, April, 1865), and that therefore different specimens of virus work with different energy, according to the degree of removal from the cow. To what extent this view is correct is not fully ascertained, but, certainly, if the virus employed continue to produce a small vesicle, attended only by a little inflammation, there is reason to believe that the protection which it imparts is less than that from virus which works with greater energy, and it should be exchanged for such. In New York we are able to obtain at any time lymph directly from the heifer. It has never passed through human blood, for the original lymph came from cattle in one of

the provinces of France, where vaccinia was prevailing epidemically. The popular objection to vaccination is obviated by the use of this lymph, but it works with great energy, producing a large pock, and a sore which is often a month in healing. I have found it very reliable, and prefer to use it in ordinary cases.

CHAPTER VI.

VARICELLA.

Varicella, chicken-pox, or swine-pox, is the shortest and mildest of the eruptive fevers. It is highly contagious, so that few children escape who are exposed to it. Its period of incubation is from fifteen to seventeen days. It is not inoculable, or at least those who have attempted to inoculate with the lymph of varicella have failed. I endeavored to communicate the disease in this way some years ago, but without result. It attacks the same individual but once, and it occurs as an epidemic. It has been thought by some to prevail most immediately before, during, or after epidemics of smallpox, and it has been conjectured that it is a modified form of variola, and hence its name, which signifies little variola. This idea is, however, entertained by few, and it is opposed by the following facts : Varicella may occur after variola, or variola after varicella, without any modification, and the two diseases are very dissimilar as regards gravity of symptoms and duration. The variolous disease, whether smallpox or varioloid, often occurs in the adult ; varicella, on the other hand, is a disease of infancy and childhood. I have seen one adult case, which I recall to mind, and Professor Flint states that he has also observed it, but its occurence at this period of life is rare. Moreover, varicella and variola have been known to occur simultaneously in the same individual. Such a case was reported by M. Delpech, in a memoir published in 1845.

Symptoms.—Varicella usually commences with such symptoms as usher in ordinary mild febrile attacks, namely, headache, languor, chilliness, and sometimes aching in the back and limbs. Fever supervenes, which is usually moderate, the pulse rising perhaps to 100 or 112, and the thermometer showing an increase of temperature, but less than occurs in the other eruptive fevers. These symptoms which precede the eruption are sometimes absent, or are so mild as to escape notice. The fever usually ceases on the second day, but it may return on the following night. The appetite is rarely lost, and most children continue, more or less, at their amusements.

When the above symptoms have continued about twenty-four hours, the eruption appears first over the trunk and soon afterwards over the face and limbs. It consists of minute disseminated papules, which become vesicular in the course of a few hours. The occurrence of the vesicular stage is nearly simultaneous on all parts of the surface. The vesicles lack the hard

indurated base of the variolous eruption, though they are sometimes surrounded by a faint zone of redness. They differ also from the variolous eruption in the absence of umbilication, and in irregularity of shape. Some are small and acuminate, some hemispherical, and of medium size, and others oval or elongated, and of large size. The inflammation is quite superficial, not involving the subcutaneous tissue, and scarcely affecting the deepest layer of the skin.

The vesicles vary in size from the diameter of half a line to that of even three lines. They occasionally give rise to slight itching. On the second day of the eruption, or third day of the disease, they are still fully developed, their liquid contents being nearly transparent. At the close of this day the liquid begins to be somewhat cloudy, and its absorption commences. On the fourth day of the disease desiccation progresses rapidly, and by the fifth the liquid has for the most part disappeared, and a scab results, small, thin, and of a yellowish-brown color. The scabs are soon detached, the redness which indicated their seat disappears, the epiderm which had been raised and removed by the eruption is reproduced in its normal state, and in a few days all evidence of varicella is effaced. A cicatrix occasionally results, but it is due not to the simple varicellar eruption, but to a sore produced from the eruption by the scratching of the child.

The number of vesicles varies considerably in different cases. They are never, so far as I have observed, confluent ; but they are sometimes so abundant in young children that, if the disease were variola, it would be called severe discrete. They occur also on the buccal and faucial surfaces, where they soon break, forming small ulcers.

Diagnosis.—Obviously the only diseases with which varicella is liable to be confounded are such as present vesicles at some stage of their course. From the local vesicular eruptions this disease is diagnosticated by the fact that the vesicles appear on all parts of the surface. It is sometimes mistaken for variola or varioloid, or *vice versa*—a mistake very damaging to the reputation of the physician. The points of differential diagnosis are the symptoms of invasion—severe, and lasting three or four days in the one ; mild, and continuing only one day in the other—an eruption passing slowly through its stages from the papulæ, to the pustulæ, umbilicated, with circular, raised, and inflamed base, appearing first on the face and neck, and not till a day later on the legs, in the one disease ; while in the other the evolution, shape, and course of the eruption, as described above, are materially different. By proper attention to these distinctive features it is rarely difficult to diagnosticate the two diseases.

The prognosis in varicella is always favorable. It does not, of itself, endanger life, nor seriously incommode the patient ; nor does it give rise to complications or sequelæ. The treatment, therefore, is the simplest possible. Mild diet, and a laxative, may be prescribed during the febrile period ; but nothing further is required.

SECTION III.

NON-ERUPTIVE CONTAGIOUS DISEASES.

CHAPTER I.

DIPHTHERIA.

Diphtheria is a disease of antiquity, dating back at least as far as the commencement of the Christian era. Aretæus, at the close of the first century after Christ, described the Malum Ægyptiacum as a malady, which occurred chiefly among children, and was characterized by a white concretion, spreading over the tonsils, a fetid breath, and in some patients by a return of food through the nostrils, and by great dyspnœa, ending in suffocation. Since the commencement of the sixteenth century, numerous epidemics of it have been observed in Europe and America, and at the present time it is one of the most common and fatal epidemic maladies in both continents, while in many localities, especially in large cities, it is established as an endemic.

Age.—Diphtheria is pre-eminently a disease of childhood, a large majority of the cases occurring between the ages of two and ten years. Under the age of one year the younger the child the less the liability to it, and it rarely occurs prior to the fourth month. The age of the youngest patient in my practice, so far as I recollect, whose disease was undoubtedly diphtheria, was three months and a few days; but in one instance, I observed upon the fauces of an infant of six weeks, whose brother had just died of diphtheria, a few white specks, like grains of salt, over each tonsil, which disappeared in three or four days, without the occurrence of any marked symptoms, by the application of a solution of chlorate of potassium. Certain physicians, having charge of maternity wards, have observed a disease, occurring in new-born infants, which bears some resemblance to diphtheria, but which, if it be true diphtheria, presents anomalous features. Thus, Dr. W. S. Bigelow reports in the *Bost. Med. and Surg. Journ.* for March 11, 1875, ten cases, occurring between September and December, 1873, in the Boston Lying-in Asylum, all fatal but two. The prominent symptoms and anatomical characters were : dark hue of skin, hæmaturia, pseudo-membranous exudation upon certain mucous surfaces, dark green stools, spleen enlarged and dark, kidneys engorged, and in some of the

cases effusion of blood into the pelves of these organs, and along the urinary tract, brownish casts in the renal tubes, etc.

Doctor Bigelow refers to what appears to have been similar cases in one of the continental asylums, and I have met one case in some respects similar, which I saw with Doctor Ewing, of New York. Malignant diphtheria appeared in a family in West Fifty-third Street, in the middle of October, 1880. The patient, a boy of ten years, died, and the remaining two children, as soon as the nature of the malady was apparent, were sent from the house. Nevertheless, one of these, precisely seven days after the removal, was attacked by diphtheria of the hæmorrhagic form, and died in less than one week. Blood escaped from the nostrils, fauces, under the skin in numerous places, causing purpuric spots and from the kidneys or urinary tract, causing hæmaturia.

The mother, who was at this time in the sixth month of pregnancy, continued greatly depressed by the occurrence, although she was robust, and her general health good. She had been in constant attendance upon her children. Her infant, born three months subsequently to the occurrence of diphtheria in her family (February 6th, 1881), was well developed, but it presented a similar hæmorrhagic cachexia to that in the second case of diphtheria. Blood escaped from the vessels under the skin, causing blotches and prominences, and from the mucous surfaces. The bleeding was especially persistent and copious from the umbilicus, so that death occurred in less than a week. The mother had at no time any diphtheritic symptoms, yet we know that the diphtheritic poison is subtle and penetrative, producing its peculiar inflammation upon the uterine walls of the parturient woman, even when her fauces are not affected. Nevertheless the ætiological relation of diphtheria to cases like the above is uncertain, and can only be determined by more numerous observations, and thorough examination. In the epidemic observed by Doctor Bigelow, so far as appears from the published account, the mothers, and other inmates, were not affected with diphtheria, and this must give rise to grave doubt whether the malady affecting the infants were really diphtheritic. Diphtheria is infrequent after the middle period of life, and old age appears to possess nearly an immunity from it.

Incubation.—It is only in exceptional instances that we are enabled to ascertain the incubative period of diphtheria. I was enabled to fix it very nearly in the following cases which occurred in my practice. A boy of nine years was in the same room, about one hour on Saturday, with a child who had fatal diphtheria. On the following Tuesday, without any other exposure, he sickened with a malignant form of the same disease. Mrs. E. assisted in nursing a fatal case of diphtheria, from November 11 to 13, 1874, after which she returned home, several blocks away. On the evening of the 15th she complained of sore throat, and on the following day the diphtheritic pseudo-membrane was observed over her tonsils. On the 19th

the exudation had disappeared, and she was convalescent. On the 20th her sister, residing with her, and who had not been elsewhere exposed, was similarly affected, and after three or four days also convalesced. The only other case in the family, a boy, sickened with diphtheria on December 2. In the first of these cases the incubative period seems to have been from two to four days ; while in the last, it was apparently longer. In April, 1876, a little girl died of malignant diphtheria in West Forty-first Street, New York city. Her sister, aged one year, remained with her from April 14 to 17, when she was removed to a distant part of the city, and placed in a family where there was no sickness, and had been no diphtheria. On the night of April 24, seven days after her removal, this infant was observed to be feverish, and on the following day, when I was called to examine her, the characteristic diphtheritic patch had begun to form over the left tonsil. In April, 1875, two sisters, aged seven and five years, resided with their parents, in a boarding-house, in West Twenty-second Street, New York. A playmate in the same house had symptoms which were supposed to be due to a cold, but which were diphtheritic, when one night severe laryngitis occurred, and ended fatally the next day. The physician who had been summoned diagnosticated diphtheria, and the two sisters were immediately removed to a hotel. But seven days subsequently, diphtheria commenced in the older child. The younger was then removed to a distant part of the same hotel, but on the sixth or seventh day subsequently she also became affected with a fatal form of the disease. It is seen that the period of incubation in diphtheria, like that in scarlet fever, varies in different cases. It is from two to eight days, with perhaps an occasional case outside these limits.

Nature.—Diphtheria resembles scarlet fever in certain particulars ; in its incubative period, as we have seen above, in its variability of type from a very mild to a malignant form, in the common seat of its inflammations, namely, upon the fauces and nasal passages, in the profound blood-poisoning and prostration in the graver cases, and in the frequent occurrence of nephritis as a complication or sequel. It resembles both scarlet fever and smallpox in the fact that it is communicable both through the atmosphere and by contact or inoculation. It resembles erysipelas in the variableness of its duration, and in the fact that one attack does not protect the system from another. In its etiology it resembles typhoid fever, for it is not only communicable from person to person, but it is produced by foul exhalations, as sewer gases. But while there are certain resemblances, it is distinguished from all these infectious diseases by marked peculiarities.

Diphtheria is primary or secondary. The secondary form most frequently occurs during epidemics of the other infectious diseases, and as a complication of them. Those infectious maladies which are accompanied by inflammation of the fauces and air passages, are most liable to this complication if they occur in a locality where diphtheria prevails ; the

inflammations of the mucous surfaces accompanying them being transformed into the diphtheritic. In New York, scarlet fever beyond any other disease appears to furnish the conditions which are most favorable for the occurrence of diphtheria, and if these maladies be epidemic in the same locality, not a few of the scarlatinous patients are affected with diphtheria in the latter part of the first, or in the second week, though the converse seldom happens, that a patient with diphtheria contracts scarlet fever. The other infectious diseases, which are most liable to the diphtheritic complication, are measles, variola, hooping-cough, and typhoid fever, the bronchitis of these diseases changing to a pseudo-membranous inflammation.

It is an interesting fact that in a patient suffering from diphtheria, the specific inflammation is apt to occur upon such surfaces as are already the seat of inflammation. A catarrhal inflammation however produced is liable, under the influence of the virus, to become diphtheritic and pseudo-membranous. Thus, if I recollect correctly, four children in the New York Foundling Asylum have had diphtheritic conjunctivitis, occurring upon trachoma, and Bilbroth remarks "catarrhal conjunctivitis," which is so very common, may become diphtheritic" (*Surg. Pathol.*, translated, page 267). All who have seen much of diphtheria are familiar with instances in which a catarrhal inflammation, as from a burn, blister, or wound, as from tracheotomy, becomes diphtheritic. This general fact, in regard to the nature of diphtheria, and its mode of manifestation, namely, that in one affected by diphtheria, the diphtheritic inflammations appear by preference upon such surfaces as are already inflamed, has an important practical bearing. In frequent instances during epidemics of diphtheria, I have known careful and experienced physicians suppose that they were treating catarrhal inflammation of the air passages, when suddenly indubitable signs of diphtheritic disease occurred, usually with a fatal ending. They were obliged to confess to the friends of the patients that they had erred in diagnosis and prognosis, and their reputation was sometimes seriously compromised. Now may there not, at least in a certain proportion of such cases, be an actual change of a non-specific catarrhal or may be croupous to a diphtheritic inflammation, such as occurs in the scarlatinous angina or rubeolous laryngitis in those who contract diphtheria?

The frequent occurrence of epidemics of diphtheria during the last twenty-five years, and the great mortality which has attended them, have awakened an interest in this malady which has led to a careful study of its causes and nature. Till recently these inquiries were entirely clinical, but, during the last few years, a new line of investigation has been followed, namely, that of experimenting on animals, the results being observed by the microscope; and while it has led to the confirmation of facts already ascertained, important discoveries have been made, and more

important ones are probably in waiting. Among those who have taken the lead in this new field of investigation are Oertel, Bühl, and Hueter, of Germany. These microscopists, and several other experimenters of equal reputation who uphold their views, believe that they have discovered the cause of diphtheria, standing, as Oertel says, "on the very borders of the visible," with a high power of the microscope.

This discovery is so important, not only in itself, but from the promise which it gives of the results of future research, and from the stimulus which it imparts to such inquiries, that a brief statement of the facts in reference to it cannot fail to be interesting at the present time, when diphtheria is so prevalent and fatal in this city and country. The minute objects which the observers alluded to have discovered in patients affected with diphtheria, and which, they suppose, cause the disease, are endued with life and motion. They belong to the class of microscopic vegetable parasites which have been designated *bacteria*. The bacteria have been divided by Cohn into four genera, with species; but only two of these, it is thought, sustain a causal relation to diphtheria, namely, the sphero-bacterium or spherical bacterium, or, as Oertel designates it, the *micro-coccus;* and secondly, though in less degree, because less numerous, though coexisting with the other form, and penetrating the tissues with it, the *micro-bacterium*, or rod-like bacterium.

The microscope, in the hands of various observers, has revealed the following important facts relative to diphtheria: In every tissue which is the seat of diphtheritic inflammation, and in every diphtheritic pseudo-membrane, the spherical bacteria occur in immense numbers, accompanied by a smaller number of the other kind. In severe cases, in which the system is infected, they occur also in the blood. Ordinarily, as the symptoms of diphtheria become more grave, a proportionate increase in the number of spherical bacteria can be demonstrated by the microscope. They are found in the discharge from the edges of the wound produced by tracheotomy, performed in the treatment of diphtheritic laryngitis, and upon these edges they multiply rapidly, just before a pseudo-membrane forms. If, upon any surface, which is the seat of ordinary catarrhal inflammation, other vegetable organisms, as the leptothrix buccalis, or oïdium albicans, are present—if diphtheritic inflammation supervene, these organisms diminish and disappear, as if deprived of the required nutriment, and are succeeded by the sphero- and micro-bacteria, which increase in numbers as the specific inflammation extends. On the other hand, when the diphtheritic inflammation abates, these bacteria disappear, and other vegetable forms may succeed. In the very commencement of diphtheria, the grayish-white spots which appear upon the inflamed surface consist entirely of these bacteria, with epithelial cells and mucus, while fibrin and pus appear at a later period, as a result of inflammatory reaction.

These facts having been ascertained, various experiments were made by

Oertel, Hueter, Von Trendelenburg, Nasseloff, Eberth, and others, in order to determine more fully the exact relation of the sphero-bacteria and micro-bacteria to diphtheria. These organisms were not found in the croupous membrane, produced by the application of a powerful chemical agent, as ammonia, nor upon the inflamed surface underneath the membrane, "although the fibrous exudation afforded a soil which varied little or not at all in its histological and chemical composition from that induced by diphtheria." (Oertel.) The mucous membrane of the air passages, the cornea and muscles in animals, were inoculated with diphtheritic matter, and these two kinds of bacteria were found to increase rapidly, penetrating the tissues in a short time, and infecting the system. Oertel says: "I have noticed in numerous inoculations that if various bacteria, besides the micrococcus, as, for instance, bacillus, spirillum, and bacterium lineola, were present in the matter to be inoculated, only micrococci (sphero-bacteria) and the bacterium termo (in its most minute forms accompanying them) showed evidence of prolific growth, while all the other forms disappeared altogether." Nasseloff and Eberth inoculated the cornea with diphtheritic matter, and found that the sphero-bacteria and micro-bacteria penetrated its layers, forcing them apart, and causing within a few days intense keratitis and the death of the animal by infection of its blood. "In the same way," says Oertel, "according to my experiments, the bacteria spread over the mucous membrane of the trachea, beset the cellular elements, crowd especially into the young exudation cells, or are taken up by them, and gradually cause their dissolution; they fill the blood and lymph-vessels, and bring about, in a mechanical way, a damming up of the fluids, and, as a consequence, serous exudation. As they close up the capillary vessels, they occasion stagnation in the blood circulation, which induces disturbance of nutrition in the walls of the capillaries, and even rupture of the same. Muscular fibres, also, which are covered and filled with colonies of micrococci, degenerate and slough; in like manner, in severe cases, immense numbers of bacteria appear heaped up in the uriniferous tubules and Malpighian corpuscles of the kidneys, and occasion there parenchymatous inflammation, capillary embolism of the glomeruli of the kidney, with ruptured vessels and formation of epithelial casts in the tubes. In the lymph and blood streams (compare also Hueter), in long-continued sickness of the animal experimented on, these bacteria also accumulate in masses. They induce, as exciters of decomposition and disorganization of organic nitrogenous bodies, septicæmia, through the vegetative process they undergo, and through their relation to oxygen."

Finally, Erfurth repeatedly inoculated the cornea with a negative result, using for the purpose diphtheritic material from which the bacteria had been so far as possible separated.

The importance of such experiments cannot be too highly estimated. In the opinion of those who have performed them, the conclusion is inevitable

that diphtheria is produced by bacteria, which, coming in contact with the mucous membrane, or the cuticle deprived of its epidermic covering, adhere to it; and these, multiplying rapidly, burrow through the tissues, and entering the vessels, infect the whole system. The reason assigned why diphtheritic inflammation in most cases appears primarily and chiefly upon the faucial and nasal surfaces is, that the air, which contains the germs of the bacteria, constantly passes over these surfaces, and, as regards the fauces, the ingesta also, which may contain them. The important practical inference from this theory is, that diphtheria is entirely local in its commencement, and is amenable to local measures.

These experiments, apparently so conclusive, and the brilliant results claimed for them, probably produce at first in most persons engaged in microscopical or pathological studies, a degree of enthusiasm in the belief that a new era is dawning in our knowledge of the contagious and miasmatic diseases. And since the German microscopists and pathologists are close and accurate observers, we accord to their researches and opinions a degree of credence which we are reluctant to yield to our own scientists who are engaged in similar studies.

But the causes and nature of a disease cannot, in general, be fully elucidated by experiments alone, such as have been detailed. They should be aided or supplemented by clinical observations, and of these, as regards diphtheria, we have had an abundance in New York during the past fifteen years. Clinical observations may modify or correct the theories derived from the results of experiments.

Two distinct propositions are evidently included in the bacterian theory, to wit: that bacteria cause diphtheria, and secondly, that this disease is at first local, and that afterwards it becomes constitutional or general by the entrance of the specific principle into the blood. Whether diphtheria be primarily local or primarily constitutional, or be in some at first local and in others at first constitutional, is of course a distinct proposition from that regarding the relation of bacteria to the malady; and whatever the truth may be in reference to the one, does not affect the other.

It is evident that the truth regarding the relation of bacteria to diphtheria is either that they are the specific principle, and therefore cause the disease, or that the cause is something more subtle, not yet discovered, which produces such deterioration of the tissues and blood that they become a nidus, in which bacteria are early and rapidly developed. My own belief is more and more established that the latter is the true theory; and that those who believe otherwise have mistaken an effect for the cause. As a deteriorated condition of the buccal surface and its secretions furnishes the nidus, in which the *oïdium albicans* springs up, so, it seems to me not improbable that those minute organisms found in and upon the tissues in the infectious diseases, as that seen by Letzerich in pertussis, and the bacteria in diphtheria, will yet be shown to be secondary pro-

ductions, and not causative agents. From the very early appearance of bacteria in diphtheritic processes, we may believe that they sustain a close relation to the specific principle, and that this principle is even attached to them, so that they are agents of infection, and yet withhold our assent from the doctrine that they are, themselves, the specific principle, or that it proceeds from them.

With an experienced microscopist of New York, I have examined the secretions and exudations upon the fauces in various cases of pharyngitis, both diphtheritic and non-diphtheritic, and we ordinarily found the micrococcus in abundance in the inflammatory product, whether diphtheritic or non-diphtheritic, a secretion or exudation, if it had remained some time upon the surface of the fauces. In one case of simple pharyngitis, no bacteria could be discovered on the first day in the secretion which lay in the depressions over the tonsils, while, on the second day, numerous micrococci had appeared. Micrococci, then, which are not distinguishable with our present means of observation from those in a diphtheritic exudation, may occur in great numbers in the secretions of non-specific inflammations, so that their presence does not afford certain indication of the diphtheritic disease. It is also well known that bacteria, which seem to be identical with those in diphtheria, are frequently found upon the gums and between the teeth in health. Moreover, in the intervals of epidemics, and in localities where diphtheria has not occurred, or has occurred rarely, the microscope discloses the existence of bacteria, which resemble in form and activity those found in diphtheritic products, and in sufficient numbers to justify the belief that they frequently pass over the fauces in the inspired air. How remarkable, if the bacterian theory be true, that fungi, which, under ordinary circumstances, are innocuous, should exhibit the fearful energy and destructive power which we observe in diphtheria! It has however been suggested to me, that the diphtheritic bacteria may possess peculiar functions and properties, since it is very difficult to observe differences which may exist, and to classify organisms which are "just on the borders of the visible." A fact which, till it is satisfactorily explained, must, I think, throw doubt on the bacterian theory, is that the bacteria do not irritate the lungs. If, during inspiration, they are carried along the current of air, and certain of them lodge upon the fauces, where they produce the specific inflammation, a larger number must enter the lungs, where we would suppose, from the delicate structure of these organs and their proneness to inflammation, they would produce severe results; so far from this occurring, bronchial and pulmonary catarrhs are rare at the commencement of diphtheria, and not common at any stage of the malady.

Since the publication of the bacterian theory, I have made microscopic examinations of diphtheritic pseudo-membranes, in order to observe the form and movements of the micrococci, and the effect upon them of the

medicinal substances which I have been in the habit of applying to the throat in diphtheria. With a magnifying power of 500 diameters, these parasites are seen as dancing or oscillating points, or rather as minute cells, shining or opaque, according to their distance from the eye. No one can, I think, observe their constant motion without admitting that they may, when in colonies, be irritants of the tissue with which they are in contact in the system, diverting nutrition and disturbing the function ; and without also believing, since they are so much smaller than the blood-corpuscles, that multitudes of them may enter the circulation, since, in the deepest portion of the pseudo-membrane, they are in immediate relation with the capillaries and lymphatic vessels. It is not improbable, in view of these facts, that the spanæmia of diphtheria is partly attributable to these organisms in the lymph and blood, for they could hardly exist in these liquids in any number without interfering seriously with the nutritive process.

We may, therefore, believe that bacteria play a certain part in producing the diphtheritic cachexia, while we hold that the specific principle has probably thus far eluded the very thorough search instituted for its detection. Does not also the prevalence of inflammatory throat affections, some of which are very mild, during an epidemic of diphtheria, indicate an obscure meteorological cause of the disease quite distinct from the bacteria? Moreover, does not that common sequel of diphtheria, namely, paralysis, indicate that there is something peculiar in the diphtheritic virus, that it is distinct in nature and action from the bacteria and from septic poison?—since those who recover from septicæmia, as it occurs in surgical and other cases, and in which disease bacteria are abundantly developed in the blood, have no special liability to paralysis. Another fact, indicating a cause distinct from the bacteria, but a cause acting probably in the same manner as that of scarlet fever and measles, is the long incubative period in certain cases, as we have seen above. Fungi visible under the microscope, and multiplying with great rapidity, would not probably remain a whole week in or upon the tissues without producing the least symptom, and then suddenly produce a dangerous disease.

If the views expressed above be correct, it seems probable that diphtheria is a constitutional disease from its inception. With sufficient observation of cases, and careful examination of the clinical history, facts appear which, I think, will lead most observers to this conclusion. The importance of the subject will justify the following statement of some of these facts.

1. It is a law in pathology that those diseases which have or may have a long incubative period—say of a week or more—are constitutional.

2. Another fact, which indicates primary blood poisoning in diphtheria, is observed in certain cases, namely, the *occurrence of severe constitutional symptoms for a longer or shorter time, perhaps for half a day, before the*

appearance of the usual inflammation. Thus a girl of five years, having malignant diphtheria, whom I saw in consultation, was carefully examined on the first day of her sickness by the attending physician, and, although he closely inspected the fauces, there was no appearance which indicated the nature of the malady till the subsequent day. In such cases, a sufficient number of which I have observed, there is apt to be complaint of soreness of the throat, or difficulty in swallowing, almost from the beginning of the general symptoms; but the pain and tenderness seem to be in the deeper tissues of the neck, and the fact that redness of the mucous surface does not appear till some hours subsequently, is evidence that the inflammation is developed from within, and not from the irritating effect of the poison upon the surface.

Again, treatment of the inflammations by the most reliable and efficient antiseptics and disinfectants which we possess, commenced at the earliest possible moment and repeated at short intervals, does not prevent the occurrence of indubitable symptoms of blood poisoning in cases of a severe type. Thus I have treated every portion of the inflamed surface, as far as it was accessible, every second or third hour, with carbolic acid and other disinfectants, almost from the very commencement of diphtheria, and so thoroughly that any vegetable or animal poison with which the remedies had come in contact would probably have been destroyed, or rendered inert, and yet, except in mild cases, symptoms of diphtheritic blood poisoning have occurred, and as early and uniformly as if less energetic local measures had been employed. While, therefore, I do not fail to recommend local treatment as calculated to diminish septic poisoning, and relieve the inflammations, I have lost confidence in it as a means of preventing the entrance of the diphtheritic poison into the blood. Its powerlessness to prevent contamination of the blood by the diphtheritic virus is an additional evidence that this contamination occurs independently of the local disease, and probably precedes it.

3. *The quick succumbing of the system in certain malignant cases* is evidently due to diphtheritic toxæmia. We sometimes observe a fatal result on the second, third, or fourth day, without any dyspnœa, or sufficient laryngitis to compromise life. Cases of this kind, terminating fatally even in the first day, have been reported. The system is suddenly overpowered by the poison, struck down, as it were, by the profound blood change, while the inflammations are still in their incipiency.

4. Important evidence of the constitutional nature of diphtheria is afforded also by the *state of the kidneys.* No internal organs are so often affected in diphtheria as the kidneys, and on account of their location and anatomical relation, it is evident that the poison first passes through the system before it reaches them. Any clinical or anatomical fact, therefore, which indicates that the diphtheritic virus has reached and affected the kidneys, affords proof that it has penetrated the system, and poisoned

the blood. Now the occurrence of albumen, with granular or hyaline casts, in the urine, in cases unattended by dyspnœa, affords proof of nephritis, caused by the action of the poison on the kidneys.

Sir John Rose Cormack, of Paris, in a series of interesting and useful papers relating to diphtheria, published in the *Edinburgh Medical Journal* during 1876, states that albuminuria, and of course the nephritis on which it depends, sometimes begin as early as the first day. My observations confirm this statement, as in the following cases :

Case I.—L. McD., aged three years, was first visited by me on February 29, 1876. I learned from the parents that she had been feverish during the preceding forty-eight hours, and her urine very scanty. A moment's examination was sufficient to show that the case was one of malignant diphtheria, for the fauces were already nearly covered by the diphtheritic pellicle, the temperature was 103¼°, and the pulse 140. The skin was hot and dry, and there was moderate swelling under the ears, and a muco-purulent discharge from the nostrils. On account of the scantiness of the urine, the amount not exceeding f ℥ iv-v daily, it was impossible to obtain sufficient for examination till the following day. It was then found to have a specific gravity of 1032, to contain a deposit of urates and hyaline and granular casts, a diminished amount of urea, and a large quantity of albumen. It can hardly be doubted, from the scantiness of the urine, and the large amount of albumen found when the urine was first examined, that albuminuria had been present on the first day.

Case II.—The following was a similar case : K., aged four years, living in West Thirty-sixth Street, was visited by me in consultation on Jan. 29, 1875. Her sickness had also continued forty-eight hours ; her fauces were swollen, and covered with the diphtheritic pellicle, which was dark and offensive ; respiration guttural ; pulse 120 ; temp. 101° ; she had a free discharge from each nostril ; urine scanty, its specific gravity 1030 ; it contained a small amount of albumen, with casts, and a large amount of urates, with no apparent diminution of the urea. Death occurred on the fourth day.

In such severe cases, in which albumen and casts are found in the urine at the first visit of the physician, there can be little doubt that the nephritis begins nearly or quite as early as the pharyngitis, and therefore, since poisoning of the blood must antedate the renal disease, diphtheria is in these cases very early, probably from the occurrence of the first symptoms, a constitutional malady.

Again there are cases, though not frequent—three I can recall to mind during the last two years in my practice—in which the external manifestations of diphtheria are very mild, even insignificant, and quickly cured, but in which the kidneys are severely affected. The occurrence of such cases is best explained on the supposition that the first departure from the state of health is in the blood, and that the blood change gives rise to the inflammation of the mucous membrane externally, and of the kidneys internally, rather than upon the supposition that the transient and insignificant inflammation of the mucous membrane is the first event in the

series of morbid changes, and that this inflammation leads to poisoning of the blood, and the establishment of a much more severe and protracted inflammation in the kidneys. The following are histories of the cases alluded to :

The house 229 West Nineteenth Street, New York, is an old wooden structure, and the family, which has occupied it during the last five years, has been three times visited by diphtheria, the first case, that of the oldest child, proving fatal. In February, 1876, one of the children had diphtheria in a moderately severe form. He recovered, and, after my visits had been discontinued, his sister, aged six years, who had had scarlet fever when eighteen months old, became feverish, and complained of her throat. No rash appeared on her skin, and there was apparently no coryza. Inspection of the fauces by the parents revealed a small diphtheritic patch over each tonsil. Although diphtheria was so frightful a malady to this family from their past experience, the case seemed so mild that the parents treated it without medical attendance, by the remedies which had been employed for the boy. A mixture of carbolic acid, subsulphate of iron, and glycerine, was applied to the fauces every third hour, sufficiently often, apparently, to destroy all bacteria or other vegetable or animal organisms with which it might have come in contact, and within two or three days the inflammation of the throat seemed to the parents to be cured. Nevertheless, with this insignificant inflammation of the fauces, so quickly subdued, and with no other apparent inflammation of the mucous surfaces, there was severe internal disease going on as the result of the general infection. The child did not regain her former appetite ; she had increasing pallor, although able to play about the house ; and, finally, in the third week, when I was called to see her, slight œdema of the face and limbs was observed. Her urine, which was scanty, was found to contain pus and blood corpuscles, albumen, and granular casts, and nearly two months elapsed before, under treatment, it became normal, and her health was restored.

The second case occurred in January, 1878, in West Fifty-first Street. A boy, aged six years, in a family in which diphtheria was occurring, had slight sore-throat, which abated in two or three days. It was attended by little or no exudation, and would not have been considered diphtheritic, except for the circumstances in which it occurred, and the subsequent history. Still, the boy remained ill, and fretful, and four days subsequently his urine was found to be very scanty and very albuminous ; and three days later death occurred, preceded by total suppression of urine. The last urine passed, which was not more than a teaspoonful, became nearly semi-solid by heat. There had been no scarlet fever in the family.

The above facts indicate, in my opinion, the constitutional nature of diphtheria ; but within the last few years the old doctrine that diphtheria is local in its commencement, and is, therefore, at least in many instances, amenable to local treatment early applied, has been so revived and promoted by the advocates of the bacterian theory that it has had a marked influence upon the treatment. It does, indeed, sometimes seem as if mild cases, which may apparently fully recover in two or three days, with only local measures, could not be attended by systemic infection ; but we ob-

serve the same mildness, though less frequently, in scarlet fever; and not infrequently, even in the mildest cases, the constitutional nature of diphtheria is shown by the return, and return more than once, of the pseudo-membrane after it has been fully removed by local treatment. The persistence of the inflammation, and of its peculiar exudative nature, corresponds more with the history of those phlegmasiæ which proceed from the state of the blood, than of those which are merely local.

Diphtheria, as experiments on animals and the histories of many reported cases show, is sometimes communicated by inoculation. Most frequently, however, the virus is received from an infected atmosphere. The anti-hygienic conditions in which it originates are well known. Many cases in New York are traced to sewer gases, which have escaped into houses through imperfect plumbing.

When diphtheria reappeared in New York in 1858, after an absence of more than fifty years, some of the first and most severe cases seen by myself occurred in the upper part of the city, along the old water-courses, where in consequence of street grading, water was stagnant and impregnated with decaying animal and vegetable matter. Though observing and treating diphtheria, both in its epidemic and sporadic form, during the last twenty-five years, I have not observed an instance in which it seemed to be communicated from house to house by the clothing of a third person, as we frequently observe in cases of scarlet fever, and sometimes of measles. When it spreads from house to house, or even from room to room, in the same house, I think that it is almost always by the visits of persons having diphtheritic inflammation. The area of contagiousness of diphtheria is therefore limited to the room in which the patient resides, or to his immediate vicinity.

But it is well known that the sputum of a diphtheritic patient and bits of diphtheritic pseudo-membrane may communicate diphtheria. The experiments indeed show this, as do many observations published in the records of diphtheria. Therefore, caution is required that children be not needlessly exposed to the handkerchiefs or towels employed by a patient, nor to his breath, especially during the act of coughing. We may here repeat that in localities where diphtheria is endemic or epidemic, certain constitutional diseases sustain a causative relation to diphtheria. Thus scarlet fever furnishes the conditions in which diphtheria arises in a house whose sanitary state is apparently good, and when there has apparently been no exposure to a diphtheritic patient. In three instances I have known diphtheria thus originating to become dissociated from scarlet fever, and spread as a primary and independent malady.

Anatomical Characters.—In the commencement of diphtheria we observe redness of some portion of the mucous surface. In most cases it is the faucial membrane which is first affected, and that part of it which covers the tonsils. If there be a pre-existing inflammation of one of the

other mucous surfaces, or a portion of the cuticle denuded of its epidermis and inflamed, the specific inflammation is apt to appear primarily upon these parts, with or without its simultaneous appearance upon the faucial surface, a fact to which allusion has been made above.

The inflammation varies greatly in severity and extent. In a mild attack it is often limited to a part of the fauces, and there are few exceptions to the rule that the tonsillar portion is affected, the redness gradually fading away in the healthy membrane beyond. In all except the mildest cases, the whole faucial surface is, in the course of a few hours, involved in the inflammatory process, its mucous membrane is thickened and softened, and its follicles tumefied, and actively secreting. In severe cases the uvula is elongated and enlarged from watery infiltration ; the submucous connective tissue also becomes involved to a greater or less extent, and swells ; and the submucous lymphatic glands, especially the tonsils, also swell, and are painful. The color of the inflamed surface is sometimes a deep, bright red, almost like arterial blood ; in other cases it is a dusky red, which indicates a vitiated state of the blood. The dusky red hue is more common in secondary than in primary diphtheria ; it is also common in the obstructive laryngitis of diphtheria, the color becoming more and more dusky as the obstruction increases.

Within a day, and usually within a few hours, from the commencement of the inflammation, a small slightly raised patch or spot is observed, usually upon the tonsillar portion of the inflamed surface, of little importance, did the disease stop here, but very significant as a diagnostic sign, and as a forerunner of what is to happen. This patch, termed the pseudo-membrane, gradually becomes firmer, and at the same time thicker and broader from fresh exudations underneath, and it has a grayish or grayish white color. Sometimes different points or patches are observed, which extend and coalesce so that the fauces are almost entirely concealed from view. The pseudo-membrane is closely attached to the mucous surface, which it penetrates, becoming firm, and not easily detached. Attempts to separate it often lacerate the engorged capillaries, producing a free flow of blood. It does not ordinarily attain a greater thickness than one-eighth to one-sixth of an inch. I have seen it, however, not far from one-third of an inch thick. By the microscope we observe numerous micrococci with a small number of rod-like bacteria in the meshes of the exudation. They can be traced through the subepithelial tissues, being adherent to and even incorporated in pus-cells, and entering into and blocking up the minute lymphatics and bloodvessels.

The same pseudo-membrane is often firmer in one part than another, the outer and central portions being more compact and tough for a time than that underneath, which is more recent, and in which there is less fibrillation. After a few days, however, decomposition commences, and then that which was first formed becomes softer than the more recent produc-

tion. When this occurs, the color of the exudation changes from a whitish or a grayish white to a dirty brown, and its exposed surface is uneven and jagged from the partial separation of shreds and fibres.

The escape of the liquor sanguinis from the engorged vessels diminishes somewhat the turgescence of the inflamed tissue. If this be considerable, the pseudo-membrane often sinks to the level of the surrounding surface, producing an appearance very much like that of an ulcer, or even of gangrene. Though there is no loss of substance in this stage of the pseudo-membrane, it does, however, often occur, being produced by the presence and contraction of the fibrin with which the mucous membrane is infiltrated. Sometimes the pseudo-membrane has a reddish tinge. This is due to rupture of the capillaries, and the escape of the blood-corpuscles. It occurs in those cases in which the inflammation is intense, and the capillaries are greatly engorged. Sometimes the lower part of the exudation is blood-stained, while the exposed surface has the usual grayish white hue. For a very interesting and instructive description of the anatomical characters of the diphtheritic pseudo-membrane, the reader is referred to the treatise of Prof. Rindfleisch, of Bonn, relating to pathological histology. His description is as follows :

" Genuine diphtheritis has no claim to be regarded as a specific process in the same measure as croup. That which microscopically characterizes it, and has become the occasion of placing it as a membranous inflammation is the formation of a whitish-gray, compact, felted membrane, which is elevated, perhaps, to the height of one-half line along the level of the mucous membrane, but penetrates just as deep into the substance of the mucous membrane, and is most intimately connected with the latter. This membrane is nothing that is superimposed, nothing secreted, but the mucosa itself, as far as it has been partly tumefied, partly rendered anæmic, even by the excessive infiltration with cells. This condition has not improperly been compared with a mortification by a chemical agent, with a corrosion, and the diphtheritic membrane has been designated as diphtheritic scab ; in fact the diphtheritic membrane is a *caput mortuum*, it can undergo no other changes than those of putrefaction, of decomposition ; and the question only is, how it is loosened and removed from the intimate organic connection in which it stands with the mucous membrane. A sharply defined boundary line separates, as we can convince ourselves with the naked eye, the living from the dead ; but numerous connective-tissue fibres, bloodvessels, nerves, and elastic fibres, pass over from the the living into the dead ; they must all have separated ere the loosening can proceed. The means which are placed at the command of the organism are inflammation and suppuration. We call this inflammation ' reactive,' and unite with it the idea as though this were an answer to the irritation, which the diphtheritic scab exerts upon the surrounding mucous membrane ; yet a portion of the hyperæmia also may be explained accord-

ing to static principles as collateral fluxion. The pus collects between the scab and the healthy parts and always, accordingly as the fibrous bridges mentioned melt down and tear, the separation begins now at the edges, then at the centre. After it is completed an ulcer remains behind which is disposed to rapid cicatrization ; not unfrequently, however, the process repeats itself again at the same place ; we have a new scab, and with it anew the necessity of a purulent separation, after whose termination a very considerable loss of substance remains. The cicatrices finally resulting distinguish themselves by their capacity of vigorous retraction, so that the danger of subsequent contraction of mucous membrane canals, especially of the large intestine after dysentery, threatens so much the more, the more diffused the ulceration was." (*Text-book of Pathological Histology*, translated, page 354.)

Two of the microscopists of New York who, for years, have been engaged in microscopical and pathological studies, kindly consented to examine for me the anatomical characters in the following cases. The examinations in the first, second, and fourth cases were by Dr. Satherthwaite ; in the third by Dr. Heitzman, formerly clinical assistant to Prof. Rokitansky, in Vienna. The specimens were placed in a solution of bichromate of potassium immediately after their removal from the bodies :

Case I.—H——, aged four years, and two brothers S., who lived directly opposite in the same street in New York, were daily playmates. On January 27, 1876, H—— became feverish and complained of sore throat, and four days subsequently died of malignant diphtheria. This case was carefully examined by me in consultation, and minute records of it preserved. Before it terminated, the two brothers S. became affected with diphtheritic laryngitis. The younger brother, aged three years, was for a time in a very critical state from the dyspnœa, but recovered in about one week. The older brother, aged six years, died, having the following history : On January 29, two days after the commencement of diphtheria in his playmate, H——, he vomited and became feverish, and his voice hoarse. These symptoms continuing, I was asked to visit him on February 2. His respiration at this time was harsh, and audible in the adjoining room, and the cough croupy ; pulse 96 ; temperature in axilla 100° ; he takes considerable nutriment, and sits quietly, or walks about the room ; fauces red, and slightly swollen, but without any diphtheritic exudation upon their surface ; has slight glandular swelling underneath the ears ; the urine contains no albumen, and the nitric-acid test shows no excess of urea. The constant inhalation of the spray of lime-water is recommended, with the use of tonics. Feb. 4. Pulse 96, temperature 99° ; breathes with much difficulty at times, but there is still no pseudo-membrane upon the fauces ; has expectorated since the last record two thick pieces of pseudo-membrane, each about one inch in length, apparently from the larynx ; specific gravity of urine 1022 ; it contains a deposit of urates, but no albumen ; urea apparently somewhat in excess of the normal quantity. Feb. 5. Pulse 92 ; temperature 101¾° ; has a small diphtheritic patch, not more than three lines in diameter, over the left tonsil. Feb. 6. The pellicle upon the tonsils has disappeared ; the urine for the first time albuminous,

thirty-six hours before death ; its specific gravity 1024 ; temperature 103° ; dyspnœa great ; pulse about 120. Death occurred on Feb. 7.

Sectio Cadaveris, nineteen hours after death.—Body spare, but not emaciated ; rigor mortis present ; has post-mortem extravasation of blood along the back, and a thin blood-stained fluid escapes from the mouth ; two or three drachms of transparent liquid in the pericardial sac ; a large yellowish-white clot fills the right ventricle, and is prolonged into the pulmonary artery ; the right auricle also contains a large clot, soft and dark in its centre, but firmer and of a whiter color externally ; left ventricle contains a few soft dark clots, with a little fluid blood ; left auricle partly filled with blood of a tarry appearance ; tonsils not enlarged, but soft, and a yellowish diffluent secretion lies in the depressions on their surface ; subcutaneous glands of the neck slightly enlarged, one being somewhat larger than a filbert ; under surface of epiglottis, and entire surface of larynx, covered by a firmly adherent pseudo-membrane which entirely conceals from view the vocal cords and sinuses of Morgagni ; the pseudo-membrane is continued over the surface of the trachea, being less adherent than in the larynx, and, near the bifurcation, it floats freely ; it does not extend into the bronchus or bronchial tubes of the left lung, and this lung is normal. In the right lung the pseudo-membrane extends as far as the bronchial tubes of the third order ; the upper lobe of the right lung is in the second stage of pneumonia, its cut surface being rough and granular, and liquid escaping from it on pressure ; the right, middle, and lower lobes are congested, and in the lower lobe is a single hepatized nodule ; those portions of the bronchial tubes which are not covered by the false membrane exhibit the appearance of catarrhal bronchitis. The liver is large, and not fatty; spleen small, moderately firm, and contracted (this is noteworthy, as the spleen has been found large and soft in diphtheria) ; kidneys congested and swollen, and a stellate appearance of the vessels under their capsules ; surface of both small and large intestines congested.

Microscopic Examination.—Red corpuscles of the blood well-preserved, some of them round, others crenated, and all granular ; large masses of transparent material, containing red corpuscles, floated in the blood. The rod and chain forms of bacteria were observed in the blood, but not in greater number than are often seen in other blood the same number of hours after death. (A few grains of chloral had been added to this specimen of blood immediately after its removal.) Substance of heart apparently normal, showing no fatty degeneration, nor infiltration ; no bacteria can be recognized in the substance of the heart. *Kidneys*. Right kidney examined ; Malpighian bodies congested, and extravasations of blood throughout this organ ; tubal epithelium granular ; increase of connective tissue in points near periphery of kidney, showing insterstitial nephritis, but no increase observed in this tissue in other parts of the organ ; no bacteria that could be certainly recognized as such in the kidney. *Spleen:* Multitudes of granules in scrapings from the cut surface of this organ, many of them so small as to be with difficulty recognized with a magnifying power of over 600 diameters ; some of them gave the appearance of the usual forms of bacteria.

Larynx: Thickness of false membrane which covered the entire surface of this organ varied from $\frac{1}{100}$ to $\frac{1}{25}$ of an inch ; thickness of mucous membrane about $\frac{1}{50}$ of an inch ; epithelial border of mucous membrane could be traced inwards $\frac{1}{200}$ to $\frac{1}{100}$ of an inch, where it became indistinct, merging into the other tissues, which were more or less infiltrated with embryonic

cells and blood. The false membrane consisted of a network of a homogeneous material, most of the meshes being empty, but those nearest the epithelial layer containing more or fewer epithelial cells. The boundary line between the false membrane and mucous surface could not be distinguished by the microscope in many of the sections, the network of the pseudo-membrane extending into the mucous membrane. But in other places the line of separation could be distinguished, and here and there the pseudo-membrane and mucous surface were separated by collections of embryonic cells. The lymph follicles and racemose glands were apparently normal ; mucous surface infiltrated with granular matter and red blood corpuscles ; cylindrical epithelial cells, some of them with cilia, were distinctly visible both along the free border, and in the under surface of the pseudo-membrane. *Trachea :* The false membrane measures from about $\frac{1}{100}$ to $\frac{1}{30}$ of an inch in thickness ; the mucous membrane $\frac{1}{50}$ of an inch, and its epithelial layer $\frac{1}{120}$ of an inch ; the epithelial cells are much more distinctly visible than in the larynx, and the line of separation of the adventitious layer and the mucous surface is everywhere distinctly seen under the microscope ; the false membrane has the same general appearance as in the larynx ; but the mucous membrane is in a better preserved state than that of the larynx ; it is nevertheless infiltrated with granular matter, plastic matter, and red blood-corpuscles ; lymph follicles and racemose glands apparently normal ; in the trachea, as in the larynx, a large number of embryonic or lymphoid cells—most of them no doubt becoming pus cells—lay between the false membrane and the mucous surface.

Case II.—A second case, having the following history, occurred in the New York Foundling Asylum in New York. George, aged two years and seven months, was under treatment for a second attack of measles, the eruption appearing on March 23, 1876. On March 24, the pulse was 136 and temperature 104½°. The fauces presented a deep-red appearance indicating severe pharyngitis, but without any membranous exudation. March 25. Pulse 140 ; temperature 103¼° ; the rubeolar eruption is very thick over the entire surface. The Sister who has charge of the ward, noticing unusual offensiveness of the breath, has inspected the fauces and found on them the diphtheritic pellicle. March 26. Cough becoming croupy, and voice hoarse ; pulse 152 ; temperature 105¼°. From this date the dyspnœa progressively increased, and death occurred on March 30.

Sectio Cadaveris.—A considerable part of the interior of the larynx is coated with the diphtheritic pseudo-membrane, which is firmly attached to the mucous surface ; it extends without interruption over the larynx, and perhaps over one-third to one-half of the tracheal surface. It is not attached to this surface, but hangs over it like a curtain, suspended from its attachment in the larynx. Further down in the air passages there is the usual catarrhal inflammation of the mucous surface.

Microscopic Examination.—Larynx : The false membrane is found to consist of a network, apparently fibrinous ; in places, in the larynx, it is raised from the mucous membrane by an accumulation of embryonic or lymphoid cells underneath ; in other places it is adherent to the mucous membrane, but with a line of attachment which can be distinctly made out with the microscope ; while in other places still the network extends down into the mucous membrane, and no distinct line of separation can be seen. In the upper or exposed portion of the false membrane, no embryonic or lymphoid corpuscles are observed, but they are abundant in the deeper portion, and they infiltrate the whole mucous membrane extensively ; upon

the mucous surface, wherever the pseudo-membrane is detached, these corpuscles are abundant ; in parts of the false membrane they fill so completely the interstices of the network that epithelial cells can scarcely be distinguished within them ; in places, in the sections examined, the epithelium seemed to be wholly replaced by granular matter ; in general, the border line between the diphtheritic membrane and the mucous surface is marked by a somewhat denser exudation of the albuminate—a fibrinous appearing material—than is seen in the false membrane generally ; the bloodvessels in the mucous membrane of the larynx are numerous, and distended with blood. *Trachea :* The epithelium, consisting of from two to three layers, is seen to be intact wherever it is observed ; the surface of the epithelium is covered with minute markings, probably the cilia in contraction ; the pseudo-membrane is not seen to be reticulated as in the larynx, perhaps from the contractions which had occurred in it ; it appeared granular and fibrous, and contained but few corpuscles. *Lungs :* A portion of one lung was found hepatized, and the alveoli of this portion contained pus cells, epithelial cells, blood, and a fibrinous appearing material (croupous pneumonia). *Kidneys :* The changes observed in these organs were those of tubal nephritis ; the tubes were highly granular, both in the pyramids and cortex ; no increase in the interstitial connective tissue was noticed ; in places the tubes were not granular. The muscular tissue of the *heart* seemed normal.

Case III.—J ——, aged four years, an inmate of the New York Foundling Asylum, began to have a sore-throat on March 4, 1876. The fauces were red and somewhat swollen, but without any membranous exudation, and the diphtheritic nature of the disease was not at first suspected. My attention was first called to this case on March 11, on account of almost total suppression of urine. The fauces were still injected, and somewhat swollen from catarrhal inflammation ; there was a copious muco-purulent discharge fom the nostrils ; pulse 148. March 13. Pulse 144 ; temperature $101\frac{1}{4}^{\circ}$; urine still nearly suppressed, though one drachm of infusion of digitalis is administered every fourth hour, and bromide of potassium, four grains, every second or third hour, for the restlessness. Dr. Reid, in using the catheter, observed a diphtheritic patch on the vulva ; there is moderate tumefaction under the ears ; the patient vomits often during the last days ; she has livid spots, from extravasation, under the skin ; and vision is much impaired, if not lost ; it is impossible to obtain any urine for examination. Death occurred without convulsions on March 15.

Microscopic Examination of the Kidneys.—The tubuli contorti of the first and second order of the cortical substance of the kidney almost all enlarged ; their epithelium swollen in many places to such a degree that no calibre of the tubules can be seen ; the epithelium richly provided with coarse granules, the enlarged living matter ; the original cement substance missing ; instead of this, new transparent lines formed within the protoplasm, indicating the earliest stage of catarrhal inflammation, with partition and new formation of epithelial elements ; the same changes, though in a less marked degree, observable in the epithelium of the straight ducts of the pyramidal substance, while the flat epithelial bodies of the narrow ducts apppear almost unchanged. The connective tissue between the ducts and the enlarged glomeruli is somewhat increased in size, and it contains newly-formed nuclei in moderate number, with enlarged bloodvessels, some of which are much distended with blood-corpuscles ; no fatty degeneration in kidneys. In a few places, accumulations of dark granules occur

within the ducts and their epithelium. These granules, not being united with each other by threads, nor staining with carmine, are considered to be micrococci, such as occur in any decomposing animal tissue. Whether they were present during the life of the patient, or were due to early cadaveric putrefaction (which is common after death from diphtheria), is uncertain. But since I have seen micrococci and bacteria in the fresh urine of children suffering from diphtheria, I would not deny the possibility of the occurrence of micrococci in the uriniferous tubules during life ; nay, even, they may produce the inflammatory process in a way still unknown to us. In the case under consideration no trace of casts was found within the tubules, so that the inflammatory process doubtless was not a croupous one, but a relatively slight process, termed catarrhal or interstitial nephritis.

Case IV.—M., aged four years, inmate of the New York Foundling Asylum, New York, began to be sick May 6, 1876 ; was languid and feverish, temperature 104°, had redness of fauces and an exudation over each tonsil, no coryza; evening temperature 103°. May 7. Pulse 120 ; temperature100°. May 8. Pulse and temperature as yesterday ; urine scanty; no albuminuria, and no discharge from nostrils: the membrane extends from the sides of the throat to the roof of the mouth ; specific gravity of urine 1021, urine contains no albumen, no excess of urea, and no deposit of urates. May 10. Pulse 140 ; has considerable œdema of fauces, and breathing guttural in sleep ; vomited once since yesterday ; the urine contains for the first time a moderate amount of albumen, with hyaline casts ; specific gravity 1018, acid ; no urea deposited on adding nitric acid ; that alarming symptom in diphtheria, epistaxis, has occurred to-day. The records which were written daily till death, which occurred on the 14th, show a gradual increase of albumen with hyaline casts in the urine, increasing scantiness of urine, so that on the 13th not more than half an ounce was passed in twelve hours ; temperature not rising abeve 100¼°, nor pulse above 108 ; poor appetite, occasional vomiting, and epistaxis. Death occurred from feebleness and blood poisoning, notwithstanding that, from the first day, three grains of salicylic acid were given the first hour, two grains of quinine the second hour, and tincture of iron and chlorate of potassium the third hour, these doses having been continued night and day in alternation; with the application of carbolic acid and subsulphate of iron to the fauces, three times daily ; with nutritious diet, and the moderate use of stimulants. There were no symptoms referable to the larynx, unless a slight cough.

Sectio Cadaveris.—Mucous membrane of larynx, trachea, and bronchial tubes intensely and uniformly injected, but without any membranous exudation ; lungs fully inflated, as if from commencing vesicular emphysema, and pale in front ; numerous extravasations of blood in the substance of the lungs and other organs ; the hæmorrhages in and under the mucous membrane of stomach so abundant that the gastric surface presented a mottled appearance like the skin in measles.

Microscopic Examination.—The mucous membrane of the larynx and trachea was hyperæmic, but was otherwise apparently normal ; muscular tissue of heart normal ; spleen soft, but not appreciably enlarged. The scrapings of the cut surface of this organ contained red blood-corpuscles ; bodies from two to five times the size of the blood-corpuscles, holding in their interior oil-drops and fine granules, and having a yellowish-red color ; granular lymphoid corpuscles, and granular débris. The walls of the

stomach were congested, but without any noticeable exudation upon the surface ; the extravasations of blood, described above, were found to be chiefly in the submucous tissue. In some places the gastric tubes were bare, but in other places covered with amorphous matter ; but whether the covering substance was altered epithelium or diphtheritic exudation was not determined. The epithelium covering the more exposed portions of the tubes was in many places not distinct, while that covering the deeper portions of the tubes was clearly defined ; at the pylorus, upon the valve, the mucous membrane was deficient ; those portions of the true peptic glands lying below the tubes were normal. The mucous membrane in the lower part of the ileum was congested. Peyer's patches, and the solitary glands, both in the ileum and large intestines, were prominent, and surrounded by halos or rings of inflammation. Both the cortical and pyramidal tubes of the kidneys contained granular epithelium.

Briefly stated, therefore, the exudation of diphtheria is found to consist of fibrin forming a delicate interlacing network, epithelial cells more or less altered by the inflammatory process, leucocytes, nuclei, mucus, and amorphous matter. Upon the faucial, buccal, laryngeal, and perhaps also nasal surfaces, the pseudo-membrane penetrates the entire mucous membrane, so that no line of demarcation between them can be seen with the microscope. Below the larynx upon the surface of the trachea and bronchial tubes, a distinct line of demarcation exists, as in the croupous exudation, so that the tracheal and bronchial pseudo-membrane can be readily detached, without impairing the integrity of the underlying mucous surface.

The inflamed mucous membrane is not only hyperæmic and infiltrated with serum, but it contains numerous round white corpuscles (leucocytes) which may result in part from proliferation of connective tissue corpuscles, but are believed by most pathologists, since Cohnheim's well-known discovery, to be in great part wandering white corpuscles of the blood, which have escaped through the walls of the bloodvessels along with the fibrin. In the commencement of the diphtheritic inflammation, before the pseudo-membrane forms, we often observe a grayish tinge of the mucous surface, which is due to the crowding of these cellular elements underneath and in the mucous membrane, for these newly-formed cells can be traced into the submucous connective tissue. Even where the inflammation remains catarrhal, as it does over certain areas in all cases of diphtheria, this infiltration of the mucous and submucous tissues with cells is common.

No certain and invariable chemical or microscopical difference has yet been established between the pseudo-membrane of croup as described in the appropriate chapter and that of diphtheria. The difference universally recognized is this, that while the croupous membrane in all situations lies upon the mucous membrane, and does not penetrate it, that of diphtheria, in the localities where it most commonly forms, namely upon the buccal, faucial, and laryngeal surfaces, penetrates and becomes blended with the mucous membrane, so that it cannot be detached by force without the risk of injuring this membrane, and lacerating its vessels ; moreover, by its

presence in the mucous layer, it is apt to obstruct circulation in it and cause ulceration, even in the submucous tissue.

During the height of the inflammation, it is astonishing often to see with what rapidity the pseudo-membrane returns, when removed by force. A few hours suffice to restore it as firm and extensive as before the interference. In favorable cases this adventitious layer is detached in a few days, and is either expectorated or swallowed with the ingesta. Its separation is promoted by the secretions underneath, especially by pus, which is formed in abundance between it and the surface on which, and in which it lies. In most cases it does not separate in mass, but disappears, by progressive liquefaction, a little less remaining at each visit till all is detached.

Such are the appearances, character, and history of the pseudo-membrane in this malady. Although its common seat is upon the fauces, and in mild cases it occurs only upon the fauces, nevertheless all the mucous surfaces are liable to be attacked by the inflammation, in consequence of infection of the blood, and therefore in severe cases, and even in cases of moderate severity, we often find the product elsewhere, as well as upon the fauces, and in localities where from its mechanical effect it greatly increases the danger and even compromises life. The mucous membrane of the nostrils, mouth, larynx, trachea, œsophagus, stomach, intestines, conjunctiva, vagina, and even the delicate lining of the middle ear, are at times the seat of diphtheritic inflammation, with the characteristic product. If the exudation occur in the larynx or air-passages below the larynx, we have diphtheric croup, more dangerous even than true croup ; if upon a surface concerned in the digestive process, this function is more or less interfered with. In a case which occurred in the Nursery and Child's Hospital of New York, the surface of the stomach was almost completely lined with the diphtheritic formation, so that the function of this organ was apparently nearly or quite abolished. The occurrence of the pseudo-membrane in the nares is common, and is attended by the discharge of thin mucus and pus, but though inconvenient to the patient, its mechanical effect is not dangerous, except in the nursing infant, in whom it interferes, more or less, with lactation. The thin irritating discharge produces excoriation around the nostrils, and upon the upper lip. I have met only one case of diphtheritic inflammation of the intestines, in which the diagnosis was certain. A physician, in whose family severe diphtheria had just occurred, took what was believed to be typhoid fever. After a long sickness he expelled, per rectum, about one foot of diphtheritic pseudo-membrane in a cylindrical form, evidently produced upon the intestinal walls. In the subsequent months the patient suffered from constipation, and severe abdominal pains, apparently due to contraction in the healing of a large diphtheritic intestinal ulcer. Death finally occurred from this state of the intestines. The formation of the diphtheritic pellicle upon the vulva and vaginal walls is occasionally observed, as in one of the cases

related above. Its occurrence upon the uterine surface is very rare, except in the parturient woman, in whom it is said to occur by preference upon that part from which the placenta has been detached. I have met only one case of uterine diphtheritic inflammation, the disease having been contracted during or immediately after parturition, and ending fatally with all the symptoms of acute metritis within the first week.

In mild cases of diphtheria, in which the pseudo-membrane is small, and quite superficial, penetrating but little the mucous membrane, in which it is imbedded, there is little danger of septic poisoning. But in grave cases, in which the diphtheritic pellicle is extensive, and deeply embedded, so that the lymphatic and blood vessels are in immediate relation with its under surface, the conditions in which septicæmia occurs, are present, as soon as decomposition begins. Therefore septicæmia is properly regarded as a not infrequent and dangerous accident in severe diphtheria, but it is obviously very difficult to distinguish septic from diphtheritic blood poisoning, from the symptoms. Septicæmia is most apt to occur in those cases in which pseudo-membrane has become dark gray, and friable, from decomposition, producing an ichorous discharge and offensive breath and in cases in which blood escapes from the capillaries underneath.

Absorption of the poisonous substance produces inflammation of the lymphatic vessels, along which it passes, and of the lymphatic glands, which these vessels enter. The adenitis also gives rise to inflammation of the periglandular connective tissue, so that the neck is thickened, hard, and tender. If we examine a gland which is swollen and inflamed by the toxic absorption, we will find that its bloodvessels are congested, and its cells have undergone hyperplasia. The periglandular connective tissue is œdematous, and sometimes infiltrated with lymphoid cell-nuclei and pus-corpuscles. Capillary hæmorrhages are also common in the connective tissue, and micrococci are found in the lymphatic vessels, lymphatic glands, and in the connective tissue.

Bronchitis also occurs in certain cases. It is usually simple or catarrhal, but in some patients it is pseudo-membranous in some of the tubes, especially in the larger, or in those which are located in the posterior part of the chest, while in the other tubes it is catarrhal.

If death occur from obstruction in the air-passages, the lungs will be found much reduced in size, the anterior superior portions being pale from lack of blood, and perhaps emphysematous, while the posterior and inferior portions have a dark-red color, many of the lobules being collapsed, and others not only collapsed or semi-collapsed, but in the commencement of pneumonia. This difference in the state of different parts of the lungs, in those who have died of suffocation in consequence of the presence of the false membrane in the air-passages, receives partial explanation from the seat of the exudation in the bronchial tubes, for in those who perish from this cause the exudation is found chiefly in such tubes as pass to the pos-

terior and inferior parts of the organ, while such as pass to the superior and anterior lobules remain free from it. In some instances, in parts of the lungs the pseudo-membrane can be traced along the minute bronchial tubes into the alveoli, where it forms a network—containing in its interstices pus, and sometimes blood-corpuscles, and more or fewer micrococci. Pneumonia is also a common complication, resulting from downward extension of the bronchitis, or occurring independently of the bronchitis.

The muscular fibres of the heart in diphtheria, as in all acute infectious diseases, are liable to granulo-fatty degeneration, so that they become softer, have a color which French writers liken to that of new leather or coffee and milk. This degeneration has been observed only in a certain proportion of the more malignant cases, and is far from being uniform. Any portion of the heart may undergo this change. It may occur in the columnæ carneæ, or in the walls of the organ. White fibrinous clots are sometimes seen in the cavities of the heart after death from diphtheria, and it is the accepted belief, in consequence of the symptoms and mode of death, that in a certain proportion of such cases the clots are ante-mortem, having formed some hours before the agony. It is well known that similar clots, thought to be ante-mortem, are not infrequent in fatal scarlet fever.

The blood in cases of a severe type is usually darker than in health, and the clots soft. After death from diphtheritic laryngitis, it is also dark from excess of carbonic acid in it. The chemical changes which the blood undergoes in diphtheria are little known. MM. Andral and Gavarret found a notable diminution of fibrin in grave infectious diseases, as typhoid fever, puerperal fever, etc., and it is not improbable that the same is true of diphtheritic blood, although the exudation of fibrin is so abundant. M. Bouchut and others have found a marked excess of the white corpuscles in the blood in a considerable proportion of diphtheritic patients, so that, instead of three or four in the field of the microscope, as many as sixty have been counted. M. Sanné writes of diphtheria "It is necessary to recognize in the dark-brown blood an abnormal accumulation of the débris of the red corpuscles, débris of little abundance in the normal state, augmented considerably under the noxious influence of the diphtheritic poison, which has rapidly produced destruction of a great number of globules" (*Traité de la Diphthérie*, page 107, Paris, 1877). Small extravasations of blood in various organs are among the most constant lesions. They have been most frequently observed in the brain and its meninges, the lungs, spleen, and kidneys. In one of the cases which I examined after death in the New York Infant Asylum, as I have stated above, the extravasations in and under the gastric mucous membrane produced a mottling as great as that of the skin in measles.

No notable changes have thus far been observed in the nervous centres,

with the exception of the apoplectic foci, and softening of adjacent brain substance, and the congestion present when death has resulted from diphtheritic croup. But certain degenerative changes have been discovered in the peripheral nerves, as well as in the muscles in parts affected with diphtheritic paralysis. Thus, in nerves from a paralyzed palate, certain nerve tubes have been observed nearly or quite destitute of medullary matter, though this is not common, but many tubes are found to contain fatty granules, the result of retrogressive metamorphosis (MM. Charcot and Vulpian).

The liver does not appear to be seriously engaged or its function compromised. In most acute infectious diseases which are fatal in consequence of blood poisoning, the spleen is apt to become softened and somewhat enlarged, but this does not always occur in diphtheria. It will be recollected from the cases related above that the spleen may not be perceptibly enlarged or softened.

The kidneys of all the internal organs are most frequently affected, as is shown by the common occurrence of albuminuria. Parenchymatous nephritis, with the characteristic hyperæmia and swelling, is the usual form of kidney disease which complicates diphtheria. In the albuminous urine are found hyaline and granular casts. This inflammation may begin early in grave cases, even as soon as the first or second day, but its commencement is ordinarily not till toward the close of the first week or in the second. It occurs in the majority of those severe cases which prove fatal from blood poisoning. Interstitial nephritis also complicates certain cases, as one of those related above, giving rise to an increase in the connective tissue.

Symptoms.—In general, in the commencement of an epidemic, diphtheria is more severe and fatal than when the epidemic influence is abating. The prominent symptoms, such as arrest the attention of the friends, are often disproportionate to the gravity of the attack. Striking cases illustrative of this have occurred in my practice, the friends not supposing that there was any serious ailment, and not seeking medical advice till the fatal termination had nearly arrived. The initial symptoms are sometimes mild, such as chilliness or rigors, often slight, and succeeded by moderate febrile reaction, languor, and perhaps more or less headache, pain in the limbs or back, and impaired appetite. Still the patient may continue to walk about as if affected with slight and temporary ailment. Such cases in New York city frequently attend the schools, and do immense harm in propagating the disease. The symptoms in these mild cases are often like those from a cold, for which light attacks of diphtheria are apt to be mistaken by the friends. With some, in mild as well as severe diphtheria, one of the first symptoms is slight tenderness or a sensation of fulness in the fauces. A distinguished clergyman of the Pacific coast, who fell a victim to this disease, dreamed, a few nights before he complained of illness, that

his throat was cut. Doubtless the diphtheritic inflammation had already commenced, so that what seemed a forewarning had a natural explanation. So insidious was the commencement in this case that the disease had advanced beyond all hope of relief when medical advice was first sought. But in most cases, other than those of a very mild type, the commencement is more severe, being attended by a temperature of 102° or 103°, or even 104°, with corresponding heat of surface, thirst, languor, loss or impairment of appetite, tenderness of throat, etc. Delirium as well as eclampsia may occur, but both are rare. The febrile reaction ordinarily abates considerably by the close of the second or on the third day, as I have noticed in many observations.

The symptoms of invasion have less prognostic value in diphtheria than in most other infectious maladies. We meet cases with a severe beginning, attended by delirium, which terminate in apparently complete restoration to health in less than a week, the presence of the characteristic pellicle upon the fauces and the occurrence of diphtheria in other members of the family rendering the diagnosis certain. On the other hand, a mild commencement sometimes ushers in a fatal form of the disease. This is notably true of those cases in which laryngitis supervenes, as it not infrequently does in cases which begin very mildly.

The fever which ushers in diphtheria abates, as stated above, after the second or third day, and subsequently, in grave as well as in benign cases, there may be but little or even no elevation of temperature. The diphtheritic poison does not therefore, like that of scarlet fever, exhibit any marked tendency to increase the animal heat. Even in profound and fatal blood poisoning in this disease, the thermometer shows the normal, or scarcely more than normal, temperature, so that the inexperienced practitioner is apt to be deceived in his prognosis. On the other hand, a continued elevation of temperature with only moderate angina should lead the physician to examine for some complication, perhaps a nephritis.

The tongue is usually moist, and slightly furred. The patient often vomits in the commencement, and if this cease or be seldom repeated, it is not a grave sign ; but vomiting occurring often, so that the food is rejected, and due often no doubt to uræmia, is not infrequent in severe cases. The appetite varies. Repugnance to food characterizes many of the gravest cases, and, if the child be compelled to take it, it is often rejected by vomiting. There are no notable symptoms referable to the state of the intestines. The stools usually appear normal, except as they are changed by medicines.

The respiratory apparatus is not involved in the benign cases in which only the fauces are inflamed. But next to the fauces and posterior buccal surface, the Schneiderian membrane is most frequently affected of all the surfaces, and when the nares are inflamed, and are covered to a greater or less extent by the pseudo-membrane, there is more or less discharge, which

may excoriate the upper lip, and cause incrustation around the entrance of the nostrils. This often renders respiration through the nostrils difficult. In cases having this severity there is usually at the same time considerable faucial swelling, so as to cause guttural respiration, which is most marked in sleep. But the most important symptoms pertaining to the respiratory apparatus, occur when the inflammation attacks the laryngeal surface, or this surface and those contiguous to and below it in the respiratory tract. Diphtheritic croup may be primary or secondary. In New York the secondary form most frequently occurs as a complication of measles, and as the rubeolar inflammation extends not only over the larynx and trachea, but bronchial tubes, the diphtheritic pseudo-membrane is apt to extend further downward than when the inflammation is primary.

Diphtheritic croup often occurs at the commencement of diphtheria, so as to be and continue to be the predominant inflammation, but in other cases it supervenes after diphtheria has continued a few days. There are many mild cases, which give no anxiety so long as the inflammation remains faucial, but in which the whole aspect is within a day changed by the occurrence of croup, and the condition becomes one of imminent danger. Usually when diphtheritic croup occurs there is a simultaneous if not pre-existing exudation upon the fauces. Occasionally in undoubted diphtheria the diphtheritic pellicle forms only upon the surface of the air-passages below the epiglottis, while the fauces present merely an inflammatory reddening, and the surface of the nares is either free from disease or only reddened. Thus in January, 1875, I attended a child, aged two years and ten months, who died from a gradually increasing dyspnœa after a sickness of four days, having during his sickness moderate swelling of the tonsils, and general redness of the faucial surface, but without membranous exudation upon it. The symptoms and history of the case were precisely those of true croup, but the diphtheritic nature of the malady was clearly shown by the occurrence very soon after the death of the patient of diphtheritic pharyngitis with the characteristic exudation upon the fauces, of the two young women who nursed him.

In New York, as will be seen by the table below, the predominant inflammation in about one fourth of the cases of diphtheria is the laryngitis.

In addition to the accelerated pulse during the febrile stage and the slow and compressible pulse during the stage of profound blood poisoning, the chief symptoms, pertaining to the circulatory system, relate to the state of the heart, and the altered state of the blood which gives rise to hæmorrhages. The ante-mortem heart-clots, the weakened action of the heart from degenerated muscular fibres, the hæmorrhages from the altered state of the blood, indicate a very dangerous condition of the circulatory apparatus.

Very little attention had been bestowed upon the state of the kidneys, and the character of the urine in diphtheria, till Mr. Wade, of Birmingham, discovered albuminuria, since which many observations in different

epidemics, and localities, have established the fact that albuminuria occurs in a majority of cases of a severe type, and in many cases of diphtheritic laryngitis in which the type is not severe. Two conditions of the kidneys give rise to albuminous urine, namely, nephritis, which is the most common, and venous congestion, which occurs in cases of embarrassed circulation, as in certain cases of diphtheritic laryngitis, and in obstruction from heart clots. The latter is comparatively infrequent.

During the latter part of 1875, and in 1876, prior to August 1, I endeavored to obtain and examine the urine in every case of idiopathic diphtheria, having a clear diagnosis, which came under my notice, both in family practice and in the institutions with which I have an official connection. Ordinarily, during the first week of a case, I found that the urine deposited urates on cooling, and that the nitric acid test showed a large relative quantity of urea, but I suspect that this was due to a somewhat diminished quantity of urine. But the occurrence of albumen was of chief interest, and the results of the examinations as regards the presence or absence of this, are recorded in the accompanying table. In most of the cases the urine was examined several times in the course of the disease, and, if albumen were present, a microscopic examination was also made. In nearly all the specimens which contained albumen—all but three or four—casts, usually granular, but now and then hyaline, and sometimes both kinds in the same specimens, were observed. In those cases of albuminuria which recovered, there were comparatively few casts, or none. If the albumen were abundant, and casts plentiful, the case was usually fatal, though not perhaps till after the lapse of three or four weeks, when death occurred with symptoms of exhaustion, paralysis, or feeble heart-action, sometimes with œdema of lungs supervening suddenly, and, probably, formation of heart clots. The albuminuria, unlike that of scarlet fever, seldom occurred except in the grave cases ; and in the majority of instances it did not appear till near the close of the first week, or in the second, and, in a few instances, not till a later period. Although the albuminuria of diphtheria is much more grave than that of scarlet fever, it has in my practice been attended by much less serous effusion or dropsy, often by none which was appreciable. The urine, although containing a large quantity of albumen, ordinarily had nearly the normal appearance, instead of the smoky or hazy color so common in the albuminous urine of scarlet fever.

I. *Cases attended with the usual membranous exudation upon the fauces, with or without coryza, and without laryngitis or with only catarrhal laryngitis ; fifty-eight cases.*

	Died.	Recovered.	Result not stated.	Total.
With albuminuria, .	13	5	1	19
Without albuminuria, .	4	27	1	32
State of urine not recorded,	3	4	..	7

II. *Cases attended with membranous laryngitis as the predominant inflammation; nineteen cases.*

	Died.	Recovered.	Total.
With albuminuria, . .	4	1 ..	5
Without albuminuria, .	2	4 ..	6
State of urine not recorded, .	7	1 ..	8

The mortality of the cases embraced in the above table was probably larger than the average in New York practice, for several of them were seen in consultation, and their type was severe. Those in which the state of the urine could not be ascertained, were usually in children so young or so near death that it was impossible to obtain sufficient urine for examination.

It is seen that in New York, where diphtheria is endemic, of 62 cases occurring in the course of about ten months, 24 were attended by albuminuria, and 38 were exempt. In a larger number of cases, of which I have preserved the records since 1876, I think that the proportion of albuminous cases has been about the same, but obviously during epidemics of a severe type, the proportion is larger than when the type is mild.

An efflorescence is sometimes observed upon the skin during the time in which the temperature is exalted. It is the erythema fugax of dermatologists, suddenly appearing and disappearing. This eruption, which is so common in the febrile and inflammatory affections of childhood, does not seem to present any peculiar characters in children. But there is another eruption, which I have several times observed, and of which I have preserved a drawing as it appeared in one case, which I have no doubt is due to diphtheritic toxæmia, or to septicæmia occurring in diphtheria. It appears after the sixth or seventh day, in the form of red points or spots, not more than a line in diameter, and interspersed with patches of larger size, and irregular margins, one to two inches in diameter. This roseolar eruption is slightly raised, like that of measles; it disappears on pressure, and so far as I recollect, it has, in my practice, appeared only in fatal cases. Occasionally extravasations of blood occur in and under the skin, like those in the internal organs. The pallor of the skin, which diphtheritic toxæmia produces in the second and third weeks, is known to all who have had experience with this disease.

Diphtheritic *paralysis* is described by some writers as a symptom and by others as a sequel. It usually begins during convalescence in the second or third week after the abatement of the inflammatory symptoms, but sometimes not till a later stage. It may on the other hand appear considerably earlier, during the stage of the development of the inflammations, as early as the fifth or sixth day, or even as early as the second or third day from the beginning of the diphtheria (Sanné). When the paralysis begins at an early period it may cease, and reappear later, and in other parts. Its

commencement may not be announced by any symptoms apart from the loss of muscular power, but in other cases there is febrile movement with albuminuria. The muscles most frequently affected are those of the pharynx, and upper part of the larynx. The muscles of deglutition are sometimes so involved, that the food and drinks are not swallowed till after several successive efforts, and a part may be returned through the nostrils. A portion of the food sometimes enters the larynx, so as to produce violent coughing. As we observe the dysphagia, it seems as if there must be pharyngitis, which renders deglutition difficult, but on inspecting the fauces we find no evidence of inflammation. The mucous membrane has recovered its normal appearance, and the nerves only are affected. The velum palati hangs flaccid and motionless like a curtain ; and the relaxed state of the muscles at the entrance of the larynx, causes guttural respiration, or snoring in certain cases, which is especially marked during sleep. In severe cases the difficulty of swallowing may endanger suffocation from the lodgment of food in the larynx, and inspire dread of taking food on the part of the child. Tickling, and even pricking the velum fails to induce motion. In some there is only faucial paralysis, but in many the loss of muscular power occurs in other parts also. Whenever it occurs elsewhere, the pharyngeal muscles are nearly always involved at the same time. Diphtheritic paralysis may affect the motor muscles of the eye, causing strabismus ; the muscles of one side, causing hemiplegia ; of the legs, causing paraplegia ; or of an arm on one side and leg on the opposite. It does not commence simultaneously in the various muscles which are affected, but in succession, those first affected being for the most part the muscles of the pharynx. In some patients the muscles of the bladder are paralyzed, leading to retention of urine or difficulty in passing it. Paralysis in the limbs is frequently preceded by tingling or a sensation of formication. There is often not a total loss of sensation or of motion in the paralyzed part, but more or less numbness with difficulty rather than impossibility of motion. A few cases have been reported in which the paralysis was almost general, and some believe that they have met cases in which the heart was paralyzed, death occurring suddenly and unexpectedly. Dr. J. B. Reynolds relates a case in the *New York Journal of Medicine*, May, 1860, in which there were not only strabismus, partial paralysis of the limbs, and paralysis of the muscles of the pharynx, so that food was regurgitated, but the head dropped forward so that the chin rested on the sternum.

A majority of those affected with paralysis recover, although few regain the complete use of their muscles in less than one month, and many do not till between two and four months.

Defect of vision is an occasional result of diphtheria ; some have presbyopia ; others myopia ; some see double ; some are amaurotic ; while in

others one pupil is more dilated than the other, or both pupils are dilated, and feebly sensitive to light. This impairment or perversion of vision gradually disappears as the vigor of system returns.

Various theories have been advanced in explanation of the occurrence of the paralysis, as that of reflex irritation advocated by Brown-Séquard, that of anæmia, etc. A careful examination of the nervous centres, made in certain fatal cases, has revealed nothing which throws light on its etiology. That the diphtheritic virus causes paralysis by some special action is evident, for there is no other infectious disease which is attended and followed by paralysis so often as diphtheria. The most plausible theory is that recently brought to light by histological examinations, which have shown that the peripheral nerves in paralyzed parts have undergone degenerative changes, as mentioned above, so that under the neurilemma, we observe more or less granular matter, in place of the normal nerve tissue, or lying in this tissue. Among the many anatomical changes which the specific principle produces, those in the peripheral nerves must therefore be regarded as important, since pathological changes in the nerves which supply paralyzed muscles sanction the belief that they sustain a causative relation to the paralysis.

Diagnosis.—In most instances the diagnosis of diphtheria is readily made when the case has continued a few hours, for the characteristic false membrane is observed on inspection of the fauces. I have usually at my first visit been able to state the nature of the pharyngitis from its appearance. But there are cases which vary from the typical form in which the diagnosis is more or less difficult. The confervoid growth of sprue, when occurring upon the fauces, is sometimes mistaken for the false membrane of diphtheria, but the error of mistaking one for the other in cases which I have met, has been due to hasty and careless examination rather than to any real difficulty in the discrimination. The peculiar product of sprue has but little depth and coherence, and is readily detached without injury to the mucous membrane or its vessels. If there be any doubt, the differential diagnosis can be readily made by the microscope.

Follicular pharyngitis, like diphtheria, commences with sharp fever, which, however, is ephemeral, and is attended with the formation of round white masses in the site of the follicles, usually over the tonsils only. These masses do not occur in patches, like those of diphtheria, except when two or three are in close proximity and unite, but at the same time a sufficient number are discrete to establish the diagnosis. Follicular pharyngitis often occurs in several members of a family at the same time, involves no danger, and is quickly cured. The white masses consist of the inspissated secretion of the follicles mixed with epithelial cells.

The diagnosis of diphtheritic from membranous laryngitis is often difficult. Diphtheritic laryngitis is usually accompanied by more tumefaction of the lymphatic glands of the neck, and more discharge from the nostrils.

Moreover the laryngitis is often secondary in point of time to the pharyngitis, so that in the first day of the former we observe so much faucial inflammation, that it is evident that the latter predominates; whereas in true croup, the laryngitis precedes and predominates.

Often the diagnosis is made clear by the history. Thus a boy, aged two years and ten months, died of acute laryngo-tracheitis, lasting about four days. He lived in the suburbs of the city, where the houses were scattered, and where there had been no recent diphtheria. The case commenced with hoarseness, which gradually increased to a fatal obstruction in the air-passages, without any pseudo-membrane upon the fauces or upon any other visible part. This case seemed to be identical with the true croup with which we were familiar before the occurrence of diphtheria in New York; and yet it was diphtheritic, for two or three days after the death of the child, two nurses who attended him were affected with severe diphtheritic pharyngitis with the characteristic pseudo-membrane.

Sometimes the occurrence of albumen in the urine, with or without fibrinous casts, aids in establishing the diagnosis, for it is more common in diphtheria than in croup. It is evident, from the above facts, that the diagnosis of diphtheritic from membranous croup, though possible in typical cases, in localities where diphtheria is not endemic or epidemic, is difficult if not impossible at the bedside in localities where diphtheria prevails, especially when there is little or no exudation upon the fauces.

Prognosis.—No infectious disease presents greater differences in type or severity. In mild epidemics, with moderate fever, slight faucial swelling, and little extent of the pseudo-membrane, a large majority recover, and would recover even without treatment. Uncertainty of prognosis, of which even physicians of ample experience complain, is largely due to the fact that diphtheria terminates fatally in several distinct ways. Hence while the patient may be secure as regards the more manifest and common conditions of danger, so as to justify a favorable prognosis in the opinion of the physician who attends him, the fatal result may suddenly occur from some unseen and unsuspected cause.

Death in diphtheria may result from—

1st. Diphtheritic blood-poisoning.

2d. Probably, also, from septic blood-poisoning produced by absorption from the under surface of the decomposing pseudo-membrane. But it is difficult to distinguish the constitutional effects of sepsis from those produced by the diphtheritic poison. Septic poisoning is obviously most apt to occur in those cases in which the pseudo-membrane is extensive, and deeply imbedded, and its decomposition attended by an offensive effluvium. Cervical cellulitis, and adenitis, which, when severe, cause very considerable swelling of the neck, appear to be often, if not usually, due to septic absorption from the faucial surface, the inflammation extending

from the absorbents to the glands and connective tissue. Considerable tumefaction of the neck, therefore, seldom occurs in diphtheria or scarlet fever, without manifest symptoms of toxæmia, and is to be regarded as a sign of its presence.

3d. Obstructive laryngitis.

4th. Uræmia.

5th. Sudden failure of the heart's action, either from the anæmia, and general feebleness, from granulo-fatty degeneration of the muscular fibres of the heart, which is liable to occur in all infectious diseases of a malignant type, or from ante-mortem heart clots.

6th. Suddenly developed passive congestion and œdema of the lungs, probably due to feebleness of the heart's action, or to paralysis of the respiratory muscles. I have known death to occur apparently from this cause during the period of supposed convalescence, and when the visits of the physician had been discontinued. Thus in a case in my practice, symptoms of œdema pulmonum (moist râles in both sides of the chest, and embarrassed breathing) suddenly occurred nearly one month after the disappearance of the faucial pseudo-membrane and inflammation. The urine, which had contained considerable albumen during the active period of the malady, had for some time shown no trace, or but slight trace of this principle by the proper tests. By active stimulation these symptoms entirely disappeared in a few hours, and the heart's action seemed normal, unless a little weakened. On the following day the same symptoms reappeared, and death occurred before I was able to reach the house.

That physician obviously is least apt to err in prognosis, who recognizes the fact that patients are liable to perish in any of these different ways, and carefully examines in reference to all the conditions which involve danger. Many physicians, as I have had the opportunity to observe, are remiss in not examining more frequently the urine of diphtheritic patients, for there is often a large amount of albumen in the urine in diphtheria, indicating a poisonous quantity of urea in the blood, and yet the appearance of the urine to the naked eye is probably normal.

Among the symptoms which render the prognosis unfavorable are, repugnance to food, vomiting, pallor of countenance, with progressive weakness and emaciation from the blood-poisoning ; a large amount of albumen with casts in the urine, showing uræmia, to which the vomiting is sometimes, but not always, attributable ; a free discharge from the nostrils, or occlusion of them by inflammatory thickening, and exudation, showing that a considerable portion of the Schneiderian membrane is involved, hæmorrhage from the nostrils or fauces, and obstructed respiration. In diphtheritic laryngitis, attended by obstructed respiration, a large majority have thus far died, whether treated by the most approved inhalations or by tracheotomy. One, at least, of the above symptoms has been present in most of the fatal cases which I have observed.

Treatment.—Although diphtheria has been one of the most common of the severe infectious maladies in this country during the last twenty-five years, physicians are far from agreeing in reference to the proper mode of treatment. This difference of opinion respecting the therapeutic requirements is due in part to difference in the type of the malady in different localities and epidemics, in part to difference in diagnosis, so that one considers a case to be diphtheritic, which another regards as a non-specific inflammation, but more to the fact that different theories are held respecting the cause and nature of diphtheria. Scarcely any other disease presents such a diversity in type as diphtheria, from cases, so mild that nearly all recover, whatever the measures employed, to those so severe that a large proportion die under the best possible treatment; and this difference in type may be observed in cases occurring at the same time in a great city like New York, and even in the cases which two physicians practising near each other may be called to treat. Hence one physician recommends with confidence a medicine or mode of treatment as eminently successful in his hands, which another speaks disparagingly of.

The germ theory, described above, according to which diphtheria is produced by micro-organisms, has in my opinion had a harmful effect on the therapeutics of this malady. Acceptance of the germ theory does not require us to believe that diphtheria is primarily local, for these organisms might enter and infect the blood through the lungs, before any symptom occurred, but as it is ordinarily promulgated, we are taught that these organisms alight upon one of the exposed surfaces, usually the fauces, where they excite local inflammatory action, and if not promptly destroyed, are very apt to penetrate the tissues, enter the blood, and establish a constitutional disease. Acceptance of this theory evidently leads to the employment of germicide medicines, the so-called antiseptics, or anti-ferments, externally and internally, to arrest and destroy the vegetable growth, their local use sufficing, according to the theory, in the early stage, when these organisms have passed no further than the surface, but their internal use being required in addition, if the malady have continued longer, and the disease have become general. Hence, in proportion as this doctrine came in vogue, carbolic acid, chlorine preparations, bromine, the sulphites, phenic acid, and, as the best representative of this class of medicines, and most powerful antiseptic, salicylic acid, attained at once prominence as the agents which would be most likely to cure diphtheria, by destroying the cause. A solution of bromine and bromide of potassium, having been used, with apparent good results, in the antiseptic surgery of the army during the late war, has obtained under the influence of this theory some reputation in New York as a remedy for diphtheria, employed externally and internally, and without the aid of other therapeutic agents. A certain number of drops are administered

internally every hour, or second hour, properly diluted, and the same medicine undiluted, or with less dilution, is applied to the fauces with a brush at regular intervals.

But experience, if sufficiently extensive, is the safe guide in therapeutics, and, according to my observations, internal antiseptic measures have not seemed to exert any marked controlling effect on the course of diphtheria.

Thus in Case IV. related above, a child of four years took, almost from the beginning of the sickness, a mixture of potassa and iron on the first hour, two grains of quinine on the second hour, and three grains of salicylic acid on the third hour, and this treatment was continued night and day ; and yet this child, having from the first taken sixteen grains of quinine, twenty-four of salicylic acid, besides the potash and iron daily, died after eight days with profound blood poisoning, having had many extravasations of blood.

This case, which presented the ordinary history of fatal diphtheria, did not seem to be materially modified by the internal antiseptic treatment. It would apparently have done as well without it. It is but one case, though an average example, and I have not observed any other in which the internal use of antiseptics seemed to produce a curative effect. My knowledge, however, of the bromine treatment is limited to the four children of one family, and to the effects of its use, which have been reported to me by others.

The theory that micrococci, or vegetable monads, are the specific principle of diphtheria, which suggests and justifies the antiseptic treatment, was promulgated to the profession by those who had seen less of diphtheria than many others, but had zealously used the microscope. Their opinion, based on microscopic examinations and experiments, plausible, because having the appearance of scientific exactness, was widely received. And since, according to this theory, diphtheria is at first localized at the point upon the surface where the micrococci are received, this opinion, so far as it was accepted, evidently led to the early energetic treatment of the local ailment, and indifference as regards constitutional measures. It is interesting to observe how the profession have been led by theories to regard the local treatment of diphtheria as of prime importance, especially during the first stage of the malady. About thirty years ago, when Trousseau was making his observations on diphtheria, and his views had great weight with the profession in both continents, it was believed that those blood diseases, which were communicated by inoculation, were at first local, even after the specific inflammation had appeared at the point of inoculation. Syphilis, for example, could be cured, it was thought, by proper applications to the specific eruption, if made within a certain number of days, and before the poison had entered the blood. In the same way it was believed that diphtheria is commonly received by inoculation, as it

confessedly sometimes is, and could be cured by early applied local measures. Hence Trousseau recommended to attack the pseudo-membrane, with what he designates "savage energy." After a time it began to be believed that the acute infectious diseases are already constitutional, although contracted by inoculation, when the specific eruption or lesion has appeared upon the surface, and that therefore no local treatment can prevent blood contamination, since it is already present. Now, when this opinion was received generally by the profession, and diphtheria began to be regarded a constitutional malady, in its inception, as much as scarlet fever or measles, the promulgation of the bacterian theory exerted a retrograde influence, so that it seemed for a time, as if the old mode of treatment of the age of Bretonneau, and Trousseau, would be restored. At this time there appeared in our language the elaborate volumes of Ziemssen's Encyclopedia, and as the authors of these volumes are for the most part patient and exhaustive investigators, these volumes occupied the centres of our private libraries, and were pointed out as the means which would be likely to elevate the profession of this country to a higher standard of medical knowledge. The treatise on diphtheria contained in this encyclopedia, the most minute of any on this subject in the English language, was eagerly sought for and read, and an immense amount of harm done. The writer of this treatise is fully committed to the bacterian theory, and the section relating to treatment begins thus : "In diphtheria we have to deal at first with an infection, which is localized, and afterward with a general disease resulting from this, out of which may ultimately be developed still later affections of various organs," and he discusses first the local treatment as of paramount importance, and, secondly, the general treatment. It was a great misfortune, that a treatise like that by Sanné had not appeared in place of the one published. But the mischief was done, the brush and inhalations were made the potent instruments of cure, and constitutional remedies held the second place, and were believed to be unnecessary, except when local treatment had failed to destroy the micrococci, and the second stage, or that of general infection had arrived. For a time this theory has had its influence on practice, but unpleasant experiences have taught, and are teaching, physicians, that local measures, however early and perseveringly employed, do not protect the system from the diphtheritic poison, do not prevent the occurrence of unmistakable symptoms of general infection in all cases of a grave type. Whatever the theory, experience gradually establishes the fact, in the minds of all observing physicians, that constitutional treatment is of paramount importance in diphtheria, as it is in that other malady, which, in my opinion, is most nearly akin to it, namely, scarlet fever, except when the danger is located in the larynx.

Between December, 1875, and July, 1878, I examined minutely, and preserved records of, 104 cases of primary diphtheria, occurring either in

my private practice, or seen by me in consultation, besides observing cases, and witnessing autopsies in the New York Foundling Asylum, where diphtheria was endemic nearly two years. From these observations, and from the many cases which I have since observed, I am persuaded that, in order to secure the best treatment, constitutional and local, of diphtheria, it is necessary that the physician should accept the following propositions :

1st. The specific principle of diphtheria, in all probability, enters the blood, in ordinary cases, through the lungs ; and after an incubative period, which varies from a few hours to seven or eight days, produces the symptoms which characterize the disease.

2d. As in vaccinia the system is infected as soon as the vaccine eruption appears, so in diphtheria the blood is infected as soon as the pharyngitis and pseudo-membrane occur. Their intimate relation to the circulatory system, and especially the fact that raising the pseudo-membrane lacerates capillaries, and causes bleeding, prevents our believing otherwise.

3d. The blood poisoning is probably sometimes septic, but as it ordinarily occurs, it is produced by a specific principle peculiar to diphtheria.

4th. Facts do not justify the belief that the system can be protected by antiseptic or preservative medicines administered internally. A quantity of this kind of medicine, introduced into the system, sufficient to preserve the blood and tissues from the action of the diphtheritic virus, would, there is every reason to think, be so large as to arrest molecular action, and therefore the functions of organs, and occasion death.

5th. There is no known antidote for diphtheria, in the sense in which quinia is an antidote for malarial diseases, and no more probability that such an antidote will be discovered than for scarlet fever or typhoid fever.

6th. Diphtheria, like erysipelas, has no fixed duration. It may cease in two or three days, or continue as many weeks ; but the specific poison acts with more intensity in the commencement than subsequently, and its energy gradually abates. Hence, diphtheritic inflammation, which arises in the beginning of diphtheria, as laryngitis, is more severe and dangerous than when the malady has continued a few days.

7th. The indication of treatment is to sustain the patient by the most nutritious diet, by tonics, and stimulants ; and to employ other measures, general and local, as adjuvants, to meet special indications which may arise. The rules of treatment appropriate for scarlet fever, apply for the most part to diphtheria. Local treatment of the inflammations should be unirritating, and designed to prevent putrefactive changes and septic poisoning. Irritating applications which produce pain lasting more than a few minutes, or which increase the area or degree of redness, are apt to do harm, and increase the extent and thickness of the pseudo-membrane.

General Treatment.—This may be conveniently considered under the three heads, food, stimulants, and tonics. All physicians of experience

recognize the importance of the use of the most nutritious and easily digested food, and the preservation of the appetite—for the safety of the patient requires that he should retain, so far as possible, his flesh and strength. The more nutritious and easily digested the food, given in sufficient quantity, with the appetite preserved, the less, obviously, the danger of the fatal prostration, which so frequently occurs suddenly and unexpectedly in grave cases. Beef-tea, or the expressed juice of meat, milk with farinaceous food, etc., should be administered every two or three hours, or to the full extent, without overtaxing digestion. Failure of the appetite, and refusal to take food, are justly regarded as very unfavorable signs. One objection to the use of the brush, instead of spraying the fauces with the atomizer, is that it is more apt to provoke vomiting, by which nutriment, that is so much required, is lost. In malignant cases of diphtheria, as in scarlet fever of a similar type, patients are sometimes allowed to slumber too long without nutriment. It is the slumber of toxæmia, and should be interrupted at stated times, in order to give the food.

Stimulants.—M. Sanné, in his elaborate treatise on diphtheria, says: "De tous les antiseptiques donnés à l'intérieur, l'alcool est de beaucoup le plus sûr. Plus l'infection est prononcé, plus il faut insister sur les composés alcoöliques." He states that Bricheteau reports the history of a patient, who took daily, during the diphtheria, a bottle and a half of the wine of Bordeaux, without the least symptom of intoxication or headache. A somewhat similar case was reported to me, in which nearly a bottle of brandy was given in less than twenty-four hours, without any ill effect, and an apparent good result on the general course of the disease. The same rule holds true in diphtheria as in other acute infectious maladies, that while mild cases do well without alcohoiic stimulants, they are required in cases of a severe type, and should be administered in large and frequent doses, whenever pallor and loss of appetite, or of strength and flesh, indicate danger from the diphtheritic or septic infection. It matters little how the stimulant is administered, whether milk-punch or wine-whey, provided that the proper quantity is employed. Dr. E. N. Chapman, of Brooklyn, a physician of large experience, considers alcohol almost a specific for diphtheria. I believe, from my observations, that, if given early and frequently in grave cases, as, for example one teaspoonful every half hour of brandy or Bourbon whiskey, it does have a tendency to render the disease more tractable, and that it therefore affords important aid in saving the patient's life, and I am willing to allow that it is as nearly a specific as any other agent. But to be instrumental in saving life in malignant cases, it must be given boldly from the start. If there be marked diphtheritic toxæmia when its use is commenced it will not save life, but it may prolong it. Although an advocate of the liberal use of alcohol I cannot regard this agent as a specific. When I commenced serving in the New York Foundling Asylum in May, 1878, the

quarantine wards contained four children, between the ages of three and five years, who had been sick a few days with severe diphtheria, and it was evident at a glance that they must soon perish with the ordinary mild sustaining treatment. Quinine, iron, the most nutritious food, and a moderate amount of alcoholic stimulants were being given, and we determined to increase the Bourbon whiskey to one teaspoonful every twenty to thirty minutes, day and night. Nevertheless, whatever the result might have been with the earlier commencement of this treatment, the blood poisoning was now too profound, and one after the other died. That intoxication is so seldom produced in this disease by frequent and large doses of the alcoholic compounds is due partly to the quick elimination of such substances from the system, and in part, probably, to the nature of diphtheria.

In fulfilling the indication for sustaining treament, the vegetable tonics have been long used, especially cinchona and its alkaloid principle quinia. The compound tincture of cinchona, and the fluid extract, have been used and recommended by physicians of experience ; but of vegetable agents, quinia has long been and still is more frequently prescribed than all others. But the doses employed vary greatly in size and frequency, in the practice of different physicians. It is administered in large doses for its antipyretic effect, so that twenty or thirty grains are given daily, and in small doses, as one to two grains every fourth hour, for its tonic effect. That there is nothing antagonistic in the action of quinine to the diphtheritic virus, and that it is beneficial in the same way, and no further, than in other acute infectious diseases is, I think, generally admitted by the profession. Large and frequent doses apparently produce no amelioration in the severity of the disease; or diminish the degree of blood-poisoning, as is shown by cases like the following, which are not infrequent during severe epidemics.

C., aged four years, male, was examined by me in consultation, on February 10th, 1876. I learned that he had apparently contracted diphtheria from the escape of sewer-gas through a defective trap in the little room where he slept, and that the disease began after midday on February 6th, with fever. At 10 P.M. of the same day, when visited by the family physician, the temperature was 103°, and the fauces were red, but without any pseudo-membrane. Four grains of quinia were ordered to be given every two hours, and ten drops of the tincture of the chloride of iron, with two grains of the chlorate of potassium, to be given three times hourly. On the 7th the exudation covered both tonsils and the half arches ; temperature 102½° ; evening, temperature 100° ; pulse 128. 8th. Is playful ; pulse 100 ; has slight swelling of the cervical glands ; evening, some extension upward of the pseudo-membrane ; has vomiting. 9th. Pulse 144 ; vomits often. 10th. At 3 P.M. began to grow worse ; pharynx and nostrils covered with the exudation. From this time the case rapidly advanced to a fatal termination.

It was impossible at the time of my visit to obtain the urine for examination and death occurred a few hours afterwards. Forty-eight grains of

quinia daily, administered from the first day, had no appreciable effect in staying the fatal progress of the malady, had no such effect as would be likely to follow were its action antidotal, or did it tend to prevent or diminish the blood poisoning. As an antipyretic, I am justified in saying from our experience in the New York Infant Asylum and New York Foundling Asylum, quinine is inferior to salicylate of sodium, both in symptomatic and constitutional fevers, but as it is a tonic, and does not impair digestion, it is to be preferred to any other medicine in diphtheria, when the febrile movement is so great that an antipyretic is needed. Great elevation of temperature, however, seldom occurs in diphtheria after the third or fourth day, for when symptoms of blood poisoning occur the temperature is apt to fall, so that in profound toxæmia, it is often not more than 101° or 102°, and the indication for quinine is then not for its antipyretic but tonic action. The following is a prescription for this agent as a tonic for a child of five years.

℞. Quiniæ sulphat., ʒ ss ;
Elix. adjuvantis (Caswell and Hazard) ;
or,
Elix. tarax. comp., ℥ ij. Misce.
Give one teaspoonful every four hours.

All physicians who are familiar with diphtheria have noticed the pallor, loss of appetite, flesh, and strength, which commence before the close of the first week in severe cases, and which are always unfavorable symptoms, indicating, as they do rapid and progressive deterioration of the blood. The use of iron is at once suggested as the proper medicinal remedy to arrest this blood change, from its known effect in increasing the number of red blood corpuscles, and the quantity of coloring matter in these corpuscles, and the nutritive elements in the blood. By its effect on the red corpuscles, which are the carriers of oxygen, it increases the functional activity of organs, and improves the general nutrition. The ferruginous preparations, therefore, hold an important place in the therapeutics of diphtheria. The one which has long stood the test of experience, and is now commonly used, is the tincture of the chloride of iron. It should be given in large and frequent doses, as five drops hourly, to a child of three to five years.

The inflammations, so far as they are accessible, should be treated by local measures, but we may combine with the iron, one which exerts a decidedly curative action on buccal and pharyngeal inflammations, which is a solvent of pseudo-membranes, and which, after it enters the system, being largely eliminated from the salivary glands, continues after the dose is taken to have effect on the inflamed surface of the buccal cavity and fauces. This medicine, namely, the chlorate of potassium, has of late years become a domestic remedy, but the laity should be cautioned in reference to its use. It is an irritant to the kidneys in large doses, pro-

ducing intense inflammatory congestion of these organs and arresting their function. The melancholy fate of Dr. Fountaine more than a quarter of a century since, whose life was sacrificed by an experimental dose of one ounce of this agent, is remembered by the older physicians. A few years since in my own practice a child of about three years, with an active pharyngitis, probably diphtheritic, and a temperature of 103°, was allowed to quench its thirst between evening and morning, by drinking from a small pitcher in which three drachms of chlorate of potassium were dissolved. In the morning I was summoned in haste, and found the surface of the patient cold and blue, and pulse feeble. The urine was totally suppressed, and instead of it a few drops of blood passed from the urethra. Death occurred before night. The chlorate had apparently produced some irritation upon the intestinal surface, but the fatal result was evidently due to the state of the kidneys. A child of three years should not take more than three grains at a dose, and no more than one drachm in twenty-four hours. The following will be found useful prescriptions:

℞. Tinc. ferri chloridi, ʒ ij;
Potas. chlorat., ʒ j;
Syr. simplic., ℥ iv. Misce.

Dose, one teaspoonful every hour to two hours for a child of three years. In place of the simple syrup three parts of water and one of glycerine may be employed.

℞. Tinc. ferri chloridi, ʒ ij;
Acidi sulphurosi, ʒ j;
Potas. chlorat., ʒ j;
Glycerinæ, ℥ ss;
Aq. calcis, q.s. ad. ℥ iij. Misce.

Dose, one teaspoonful every hour to two hours for a child of three years.

The citrate of iron and ammonia alone, or in combination with carbonate of ammonium, may be given in two-grain doses, dissolved in simple syrup, in place of the above mixture, when the inflammation of the fauces has considerably abated or is moderate; or the beef, iron, and wine of the shops may be given every hour or second hour. If the patient improve, and the disease begin to decline, the intervals between the doses may be lengthened, but the tonic should not be entirely discontinued until the patient is far advanced in recovery, on account of the dangerous sequelæ, which take their origin in an impoverished state of the blood.

Local Treatment.—It is important to keep in mind the purpose for which local measures should be employed, as stated above. It is to reduce the inflammation of the mucous surfaces, and destroy the diphtheritic poison, and contagious properties in the pseudo-membrane, and to destroy the septic poison, and prevent its absorption, if any form. Forcible removal of the pseudo-membrane, irritating applications, the use of a sponge or other rough instrument, for making the applications, should be avoided as

likely to do harm. The applications should be made either with a large camel's-hair pencil, or, better for most of the mixtures employed, with the atomizer. The hand atomizer, like Richardson's hard rubber, or Delano's, which is of simple construction, while it carries a heavy spray from the curved tube, which is introduced over the tongue, is very useful.

Half a dozen to a dozen compressions of the bulb of the hand atomizer cover the surface of the throat more effectually with the liquid than can be done by several applications of the brush, and it is usually not dreaded by the patient. Diminution of size of the pseudo-membrane under the use of the spray is a favorable sign, but if it do not diminish, its presence can do little harm, provided that it is properly disinfected.

The steam atomizer may also be used, and in some cases it is more convenient than that worked by the hand, but the medicine employed in it is necessarily much diluted by the steam from the boiler, unless it be of such a nature that it can be used in both cup and boiler. The steam atomizer possesses the advantage of producing a steady spray, without exciting or disturbing the patient, so that it can be inhaled even during sleep, but it is best often to supplement its action by the hand instrument. The hand atomizer is less apt to be clogged than the delicate glass points of the steam instrument, and will vaporize a thicker liquid. This is an important advantage, especially in using the lime-water for inhalation in croup, since it can be employed in the hand atomizer even when it presents a milky appearance from the amount of lime.

At a recent meeting of the New York Pathological Society I presented a specimen showing the diphtheritic exudation, and a discussion arose as to what is the safest and most efficient solvent of the false membrane, full and exact knowledge of which is very important, especially for correct treatment of diphtheritic croup. Chlorate of potassium, pepsin, lactic acid, and lime, are solvents of pseudo-membranes, and after the meeting of the Pathological Society Dr. Chadbourne, resident physician of the New York Foundling Asylum, and myself, determined to ascertain experimentally which is the best solvent. We employed reliable liquid pepsin, acidulated with lactic acid, thirty drops to the ounce, for one solvent, and the officinal lime-water for the other. Equal portions of pseudo-membrane, removed from the larynx in a fatal case of diphtheritic croup, were added to the same quantity of these liquids. The-lime water produced complete solution in about twenty-five minutes, while the lactic acid and pepsin required more time. I have repeated the experiment since, with a similar result, and have employed the lime-water mixed with about one-fourth its quantity of carbonic acid water, but this did not seem to impair materially the solvent power of the lime. This last experiment was made in order to determine whether the carbonic acid, which passes over the pseudo-membrane in each expiration, impaired the solvent action of the lime.

Therefore in the local treatment of diphtheritic pharyngitis, plain lime water is one of the best solvents of the pseudo-membrane used by the atomizer or gargle, preferably by the former, or one of the following mixtures may be employed :

No. 1.

℞. Acid. carbolic., ʒ ss ;
Aquæ calcis, ℥ viij. Misce.

No. 2.

℞. Acid. carbolic., ʒ ss ;
Potas. chlorat., ʒ iij ;
Glycerinæ, ℥ ij ;
Aquæ calcis, ℥ vj. Misce.

More recent investigations, conducted by Dr. Chadbourne, have shown that liquor potassæ, or liquor sodæ, one part to forty of water, is a still more active solvent of fibrin. For further particulars relating to these investigations the reader is referred to our remarks on the treatment of pseudo-membranous laryngitis.

Employ atomizer every hour or second hour. India-rubber tubing, which does not interfere with the action, should be drawn over the sharp point of Delano's atomizer. In this connection, I would state that the hand atomizer with double bulb is preferable to that with single bulb, as the child tolerates better the steady spray. The advantage of its use is very notable in the treatment of diphtheritic croup.

In most cases of diphtheritic inflammation of the fauces the spray suffices for local treatment, but the following mixture, applied by a large camel's-hair pencil, is also very effectual, immediately converting the pseudo-membrane into an inert mass, and putting a stop to all movements of the bacteria which swarm in it, as I have observed under the microscope :

℞. Acid. carbolic., gtt. viij ;
Liq. ferri subsulphat., ʒ ij–iij ;
Glycerinæ, ℥j. Misce.

This may be used two or three times daily, between the spraying, or oftener without the spraying. It is not irritating (such an effect would condemn it), but it is dreaded by most children, on account of the unpleasant "puckering" which it produces, and the pain from the contraction, which sometimes extends to the ear.

That form of diphtheritic inflammation which most imperatively requires local treatment, and in which local measures are of more importance than the constitutional, is obviously the laryngeal. Catarrhal laryngitis sometimes occurs in diphtheria, as I have occasionally observed in the dead-house, without producing any marked symptoms, but the pseudo-membranous laryngitis of diphtheria is also common, and, as all know, is one of the most dangerous forms of disease.

Diphtheritic Croup.

Of the 104 cases of primary diphtheria, which I have alluded to above as having been seen by me in family practice, between December 1, 1875, and July, 1878, and notes of which I have preserved, in twenty-five the predominant inflammation was pseudo-membranous laryngitis. Cases in which there was some huskiness or hoarseness of voice, but no obstruction in the respiration, were not included in this number. Of these twenty-five cases, in which there seemed to be no reasonable doubt of the presence of a laryngeal pseudo-membrane, nine recovered, two by tracheotomy, and seven by the inhalation of the spray. Of the sixteen who died, upon two tracheotomy was performed, while the others were treated by the spray. It will be admitted, I think, that recovery of nine in twenty-five cases was an exceptionally good result, and was probably in part due to mildness in the type of diphtheria, during a portion of the time, in which these cases occurred, for if the type be severe, the exudation is more abundant, and the exudative process continues longer. But those who observe carefully the effects of the spray (of liquor potassæ, or liquor sodæ, one part to forty of water, or of lime-water, as the most powerful solvent which can be safely employed), must admit that it is the most effectual agent at our command for treating this very fatal affection. The following cases may be cited as examples, showing what may be accomplished by the spray :

L., æt. 9 months, began to have croupy cough on February 16, 1877, but it was slight at first, so as to attract little attention. Gradually this symptom became worse, and on the 19th I was asked to see her. At this time both inspiration and expiration were noisy, the cough frequent and croupy, the temperature 101°, and the fauces red, but without any pseudo-membrane upon them. In addition to the internal treatment, the steam atomizer was ordered to be used every half hour to every hour. On the the 22d small patches of pseudo-membrane were observed upon the fauces, the noisy respiration and croupy cough remained with little change, and the same treatment was continued.

24*th*. Symptoms worse ; temperature 103° ; respiration still more embarrassed, and the sternum is depressed in each respiration. Evening, temperature 101° ; respiration 40 ; pulse 136 ; urine scanty, none of which can be collected for examination. The steam atomizer is to-day substituted for the hand atomizer, and its constant use directed.

25*th*. No lividity of fingers or lips, but very great dyspnœa; struggles for breath at times, with a wild expression of the eyes ; respiration 40 ; pulse 164 ; temperature 103°. On the evening of this day it did seem that the child would die before morning, and I greatly regretted that tracheotomy had not been performed, and would then have prepared for it, except for the opposition of the family. The steam atomizer was used without intermission.

26*th*. Respiration 48, its character as before, but the mother states that the cough is somewhat looser ; temperature 103½°. The membranous

exudation has disappeared from the fauces. From this time there was gradual improvement, and in a few days the child was out of danger.

In the same month in which the above case occurred, diphtheritic laryngitis appeared in two other families in my practice, and the following histories of them will also show the probable good effects of the atomizer :

B., æt. 13 months, began to be croupy on February 14. On the 16th, when visited by me, there were small isolated patches of pseudo-membrane upon the fauces, and the uvula was completely covered by this exudation. The cough was croupy, but the respiration was much easier than in the above case, and there was much less hoarseness of voice. The No. 2 mixture was used every half hour with Delano's hand atomizer, and the symptoms, which never showed any immediate danger, gradually abated.

B., a girl, æt. 4 years, living in the east side of the city, began to be hoarse on February 14, and on the 15th the dyspnœa became so urgent that the attending physician performed tracheotomy. A cast two inches in length, circular, and evidently extending nearly to the bifurcation, was expectorated from the opening, after which the respiration was easier. Her temperature was constantly under 100°. A few days after the operation, symptoms of profound blood-poisoning occurred. The urine was very albuminous, and it contained casts. The edges of the opening into the trachea became covered with the diphtheritic pellicle, and the characteristic offensive odor was observed. Her death occurred on February 22.

The second child, æt. 20 months, began to be hoarse on February 15, and was visited by myself with the attending physician on the 17th. Her temperature was 101° ; her fauces were red, but with only small patches of exudation, and her respiration was embarrassed and noisy, so as to be heard in the adjoining room. We prescribed, in addition to sustaining remedies, the constant use of the No. 1 mixture through the steam atomizer. Some of the time two steam atomizers threw the spray upon the face of the child. It was obvious within a day or two, that the obstruction within the larynx had not increased, and with the constant use of the instruments night and day the inflammation gradually abated, and the life of the child was saved.

These cases indicate, in my opinion, the proper course of treatment in diphtheritic laryngitis, but while we accord to local measures the first place in the rôle of therapeutic agents for this form of inflammation, internal treatment should not, as a rule, be suspended. Even mild cases of diphtheritic laryngitis may end fatally by systemic infection after the obstruction in the larynx is removed as in the above case, in which tracheotomy was performed, although the temperature during the period of the dyspnœa had been constantly under 100°.

In treating diphtheritic croup, I have in some cases employed almost constantly the steam atomizer, which vaporizes the officinal lime-water without clogging, and through the glass cylinder which conveys the steam, have worked the hand atomizer, containing a thick or milky solution of lime. The conjoined vapors are heavily charged with lime. I do not now trust to the steam atomizer alone, if lime-water be employed, unless in the mildest cases in which the voice is clear, and there is no ob-

struction to respiration. In obstructive laryngitis the use of the hand atomizer every half hour, in addition to the steam atomizer, will save a certain proportion of cases from the necessity of tracheotomy, as I have every year had the opportunity to observe. If the tongue be strongly depressed by a spoon or spatula, or if the patient protrude his tongue, or the tongue be seized with a napkin and drawn forward, the epiglottis is more elevated, and the vapor more readily enters it, so as to immediately excite a strong cough. In a case at present under treatment, the patient either protrudes his tongue or I draw it forward with a napkin, and with every compression of the bulb of Delano's atomizer a strong cough is excited, showing that the spray has entered the glottis. But although the spray of lime-water is a good solvent, it seems probable from the recent experiments, to which I have alluded, that liquor potassæ, or liquor sodæ, will yet be employed by the profession generally, for while it is apparently more efficient than the lime it does not clog the atomizer, when used in the proper proportion of one part to forty of water.

In the New York Foundling Asylum during the last year, the resident physician, Dr. Chadbourne, has employed a hand atomizer with three india-rubber bulbs, and a tip about four inches in length, with the last inch curved downward at a right angle. The bulbs are first distended with air, which is retained in them either by compressing the tubing with thumb and finger or by a stop-cock. The curved end of the tip is then inserted back of the epiglottis into the upper part of the larynx and the air allowed to escape. This rapidly throws a heavy vapor into the larynx, and excites a severe cough. By this apparatus Dr. Chadbourne has succeeded in saving the lives of certain children which under other treatment would apparently have been lost.

If the inflammation do not begin to yield, and death seem imminent, tracheotomy should be considered. During an epidemic of severe type this operation will not, with an occasional exception, save life, but when the type is mild a considerable proportion recover after it, with judicious subsequent treatment. When the type was severe in New York, and blood-poisoning a prominent feature, one of our surgeons operated about forty times, with only two recoveries, and the experience of others was nearly the same ; but during the last two years, with a milder type, the result has been much more favorable. Tracheotomy should therefore be performed as a last resort in certain cases.

Except in comparatively rare instances, there is only one other diphtheritic inflammation which requires special treatment, namely, that affecting the Schneiderian membrane. This membrane, in sensitiveness and liability to irritation, is intermediate between the conjunctiva and buccal or faucial membrane, and, therefore, when inflamed it requires milder applications than such as are appropriate for the fauces. Applications suitable for the fauces would, if thrown into the nostrils, be too painful, and

might increase the inflammation. I know no better treatment of the nostrils than to inject with a small syringe or india-rubber bulb and tip, one to two teaspoonfuls of the following mixture every third or fourth hour. It should be used at the temperature of the body, with the head thrown back and the eyes covered with a cloth. I have sometimes employed it with the atomizer, its tip being covered with india-rubber tubing.

℞. Acid. carbolic., gtt. xxiv;
Aquæ calcis, ℥viij.

Diphtheritic paralysis requires the use of strychnine with tonics. I ordinarily employ the elix. phosphat. ferri. qui. et strychniæ of the shops. Each drachm of this contains gr. $\frac{1}{60}$ of strychnia, and by dilution with water the proper dose can be administered to a child of any age. Thus, recently, a child aged six years, having paralysis of the muscles of the pharynx, recovered in about one week, by the use of one drachm of this medicine daily, given in four or five doses. I have not found it necessary, in any case which I have observed, to employ electricity, but it is no doubt useful in expediting recovery, especially if the paralysis be in the limbs. The anæmic state which succeeds diphtheria requires the use of iron for several weeks.

Preventive Measures.—The occurrence of diphtheria in a family necessitates the prompt removal of other children of the family either out of the house or to a distant part of it, and the disinfection of the room, and the handkerchiefs, and other linen, and spittoons employed. The diphtheritic, like the scarlatinous, virus may remain for weeks or months in a locality or apartment. In East Fifty-fifth Street two families resided in a brown-stone house, the sanitary condition of which was apparently good. In December, 1874, diphtheria occurred in one of these families, who occupied the lower floor and the basement, causing the death of two of the children. The other family, in order to escape the danger, immediately removed to another part of the city, where they remained two months, returning home on March 6th. On March 14th and 15th, eight and nine days after the return, their two children, aged $2\frac{1}{2}$ and $4\frac{1}{2}$ years, who had been allowed free access to the room in which the fatal cases had occurred, also took severe diphtheria, one of them dying.

In another family, living in the suburbs of New York, a lady contracted diphtheria from her brother's child, who died of the malady a few blocks distant. Returning home, she occupied a small room, remaining constantly in it, and by prompt local treatment was soon convalescent. Her only child, a boy of six years, was excluded from her companionship about one month, after which he was allowed to enter the room, and slept in it. Within a few days, namely, thirty-five days after it commenced in the mother, the diphtheritic patch appeared upon his fauces. In one of the asylums of this city, diphtheria has been prevailing more than a year,

the cases occurring mainly in one of the buildings, and with so little break or intermission that it appears that the diphtheritic virus has not been eradicated from one or more of the wards since the first case occurred. Such instances show the danger of admitting children into rooms where diphtheria has occurred, until a considerable period has elapsed, and thorough disinfection has been employed.

When diphtheria is prevalent, indisposition on the part of a child, and especially febrile symptoms, or defluxion from the nostrils, should at once arrest attention. Although there be no complaint of soreness of the throat, the fauces should be carefully inspected, and if they seem too red, they should be sprayed with one of the mixtures recommended above.

Pertussis.

Pertussis is an infectious disease attended and manifested by a catarrh of the air-passages. This catarrh gives rise to a cough which does not differ, during the inception and in the declining period, from that in an ordinary catarrh, but during the middle period of the malady is spasmodic. Exceptionally the system is so mildly affected that the spasmodic element of the cough is lacking through the whole course of the malady, or is confined to a brief period. This distinctive symptom, namely, the peculiar cough, has been attributed to the irritating and disturbing action of the specific principle on the nerves which control the muscles of respiration. Some attribute it to the impression produced upon the filaments of the pneumogastric, especially upon those of the internal branch of the superior laryngeal nerve, by the mucus which collects in the larynx and trachea, and which is known to contain the contagious principle in abundance. This cough consists in a series of forcible and loud expirations, followed by a noisy and difficult inspiration. Its special character is due to spasmodic contraction of the muscles of expiration, and notably of the small muscles of the larynx so as to produce narrowing or even closure of the aperture of the glottis. Each paroxysm of the cough usually ends, not always, in the expectoration of viscid mucus. With rare exceptions pertussis affects the same individual but once. Rilliet and Barthez report a case of its second occurrence, and West another case. I have attended two adult patients, both women of intelligence, who stated that they had had previous attacks in early life. Pertussis usually prevails as an epidemic, but is occasionally sporadic, at which time its type is mild. It is highly contagious through the breath of the patient, or from exhalations from his surface.

In one instance I was able to ascertain accurately the incubative period of pertussis. Mrs. B. having a cough for two weeks, which was afterward ascertained to be that of pertussis, came from Boston to a family in New York. She remained with this family from 2 P.M., January 2,

1879, till the evening, when she left the city. During her stay she held and kissed an infant that was previously well, and had never been removed from the floor on which it was born. Pertussis was not at that time prevailing in New York. On the 6th, or four days after exposure, the infant began to cough, and this proved to be the beginning of a severe pertussis.

Age.—Most cases of pertussis are between the ages of one year and eight years, but it occasionally occurs in adults and even old people who have not been attacked previously. It is rare under the age of three months, but through the kindness of Dr. Ewing, of New York, I was enabled to see a new-born infant with pertussis, whose mother had had the disease during the two months preceding her confinement. This infant when fifteen minutes old, and during the washing, had the first convulsive seizure, which appeared to consist chiefly of a spasm of the laryngeal muscles, with temporary suspension of the respiration, and attended by deep lividity of the features, with some frothing from the mouth. These attacks occurred nearly every hour, with intervals of complete cessation of symptoms. The mucus between the lips finally became stained with blood, and death occurred on the third day. The mother, the intelligent wife of a clergyman, believes that the infant had similar attacks before its birth. A parallel case is related by Rilliet and Barthez.

Causes.—Climate, race, and nationality do not seem to exert any decided influence on the spread of pertussis. Females are somewhat more liable to be attacked than males, and, as we have seen, a large majority of the cases occur between the ages of one and ten years. The nature of the contagious principle of this disease has, in my opinion, thus far eluded detection, and is likely to, for some time to come, on account of its subtlety. The last ten years have been characterized by very active search, chiefly with the microscope, for the *contagia* of the infectious diseases. Many suppose that it has been discovered, as regards diphtheria, in the countless bacteria which swarm in the pseudo-membrane, and even in the tissues and excretions, and Letzerich, about the year 1870, supposed he had discovered the cause of pertussis in a fungus, which received upon the surface of the air-passages in inspiration, increases rapidly and produces the spasmodic cough by its irritating effect, or the irritating property which it imparts to the mucus. In the first stage of pertussis he found only the spores of the fungus, and at a more advanced stage in addition to the spores he discovered the irregularly ramifying branches of the thallus. He introduced the mucus upon the fauces of the rabbit, and witnessed the production of pertussis in this animal. But a moment's thought shows us that this theory fails to explain the history and phenomena of this disease, for, unless the cause were something more subtle than the spores and branches of a fungus, we do not see how it is possible that the mother, contracting pertussis during the last weeks of her pregnancy, should infect

her fœtus, whose circulation is entirely distinct; nor does this theory comport with the fact that pertussis passes through regular stages and declines, without any measures which are calculated to destroy the fungus. Besides, it is stated by Steffen, in *Ziemssen's Encyclopædia*, that other microscopists have failed to verify the theory of Letzerich.

Lesions have been discovered in certain fatal cases which have been supposed to throw light on the etiology of pertussis, but which are now known to have been merely coincidences or results of the disease. Such are congestion of the spinal cord and its meninges, hyperæmia of the pneumogastrics, and tumefaction of the tracheo-bronchial glands, which it was claimed produced the spasmodic cough by compressing the recurrent laryngeal nerve.

Pathological Anatomy.—Catarrhal inflammation of the air-passages is uniformly present. It occasionally occurs on the mucous surface of the nostrils and pharynx, but is often absent from these parts. In the majority of cases the inflammation affects the surface of the glottis and that below the glottis. However, in not a few cases the surface of the larynx and trachea is pale and not swollen, or the inflammatory appearance is limited to a small part, as the ventricles of the larynx, while the mucous coat of the bronchi and their branches is swollen and red, and covered with tenacious mucus. Sometimes certain alveoli are found distended by a thick muco-pus, producing an appearance like minute tubercles.

A common lesion found in the lungs of those who have perished with this malady is emphysema, affecting chiefly the peripheral portions of the upper lobes. It is commonly vesicular emphysema occurring from over-distension of the air-cells, but in some instances the air has escaped into the connective tissue, causing interstitial emphysema. According to my recollection of fatal cases, which have occurred from time to time in the institutions of New York, and in which I have made post-mortem examinations, the upper lobes were exsanguine and inflated to nearly the fullest extent possible within the thorax, while other portions of the lungs presented areas of pneumonic, or more or less complete atelectatic solidification. Pneumonia, atelectasis, and small extravasations of blood in the lungs, are, indeed, common lesions. Hyperplasia of the bronchial glands is also common, and hyperplasia has also been occasionally observed of other lymphatic glands, as the mesenteric. An ulcer under the tongue which observers have frequently noticed is now attributed to pressure of the tongue on the lower incisors during the cough.

In fatal cases, small extravasations of blood in or upon the brain are common, as is also passive congestion of the sinuses, veins, and capillaries, meningeal and cerebral, attended with more or less transudation of serum within the ventricles of the brain, and between the meninges. Large dark and soft clots, and occasionally some that are white or yellow, are common in the intra-cranial sinuses, especially if, as often happens, death have

occurred in convulsions, which supervened upon the severe spasmodic cough.

Symptoms.—Pertussis consists of three stages : first, that of catarrh of the air-passages ; secondly, the stage of spasmodic cough, or for brevity the spasmodic stage ; thirdly, the stage of decline.

The first period is characterized by the symptoms of coryza and bronchitis, which present nothing peculiar or different from ordinary catarrh of the same parts, unless occasionally the cough be more frequent and teasing. Trousseau has known it to be repeated forty or fifty times per minute. The eyes present a moderately suffused appearance, and there is sneezing, with defluxion from the nostrils, but less than in the commencement of measles. The cough, which commences as soon as the catarrh affects the larynx, is accompanied by little or no expectoration. The pulse and respiration are moderately accelerated, and such other symptoms as commonly accompany catarrh of a mild grade are present, namely, increased heat of surface, thirst, and impaired appetite.

The duration of the first stage varies in different cases. In severe hooping-cough it may last only two or three days, and in mild cases, be protracted to five or six weeks. It may be absent especially in very young infants. We have alluded above to the new-born infant, in whom there was no first stage, a glottic spasm occurring soon after birth. The first stage commonly ends in from eight to fifteen days. In fifty-five cases observed by Dr. West its average duration was twelve days and seven tenths of a day. It is stated above that the first stage in rare instances continues during the entire course of pertussis ; at least no spasmodic cough occurs. In two such cases which I now recall to mind, both girls, the inflammatory symptoms abated somewhat after the first few days, and there remained an occasional easy cough like that of simple bronchitis, which continued during a period corresponding with the ordinary duration of pertussis. The diagnosis would have been doubtful, except for the occurrence of pertussis, with its regular stages, in other children of the same families.

Second Period.—This may commence quite abruptly, but ordinarily its beginning is gradual. While the cough commonly has the character present in the first stage, it is now and then observed to be more severe and spasmodic, especially at night, and when the patient is in any way excited. The spasmodic element increases, so that in the course of a week all doubt as to the nature of the disease is removed.

The severity of the cough in the second stage varies considerably in different cases. It sometimes commences quite abruptly, with little warning, but commonly there is premonition of it, and the child endeavors to repress it. He experiences a tickling sensation in the throat, or median line of the chest, or a feeling of constriction. He leaves his playthings, and rests his head on his mother's lap, or takes hold of some firm object for support ; his face has a grave or even anxious appearance, while the

pulse and respiration are somewhat accelerated. Immediately the cough begins. It consists in a series of short and hurried expirations, which expel a large part of the air contained in the lungs, followed by a hurried inspiration, which is difficult and noisy on account of the spasmodic contraction of the laryngeal muscles, and narrowing of the glottic aperture. The sound which accompanies the inspiration, and which is often absent, especially in infants, is designated the hoop. The forcible expirations, and difficulty experienced in expelling the air from the lungs on account of the constriction of the glottis, afford explanation of the emphysematous distension of the air-cells in the upper lobes, which we have seen is so common in severe pertussis.

There may be a single series of expirations terminating in the manner stated, but often there are several such series embraced in a paroxysm. The cough commonly ends in the expulsion of frothy mucus from the bronchial tubes, and sometimes in vomiting. During the cough there is temporary arrest of blood in the lungs, leading to congestion in the right cavities of the heart, and throughout the systemic circulation ; therefore the face is flushed and swollen, and occasionally hæmorrhage occurs under the conjunctiva, or from one of the mucous surfaces. The most frequent hæmorrhage is epistaxis. When the cough ceases, and normal respiration is restored, the fulness of the vessels immediately abates ; but often puffiness of the features is observed, due to serous infiltration of the subcutaneous connective tissue, and continuing for days or weeks during the period when the cough is most severe. The paroxysm lasts from a quarter to a half or even a whole minute, and in that time, in cases of ordinary severity, there are often as many as fifteen or twenty series of expirations.

At the close of the paroxysm, if there be no complication, the symptoms soon abate ; the temperature, pulse, and respiration become normal, and there is no evidence of disease. The cough in the second stage is much more frequent in one case than another. At the height of this stage it is generally more severe if it occur at long intervals than when frequent. During the weeks in which pertussis is most severe, there is, in the average, about one paroxysm of coughing in each hour.

The cough increases in severity till the third week of the second stage, or the thirtieth to thirty-fifth day of the disease, after which it remains stationary for a certain time. It is apt to be more frequent in the night than daytime. Sometimes it occurs while the child is quiet ; it may even awaken him from sleep, but it is often also produced by mental excitement or by physical exertion. Anger or fright gives rise to it, and therefore the child is apt to cough when being examined by the physician, or when his wishes are not complied with. The ordinary duration of the second stage is from thirty to sixty days. It may, however, be considerably longer or shorter than this.

The *third stage*, which commences at the time when the spasmodic

cough begins to abate, is short, not continuing longer than two or three weeks. A protracted stage of decline indicates some complication. While the sputum in the second stage is mucous and frothy, that in the third stage is more opaque and puriform.

In the third as in the second stage, if there be no complication, the pulse and respiration in the intervals of the paroxysms are nearly or quite natural. Febrile excitement may, however, now and then occur from trifling causes, or, indeed, without any apparent cause. The digestion and the general health in uncomplicated pertussis remain unimpaired, with the exception of more or less emaciation, which is apt to occur in all but the mildest cases, in consequence of the frequent vomiting. After complete recovery, it is not unusual for the spasmodic cough to reappear, at times, for one or even two years. The cough of ordinary simple laryngitis, or bronchitis, assumes this character.

Complications.—These, like the symptoms, are chiefly of a twofold character, namely, inflammatory and neuropathic. From the nature of the cough in pertussis, it would naturally be supposed that that spasmodic affection, which is now designated internal convulsions, and which is characterized by spasm of certain muscles of respiration, would be a frequent complication. It does sometimes occur in young children, but it is not common. Clonic convulsions affecting the external muscles are, on the other hand, not infrequent. They occur chiefly in the second stage, when the cough is most severe, and in infancy much more frequently than in childhood. They are apt to be general and severe, or if not of this character at first, to become such. The convulsions commence, in most instances, in or directly after the paroxysm of coughing ; but they sometimes occur in the interval when the child is quiet.

Rilliet and Barthez remark : " Almost all infants succumb to this complication, ordinarily in the twenty-four hours which follow the first attack ; nevertheless, life may be prolonged during two or three days." (Article *Coqueluche.*) In my own practice this complication usually ended fatally before bromide of potassium and chloral were employed, but with the proper use of these agents it can often be arrested. In the month of June, 1867, I was attending a little girl two years and four months old, who had reached the fifth week of pertussis, when she was seized with general clonic convulsions. The mother, who was requested to keep a record of the number of convulsions, stated that there were twenty in all, occurring within forty-eight hours. They affected both sides, the shortest lasting only three or four minutes, the longest seventy-five minutes. The treatment in this case, which eventuated favorably, will be noticed hereafter.

In those who die of convulsions occurring in hooping-cough, the most constant lesion is congestion of the cerebral veins and sinuses, often with transudation of serum. This congestion is due in part to the cough which

precedes the convulsions and in part to the convulsions themselves. At the autopsies which I have made of two infants, who died in hospital practice from hooping-cough, accompanied by convulsions, all the cerebral sinuses were filled with clots, which were generally soft and dark ; but in the lateral sinuses clots were found which were light-colored. The light color of a clot, either in a vein or sinus, indicates its ante-mortem formation.

The gravity of the convulsive attack can be ascertained by observing whether the patient readily recovers consciousness. Its return indicates that there is no serious congestion. On the other hand, great drowsiness remaining, or a semi-comatose state, indicates persistent congestion, and, perhaps, even the formation of clots in the sinuses of the brain. Death from convulsions is usually preceded by coma. Occasionally meningeal apoplexy supervenes upon the congestion, and death is immediate.

The most frequent inflammatory complications are bronchitis and pneumonitis. Inflammation of the bronchial tubes of a mild grade, we have seen, is a common accompaniment of pertussis, but when it extends to the minuter tubes, or becomes so severe as to cause acceleration of respiration, it is, properly, a complication. Both bronchitis and pneumonitis, occurring as complications, are developed, with few exceptions, in the second stage. Bronchitis is accompanied by accelerated respiration and pulse, and increased temperature. The danger is proportionate to the amount of dyspnœa.

Pneumonitis is a less common complication than bronchitis, but it occurs more frequently in pertussis than in any other constitutional malady of early life, excepting measles. The congestion, which results and remains in the lung when the cough is frequent and severe, favors the development of pneumonia. The symptoms and physical signs which accompany this inflammation and serve for its diagnosis are the same as in the primary form of the disease, and are described elsewhere. Bronchitis or pneumonia usually moderates the severity of the spasmodic cough, for when the inflammatory element in pertussis increases, the spasmodic abates. On the abatement of the inflammation, however, the cough usually regains its former convulsive character. The fact may be stated in this connection, that any complication or intercurrent disease, which is attended by decided febrile reaction, ordinarily renders the cough for the time less spasmodic.

The occurrence of bronchitis or pneumonia is shown by the elevated temperature, acceleration of pulse and respiration, short and frequent cough. These symptoms do not cease so long as the inflammation continues, whereas in uncomplicated pertussis the patient seems nearly or quite well between the coughs. In pneumonia the respiration is accompanied by the expiratory moan, and in both bronchitis and pneumonia there is more or less depression of the infra-mammary region during inspiration. These symptoms, in connection with the physical signs, render

diagnosis in most instances easy. Although the general character of the cough is changed, a cough now and then occurs, even when the inflammation is pretty severe, sufficiently spasmodic to indicate the nature of the primary affection. Capillary bronchitis and pneumonia are always serious complications.

Not only is more or less emphysema a common complication of severe pertussis, but bronchiectasis also occurs in certain cases, due to the same conditions. Emphysema is a common lesion in young and feeble infants, even when there is no history of any previous severe disease of the respiratory organs. I have found it one of the most common lesions in infants of feeble constitutions, who die in the hospitals and asylums of New York, but it is apt to be interstitial and confined to a small part of the upper lobes. It is not accompanied by that general distension of the alveoli and consequent enlargement of the lobes, which occur in the emphysema of pertussis. Its chief cause in these feeble and wasted infants appears to be impaired nutrition and change in the molecular condition of the pulmonary tissue. The same condition often occurs in severe and protracted pertussis, and therefore serves as an additional and efficient cause of the emphysema.

The following was a not unusual case of this disease as it occurs in the tenement houses and asylums of New York. At the meeting of the New York Pathological Society, October 14, 1868, I exhibited emphysematous lungs, removed from an infant who died at the age of nineteen months, at the commencement of the fourth week of pertussis. Death occurred from thrombosis in the lateral sinuses of the cranium, resulting from the severe spasmodic cough, eclampsia, and feebleness of the circulation, as the infant was previously in a reduced state from chronic entero-colitis. At the autopsy the superior lobes of both lungs were found exsanguine, doughy to the feel, and enlarged so as to rise above the level of the other lobes. The resiliency and elasticity of the lung tissue in these lobes were evidently greatly impaired, and their air-cells in a state of over-distension. The other lobes were healthy, except that one of them was the seat of catarrhal pneumonia. In this case there had been no disease affecting the respiratory apparatus previously to the pertussis, so that the incipient vesicular emphysema was referable to the severe cough and impaired nutrition of the lungs.

Occasionally we meet cases of severe pertussis in which, while there is over-distension of the alveoli of the upper lobes, collapse occurs over a greater or less extent of the lower lobes. Collapse, like emphysema, may continue for weeks or months subsequently to pertussis, and then gradually disappear, but in the following rare case in my experience it was permanent. John O'Neil, aged 5½ years, was brought to the Bureau for the Relief of the Out-door Poor in New York, in December, 1876. He lived in the underground basement of a tenement house, and was supported

by charity, except, at intervals, when his father, who was dissipated, could obtain work. At the age of fifteen months he had a glandular swelling on the right side of the neck, which suppurated, and three months later one on the opposite side, which also suppurated. At the age of 2½ years he had bronchitis, the cough of which did not abate till two months subsequently. When near the age of three years he had measles, and the cough from this disease lasted three or four months. In the summer of 1875, or about one year subsequently to the measles, he contracted pertussis, which was severe, but was allowed to run its course without treatment. It lasted four months, never, however, confining him to bed or materially impairing his appetite. One morning about the close of the second month of the malady, the parents first observed depression of the right side of the thorax. This gradually increased for a few weeks and has been permanent. The parents stated that he had never been confined to the house or without appetite except during the week of measles.

Fig. 14.



Since his recovery from pertussis he has had his usual appetite and general health, but crying or excitement commonly brings on a pretty severe cough. The depression of the thorax examined in front, begins quite abruptly in the line of the left costo-chondral articulations. Circumferential measurement of the left side from the middle of the sternum to the spine, the tape lying a little below the nipple, gives eleven and a half inches, while corresponding measurement of the right side gives seven and a half inches; pulse 136, sounds of the heart normal; respiration 44. On auscultation over the right side of the chest we observed bronchial respiration, and a feeble bronchophony, with perhaps slight vocal fremitus. The accompanying figure is from a photograph by Mr. Mason, photographer to Bellevue Hospital. My first impression on observing this case was that it was one of unexpanded lung, which had been compressed by a pleuritic effusion, but it is seen that the history points clearly to pertussis as the cause of the deformity. The depression occurred somewhat suddenly when the cough was most severe, and when there was no fever, loss of appetite, or other symptoms of pleuritis. The patient had not presented any marked evidence of rachitis, but was decidedly strumous.

Pertussis is sometimes complicated by the eruptive fevers. There does indeed seem to be some affinity between it and measles, so that many epidemics of the two have been observed at about the same time. During my term of service in the New York Foundling Asylum, in May, 1878,

measles and pertussis prevailed in the wards at the same time. Eighteen of the children, who were having pertussis, contracted measles, and the Sisters, who were very intelligent and faithful observers, and were requested by me to notice the effect of the complication, stated that with few exceptions the severity of the hooping-cough was increased during the continuance of the exanthem. This is contrary to the general belief of the effects of inter-current febrile diseases.

Diagnosis.—During the period of invasion it is impossible to diagnosticate pertussis. Its nature can only be conjectured from a known exposure or from the epidemic occurrence of the disease. In the second stage, which is characterized by the spasmodic cough, diagnosis is ordinarily easy, and often the parents are able to announce the nature of the disease when the physician is called. Still, a mistake is sometimes made; a spasmodic cough very similar to that of pertussis occasionally occurs in other maladies. Young infants with bronchitis frequently experience great difficulty in the expectoration of mucus, which collects in the air-passages and provokes a suffocative cough. The following facts will aid in making the diagnosis. Bronchitis, accompanied by a suffocative cough, is an acute disease, and the cough occurs at an early period, usually in the first week. It lacks the inspiratory sound or the hoop, and is associated with constantly accelerated respiration and well-marked febrile symptoms, dependent on the inflammation. Moreover, the cough is only occasionally suffocative, according to the amount of mucus in the tubes. The spasmodic cough of pertussis, on the other hand, is preceded by the stage of invasion, and it occurs only in the second stage, when the febrile symptoms have abated. Again, the suffocative cough of bronchitis rarely ends in vomiting, which has been seen to be so common in the cough of pertussis.

The only other disease with which there is much likelihood of confounding pertussis is bronchial phthisis. The points of differential diagnosis are the following: the one epidemic, and spreading by contagion; the other non-contagious and isolated: the one embraced in three distinct stages, and much shorter; the other chronic, and presenting no stages, but commencing with mild non-febrile symptoms, and progressively becoming more severe: in the one an absence of symptoms in the intervals of the cough, provided there be no complication; in the other constant symptoms, such as are common in tubercular disease. The previous health, and the presence or absence of a tubercular cachexia, should be considered in determining the nature of the disease, and usually, in bronchial phthisis, the lungs are also affected, so that auscultation and percussion may furnish positive proofs of the nature of the cough.

The attacks of suffocative cough, which are produced by the lodgment of a foreign body in the larynx, or lower down in the air-passages, bear a close resemblance to those of pertussis. The diagnosis can be made by

the history, for in the one case there is a preliminary catarrhal stage, and in the other the cough begins abruptly, and usually after the known swallowing of the offending substance, which produces dyspnœa and a spasmodic cough as soon as it enters the larynx. The presence of the body can also be determined in a large proportion of cases by the larnygoscope and auscultation.

Prognosis.—A larger proportion doubtless recover under the better therapeutics of the present time than in former years. According to Hirsch (II., p. 105) 72,000 persons perished from this disease in England and Wales between 1848 and 1855, or one in every forty who died ; and Wilde's reports show that it stands fifth as regards mortality among the epidemic diseases of Ireland. In New York City during the half century ending with 1853, 4,840 died of pertussis, or one died from this disease in every 76 of deaths from all causes.

As a rule, the older the child the better the prognosis. Young infants may die of suffocation due to the glottic spasm. Eclampsia with extreme passive congestion of the encephalon is a not infrequent complication in children under the age of five years, and it is apt to terminate fatally. It may, however, in my opinion, be averted in most cases by proper treatment. In rare instances death may occur in or immediately after a paroxysm of coughing, in consequence of the rupture of cerebral or meningeal capillaries, and the effusion of blood, or from stasis and coagulation of blood in the venous system, especially if convulsions have supervened upon frequent and protracted paroxysms of coughing. Other complications, which are likely to arise under conditions which favor their development, and which greatly increase the danger and render the prognosis unfavorable, are capillary bronchitis, pneumonia, diphtheria, and in the summer season intestinal catarrh. In New York I have noticed that pertussis occurring in the summer is much more fatal if it become complicated with the intestinal catarrh which is an epidemic among infants during that season.

Feebleness of system and antecedent and accompanying chronic disease increase the danger. Pertussis sometimes produces so much emaciation and loss of strength, in consequence of the severity and frequency of the cough, and the repeated vomiting, that intercurrent diseases which in favorable states of the system would probably end in recovery, are very apt to prove fatal.

I usually inform the family that the patient is doing well, if he seem entirely well between the paroxysms ; but if he appear ill, whether with somnolence, fretfulness, fever, loss of appetite, accelerated breathing, or diarrhœa, he is not doing well, and probably has some complication, which requires immediate attention. Sudden deaths occur in the second stage ; but deaths from causes and conditions which operate in a gradual and protracted manner, may occur in the second or third stage.

Treatment.—In the catarrhal stage the treatment should be the same as in mild idiopathic catarrh. Demulcent and gentle expectorant measures are required. Care should be taken to employ nothing which reduces the strength or impairs the general health. If there be much bronchitis with accelerated breathing and frequent cough, mild counter-irritation to the chest, and the use of the oil-silk jacket are proper.

Therapeutic measures are chiefly indicated in the second stage, or that of convulsive cough. Proper treatment may control the severity of the cough, and abridge the duration of the second stage, and prevent or control complications. As with most other diseases whose cause and nature are obscure, and which under ordinary circumstances terminate favorably, pertussis has received a great variety of treatment. The enumeration of the medicines and modes of treatment which have had their season of repute, and been employed by intelligent physicians, would occupy too much time. The treatment should vary in some respects according to the case, but a small number of medicines suffices, even in the most severe and obstinate forms of the malady. Those which I have found most useful for internal treatment, and which are employed more than any others in the institutions of New York, are belladonna, quinine, the bromides, and hydrate of chloral. They are now largely used in the treatment of pertussis in this city, and I can bear witness that a larger number of cases treated by them escape complications and recover, than under other modes of treatment which were formerly employed.

When the second stage commences, belladonna should be given in ordinary cases in morning and evening doses. Children require a larger proportionate dose than adults, and it can with few exceptions be safely administered even to the youngest infant in a quantity gradually increased till the cough is moderated or physiological effects are produced. The physiological effects are more readily produced in some than in others. Thus recently I gradually increased the doses of the tincture of belladonna to twelve drops for a child aged three and a half years, who had severe pertussis, without producing the characteristic efflorescence, while smaller doses from the same bottle produced this effect in older children. Probably the action of the drug is on the respiratory centres in the medulla, and not directly on the muscles, as once held. Rarely I have discontinued the belladonna on account of diminished flow of urine, which this agent may or may not have produced, and very rarely on account of suddenly developed muscular weakness, which I had reason to think the belladonna caused. This occurred in the case alluded to above, in which twelve drops of the tincture were given, so that the muscles seemed flabby, and the trunk and head were supported with difficulty.

Trousseau sometimes employed atropia in place of belladonna, since the medicinal property of the plant resides in this alkaloid, which being crystalline has uniform strength. He gave the neutral sulphate of atropia

in doses of about $\frac{1}{114}$ part of a grain, dissolved in distilled water, to infants or young children. He gave the medicine twice each day, and for older children ordered a proportionately larger dose. Brown-Séquard, in remarks made before the United States Medical Association in May, 1866, maintained that the duration of pertussis, so far as its nervous element is concerned, might be abridged to a few days by doses of atropia sufficiently large to produce toxical effects. He recommended a dose which will cause, and repeated will maintain, delirium for three days, after which he stated that the cough is no longer spasmodic. But a more moderate dose, even with a longer time to effect a cure, seems preferable. The tincture of belladonna is most convenient for use, and most of that kept in the shops is active and reliable. The doses which I have ordinarily found to be sufficient, and which also produced efflorescence, were as follows : to a child of two years three drops, and to one of six or eight years, eight or ten drops, morning and evening. I always, however, commence with a smaller number, and continue to administer the dose which produces the local effects alluded to, unless the cough be moderated with smaller doses. In the majority of cases I have noticed no decided effect till the rash was produced, when the symptoms improved, the cough becoming less frequent or less severe. By the belladonna treatment the spasmodic stage may not only be rendered mild, but abridged to two or three weeks. In some cases the severe cough begins to yield almost immediately under full doses of this agent, but in other cases its continuance for some days is necessary, with other remedies as adjuvants, before there is any appreciable benefit from its use.

The use of quinine as a remedy for pertussis was first strongly recommended by Binz, who embraced the theory of Letzerich, that this disease is produced by a fungus, upon which the quinine acts injuriously. I have not observed that improvement from the use of this agent, when employed alone—and it has been largely prescribed in the institutions of New York—which I have observed in cases treated at the same time with morning and evening doses of belladonna. Its good effects upon the spasmodic cough are probably due to the fact that it diminishes reflex irritability (Schlakow and Eulenberg). At the same time it acts as a tonic, and improves the appetite, and tends to prevent any depressing effect which might occur from the belladonna. It is beyond question the proper remedy in those frequent cases in which febrile symptoms arise, whether from some complication as bronchitis, pneumonia, or other causes. In ordinary cases a child of five years should take about two grains four times daily, in the elixir adjuvans or other convenient vehicle. As an antipyretic a larger dose may sometimes be needed.

As the paroxysms are apt to be more severe at night, and the patient consequently be deprived of the required sleep, a medicine is indicated which will procure some hours of rest, and thereby diminish the number

of paroxysms. For this purpose the hydrate of chloral is especially useful given in doses of two to five grains, according to the age, and perhaps repeated. It does not seem to me that chloral exerts any marked influence upon the cough ; it seems to be useful chiefly in the manner stated, namely, by procuring prolonged sleep.

One of the chief dangers from pertussis we have seen to be the occurrence of great passive congestion of organs, especially of the brain, with the liability to hæmorrhages, serous effusion, and eclampsia. This is in great part prevented by the action of the medicines mentioned above, which diminish the severity of the cough, or its frequency. But when there are great and frequent congestions of the nervous centres, producing eclampsia or premonitions of eclampsia, the use of one of the bromine compounds is indicated for its prompt and decided action in averting the danger. Even if the symptoms be not urgent, its tranquillizing effect, and especially its prompt action in diminishing reflex irritability, render it one of the most useful agents in pertussis. If there be sudden twitching of the muscles, marked stupor, headache, or fretfulness, or adduction of the thumbs across the palms of the hands during the cough, I never fail to give the bromide of potassium in sufficiently large and frequent doses, and now eclampsia occurs much more rarely in a case which I treat from the commencement, than in former years.

Although the treatment described above renders pertussis more manageable and less fatal than formerly, we have during the last three years achieved still greater success by the use of the steam atomizer. This instrument was first used for the treatment of pertussis during a severe epidemic, in the New York Foundling Asylum, and the result was so satisfactory, that it has been uniformly employed since in this institution, during the epidemics, to the almost total exclusion of other remedies. With this treatment very few complications have occurred, such as eclampsia or pulmonary inflammation, and the spasmodic cough has been almost uniformly so modified that the usual remedies did not seem to be required, and what often promised in the beginning to be a severe attack became mild. The same success has attended the treatment of cases in my private practice. The steam atomizer is used from three to five minutes every six hours, and in severe cases oftener, and it is the uniform opinion of the resident physician, the sisters, and nurses of the asylum, that no other treatment is required for uncomplicated pertussis. The medicine used in the atomizer has been the following :

℞. Acid. carbolic., ʒ ss ;
Potas. chlorat., } āā ʒ ij ;
Potas. bromidi, }
Glycerinæ, ℥ ij ;
Aquæ, ℥ vj. Misce.

From the experience therefore of two years, I give the preference to

inhalations over all other modes of treatment. The good result from their use is probably due to the anæsthetic effect, particularly of the carbolic acid, on the terminal filaments of the sensitive nerves in the laryngeal surface.

The complications of pertussis require prompt treatment. Whenever the child feels ill between the paroxysms, he should be carefully examined, and some complication will probably be found which requires treatment. If the bronchitis have increased so as to become a complication, or pneumonia have arisen, the whole chest should be covered with a light flaxseed poultice containing one-sixteenth part of mustard, while quinine and ammonia with alcoholic stimulants are given at regular intervals. Cerebral accidents are best arrested by the warm foot-bath, cold to the head, and by the bromide and chloral.

Diphtheria not infrequently supervenes as a complication in a locality where it is endemic or epidemic, and if mild is apt to be overlooked. Recently I have seen a case in which diphtheria complicating pertussis had continued four days, without being recognized by the attending physician, the symptoms being attributed to other causes. The diphtheritic patch in these cases is apt to appear upon the well-known sore under the tongue, in addition to its occurrence upon other parts. This secondary form of diphtheria requires the same treatment as the primary form.

Hauke, in 1862, published experiments which showed that both carbonic acid and ammoniacal vapors when inhaled increase the cough, while the inhalation of oxygen produced no cough and was agreeable to the patient. Hence children in close and crowded apartments suffer most severely from pertussis, and those who are taken to parks, or the country, where vegetation absorbs the carbonic acid, not only obtain benefit from the general invigorating influence, but also as regards the cough. The fact that fresh and pure air benefits the cough has indeed long been known, and has influenced practice, for patients are almost universally allowed to be much of the time in the open air, and are taken to the parks and upon excursions. Nevertheless caution in this regard is required, for exposure in wet weather or to sudden changes of temperature is very apt to develop bronchitis or pneumonia.

Prophylaxis.—Pertussis is very contagious, and it appears to be, in nearly all instances, if not in all, contracted by inhaling the breath of the patient. I have never observed a case in which it seemed to be communicated through a third person, and it is not, I think, usually contracted by children living in the same house, if there be no personal contact. There is not, therefore, that urgent need of disinfection, and of caution on the part of physician and nurse in their subsequent intercourse with healthy children, as in case of the eruptive fevers.

CHAPTER II.

PAROTIDITIS.

Ordinarily, parotiditis, or parotitis, or mumps, has no premonitory stage ; but in exceptional cases languor with fever precedes the disease for a few hours. Mumps commences with tenderness in the parotid region, followed soon after by tumefaction. The swelling gradually increases ; it fills the depression under the ear, extends forward and upward upon the cheek, and downward to a greater or less extent upon the neck. It has been demonstrated in case of symptomatic parotiditis, and the same is probably true of the idiopathic disease, or mumps (Virchow), that the swelling is due to inflammation of the gland-ducts and consequent œdema of the interstitial tissue. The inflammation is specific, due to a materies morbi in the blood, and hence its decline after a fixed period. It reaches its maximum from the third to the sixth day. The most prominent point at this time is immediately underneath the lobule of the ear. The tumor, which is firm but slightly elastic, presses outward the lobule. In most cases the skin preserves its normal appearance over the swelling, but occasionally it presents a faint blush. The pressure which movements of the jaw produce on the gland renders mastication and even talking painful. Febrile movement more or less intense occurs, lasting, in ordinary cases, not more than forty-eight hours, but occasionally it is more protracted. Vomiting and epistaxis are sometimes present. The swelling having attained its maximum size, remains stationary a short time, when it begins to decline, and by the sixth to tenth day it has entirely subsided.

In most cases parotiditis is double ; it commences on one side, more frequently the left than right, and in from one to four days the opposite gland is involved. In those exceptional cases in which only one parotid is affected, the opposite gland may be the seat of the disease at some subsequent period. It has been estimated that the proportion of unilateral to double mumps is as one to ten.

The total duration of parotiditis is usually from eight to ten days ; in the mildest cases it may not be more than five days. The submaxillary glands are often involved in connection with the parotids, and sometimes also the sublingual, although, from their small size and concealed position, their tumefaction escapes notice. Rarely the tonsils are also tumefied. Sometimes free perspiration occurs at the commencement of convalescence.

The swelling of the parotids sometimes abates suddenly, and in the male the testicle, epididymis, and tunica vaginalis become inflamed ; while in the female the mammary glands, ovaries, or the labia majora,

are the seat of the so-called metastasis. Occasionally these inflammations, which are less frequent in young children than those near the age of puberty, when the sexual organs are becoming more developed, occur without subsidence of the parotid swelling. They cause considerable increase in the fever and constitutional disturbance, but with proper treatment decline in six to eight days, pursuing the same course as the parotid inflammation.

NATURE.—Parotiditis is contagious. It is rare in infancy and after the middle period of life, occurring chiefly in childhood, youth, and early manhood. An incubative period of about twelve days was ascertained by me in cases under observation in the Protestant Episcopal Orphan Asylum of this city. The observations of others give a similar result. Parotiditis is a blood disease, having the local manifestation described above, and which is our only means of diagnosis.

DIAGNOSIS.—If the physician have seen but few cases of mumps there is danger that he may mistake the swelling for an inflamed cervical gland, or *vice versa*, but an inflamed cervical gland presents to the finger a hardness almost like that of cartilage, and it is circumscribed or round, and does not invest the ear. These characteristics contrast with the elasticity, seat, and shape of the parotid swelling, which extends forward on the cheek and surrounds and elevates the lobule of the ear. Tumefaction resulting from diphtheritic or any other form of faucial inflammation, or from periostitis affecting the root of the posterior molar, may be detected by examining the fauces and interior of the mouth.

TREATMENT.—This is very simple. Oakum or carded wool may be bound over the swelling, and the surface occasionally rubbed with sweet oil. Mild laxative and diaphoretic drinks, such as bitartrate of potassium or lemonade, are useful. If metastasis occur, the new local affection should receive chief attention. It should be treated in the same manner as if it occurred independently of the mumps, while emollient poultices or fomentations should be applied over the parotids. The ill effects of repellant applications in mumps are shown by the following case :

On March 19, 1877, I was requested to see a young gentleman of eighteen years. He had been well till March 14th, when he complained of pain below his ears, and his mother applied a towel, wrung out of cold water, around his neck. On the following day slight swelling was observed under the angle of the lower jaw, on the right side (submaxillary gland), and the cold application was continued. On the 17th the swelling had disappeared, but the fever and headache had greatly increased, so that he was compelled to lie in bed. On the 19th, at my first visit, he had such violent headache, and was so intolerant of light and noise, that I greatly feared that he had acute encephalitis. All swelling under the ears was gone ; the left testicle was tender, and beginning to swell ; axillary temperature 102°. The cold cloths were removed from the neck and applied

to the head, and potass. bromid., gr. xxv, administered every third hour. 20*th*. Axillary temperature 104° ; symptoms unabated and alarming. Ordered six leeches to be applied upon the temples and left groin, and a purgative, and two drops of the tincture of aconite to be given with each dose of the bromide. 21*st*. Temperature 103°. States that numbness and a pricking sensation which he had felt in both legs during the last forty-eight hours had ceased (possibly from the aconite). 23*d*. Is convalescent. Has no return of the swelling under the ears, and the orchitis has abated.

SECTION IV.

OTHER GENERAL DISEASES.

CHAPTER I.

INTERMITTENT FEVER.

This is a constitutional malady produced by a miasm which emanates from the soil. I have notes of 36 cases of this disease occurring under the age of 3½ years. Several of these patients were treated in private practice, and the rest in the institutions with which I have been connected. In children above the age of 3½ years intermittent fever differs but little from that of the adult, while in those under this age it presents certain peculiarities. Of the 36 cases which I have observed, 19 had the quotidian form, 10 the tertian, 2 the tertian becoming afterward quotidian, 1 the quotidian becoming afterward tertian, while in the remaining 4 cases the form of the disease is not stated. In quotidian ague the malaria has been supposed to act more powerfully on the system, or the system is more susceptible to its influence than in the tertian form, and hence the fact that the quotidian is the prevailing type of ague in tropical regions, where vegetation is luxuriant, marshes extensive, and the heat intense. According to this theory, the feeble resisting power in the system of the infant explains the fact that it has quotidian more frequently than tertian intermittent, although the latter is much more common in the adult in this climate.

Facts demonstrate that infants sometimes receive intermittent fever from their mothers. If mothers during gestation have malarious cachexia, their infants, whether born at full time, or, as often happens, prematurely, are apt to be small, thin, and feeble, and occasionally they have soon after birth distinct paroxysms of the ague. Dr. Stokes related the case of a pregnant woman with ague, who believed that she noticed periodical tremors of her fœtus, but I suspect that she was mistaken, as regards the cause, for the paroxysm of intermittent in young children is not ordinarily accompanied by tremors.

The youngest infant in my practice who apparently derived the ague from its mother, and probably through the fœtal circulation, had the following history : Its mother had occasional attacks of tertian intermittent during the two years preceding her confinement, and her baby when one

week old was observed to have the same disease, occurring also each second day, the coldness and blueness in the first stage of the paroxysm lasting from half an hour to one hour.

It is not fully ascertained whether a nursing infant may contract intermittent fever by lactation, but if it be admitted that it is sometimes communicated to the fœtus through the maternal circulation, it does not seem improbable that the specific principle occasionally enters the milk as well as other secretions. I have frequently remarked the presence of the disease in nursing infants whose mothers were affected, and in one instance, an infant at the breast, whose mother had the ague, having contracted it in a suburban village, but was since living in a non-malarious part of the city, presented evident symptoms of the disease. Similar observations by Frank, Burdel, and others, do not indeed fully prove the communicability of intermittent fever by lactation, but render it highly probable.

The period of incubation in the infant varies greatly, as in the adult. When the malaria is concentrated and unusually active, or the condition of system is favorable for its reception, the disease may commence soon after exposure. Thus, in tropical regions, travellers exposed for a single night have been known to sicken within twenty-four hours ; but in our cooler latitude, a longer incubative period is the rule. In the infant, however, in our climate, intermittent fever often begins in a very short time after exposure, though there may be an incubative period of some weeks. The following have been my observations relating to this point : A. M., female, 8 months old, remained two days on Long Island, in October, 1870, and three days after her return to the city, a quotidian commenced. P. S., male, 11 months old, remained three days on Long Island, and a quotidian commenced four days after his return. K., 9 months old, remained on Staten Island one week, and eleven days after his return, a tertian commenced. G. K., aged 3 years, remained a day and a night on Staten Island in 1870 ; three weeks afterward intermittent fever commenced, preceded by a week of languor. A. U., female, aged 2 years and 2 months, had the first paroxysm of a tertian, two and a half weeks after returning from a visit of one week in Hoboken. As there was no malaria in the portions of the city where these infants resided, the incubative periods are nearly ascertained.

Whatever may be the nature of the malarial poison, whether a vegetable cell, as Prof. Salisbury believes, or something else, it often clings tenaciously to the system, and is probably reproduced in it, even under circumstances favorable for its elimination. Thus, at one of my cliniques at Bellevue Hospital Medical College in 1871, a child, 10 years old, was presented, who had had every year for seven years attacks of intermittent fever. The disease was contracted at the age of three years in Harlem, and the subsequent residence of the family had been in a part of the city where there was no malaria.

Symptoms.—In infancy, and especially prior to the age of eighteen months, the symptoms differ in certain respects from those which characterize the malady in the adult, and are universally known. In childhood the symptoms are similar to those in the adult, and need not, therefore, be described in this connection.

In the infant the type as we have seen is quotidian, with now and then a tertian. Advancing beyond the age of eighteen months, we meet more and more cases of the tertian type, and in childhood it is the common form. I have known the quotidian in the infant, when cured, to reappear a few weeks after as a tertian ; but ordinarily it remains quotidian, unless the patient have reached the age at which the tertian type predominates.

The paroxysm in the young infant presents three stages, as in the adult, but while the second, or febrile, is well marked, the first and third are much less pronounced. The patient does not shake (exceptionably, one does even within the first year) in the first stage, but a slight tremor may or may not be observed. The countenance presents a sunken appearance ; the lips and fingers are livid, while portions of the surface not livid are pallid, with the goose-flesh appearance, which is, however, less marked than in children of a more advanced age. The blood leaves the surface, which consequently shrinks, while it accumulates in the veins and internal organs ; the pulse is feeble, and readily compressed ; the surface grows cool from the diminished supply of blood, but the breath is warm, and the internal temperature, so far from being reduced, is elevated two or three degrees. The parents may be alarmed at the sudden sinking of the vital powers, and seek medical advice, but in other instances the first stage is so slight that it passes unperceived till they have been taught to watch for it, and the second stage first attracts attention.

In the second or febrile stage, which immediately succeeds, the pulse becomes full and rapid, 120 to 130 or 140 beats per minute, and the external as well as internal temperature is elevated as in few other diseases (104°–108°). The face is flushed, surface dry, and head painful, as evinced by the features. This stage lasts about two or three to six or eight hours. The third stage, or that of perspiration, succeeds, which terminates the suffering of the patient till the following paroxysm. In infancy the perspiration is not abundant, and in the first half of this period is nearly absent. In the interval of the paroxysms the patient appears well, except a degree of languor.

In twenty-four of the cases of infantile intermittent which I have treated my notes describe the character of the paroxysms. In sixteen of these there was no chill or trembling in the first stage, but blueness and coolness of the extremities and features, and sudden prostration. This stage lasted from ten minutes to one hour. In the eight remaining cases the infants were observed to tremble or shake as in adult cases. The perspira-

tion of the third stage was in nearly all cases, when observed, slight and of short duration, but in some it was not observed.

During the cold stage, passive congestion of the internal organs occurs to a greater or less extent, but the circulation is equalized during the reaction of the second stage. The spleen, whose capsule is distensible, soon enlarges in many patients, in consequence of the frequent and great congestions, constituting the "ague cake." This enlargement is more common in children than adults. Since my attention has been particularly directed to this subject, I have been able to feel the enlarged spleen, by examination through the abdominal walls, in probably one-third of the cases under the age of ten years. This organ returns to the normal size after the ague is cured. From the intimate relation of the spleen to the composition of the blood, it is evident that the character of this fluid must be affected if intermittent fever be protracted. The blood becomes more and more impoverished, and a state of decided hydræmia supervenes. A few weeks' continuance of the ague suffices to produce decided pallor of the features, and surface generally, and as all watery blood is prone to transudation, such patients not infrequently present more or less œdema of the face, ankles, and other parts. Sometimes, also, especially under unfavorable hygienic circumstances, purpuric spots (purpura hæmorrhagica) appear under the skin, affording additional proof of the change which the blood has undergone.

In long-continued cases of malarial disease in the adult waxy degeneration of organs is apt to occur, as well as melanæmia. Pigment cells, flakes, and particles appear in the blood, the coats of the minute arteries, and in various organs, as the spleen, liver, etc. In the child these results are more rare.

Intermittent fever in children, if proper remedial measures are employed at an early period, is ordinarily not dangerous, and is quite amenable to treatment; but that comparatively infrequent and fatal form of it, designated the pernicious, occurs more frequently in children than adults. In New York City, where the type of malarial diseases is mild, I have never met a case of pernicious intermittent in the adult, but I can recall to mind such cases in children, two of them fatal. This form of the fever occurs in a smaller proportionate number of cases in infancy than in childhood, probably because the cold stage is less pronounced. In the pernicious ague the system is overpowered—it does not react in a degree commensurate with the intensity of the disease. The patient enters the cold stage, becomes stupid, and, if not relieved by prompt and efficient measures, passes into fatal coma. A type of the disease, therefore, which would not be pernicious in a robust individual, may be such in one of a broken-down constitution and feeble reactive power. In most cases occurring in children the coma is preceded by eclampsia, which is apt to be general and protracted.

Eclampsia increases the passive congestion of the cerebro-spinal axis

already present in this stage, and if not speedily relieved may end in transudation of serum over the surface of the brain, and perhaps meningeal apoplexy, causing fatal coma. This has occurred twice in my practice.

Sometimes in young children the diagnosis of intermittent fever is doubtful, either because the disease has not continued sufficiently long, or there has not been the characteristic paroxysm. The patient may be feverish, and fretful, with anorexia, and evidences of headache, but without the usual distinctive symptoms. I have sometimes in such cases been able to establish the diagnosis by detecting enlargement of the spleen. In examining for the "ague cake," the child must lie quietly on its back, and the fingers, placed midway between the epigastrium and umbilicus, be carried gently but with firm pressure outward in the direction of the spleen, when the anterior edge of this organ will be felt, if it be enlarged. It is impossible to make the examination when the child cries, on account of the contraction of the abdominal muscles.

TREATMENT.—It is evident that no time should be lost in applying appropriate remedies in a case of infantile ague; for, although the first paroxysm may be mild, the next may be more severe, and attended by danger. Moreover, the sooner the disease is cured the less liable it seems to be to return. Therefore we prescribe at once the sulphate of quinia or cinchonia, one and a half grains of the latter producing the effect of about one grain of the former. Our experience in the children's class in the Outdoor Department has been chiefly with the sulphate of cinchonia, on account of its cheapness, and there has yet been no case of ague which it has failed to control. A recent writer has published statistics showing his success in curing intermittent fever by this agent, but nothing in therapeutics is more easy than to cure this disease in our climate by either of the sulphates mentioned. The chief difficulty consists in preventing a return. To an infant of two years I prescribe one grain of sulphate of quinia, or the equivalent of sulphate of cinchonia, three times daily, till all symptoms of the ague have disappeared; then twice a day during the subsequent week, and afterward once a day for some days; and finally twice or thrice a week. It is only by the protracted use of the drug in occasional doses that the return of the intermittent can be prevented.

It is important in administering these sulphates to infants to employ a vehicle which will, so far as possible, disguise the bitterness. The vehicle which I prefer for their administration is the elixir adjuvans or elixir tarax. co. The following formula is for a child of three years:

℞. Quiniæ sulphat., gr. xij;
Elixir adjuvantis, ʒjss. Misce.

The following is also a good formula:

℞. Quiniæ sulphat., gr. xvi;
Ext. glycyrrhizæ, ʒi;
Syr. rubi. idæi., ʒii. Misce.
(Raspberry.)

One teaspoonful three to five times daily. The first dose should be given immediately after the fever abates. In this climate two or three days suffice to cure the disease, after which by daily but gradually diminished use of the medicine in the manner stated above, the return of the malady is prevented. Protracted cases attended by anæmia require the use of iron in addition to the remedy which is designed to control the disease.

CHAPTER II.

REMITTENT FEVER.

If a physician were to consult the standard treatises on diseases of children, in order to ascertain the nature of remittent fever, he would rise from the perusal with no clear idea of it. One tells us that the remittent fever of children is identical with typhoid fever of adults; another, that it is a gastro-intestinal inflammation; and, finally, Hillier believes that there is properly no such disease, and that the term should be dropped from the nosology of children. There is, however, a remittent fever of children as well as adults, and much of the confusion which exists in reference to it arises from the fact that writers have not kept in view what constitutes a fever.

Febrile action which has a local cause is not an essential fever, and should not be described as such. It happens that in children a symptomatic remittent fever arises from a variety of local causes, as dentition, intestinal worms, subacute gastro-intestinal inflammation, etc. But all such cases should be excluded from our consideration of remittent fever, as clearly as we distinguish the continued fever of pneumonia or bronchitis from that of typhus or typhoid.

There is an essential remittent fever of children due to malaria. The same conditions which produce intermittent fever do, in a certain proportion of cases, produce a fever which does not intermit, but continues with more or less pronounced exacerbations a certain number of days, when it ceases or becomes intermittent. Those who practise in malarious localities notice a larger proportion of cases of remittent fever among children than adults, because their constitutions are less able to resist the malarial poison, so that an exposure which in an adult would produce milder disease, namely, a tertian ague, is apt to cause a quotidian or remittent in the child. In young and feeble infants the proportionate number who have remittent fever is large. Cases, too, are not infrequent in localities not malarious, of a remittent fever, occurring more frequently in the spring and autumn than in other seasons. Some of these cases are per-

haps a mild type of typhus, but in most instances the conditions do not appear to be present which ordinarily give rise to typhus, and they do not occur in connection with cases of typhus in adults. The cause, though obscure, is apparently atmospheric.

The SYMPTOMS of remittent fever vary in different cases. The exacerbations and remissions are more pronounced in some than others. Even in those cases in which the fever is due to paludal emanations, and occurs in connection with cases of the intermittent, the febrile movement may be almost uniform, slight exacerbations occurring in the latter part of the day. In other cases the exacerbations and remissions are pronounced, the febrile excitement abating in a perspiration. Occasionally the fever is higher on each second day. Cephalalgia is common, and in severe cases delirium and stupor are not infrequent. There may be distinct remissions in the beginning, and afterward, for a few days, the fever be pretty uniform, when it again remits or ceases. The tongue is covered with a light fur. Thirst, loss of appetite, a tendency to constipation, scanty and high-colored urine, containing perhaps urates, and a cough due to mild bronchitis, are common symptoms.

When remittent fever is due to marsh emanations, the same anatomical characters are doubtless present as in the adult, namely, blood containing more or less pigmentary matter, enlargement of the spleen, bronzing of the spleen, and, in severe cases, of the liver, and sometimes of the brain.

The DIAGNOSIS is not always easy. On the one hand, local diseases with symptomatic remittent fever are to be excluded, and, on the other, typhus and typhoid. The discrimination of it from typhus and typhoid fevers is practically of little moment, but it is a matter of vital importance to make a differential diagnosis between it and the local diseases. I have known one of the acutest diagnosticians and most eminent physicians of New York mistake incipient meningitis for it, a mistake indeed not uncommon. The points involved in a differential diagnosis will be considered in our descriptions of the local diseases.

TREATMENT.—If we have ascertained by a careful examination that the fever is remittent, and not symptomatic, but essential, there is one remedy which is required in nearly all cases, namely, quinia, or its equivalent, cinchonia. Mild febrifuge medicines, with light diet, may be first employed in sthenic cases, in which the pulse is full and strong, and the quinia given when the fever has somewhat abated. The diet should be bland, but nutritious, and the bowels be kept regularly open by citrate of magnesium or other mild aperient. Bromide of potassium or hydrate of chloral may be occasionally employed, as recommended in the treatment of typhoid fever, to produce quietude or sleep, in cases attended by delirium or insomnia. A warm mustard foot-bath and cool applications to the head are useful in such cases.

CHAPTER III.

TYPHOID FEVER.

Typhus and typhoid fevers occur in children, but the former is mild and infrequent, rarely occurring except when adults of the same household are affected. It requires little treatment, except good nursing. Typhoid fever, on the other hand, is not infrequent in children, and, as it presents certain peculiarities prior to the age of puberty, it is proper to describe it in this connection. This disease is much less common in infancy than in childhood, and in the first half of infancy is believed to be rare. Still, there can be no doubt that many cases in the first years of life are not diagnosticated, being mistaken for subacute and protracted entero-colitis. It may, therefore, be more common in the infant than is commonly supposed. Its period of greatest frequency in children is between the ages of six and twelve years.

Causes.—It is now generally admitted that typhoid fever is mildly contagious, and that its specific principle abounds largely in the dejections and excretions of the patient. It is uncertain whether it is communicable by the breath of the patient, or exhalations from his surface. If it is, it is slightly so, while numerous observations demonstrate its communicability through the use of night-stools or privies which contain the evacuations.

There is little doubt also that typhoid fever originates *de novo*, caused by the miasm produced by decaying animal or vegetable matter. Numerous cases have been observed in which it originated from defective sewerage, or decaying vegetables in cellars, in localities in which no case had previously been observed. The germs of the disease when it originates under such circumstances may probably be received into the system by inspiration and in the ingesta. The use of well-water which is contaminated with sewer drainage has been repeatedly known to produce it. It has even been traced to impure water used in rinsing milk-cans which contaminated the milk, and to impure ice which contained the subtle specific principle. Boys are more frequently attacked than girls ; according to some statistics in the proportion of three to one. Deterioration of the health from general causes increases the liability to be attacked. On the other hand, those having tuberculosis, carcinoma, heart disease, and probably certain other visceral lesions, are more apt to escape than those in health.

Anatomical Characters.—As typhoid fever is a constitutional disease, we would expect to find early and important changes in the blood.

No alteration, however, has been discovered in this fluid peculiar to typhoid fever. The amount of fibrin is diminished as in most of the essential fevers, and its coagulation is feeble, forming, when the blood stands, soft, small, and dark clots. When the fever has continued for some time, a state of anæmia more or less decided supervenes, in which the amount of albumen and blood-corpuscles is diminished. Although there are often decided symptoms referable to the nervous system, no constant changes have been discovered in the brain or spinal cord. The changes observed in them when death has occurred in the course of typhoid fever have been for the most part due to other causes. It is different with the respiratory system. After the first week of typhoid fever bronchitis is almost as constant as inflammation of the fauces in scarlet fever, and accordingly we find in fatal cases redness and thickening of the bronchial mucous membrane, which is covered with a viscid and ordinarily scanty secretion. Hypostatic congestion of the lungs, with more or less œdema, and in severe and enfeebled cases hypostatic pneumonia, are not uncommon. In the bronchitis and state of feebleness we have the causes of pulmonary collapse, and this lesion is not infrequent over limited portions of the lungs, especially if the bronchitis affect the smaller tubes.

The lesions occurring in the digestive system are important. The mucous membrane of the small intestine is more or less injected, and at an early period, even by the second or third day, the patches of Peyer, solitary glands, and at the same time the mesenteric, begin to enlarge. It has been stated by high authorities that the enlargement is due to infiltration with a peculiar substance, which has been termed the typhus material. I have made microscopic examination of these glands in typhoid fever of the adult, and have found a considerable increase of the small round granular cells of which they are composed. I do not, therefore, doubt that the enlargement is due mainly to hyperplasia of the cellular elements of the glands, though there is probably infiltration to a certain extent of inflammatory products between the cells. The mucous membrane over the glands undergoes inflammatory thickening and softening. In the adult, sloughing of this membrane is frequent, with the disintegration of the glands and their elimination into the intestines, producing ulcers, small and circular, corresponding with the site of the solitary glands, large and oval or irregular, corresponding with the site of the agminate. Disintegration of these glands and the formation of ulcers are less frequent in children than in adults. In the adult, who recovers, the mesenteric glands, and those of the solitary and agminate which are not destroyed, return to their normal state by fatty degeneration, liquefaction, and absorption of the redundant cells. In the child this is the common result, instead of sloughing and disintegration, as regards both the solitary and agminate glands, and uniform result as regards the mesenteric, and I may add bronchial glands, which are also in a state of hyperplasia. The absence of ulcer-

ation or its slight extent affords explanation of the fact that intestinal perforation is very rare in children.

The spleen gradually enlarges, often to twice the normal size, has a dark-red color, and is softened. Enlargement of the spleen possesses great diagnostic value in those cases in which the diagnosis is obscure. For while very similar intestinal lesions may occur in chronic entero-colitis, the coexistence of these lesions with the splenic enlargement and softening shows the constitutional nature of the malady.

In cases which are severe, and which present a decidedly adynamic type, the muscles become soft and flabby, the action of the heart is feeble, and more or less passive congestion of the viscera results. In such cases congestion of the kidneys and albuminuria are not infrequent.

Symptoms.—Typhoid fever has a prodromic stage of a few days, sometimes of a week or more, in which the child appears languid, indisposed to play, and has little appetite, but complains of no pain unless occasional slight headache, and has no symptom which would lead the friends or even physicians to suspect the grave nature of the disease which impended. By and by a slight fever occurs.

The febrile movement, which gradually becomes more pronounced, remits, but does not cease in the morning, and has evening exacerbations. After the first week of fever the remissions are less marked, but the fever is not uniform at any period in its course. Hence some of our ablest writers on diseases of children continue to designate typhoid fever of children remittent fever, fully aware of its identity with typhoid fever of the adult. As the case advances, the appetite fails, all solid food being refused, and liquid food being taken more from thirst than hunger. The tongue in the first week, and in some patients throughout the course of the disease, is covered with a light moist fur, while in others having a graver type of the fever the tongue after the first week is dry and brown. During the prodromic period, and in the first week, the bowels act regularly, or are slightly relaxed, and they are readily affected by purgative medicines. After the first week there is in most children a tendency to diarrhœa, which requires now and then the use of astringents, the stools being watery and brown, or dark yellow. The abdominal walls are seldom retracted, but prominent, especially after the first week, in consequence of meteorism, which is present in children as well as adults. Sometimes there is apparent tenderness, when pressure is made over the right iliac region, but this must not be confounded with hyperæsthesia, which is common in the commencement of febrile diseases in children, and which is observed especially upon the abdomen, chest, and inner part of the thighs.

The respiration in the first week is slightly accelerated, as it is in all febrile diseases. In the second week, and subsequently when bronchitis is developed, the respiration is ordinarily more accelerated, though not in a marked degree, unless in those exceptional instances in which there is an

abundant collection of mucus in the smaller bronchial tubes. A cough is often present, dependent on the bronchitis, and varying in character according to the degree and stage of the inflammation. In the first days of the fever it is infrequent, and hacking ; at a later stage it is more frequent, and not so dry, though in cases of ordinary severity the amount of expectoration is inconsiderable. Hypostatic congestion, œdema, hypostatic pneumonia, splenization, or thickening of the alveolar walls, and collapse, which may, and some of which not infrequently do, occur in the advanced disease, increase, more or less, the frequency of the respiration and the cough, and modify the physical signs.

The pulse in the first week, in ordinary cases, is from 100 to 110 or 115. It gradually becomes more accelerated, numbering in the second week 123 or more ; in grave cases even 160. The more frequent the pulse, the greater the danger and more unfavorable the prognosis. During the exacerbations the number of pulsations per minute is 15 or 20 more than in the remissions. The change in temperature corresponds with that of the pulse, being from 1° to 2° higher in the exacerbation than remission. The extremes of temperature in cases of ordinary severity are about 101° and 104°. A temperature above 105° shows a grave, probably a malignant, type of the disease, or else a serious complication.

There is great variation as regards the symptoms referable to the nervous system. Headache is common in the prodromic and initial stages, after which it ceases. A few are delirious even from an early period, screaming loudly, or muttering incoherently, but the majority are quiet, having, indeed, a degree of mental dulness, but being able to appreciate questions when aroused, and answering correctly. Subsultus tendinum and carphologia, which some exhibit, show that there is profound disturbance of the nervous system. Epistaxis occurs occasionally in the first week, as in the adult, but is not abundant.

The rose-colored eruption appears in children as well as adults between the sixth and twelfth days, but is more frequently absent in the former than the latter ; sometimes the number of spots is less than half a dozen. Sudamina are common in the second and third weeks, and perspirations may occur at any time in the course of the fever, but without amelioration of symptoms. More or less deafness is common, being in most instances a purely nervous symptom, without, therefore, any structural change in the ear, but it is possible, as has been suggested by certain writers, that it sometimes results from inflammatory thickening of the Eustachian tube or external meatus, or to a weakened and flabby state of the muscles of the ear.

The duration of typhoid fever is not uniform ; while mild cases may end in two weeks, those of a severer type continue three or even four. The patient becomes progressively more emaciated and feeble. In protracted and severe cases his condition seems very unpromising to one not familiar

with the clinical history of the fever. Pale, emaciated, and feeble, probably passing his evacuations in bed, taking little notice of objects around him, he presents, at the close of the third week, an appearance of helplessness, notwithstanding the best of nursing, and the constant employment of sustaining measures, which is truly discouraging.

Complications.—The chief complications of typhoid fever are broncho-pneumonia, already sufficiently described, enteritis, intestinal hæmorrhage, peritonitis, otitis, parotiditis, and muguet. In one instance I lost a patient about ten years old, in whom the fever had nearly terminated, by the sudden accession of croup. There is, as we have seen, in ordinary cases, more or less inflammation of the mucous membrane of the air-passages, and of the intestines, especially, in the vicinity of the patches of Peyer. It is easy to understand how, under circumstances which may arise in the fever favorable to the development of mucous inflammations, the bronchitis and enteritis may so increase as to constitute complications. They are the most frequent of the serious complications.

Feeble action of the heart, common in severe cases of typhoid fever, and which after the second week is partly attributable to granulo-fatty degeneration in the muscular fibres of the heart, which is frequent in grave forms of the infectious diseases, obviously favors the occurrence of bronchial and pulmonary congestion. Hence the proneness in these cases of the inflammation to extend downward from the larger to the smaller bronchial tubes and to the lungs, so that broncho-pneumonia becomes an occasional very grave complication.

In the child as well as adult the mucous membrane of the lower part of the ileum in the vicinity of Peyer's patches is apt to be thickened and hyperæmic, a true intestinal catarrh. It is easy to understand how under certain circumstances this may become aggravated, so as to constitute an intestinal inflammation of considerable extent and gravity, a severe entero-colitis, so that the local symptoms predominate over the constitutional and aggravate the latter.

In the adult, as is well known, the Peyerian and solitary glands becoming more and more prominent by proliferation of their cellular elements (the lymphoid cells) begin to ulcerate in the second week, and slough in the third, forming the typhoid ulcer, which is slow in healing, and aids in keeping up the diarrhœal state. Although such destructive or necrotic inflammation is rare in young children, it may occur in those of a more advanced age.

Intestinal hæmorrhage is therefore an occasional accident. Hillier met four cases in thirty of the fever. It indicates the presence of ulcers upon the surface of the intestines. The younger the child, the less the liability to it. Some, in whom it has occurred, recover, but others die.

Intestinal perforation is more rare in children than in adults, as might be inferred from the statement already made, that intestinal ulceration is

less frequent and extensive in them. Statistics show that perforation occurs only once in 232 cases. Therefore, as perforation is the common cause of peritonitis in this disease, this inflammation is a rare complication. Peritonitis may, however, occur in typhoid fever without perforation. In one such case (an adult) in the fever wards attached to Charity Hospital, local peritonitis with fibrinous exudation occurred opposite two ulcerated patches of Peyer, the ulcers extending nearly to the peritoneum, but not perforating. The lesions observed in this case throw light on those cases of peritonitis complicating typhoid fever which recover, the cause of which has received a different explanation.

In advanced and greatly debilitated cases, thrush sometimes appears in the interior of the mouth, and upon the fauces. It is always an unfavorable prognostic symptom in children suffering from chronic or protracted disease. Parotiditis is also a rare complication. Otitis, commencing with pain, and producing a discharge which may continue for weeks, is not rare, though less frequent than in scarlet fever. The otitis is commonly external, but it may, in scrofulous subjects, extend to the middle ear.

Diagnosis.—This is more difficult in children than in adults, and the younger the child the greater the difficulty. In infants protracted entero-colitis, with febrile action and dry furred tongue, cannot in certain cases be positively diagnosticated from typhoid fever by the symptoms and clinical history. Typhoid fever is believed, however, to be rare at this age, for an infant nourished at the breast, and rarely drinking from a cup, is very seldom exposed to the cause of the disease. When, however, as now and then happens, a young child presents the symptoms characteristic of protracted subacute entero-colitis, or typhoid fever, and older members of the household have the fever, it is highly probable that the case is one of the latter disease, and it should be treated accordingly.

Even in older children typhoid fever is apt to be mistaken for simple subacute enteritis, or entero-colitis, or *vice versâ*. The following facts aid in the differential diagnosis. In typhoid fever there is total loss of appetite, while in the subacute intestinal inflammation food is not entirely refused. Diarrhœa commences early in the inflammation, while in the fever it is not ordinarily till after the lapse of a few days. Abdominal tenderness in the fever is not appreciable, or is located in the right iliac region ; in the other disease it is general over the abdomen, or located in the umbilical region. In typhoid fever there is bronchitis with a cough which is absent in the inflammation. In typhoid fever there are certain other symptoms, more or fewer of which are present in most cases, and which do not occur in the intestinal diseases, except as a coincidence ; for example, headache, epistaxis, stupor, delirium, and perhaps the rose-colored spots.

Typhoid fever may be mistaken for meningitis, during the first week,

but in meningitis there is more constipation, irritability of stomach, and less elevation of temperature. Moreover, in meningitis, at a comparatively early stage, we are able to detect patches of congestion of the features coming and disappearing suddenly ; and slight inequality of the pupils, or their oscillation when the light is uniform ; signs which are lacking in typhoid fever. In a doubtful case the ophthalmoscope might be employed, which in meningitis discloses congestion of the vessels of the retina, œdema, etc., anatomical changes which do not pertain to typhoid fever.

The differential diagnosis of typhoid fever and acute tuberculosis may be made by attention to the following points. In tuberculosis there is cough, with some acceleration of respiration from the first, without epistaxis, stupor, or other nervous symptoms, and without the abdominal symptoms which are so prominent in the fever.

Duration.—The duration of typhoid fever varies from two to about four weeks, but complications which may arise may protract the febrile movement. Recovery from a severe and protracted attack is slow, several weeks or even months elapsing before complete restoration to health. A tendency to diarrhœa often continues several weeks after the fever proper ceases, necessitating a rigid oversight of the diet, and the occasional employment of astringents.

Prognosis.—A much larger percentage of children recover than of adults. Although there be great emaciation with loss of strength, recovery may be confidently predicted, provided that no serious complication occurs. In fatal cases which I have met, the unfavorable result occurred as a rule from the complications, rather than directly from the malady. The condition in which severe typhoid fever leaves a patient is favorable to the development of tubercles, and now and then they occur, disappointing our expectations and prediction of recovery.

Treatment.—Typhoid fever, like typhus, cannot be abridged by treatment, and the indication is to sustain the vital powers, diminish the intensity of the febrile movement, and to control any untoward symptom or complication. Quinia, so useful in malarial diseases, may be administered in small doses for its tonic effect, and as an aid in promoting digestion. It is commonly and properly prescribed in some convenient vehicle for this purpose, but it does not antagonize the typhoid, as it does the malarial poison. Perturbating medicines, and especially cathartics, should be given with caution. The tendency to intestinal ulceration and hæmorrhage, and the asthenic nature of the fever, require abstinence from or cautious use of such agents. A temperature remaining under 103° usually involves little danger. If it rise above that, antipyretic measures should be employed. The use of salicylate of sodium, large doses of quinine, and cold-water ablutions, are the three admissible remedies for this state. The salicylate I suspect impairs the appetite, and retards

digestion, and the quinine is much less efficient as an antipyretic in this fever than cold-water bathing. I therefore order the nurse to bathe frequently the forehead, face, hands, arms, neck, and sometimes the chest, with cold water, to which it is proper to add alcohol or some spirituous lotion. A cloth wrung out of ice water or an ice bag should be applied over the head, and the hands may be allowed to lie a considerable time in a wash-bowl containing the lotion, which is always grateful to the patient. The water treatment thus applied will usually reduce the temperature one, two, or three degrees within a few hours.

In all cases of typhoid, as in other essential fevers, free ventilation is required from an open window, and the bedding and body linen should be changed every day.

Observations made during the last dozen years appear to show that the mineral acids have a salutary effect upon the course of the fever.

The dilute nitric, muriatic, or nitro-muriatic acid should be given largely diluted with water, and, if possible, through a glass tube so as to protect the teeth. I have recently administered the dilute muriatic acid in the acidulated liquid pepsin prepared by Mr. Kress, of Fifty-second Street and Broadway, in the treatment of typhoid fever. One ounce of the liquid contains 30 min. of the dilute acid, and one teaspoonful can be given every third hour to a patient of five years. The scanty secretion of gastric juices in this disease, the poor appetite and slow digestion, indicate the need of such medicine, and thus far the result has been good.

If the pulse be rapid and weak, or fluctuating, digitalis meets the special indication, and it can be administered with or between the doses of quinine. As there is great proneness to diarrhœa and intestinal ulceration, the selection of the proper diet is important, and of all the dietetic articles milk is the one upon which we must chiefly rely for the sustenance of the patient. While it contains the desired nutriment it is easy of digestion, and possesses, when fresh and of good quality, no irritating property which would aggravate the intestinal disease. The meat broths or juices, fresh eggs beaten up in milk, farinaceous foods, as barley, wheat, or rice flour in the milk, are proper adjuvants to the milk diet. The dry state of the mouth, and scanty secretion of saliva, and probably also of the pancreatic juice by which starch is digested, show, however, that only a moderate amount of farinaceous food can be assimilated during the fever. The patient may be allowed to drink cold water in moderate quantity.

Mild cases of typhoid fever do not require alcoholic stimulants, but they are useful in severe cases in the form of wine whey or milk punch, especially in the third and fourth weeks, and during convalescence. When the pulse is feeble and quick, the mind wandering and the fingers tremulous, the regular and judicious use of alcohol aids materially in sustaining the vital powers during the critical period.

The complications which may arise in the course of the fever require prompt treatment. For diarrhœa opium and bismuth are needed ; for intestinal hæmorrhage an ice bag over the right iliac region, and internally opium with acetate of lead, or with a large dose of subnitrate of bismuth, or small and repeated doses of turpentine. A one-grain ergotine pill every fourth hour to a child of eight years, also aids in arresting the hæmorrhage. But intestinal hæmorrhage as a result of typhoid ulcerations is much more rare in children than in adults. Bronchitis and pneumonia require mildly irritating poultices, with the oil silk jacket.

Typhoid fever may relapse, but the second attack is commonly milder than the first. Nevertheless on account of the liability of its return, the patient should be quiet and free from perturbating influences during convalescence.

To guard against the spread of the disease, the stools should always be promptly disinfected, by adding to the night-stool carbolic acid and a solution of the sulphate of iron, or a solution of the chlorides, and all soiled linen should be placed in boiling water.

CHAPTER IV.

CEREBRO-SPINAL FEVER.

Cerebro-spinal fever, designated also spotted fever, tetanoid fever, and cerebro-spinal meningitis, is an epidemic constitutional disease, manifesting itself by lesions and symptoms which pertain chiefly to the nervous system. Descriptions of occasional epidemics, which appear to have been of this malady, have been left us by writers as far back as the fifteenth century, but it was not clearly distinguished from typhus on the one hand, and local inflammatory affections of the cerebro-spinal axis on the other, till after the present century commenced.

In New York City only two epidemics of this disease have occurred within the recollection of the oldest physicians, one commencing in the autumn of 1871, and ending with the occurrence of warm weather in 1872 ; the other beginning in the autumn of 1880, and ending about the month of May, in 1881. The number of cases was considerably greater in the former than the latter epidemic.

Few diseases more urgently demand elucidation than this, for while it is very fatal, there is discrepancy in the views of physicians in regard to its cause, nature, and proper treatment. As cerebro-spinal fever results from some pervading cause, probably as we will see atmospheric, we would expect to observe effects of this cause, in some other way, in addition to the disease of which we are treating. Accordingly, the histories of at

least a portion of the epidemics of cerebro-spinal fever show an unusual prevalence of pneumonias of an ataxic type, and sometimes also of pharyngitis, in addition to the cerebro-spinal disease, and this disease is sometimes complicated by congestion and less frequently by inflammation of the lungs. The prevalence of typhoid pneumonias during cerebro-spinal fever was long ago observed. Thus, in Bascome's history of epidemics, it is stated that "epidemic encephalitis and malignant pneumonias prevailed in Germany (Webber) in the sixteenth century." In this country, in the epidemics of cerebro-spinal fever from 1811 to 1815, pharyngeal and pneumonic inflammations were unusually frequent. In more recent epidemics observers have not so often, but have occasionally, recorded the prevalence of pneumonias in connection with cases of the cerebro-spinal disease. Accordingly, Webber, who has examined the histories of the various epidemics, describes in his prize essay a second variety of cerebro-spinal fever, which he designates pneumonic, in which the cerebro-spinal axis is involved but slightly, or not at all, and the brunt of the disease falls upon the respiratory organs. In certain epidemics, according to him, the pneumonic form is common, while in others it is infrequent.

During the time when the epidemic of 1872 in New York City was at its maximum, an unusually large number of cases of pleuro-pneumonia of an asthenic type, and I may add, I think, of pharyngitis, occurred; and while cerebro-spinal fever rarely affected those above the age of fifty years, many of those with pneumonia were old people. According to the statistics of the New York Health Board, there were 1707 deaths from diseases of the respiratory organs, exclusive of phthisis, during the four months from February 1st to June 1st, 1872, when the epidemic of cerebro-spinal fever was at its height, while during the remaining eight months of the year there were only 1336 deaths from the same diseases; and I need not add that deaths from affections of the respiratory apparatus are largely from pneumonia. Moreover, I am of opinion, from my own observations, that many of the cases of pneumonia, during that period, presented symptoms of greater gravity than usually accompany this form of inflammation of the same extent. The patients were greatly prostrated from the first, and in some of them febrile movement, muscular pains, restlessness, or delirium preceded for hours or even days the pneumonic symptoms, affording evidence that the lung disease, if not due entirely to the same atmospheric conditions which give rise to cerebro-spinal fever, was at least under their influence. Although it is probable that pneumonia occurring during an epidemic of cerebro spinal fever is in most instances a strictly local malady, as it is at ordinary times, more or less modified perhaps by the epidemic influence, there can be little doubt that Webber's view is correct, that there are occasional cases of true cerebro-spinal fever, in which the local manifestations are chiefly in the lungs;

cases in which the cerebro-spinal affection is of less importance apparently than the pulmonic. I might relate striking examples, observed in the New York epidemic of 1872.

In one case three prominent physicians, one of them known throughout the country as an excellent diagnostician, pronounced the disease cerebro-spinal meningitis, but on the sixth day, the cerebro-spinal symptoms having considerably abated, pneumonia occurred, and afterward the pulmonary symptoms predominated.

CAUSE.—*Does the cause of cerebro-spinal fever emanate from the soil?* Facts show that it does not. Most of the epidemics commence in winter when the ground is frozen ; the disease occurs in valleys, and on hilltops, and upon all varieties of soil ; it invades one district, passes over another adjoining, and affects, perhaps, a third beyond, although the geological formation of all is the same.

Does the cause exist in the diet, as some competent observers have supposed ? The following facts, I believe, are sufficient to justify a negative answer : Of two adjacent localities, in which the nature of the diet of the inhabitants is the same, one escapes and the other is visited by the epidemic ; an epidemic sometimes prevails here and there over an area of many thousand miles, as recently in North America. It is hardly reasonable to suppose that any deleterious property would occur in the food over so wide a territory. An epidemic ceases, although the food of the people continues the same. Infants at the breast, having only the mother's milk, are sometimes affected, and likewise certain animals, whose food is very different from that of man, and finally the most careful examinations have hitherto failed to discover any change in the cereals, or other food, or noxious principle sufficient to explain the occurrence of the disease over a wide extent of territory.

There can, therefore, be little doubt that the cause exists in the atmosphere, though so subtle that we may never be able to detect it. Cerebro-spinal fever is, indeed, one of many examples in corroboration of the statement made by Humboldt, that there is no subject of scientific inquiry more obscure than the laws which control epidemics. Among the meteorological conditions which favor the occurrence of this disease, cool weather has already been alluded to. Statistics collected in France and the United States show that, while 166 epidemics occurred in the six months commencing with December, only 50 occurred in the remaining six months of the year. According to Professor Hirsch, whose statistics were obtained largely from central Europe, there were 57 epidemics in winter or winter and spring, 11 in spring, 5 between spring and autumn, 4 commencing in autumn and extending into winter or winter and spring, and 6 lasting through the entire year.

All observers have remarked the fact that anti-hygienic conditions, though obviously subordinate to the unknown atmospheric cause, never-

theless strongly predispose to this disease. Hence, soldiers in barracks and the poor in tenement houses suffer most severely. During the epidemic of 1872, in New York, unusually severe or multiple cases occurred for the most part where there were obvious anti-hygienic conditions, as in apartments which were unusually crowded and filthy, or in tenements around which refuse had collected or which had defective drainage. The interesting chart, prepared under the direction of Dr. Moreau Morris for the Health Board, shows that comparatively few cases occurred in those portions of the city where the sanitary conditions were good. I cannot, however, agree with Professor Hirsch that the greater crowding, domiciliary and personal uncleanliness, and imperfect ventilation in the cool than in the warm months, explain the fact that epidemics occur chiefly in winter and early spring ; for in clean and well-ventilated apartments, in sparsely settled and salubrious localities, epidemics occur for the most part in these seasons. Anti-hygienic conditions probably predispose to this disease in the same way, and no more than to any other grave epidemic which happens to be prevailing, as, for example, to Asiatic cholera, whose ravages are largely in the crowded and uncleanly quarters of the poor.

Is cerebro-spinal fever propagated by contagion ?—It is the almost unanimous opinion of those who are most competent to judge from their observations, that it is either not contagious or is so only in a very slight degree. It is certain that the vast majority of cases occur without the possibility of personal communication. Thus, in the commencement of an epidemic, the first patients are affected here and there at a distance from each other, often miles apart, and throughout an epidemic usually only one is seized in a family. Children may be around the bedside of the patient, passing in and out of the room without restriction, and yet we can confidently predict that none of them will contract the disease if there are proper ventilation and cleanliness. And when two or more cases occur in a family, it commences at such irregular intervals in the different patients that the presumption is strong that they receive it from the same extraneous source, and not one from the other, for contagious diseases usually have a pretty uniform incubative period. Thus, in the Brown family, treated by the late Dr. Sewall (*N. Y. Med. Rec.*, July, 1872), the first child sickened January 30th, and the remaining five children at intervals respectively of 5, 7, 11, 25, and 45 days. The following have been my observations relating to this point :

Single cases, No. 39 (4 adults).

Two in a family, No. 16 (8 families).

Three in a family, No. 3 (1 family).

In most of the 39 families in which single cases occurred, there were children who were allowed free intercourse with the patients. Is there any other malady of childhood known to be infectious, which affords such a record of non-contagion ? In those instances in which two in a family

took the fever, those who were last attacked did not seem to receive it from those who were first affected, for the reason already stated, namely, the very variable intervals between the two cases in the different families. The facts, in the family in which three cases occurred, did seem to lend support to the doctrine of contagion. A boy, twelve years of age, died of cerebro-spinal fever, and was buried on Saturday or Sunday. On the following Monday the mother washed the linen of the boy, which had accumulated, and within two days was herself affected with the disease. She and her infant, who was also seized with it, died. Were such cases frequent or not infrequent, the argument in favor of contagion would certainly be strong ; but as they are infrequent, it is proper to accept any other reasonable explanation instead. The state of the bedding and apartments, as observed by me, was such as to render the atmosphere in which this family lived noxious in a high degree, and therefore such as to attract the prevailing epidemic. Moreover, the mother, exhausted by her long watching, and deprived of needed sleep (for the boy was several days sick), instead of obtaining the required rest, rendered her system more liable to the fever by her self-imposed duties on the day following the burial. These manifest anti-hygienic conditions appeared quite sufficient, without the aid of any contagious principle, to explain the occurrence of the cases in this severely-visited family. My statistics, therefore, harmonize with the doctrine of non-contagiousness, but it is obviously very difficult to determine from clinical experience whether an epidemic constitutional disease is absolutely non-contagious, or contagious in a very low degree. Experience shows that the attendants upon a case of cerebro-spinal fever have immunity, unless the hygienic conditions are very bad.

Allusion has been made to the fact that this malady sometimes occurs among the lower animals. In the epidemic of 1811, in Vermont, Dr. Gallop remarks that even the foxes seemed to be affected, so that they were killed in numbers near the dwellings of the inhabitants. The New York epidemic of 1871–72, it is well known, prevailed among horses several months before it occurred among the people. It was common and fatal in the large stables of the city car and stage lines in 1871, while among the people the epidemic did not properly commence, although there were previously isolated cases, till January, 1872. It has been asked whether in epidemics like this, in which the lower animals are first affected, the disease may not be communicated from them to man ? This obviously brings up the question of contagiousness. From my own observations I should certainly answer in the negative, for I have not been able to ascertain that those who had charge of the affected horses in the recent epidemic, as the veterinary surgeons or stablemen, were any more liable to the fever than others who were not so exposed. They apparently were not, and we must, therefore, believe that this disease is not propagated from one species of animals to another, certainly no more than from one

animal to another in the same species, and the fact that different animals are affected by the epidemic is due to the potent and pervading nature of the cause. Cerebro-spinal fever is indeed, so to speak, pandemic in a double sense ; on the one hand affecting both sexes, different ages, and all conditions of people over a wide extent of territory, and on the other hand different species of animals, but with little or no contagiousness.

Not infrequently we are able to discover some exciting cause of the fever, usually an exhausting or perturbating influence of some sort. An individual whose system is affected by the epidemic influence, and is therefore predisposed to the disease, may, perhaps, escape by a quiet and regular mode of life; but if there be an exciting cause of the nature alluded to, the fever may be developed. Among these exciting causes may be mentioned over-work, fatigue, mental excitement, prolonged abstinence from food, followed by over-eating, and the use of indigestible and improper food. Thus in one instance in my practice, a delicate young woman at the head of one of the departments in a well-known Broadway store, was anxious and excited and her energies overtaxed at the annual reopening. Within a day or two subsequently the disease commenced. Another patient, a boy, was seized after a day of unusual excitement and exposure, having in the mean time bathed in the Hudson when the weather was quite cool. During the recent epidemic in New York those children seemed to me especially liable to be attacked who were subjected to the severe discipline of the public schools, returning home fatigued and hungry, and eating heartily at a late hour. In one instance which I observed, a school girl of ten years returned from school excited and crying, because she had failed in her examination and was not promoted. In the evening, after she had closely studied her lessons, the fever commenced with violent headache. Dr. Frothingham (*Am. Med. Times*, April 30, 1864) writes as follows of the brigade in which cerebro-spinal fever occurred in the Army of the Potomac : " Under Gen. Butterfield, a stern disciplinarian . . . . the men were drilled to the full extent of their powers—often to exhaustion. I did not at the time recognize this as the cause of the disease in question, but I learned that in the present epidemic in Pennsylvania the attack generally follows unusual exertion and exposure to cold." Observers have long recognized the fact of such exciting causes. Dr. Gallop, in his history of the epidemic of Vermont, in 1811, directs attention to the severity of the disease among the troops under General Dearborn, who were fatigued by marches, and greatly dispirited by a repulse which they had sustained from the British.

Sex.—It is stated by writers that more males are affected than females. Hospital and military statistics show this ; but in family practice, in which a large proportion of the patients are children, the number of males and females is about equal. Thus in 75 cases occurring in the 20th and 22d wards, mainly in the practice of two other physicians and myself, I find

that there were 39 males and 36 females. Sixty-four of these were children. From January 1st to November 1st, 1872, 905 cases in which the sex was stated were reported to the Health Board. Of these, 484 were males and 421 females. Dr. Sanderson's statistics of the epidemic in the provinces around the Vistula, the cases being chiefly children, give also but a slight excess of males. Probably, therefore, the sex under the age of puberty makes no difference in the liability to this disease, and the same may be said of all other constitutional affections. Men are more liable than women, only when they lead a more irregular life, and are subject to more privations and exposures.

Age.—Children, as already stated, are much more apt to contract cerebro-spinal fever than adults. The following are the statistics of the Health Board relating to this point, the cases occurring in 1872 :

Under 1 year,	125
From 1 to 5 years,	336
" 5 " 10 "	204
" 10 " 15 "	106
" 15 " 20 "	54
" 20 " 30 "	79
Over 30 years,	71
Total,	975

In the statistics which I have obtained of 81 cases occurring in the 20th and 22d wards, the ages were as follows :

Under 1 year,	8
From 1 to 3 years,	18
" 3 " 5 "	20
" 5 " 10 "	17
" 10 " 15 "	7
Over 14 years,	11
Total,	81

It is seen that nearly three-fourths of the whole number of cases in the recent epidemic in New York City were under the age of ten years. The statistics of other epidemics occurring in civil practice are similar. Thus Dr. Sanderson, in examining the mortuary statistics of the epidemic in Germany, ascertained that there had been 218 deaths under the age of fourteen years, and only 17 above that age, and although this does not show the exact ratio of children to adults, in the entire number of cases it is apparent that children greatly preponderated.

The more advanced the age after childhood, the less the liability to this malady ; so that after the middle period of life few cases occur, and after the age of fifty years there is nearly an immunity. The oldest two in the New York epidemics, of whose cases I have the records, had attained the ages respectively of 47 and 63 years.

Symptoms.—During epidemics of cerebro-spinal fever, we are now and

then called to patients who present certain of the characteristic symptoms, but in so transient and mild a form that they are soon restored to health. The fever is said to have aborted. I have met the following cases :

A boy of eight years, previously well, was taken with headache, vomiting, and moderate febrile movement on April 2, 1872. The evacuations were regular, and no local cause of the attack could be discovered. On the following day the symptoms continued, except the vomiting, but he seemed somewhat better. On April 4th the febrile movement was more pronounced, and in the afternoon he was drowsy and had a slight convulsion. The forward movement of his head was apparently somewhat restrained. On the 6th the symptoms had begun to abate, and in about one week from the commencement of the attack his health was fully restored.

A boy aged six years was well till the second week in May, 1872, when he became feverish, and complained of headache. At my first visit, May 14th, he still had headache, with a pulse of 112. The pupils were sensitive to light, but the right pupil was larger than the left. The bromide and iodide of potassium were prescribed with moderate counter-irritation behind the ears. The headache and febrile movement in a few days abated, the equality of the pupils was restored, and within a little more than a week from the first symptoms he fully recovered.

Obviously the diagnosis, when symptoms are so mild, must sometimes be doubtful ; but as observers in different epidemics report such cases, it seems proper to regard them with perhaps occasional exceptions as genuine, but aborted cases. The epidemic influence acts so feebly on these patients, or their ability to resist it is so great, that they escape with a short and trivial ailment.

Occasionally, also, during the progress of an epidemic, we meet patients who present more or fewer of the characteristic symptoms, but in so mild a form that they are never seriously sick, and never entirely lose the appetite, but the disease, instead of aborting, continues about the usual time.

Thus, on the 4th of January, 1873, I was called to a girl of thirteen years, who had been seized with vomiting followed by headache in the last week in December. During a period of six to eight weeks, or till nearly the 1st of March, she presented the following symptoms : Daily paroxysmal headache, often more severe in the forenoon ; neuralgic pain in the left hypochondrium, and sometimes in the epigastric region ; pulse and temperature sometimes nearly normal, and at other times accelerated and elevated, both with daily variations ; inequality of the pupils, the right being larger than the left during a portion of the sickness. This patient was never so ill as to keep the bed, usually sitting quietly during the day in a chair, or reclining on a lounge, and she never fully lost her appetite. Quinia had no appreciable effect on the paroxysms of pain or fever.

There can, in my opinion, be little doubt that this girl was affected by the epidemic, but so mildly that there was, for a considerable time, much uncertainty in the diagnosis. Cases like this, in which the disease is so

feebly developed, and those in which it aborts, though they deserve recognition, evidently should not be employed in the statistics.

Mode of Commencement.—In all the cases which I have observed, cerebro-spinal fever commenced between 12 M. and 6 A.M., and in the records of cases published by others the time of commencement, so far as I have observed, was between the same hours. The fact that this disease does not commence after the repose of night till several hours of the day have passed, shows the propriety, as we shall see hereafter, of enjoining a quiet and regular mode of life, free from excitement, and with sufficient hours of sleep during the time that the epidemic is prevailing.

Cerebro-spinal fever usually has no premonitory stage, or it is so slight as to escape notice. Exceptionally there are certain premonitions for a few hours or days, such as languor, chilliness, etc. Premonitions occur more frequently in mild than in severe forms of the fever. The ordinary mode of commencement in a typical or somewhat severe case is as follows: The patient has a rigor or chill, or rarely two or three of them at irregular intervals of some hours. One patient, an adult female, had three or four pretty severe chills, the last occurring, from recollection, as late as the fourth day. Children often have clonic convulsions in place of the chill, or immediately after it, partial or general, slight or severe. Apathy, more or less profound stupor, or less frequently delirium succeeds. In the gravest cases semi-coma occurs, from which the patient is with difficulty aroused, or profound coma, which, in spite of prompt and appropriate treatment, may prove speedily fatal. If aroused to consciousness, he now complains of violent headache, with or without, or alternating with equally severe neuralgic pains in the neck, some part of the trunk, or in one of the extremities. The pupils are dilated, or less frequently contracted, and they respond feebly, or not at all, to light. Often they oscillate, and occasionally one is larger than the other.

Vomiting, with little apparent nausea, is also an early and prominent symptom, evidently having a cerebral origin. It occurred as an initial symptom in 51 of 56 cases observed by Dr. Sanderson. Of 61 cases observed by Dr. Sewall and myself, neither its presence nor absence was recorded in 13 cases, its absence in only 1, and its presence as an early symptom in 48 cases.

Unlike typhus and typhoid fevers, the temperature on the first day is usually as elevated as, and sometimes more so than subsequently. Indeed, the highest temperature which I have observed in any case was only two or three hours after the commencement of the attack in a child of three years, namely, an axillary temperature of $107\frac{2}{5}°$.

Exceptionally the initial symptoms occur in a more gradual manner, becoming by degrees more severe, so that a few days elapse before they are so pronounced that a clear diagnosis is possible. The febrile movement, headache, neuralgic pains, lassitude, vomiting, and fretfulness,

though pretty uniformly present in the commencement, are not in these cases so severe at this period as to excite any apprehension.

Symptoms pertaining to the Nervous System.—Pain, already described as an initial symptom, continues during the acute period of the malady. It is ordinarily severe, eliciting moans from the sufferer, but its intensity varies in different patients. Its most frequent seat is the head, where it may be frontal or occipital. It is described as sharp, lancinating, or boring. It is also common in the neck, especially the nucha, the epigastrium, umbilical and lumbar regions, in one or more of the limbs, and along the spine (rachialgia). It shifts from place to place, but it is commonly more persistent in the head and along the spine than elsewhere. The patient, if old enough to speak, and not delirious or too stupid, often exclaims, "Oh, my head!" from the intensity of his suffering, but after some moments complains equally of pain in some other part, while perhaps the headache has ceased, or is milder. In few instances the headache is absent, or is slight and transient, while the pain is intense elsewhere. After some days the pain begins to abate, and by the close of the second week is much less pronounced than previously. Vertigo occurs with the headache, so that the patient reels in attempting to stand or walk. Contributing to the unsteadiness of the muscular movements is a notable loss of strength, which occurs early and increases.

The state of the patient's mind is interesting. It is well expressed in ordinary cases by the term apathy or indifference, and between this and coma on the one hand, and acute delirium on the other, there is every grade of mental disturbance. Sometimes patients seem totally unconscious of the words or presence of those around them, when it appears subsequently that they understood what was said or done. Delirium is not infrequent, especially in the older children and adults. Its form is various, most frequently quiet or passive, but occasionally maniacal, so that forcible restraint is required. It sometimes resembles intoxication, or hysteria, or it may appear as a simple delusion in regard to certain subjects. Thus, one of my patients, a boy of five years, appeared for the most part rational, protruding his tongue when requested, and ordinarily answering questions correctly, but he constantly mistook his mother, who was always at his bedside, for another person. Severe active delirium is commonly preceded by intense headache. In favorable cases the delirium is usually short, but in the unfavorable it is apt to continue with little abatement till coma supervenes.

On account of the pain and disordered state of mind, patients seldom remain quiet in bed, unless they are comatose, or the disease be mild, or so far advanced that muscular movements are difficult from weakness. In severe cases they are ordinarily quiet a few moments as if slumbering, and then, aroused by the pain, roll or toss from one part of the bed to another. One of my patients, a boy of five years, repeatedly made the

entire circuit of the bed during the spells of restlessness. In mild cases patients lie quiet, usually with their eyes closed, except when disturbed.

All writers record a general hyperæsthesia of the skin. Few patients that are not in a state of profound coma are free from it during the first weeks, and it increases materially the suffering. Frictions upon the surface, and even slight pressure with the fingers upon certain parts, extort cries. Gently separating the eyelids for the purpose of inspecting the eyes, and moving the limbs, or changing the position of the head, evidently increase the suffering, and are resisted. I have sometimes observed such outcries from slowly introducing the thermometer into the rectum, that I was forced to believe that the anal, and perhaps rectal, surface was also hypersensitive. The hyperæsthesia has diagnostic value, for there is no disease with which cerebro-spinal fever is likely to be confounded in which it is so great. It is due to the spinal meningitis, and is appreciable even in a state of semi-coma.

Tonic contraction of certain muscles, or groups of muscles, is present in all typical cases. In a small proportion of patients it is absent, or is not a prominent symptom, namely, in those in whom the encephalon is mainly involved, the spinal cord and meninges being but slightly affected, or not at all. This contraction is most frequent and marked in the muscles of the nucha, causing retraction of the head, but it is also common in the posterior muscles of the trunk, producing opisthotonos, and in less degree in those of the abdomen and lower extremities, and hence the flexed position of the thighs and legs, in which patients obtain most relief. The muscular contraction is not an initial symptom. I have ordinarily first observed it about the close of the second day, but sometimes as early as the close of the first day, and in other instances not till the close of the third day. Attempts to overcome the rigidity, as by bringing forward the head, are very painful, and cause the patient to resist. In young children having a mild form of the fever with little retraction of the head, the rigidity is sometimes not easily detected. I have been able in these cases to satisfy myself and the friends of its presence, by observing the difficulty with which the head is brought forward on presenting to the patient a tumbler with cold water, which is craved on account of the thirst. The usual position of the patient in bed is with the head thrown back, the thighs and legs flexed, with or without forward arching of the spine (see figure). The muscular contraction continues from three to five weeks, more or less, and abates gradually ; occasionally it continues much longer. Through the kindness of Dr. Griswold, of Thirtieth Street, I was allowed to see an infant of seven months in the tenth week of the disease. It exhibited great fretfulness, decided prominence of the anterior fontanelle, probably from intracranial serous effusion, and marked rigidity of the muscles of the nucha, with retraction of the head.

Paralysis occasionally occurs, but is less frequent than we would be

led to expect from the nature of the lesions. It may occur early, but it is more frequently a late symptom. It may be limited to one or two of the limbs, as a leg, or arm and leg, or it may be more general. Thus a man treated by Dr. Law in the Dublin epidemic of 1865 could move neither arms nor legs, and Wunderlich saw a patient who had paralysis of both lower extremities and a considerable part of the trunk. As the paralysis is due to inflammatory processes in the cerebro-spinal axis, it usually disappears in a few weeks as the inflammation abates, and convalescence is established, but it may be more protracted. Thus in Wunderlich's case there was only partial recovery after the lapse of five months.

Digestive System.—The tongue is ordinarily lightly covered with a whitish fur. Occasionally in cases attended with great prostration the fur is dry and brown, but only for a few days, when the moist whitish

Fig. 15.



fur succeeds. The habitual brownish and dry fur on the tongue, and sordes upon the teeth, so common in typhus and typhoid fevers, are seldom observed in uncomplicated cases of this disease. Vomiting, which I have described as an initial symptom, usually ceases in a few hours, or not till the lapse of several days, and it frequently recurs at intervals during the periods of recrudescence, which are common in the progress of the fever.

It occurs with little effort, often like a regurgitation, as is common when this symptom has a cerebral origin. The ejecta consist at first of the contents of the stomach and afterward partly of bile. It does not differ as a symptom from the vomiting which is so common in sporadic meningitis. Having a similar origin is a sensation of faintness or depression referred to the epigastrium.

The appetite is poor or entirely lost during the active period of the malady, and it is not fully restored till convalescence is well advanced. On account of the imperfect nutrition, patients progressively waste, and when the case is protracted there is notable emaciation. Thirst, already alluded to, and more or less constipation are common, but the latter

readily yields to purgatives. On the other hand, diarrhœa sometimes precedes, and accompanies the disease. I observed this in a few instances in 1872, when the weather had become warm. The patients were young children.

Pulse.—The pulse in children is constantly accelerated. Even in mild cases it is rarely below 100 per minute, and its ordinary range is from 112 to 160. I have seventy-five recorded observations of the pulse in children who recovered, taken before there was any decided improvement. The maximum pulse in these observations was 168 per minute, which was on the first day ; the minimum 82, and the average 123. The more severe and dangerous the attack, the greater the frequency of the pulse, unless occasionally in the comatose state. But even in profound coma the pulse was in my observations accelerated, and as death grew near, however great the stupor, it was progressively more frequent and feeble. Intermissions in the pulse do not seem to be as frequent as in sporadic meningitis. The pulse is liable to daily variations in frequency, which occur suddenly and without appreciable cause. The following consecutive enumerations of the pulse in four favorable cases which I have selected as typical will give an idea of these variations.

1st case, an infant of 14 months, 168, 120, 108, 120, 140, 150, 136, 128, 120.
2d case, an infant of 2 years, 136, 152, 130, 132, 136, 140, 152, 140, 136, 148.
3d case, a boy of 6 years, 120, 120, 88, 84, 92, 124, 128, 120.
4th case, a girl of 4 years, 116, 100, 124, 116, 120, 136, 140, 128, 128, 104.

I have preserved observations of this symptom made daily in nine fatal cases, and these show similar fluctuations in the frequency of the heart's contractions. The patients were children, all dying comatose. The maximum pulse in these observations was 204, which was on the first day ; the minimum 88, and the average 140. The following are the consecutive enumerations of the pulse usually made twice daily in two of these cases. It will be seen that there was not only greater frequency of the pulse, but fluctuations from day to day similar to those in the favorable cases :

1st case, age 8 months, 204, 164, 116, 160, 164.
2d case, age 2 years 8 months, 192, 168, 200, 152, 160.

In most inflammatory and febrile diseases exacerbations commonly occur in the latter part of the day, but in this disease they do not seem to be influenced by the time of day, so that sometimes the temperature is highest and pulse most frequent in the morning, sometimes in the evening, and then again at midday.

In favorable adult cases the pulse often remains under 100, and in certain patients it scarcely has more than the normal frequency, but if the

type be severe it rises to 110, 120, or over. In the adult as in the child, as death approaches, the pulse becomes more and more frequent and feeble, and it seldom even in the most asthenic cases has the fulness and force observed in idiopathic inflammations.

Temperature.—Certain of the older observers before the days of clinical thermometry, asserted that the temperature is not increased. North remarked as follows : " Cases occur, it is true, in which the temperature is increased above the normal standard, but these are rare ;" and Foot and Gallop made similar statements. I am surprised also that some of the recent writers state that febrile movement is often absent. Thus, in a well-written American treatise, bearing the date 1873, it is stated " that febrile symptoms do not necessarily belong to epidemic cerebro-spinal meningitis as a substantive disease, for it may and not unfrequently does occur without exhibiting any such symptoms." (Lidell.)

I have no doubt, from the nature of cerebro-spinal fever, and from thermometric examinations, which I have made now in more than fifty cases, that there is always an elevation of the internal temperature above the normal standard during the active period of the disease. I have never observed a temperature of less than 99½° if the examination were made within the first fourteen days, and the reason that certain other observers state differently is probably because they have taken the temperature of the cutaneous surface, which is very fluctuating and is often much below that of the blood. The temperature should be ascertained *per rectum*, where it corresponds pretty nearly with that of the blood. In one instance I supposed that I had met a case in which the temperature was not elevated, and I cite it as showing the liability to error in the thermometric examinations of these cases : A female patient, forty-seven years old, three days sick and comatose, whom I was allowed to examine with the family physician, exhibited no elevation of temperature when the instrument was placed in the mouth and the axilla, but on introducing it into the rectum it rose to 99½°.

The internal temperature, although uniformly elevated, undergoes greater and more sudden variations than occur in any other febrile or inflammatory disease. These fluctuations, which correspond with similar changes in the pulse, are observed during the different hours of the same day. I have in the statistics of my practice 146 observations of the temperature in 35 patients taken before the close of the second week. The highest I have already stated in speaking of the mode of commencement, namely 107⅔° in a child of two years. It fell a little subsequently, but rose again on the third day to 107°, when she died. In two other cases the temperature was 106° on the first day, and it did not afterward reach so high an elevation. One of these died on the ninth day, and the other in the ninth week. The next highest temperature was 105⅘°, also on the first day, in an infant of eight months, who died on the ninth day. The

first and last of these cases occurred in an old wooden tenement-house in the suburbs of the city and upon an elevated outcropping of rock. Wunderlich has recorded a temperature of 110° in one or two cases, but so great an elevation must be very rare in cerebro-spinal fever, and is of course prognostic of an unfavorable ending.

The external temperature undergoes similar but greater fluctuations, rising above and falling below the normal standard several times in the course of the same day. Similar fluctuations occur in sporadic meningitis, but they are much less pronounced. The more grave the case in those not comatose, the greater these variations. The following is a common example : the patient was two years old, and the case was one of considerable severity. The observations were made at four consecutive visits during the first week. The internal temperature varied from 101½° to 104⅘° as the extremes, while that of the fingers and hand at the first examination was 90½°, at the second 90°, at the third 103°, and at the fourth 83°. Thus the temperature of the extremities at the first and second examinations was about 8° below that of health, while at the third examination it had risen 13°, so as nearly to equal the internal temperature, and at the fourth examination it had again fallen 20°, or 15½° below the normal standard. The patient recovered. These sudden and great variations in the pulse and temperature have considerable diagnostic value in obscure and doubtful cases.

Respiratory System.—The symptoms which are referable to the respiratory apparatus are for the most part quite subordinate except when an inflammatory complication occurs. The respiration in uncomplicated cases is quiet and easy, and a cough if present is usually slight and accidental. Intermittent, sighing, or irregular respiration is less frequent in cerebro-spinal fever than in sporadic meningitis, but it does occur. In ordinary cases the respiration is somewhat accelerated, but without any marked disturbance in its rhythm. In 31 observations in children who had the disease without complication, I found the average respirations 42 per minute, while the average pulse was 137. It is seen therefore that the respiration as compared with the pulse was proportionately more frequent than in health. This appears to be due to the fact, that certain muscles which are concerned in respiration, as the abdominal and perhaps others, are embarrassed in their movements by the tonic contractions. In cases of pulmonary congestion, œdema, or inflammation, of course, the symptoms of this affection are superadded to those of the primary disease.

Cutaneous Surface.—The features may be pallid, of normal appearance, or flushed in the first days of the disease ; but in advanced cases they are pallid, as is the skin generally. A circumscribed patch of deep congestion often appears, as in sporadic meningitis, upon some parts of them, as the cheek, forehead, and ear, and after a short time disappears.

Friction for a moment upon any part of the surface, when the temperature is not reduced, causes the same capillary congestion, a fact to which Trousseau has called attention as regards sporadic meningitis.

The following are the abnormal appearances of the skin which I have most frequently observed : 1st. Papilliform elevations, due to contraction of the muscular fibres of the corium, namely the so-called goose-skin. This is not uncommon in the first weeks. 2d. A dusky mottling, also common in the first and second weeks, in grave cases, and most marked where the temperature is reduced. 3d. Numerous minute red points over a large part of the surface, bluish spots a few lines in diameter due to extravasation of blood under the cuticle, resembling bruises in appearance, and large patches of the same color, an inch or more in diameter, less common than the others, and usually not more than two or three upon a patient. These last I believe from certain observations are sometimes the result of bruises, which the patients receive during the times of restlessness. 4th. Herpes. This is common. It sometimes occurs as early as the second or third day, but in other instances not till toward the close of the first week or in the second. The number of herpetic eruptions varies from six or eight to a dozen or more. This affection evidently has a nervous origin, the vesicles occurring chiefly on those parts of the surface which are supplied by branches of the fifth pair of nerves. Its most common seat is upon the lips, but I have occasionally observed it upon the mucous membrane of the nasal and buccal surfaces, upon the cheek, around the ears and upon the scalp.

During the first days the skin is apt to be dry. Afterward perspirations are not unusual, and free perspirations sometimes occur, especially about the head, face, and neck. The quantity of urine excreted is normal, or it may be in excess of the normal amount. It occasionally contains a moderate amount of albumen, and in exceptional instances cylindrical casts and blood-corpuscles. A deposit of urates in the urine is not infrequent, but this so often occurs in inflammatory and febrile diseases that it is of little moment.

Arthritic inflammation, apparently of a rheumatic character, has been occasionally observed. It is commonly slight, producing merely an œdematous appearance around one or more joints. Thus, in one case which came under my notice, and which was subsequently fatal, the parents, who were poor, and were therefore without medical advice till the case was somewhat advanced, had already diagnosticated rheumatism on account of puffiness, which they had noticed around one of the wrists.

The organs of the special senses are more or less involved in most cases, and the eye and ear are not infrequently the seat of serious lesions. Taste and smell are rarely affected, so far as known, but it is possible that they may sometimes be perverted or even temporarily lost during the time of greatest stupor. In one case at least the smell in one nostril was entirely

lost. The affections of the eye and ear are the most important and interesting of those of the special senses. Strabismus is common. It may occur at any period of the fever, continuing a few hours or several days, and it may appear and disappear several times before convalescence is established. Occasionally it continues several weeks, but with few exceptions the parallelism of the eyes is finally restored. In a boy of five years, whom I last saw three months after convalescence, there was still convergent strabismus of the right eye and double vision.

Changes in the pupils are among the first and most noticeable of the initial symptoms, as I have already stated in describing the mode of commencement. These are dilatation, less frequently contraction, oscillation, inequality of size, feeble response to light, etc. Most patients present one or more of these abnormalities of the pupils, and they continue during the first and second weeks, and gradually abate as the condition of the patient improves. Inflammatory hyperæmia of the conjunctiva often occurs. It commences early, and, now and then, the conjunctivitis is so intense that considerable tumefaction of the lids results, with a free muco-purulent secretion. The false diagnosis has indeed been made of purulent ophthalmia, in cases in which this affection of the lids was early and severe. But such intense inflammation is quite exceptional. More frequently there is a uniform diffused redness of the conjunctiva, not so dusky as in typhus, and the injected vessels cannot be so readily distinguished as in that disease.

In certain cases almost the whole eye (all, indeed, of the important constituents) becomes inflamed ; the media grow cloudy, the iris discolored, and the pupils uneven and filled up with fibrinous exudation. The deep structures of the eye cannot, therefore, be readily explored by the ophthalmoscope, but they are observed to be adherent to each other, and covered by inflammatory exudation. They present a dusky red, or even a dark color, when the inflammation is recent. Exceptionally, the cornea ulcerates, and the eye bursts, with a loss of more or less of the liquids and shrinking of the eye. But ordinarily no ulceration occurs, and, as the patient convalesces, the œdema of the lids, hyperæmia of the conjunctiva, the cloudiness of the cornea, and of the humors, gradually abate, and the exudation in the pupils is absorbed. The iris bulges forward, and the deep tissues of the eye, viewed through the vitreous humor, which before had a dusky red color from hyperæmia, now present a dull white color. The lens itself, at first transparent, after a while becomes cataractous. Sight is lost, totally and forever. This form of ophthalmia is sometimes rapidly developed, as in the following example :

On July 5th, 1873, I was called to a boy, five years of age, who had reached the tenth day of cerebro-spinal fever without apparently any affection of the eyes, as both presented the normal appearance. On the following day the left eye was red and swollen from the inflammation and

chemosis, so that the lids could not be closed, and the media were cloudy. Death occurred on the same day.

If the patient live, the volume of the eye diminishes, as the inflammation abates, to less than the normal size, even when there has been no rupture, and divergent strabismus is apt to occur. Professor Knapp, whose description of the eye I have for the most part followed, says: "The nature of the eye affection is a purulent choroiditis, probably metastatic." Fortunately so general and destructive an inflammation of the eye, as has been described above, is comparatively rare. On the other hand, conjunctivitis of greater or less severity, and hyperæmia of the optic disk, consequent on the brain disease, are not unusual, but they subside, leaving the function of the organ unimpaired.

Inflammation of the middle ear of a mild grade, and subsiding without impairment of hearing, is common. The membrana tympani, during its continuance, presents a dull yellowish, and in places a reddish, hue. Occasionally a more severe otitis media occurs, ending in suppuration, perforation of the membrana tympani, and otorrhœa, which ceases after a variable time. But otitis media is not the most severe affection of the organ of hearing. Certain patients lose their hearing entirely and never regain it, and that, too, with little otalgia, otorrhœa, or other local symptoms, by which so grave a result can be prognosticated. This loss of hearing does not occur at the same period of the disease in all cases. Some of those who become deaf are able to hear as they emerge from the stupor of the disease, but lose this function during convalescence, while the majority are observed to be deaf as soon as the stupor abates and full consciousness returns.

Two important facts have been observed in reference to the loss of hearing in these patients, namely, it is bilateral and complete. When first observed it is in some, as stated above, complete, but in others partial, and when partial it gradually increases till after some days or weeks, when it becomes complete. I have the records of ten cases of this loss of hearing, or about one in ten of the total number of cases which have either come under my observation, or have been reported to me by physicians in whose practice they occurred. One was a young lady, and the others children under the age of ten years. Prof. Knapp has examined thirty-one cases. "In all," says he, "the deafness was bilateral, and with two exceptions, of faint perception of sound, complete. Among the twenty-nine cases of total deafness there was only one who seemed to give some evidence of hearing afterward."

One theory attributes the loss of hearing to inflammatory lesions, either at the centre of audition within the brain, or in the course of the auditory nerves before they enter the auditory foramina. Thus Stillé says: "This symptom appears to depend chiefly upon the pressure of the plastic exudation in which the nerves are imbedded." The other theory attributes the

loss of hearing to inflammatory disease of the ear, and especially of the labyrinth. Dr. Sanderson, who is an advocate of this latter theory, remarks as follows : "As regards the nature of the affection, there appears to be good reason for believing that, like the blindness observed under similar circumstances, and sometimes in the same cases, it is dependent on inflammatory changes in the organ of hearing itself. Dr. Klebs was kind enough to show me in the pathological museum of the Charité, at Berlin, a preparation of the internal ear of a soldier who had died of epidemic meningitis complicated with deafness, in which fibrinous adhesions existed between the bones of the internal ear and the walls of the vestibule. Dr. Klebs stated that in the recent state the mucous lining of the vestibule was detached." In the case of a young woman who was deaf from the commencement and died on the eighth day, "both tympana were natural, but in the left membrana tympani was found a dense white thickening as large as a pin's head. On the same side the lining membrane of the semicircular canals was distinctly thickened and loosed, and in the anterior canal there was semifluid purulent masses." Professor Knapp also states : "The nature of the ear disease is, in all probability, a purulent inflammation of the labyrinth." According to him no disease of the middle ear could cause such complete deafness, and, as evidence that the deafness is not due to central disease, Dr. Gruening obtained by electrization the normal reaction of the auditory nerve within the cranium. Moreover, if the lesion which destroys hearing be within the cranium, why is not the function of the other cranial nerves also abolished. Drs. Keller and Lucae have also, in three post-mortem examinations, found evidences of disease of the labyrinth.

An argument in support of the former of these theories is the fact, that the lesion which produces the deafness is not ordinarily attended by any marked subjective symptoms referable to the ear, as otalgia, etc. Again, the fact that the deafness is always bilateral and simultaneous in the two ears, comports better with the doctrine of a central lesion than with that which locates the lesion in the ear. But the true theory can only be positively established by dissections, and as we have seen, several post-mortem examinations have revealed inflammatory disease of the labyrinth in those who have died having this form of deafness, while in no case, so far as I am aware, has the ear been found free from inflammatory lesions. Therefore, the theory which ascribes the deafness to disease of the ear is much better established than the other, and in the present state of our knowledge we must accept it. Moreover, most of the aurists of this city, who have had excellent opportunities to examine these cases, believe in this theory.

Nature.—If we examine the literature of cerebro-spinal fever we will find that three theories relating to its nature have been advocated : one that it is a local disease, occurring epidemically ; the second, that it is

akin to typhus fever, or is a form of it ; and the third, that it is a disease *sui generis*.

The first theory, that it is an epidemic local disease, once had many adherents, but it is now nearly discarded. Job Wilson, in 1815, considered it a form of influenza, and he could discern no utility in drawing a distinction between spotted fever and influenza. We, in this day, can see no resemblance between the two, except that they are both epidemics. A more plausible view is, that it is merely an epidemic inflammation of the cerebral and spinal meninges. Even Niemeyer says that it presents no symptoms except such as are referable to the local affection. But a moment's thought will show us that cerebro-spinal fever differs as widely from simple meningitis, as scarlet fever with its pharyngitis differs from idiopathic pharyngitis. Cerebro-spinal fever begins abruptly, usually in those with previous good health ; and its initial symptoms, we have seen, are severe ; while sporadic meningitis ordinarily occurs in those of feeble or failing health, with an insidious approach, and with gradually increasing symptoms. And though the two diseases have many symptoms in common, they differ in others. Scantiness of the urine, dryness of the skin, and retraction of the abdomen, are observed in sporadic meningitis, while a normal or increased amount of urine, a normal or even rounded fulness of the abdomen, and often, also, perspiration, are symptoms of cerebro-spinal fever. The two diseases differ also strikingly as regards the periods of greatest danger and the prognosis ; but the conclusive proof that the disease of which we are treating is not a local affection, but constitutional, with local manifestations, is found in the fact of a constant and early blood change, which in all severe cases is manifested by the appearance of the skin, and in other ways.

Cerebro-spinal fever differs widely in many particulars from typhus, although it is probable that it was confounded with it previously to the present century, and many even now consider it a form of that disease. Their theory is, that from some unknown cause or influence the poison of the constitutional disease acquires for the time an affinity for the great nervous centres, producing their congestion and inflammation, just as that of scarlet fever causes a pharyngitis, and if we could detach from it these local manifestations, we would have a malady which differs but little, if at all, in its clinical history and nature, from typhus.

The following are some of the differences which, in my opinion, not only establish the non-identity of these two fevers, but show that there is no close relationship between them. The causes of typhus are determined. Crowding, personal uncleanliness, and imperfect ventilation are sufficient to produce it in any season or climate. Such is not the case with cerebro-spinal fever. The most that can be said of the agency of these and similar anti-hygienic conditions in causing this fever is, as we have already stated, that they produce deterioration in the tone of the

system, so that it is less capable of resisting the prevailing epidemic influence. The cause of cerebro-spinal fever occurs independently of the usual conditions of life, and is present or operative only at long intervals; else the epidemic would not be so rare. Typhus is highly contagious; cerebro-spinal fever is not contagious, or is feebly so. Typhus is rare under the age of ten years, and is most frequent in youth and manhood, while the reverse is true of cerebro-spinal fever. Typhus commences with mild or moderately severe symptoms, which increase in severity day by day, and the period of greatest danger is therefore at an advanced stage of the disease. Contrast this with the violence of the initial symptoms of cerebro-spinal fever, and the fact that the first and second days are most perilous. Moreover, typhus does not seem to be more prevalent during epidemics of cerebro-spinal fever than at other times.

If we pass over those many symptoms due to lesions of the cerebro-spinal axis, which are present in cerebro-spinal fever, but are absent in typhus fever, there are other points of dissimilarity which cannot be satisfactorily explained, except on the supposition of an essential difference in the two diseases. The sordes on the teeth and gums, dry and brown fur upon the tongue, peculiar mouse-like odor, and more definite duration of typhus, are points of contrast with cerebro-spinal fever. Moreover, and as, in my mind, very conclusive evidence of the non-identity of typhus and cerebro-spinal fever, that common lesion of the former, namely, enlargement and softening of the spleen, is seldom present in the latter. The spleen has usually been found normal or moderately congested in most post-mortem examinations of cerebro-spinal fever.

Where, therefore, should cerebro-spinal fever be placed in the catalogue of diseases? It resembles scarlet fever in the suddenness and violence of its onset; sporadic meningitis on the one hand, and typhus on the other, as we have seen, in many of its symptoms; influenza and cholera, in the infrequency of its visitations, and its epidemic nature. But the particulars in which it differs from these diseases are more numerous and important than those in which it resembles them. Like a rare object in nature, which naturalists are not able to classify with others on account of dissimilarities, though it has its resemblances to more than one, cerebro-spinal fever appears to stand alone, as a peculiar constitutional disease, having a peculiar but obscure cause, and a dangerous manifestation or expression located in the cerebro-spinal system.

Prognosis.—Cerebro-spinal fever is justly one of the most dreaded of the epidemic diseases, on account of the great mortality which attends it, and the fact that those who survive are often left with some incurable ailment. The following are the statistics of fifty-two cases, most of which occurred in my own practice, and the rest I visited in consultation: twenty-six were cured and twenty-six died. Sixteen of the twenty-six who died were profoundly and hopelessly comatose within the first seven days, most

of them dying within that time, and some even on the first and second days, while others lingered into the second week and died without any sign of returning consciousness. These statistics therefore show, and the same is true of the statistics of other observers, that the first week is the time of greatest danger, and if no fatal symptoms are developed during this week recovery is probable. Only three deaths occurred after the twenty-first day, one from purpura hæmorrhagica, the hæmorrhages taking place from the mucous surfaces, and the other two after a sickness of more than two months, in a state of extreme emaciation and prostration. In these last cases muscular tremors and convulsions preceded death. The ten who subsequently died, but did not become comatose during the first week, were nevertheless seriously sick from the first day, but there was hope and some expectation of a different issue till near death.

There is probably no disease which falsifies the predictions of the physician more frequently than this. This is due partly to the severity of the cerebral symptoms in the commencement, which, did they occur in the common forms of meningitis, with which he is more familiar, would justify an unfavorable prognosis, and partly to the remissions and exacerbations, the occurrence alternately of symptoms of apparent convalescence and recrudescence, or relapse, which characterizes the course of this disease. Grave initial symptoms, which might seem to have a fatal augury, are often followed by such a remission, that all danger seems past, and in a few hours later perhaps the symptoms are nearly or quite as grave as at first.

Under the age of five years, and over that of thirty, the prognosis is less favorable than between these ages. An abrupt and violent commencement, profound stupor, convulsions, active delirium, and great elevation of temperature are symptoms which should excite solicitude, and render the prognosis guarded. If the temperature remain above 105° death is probable, even with moderate stupor. Numerous and large petechial eruptions show a profoundly altered state of the blood, and are therefore a bad prognostic, and so is continued albuminuria, since it shows great blood change, or nephritis, while other internal organs are probably also involved. In one case, a boy, which I had an opportunity of examining nearly a year after the attack, the kidneys were still affected. He had anasarca of the face and extremities with albuminuria. The renal congestion had apparently degenerated into a chronic Bright's disease. The result of the case I have not ascertained. Profound stupor, though a dangerous symptom, is not necessarily fatal so long as the patient can be aroused to partial consciousness, and the pupils are responsive to light; so long as it does not pass into actual coma, it is less dangerous than active or maniacal delirium, which is apt to eventuate in this coma.

A mild commencement, with general mildness of symptoms, as the ability to comprehend and answer questions, moderate pain and muscular rigidity,

some appetite, moderate emaciation, little vomiting, etc., justifies a favorable prognosis, but even in such cases it should be guarded till convalescence is fully established.

Death in the first stages of cerebro-spinal fever appears to occur ordinarily from coma, but we will see from the lesions that congestion of the posterior portions of the lungs is frequent, and Sanderson says :

"In all the fatal cases which came under my notice, the most prominent symptoms, which preceded death, were those which indicate impairment and perversion of the respiratory functions. As the breathing became more hurried and difficult, the general depression became more intense, the pulse became weaker and quicker, and the temperature of the skin more elevated."

He cites the case of a child, who died in that way, but was at the same time comatose. In more protracted cases in which there is softening of portions of the cerebro-spinal axis, or fibrino-purulent collections around it, which are not absorbed, death may occur either from convulsions and coma, or from exhaustion. We have already alluded to one case in which purpura hæmorrhagica was developed, and the child was exhausted by the hæmorrhages.

Those who fully recover often exhibit symptoms usually of a nervous character, as irritability of disposition, headache, etc., for months after convalescence is established.

Diagnosis.—Cerebro-spinal fever, on account of the nature and severity of its symptoms and the suddenness of its onset, may be mistaken for scarlatina, and *vice versâ*. In one instance, to my knowledge, this mistake was made. High febrile movement, vomiting, convulsions, and stupor, are common in the commencement of scarlet fever, and we have seen that the same symptoms ordinarily usher in the severer forms of cerebro-spinal fever. It will aid in diagnosis to ascertain whether there be redness of the fauces, for this is present in the commencement of scarlet fever, and in a few hours later the characteristic efflorescence appears upon the skin.

The diagnosis of cerebro-spinal fever from the common forms of meningitis is ordinarily not difficult, for while in the former there is the maximum intensity of symptoms on the first day, in the latter there is a gradual and progressive increase of symptoms from a comparatively mild commencement. Moreover cases of ordinary or sporadic meningitis occurring at the age when cerebro-spinal fever is most frequent, are commonly secondary, being due to tubercles, caries of the petrous portion of the temporal bone, or other lesion, and there are, therefore, in these cases preceding and accompanying symptoms, which are directly referable to the antecedent disease. We have seen how different the case is with cerebro-spinal fever, which in most patients begins abruptly in a state of previous good health. Again in cerebro-spinal fever, after the second or third day, hyperæsthesia, retraction of the head, and other characteristic symptoms

occur, which are either not present, or are much less pronounced, in ordinary meningitis. The symptoms of hysteria sometimes bear a close resemblance to the delirium observed in certain cases of cerebro-spinal fever. But the thermometer enables us to make the diagnosis, for in hysteria there is no febrile movement. In our remarks on the nature of cerebro-spinal fever we have sufficiently described the differences between this disease and typhus.

Anatomical Characters.—I have notes of the post-mortem appearances in 76 cases, published chiefly in British and American journals ; 29 died within the first three days ; 28 between the third and twenty-first days ; 8 died after the twenty-first day, and the duration of the remaining 11 was unknown. These records furnish the data for the following remarks :

The blood undergoes changes, which are due in part to the inflammatory, and in part to the constitutional and asthenic, nature of the disease. The proportion of fibrin is increased in cases that are not speedily fatal, as it ordinarily is in idiopathic inflammations. Analyses of the blood, published by Ames, Tourdes, and Maillot, show a variable proportion of fibrin from 3.40 to more than six parts in 1000. In sthenic cases accompanied by a pretty general meningitis, cerebral and spinal, there is, after the fever has continued some days, the maximum amount of fibrin, while in the asthenic and suddenly fatal cases, with inflammation slight, or in its commencement, the fibrin is but little increased. The most common abnormal appearance of the blood observed at autopsies is a dark color with unusual fluidity, and the presence of dark, soft clots. Exceptionally bubbles of gas have been observed in the large vessels and the cavities of the heart. An unusually dark appearance of the blood, small and soft dark clots, and the presence of gas bubbles, when only a few hours have elapsed after death, indicate a malignant form of the disease, in which this fluid is early and profoundly altered. In certain cases the blood is not so changed as to attract attention from its appearance. The points or patches of extravasated blood which are observed in the skin during life in a certain proportion of cases, usually remain in the cadaver. In incising them the blood is seen to have been extravasated, not only in the layers of the skin, but also in the subcutaneous connective tissue. Extravasations of small extent are also sometimes observed upon the thoracic and abdominal organs.

In those who die after a sickness of a few hours or days, namely, in the stage of acute inflammatory congestion, the cranial sinuses are found engorged with blood, and containing soft, dark clots. The meninges enveloping the brain are also intensely hyperæmic in their entire extent in most cadavers ; but in some, in certain parts only, while other portions appear nearly normal. In those cases which end fatally within a few hours, this hyperæmia is ordinarily the only lesion of the meninges ; but if the case be more protracted, serum and fibrin are soon exuded from the

vessels into the meshes of the pia mater, and underneath this membrane over the surface of the brain. Pus-cells also occur mixed with the fibrin, sometimes so few as to be discovered only by the microscope, but in other cases in such quantity as to be much in excess of the fibrin, and be readily detected by the naked eye. Pus, which in these cases, no doubt, consists of white blood-corpuscles which have escaped with the fibrin from the meningeal vessels, sometimes appears early in the disease. Thus, in the *Dublin Quarterly Journal*, 1866, Dr. Gordon relates the history of a case in which death occurred after a sickness of five hours, and a purulent-appearing greenish exudation had already occurred in places under the meninges. The exudation of fibrin commences also in the course of a few hours. Thus in a case of thirty hours' duration, published by Dr. William Frothingham, in the *American Medical Times*, April 30th, 1864, and in another of one day's duration, published by Dr. Haverty, in the *Dublin Quarterly Journal* for 1867, exudation of fibrin had already occurred in and under the pia mater. The arachnoid soon loses its transparency and polish, and presents a cloudy appearance over a greater or less extent of its surface. This cloudiness is greatest in the vicinity of the fibrinous exudation, but it occurs also where no such exudation is apparent to the naked eye. Dr. Gordon describes a case of only eight hours' duration, in which the arachnoid was already opaque at the vertex, but of normal appearance at the base of the brain (*Dublin Quarterly Journal*, 1866), though the vessels of the pia mater were everywhere greatly congested.

The exudation, serous, fibrinous, and purulent, occurs, as in other forms of meningitis, within the meshes of the pia mater, and underneath this membrane over the surface of the brain. The fibrin is raised from the surface of the brain with the meninges. It is most abundant in the intergyral spaces around the course of the vessels, over and around the optic commissure, the pons Varolii, the cerebellum, medulla oblongata, and along the Sylvian fissures. It is most abundant in the depressions, where it sometimes has the thickness of $\frac{1}{10}$ to $\frac{1}{4}$ of an inch, but it often extends over the convolutions so as to conceal them from view.

Most other forms of meningitis have a local cause, and are therefore limited to a small extent of the meninges, as, for example, meningitis from tubercles, or caries of the petrous portion of the temporal bone, in both of which it is commonly limited to the base of the brain, or from accidents, when the meningitis commonly occurs upon the side or summit of the brain. The meningitis of cerebro-spinal fever, on the other hand, having a general or constitutional cause, occurs with nearly equal frequency upon all parts of the meningeal surface, except that it is, perhaps, most severe in the depressions where the vascular supply is greatest. In cases of great severity, the inflammatory exudation, fibrinous, or purulent, or both, may cover nearly, or quite, the entire surface of the brain. Thus, in the case of a negro, 35 years old, only four days sick, whose body was examined at

Bellevue Hospital on May 30th, 1872, the record states that there was a purulent exudation over the entire surface of the cerebrum and cerebellum. The quantity of serous exudation varies according to the duration and amount of congestion. In some the quantity is so small as scarcely to attract attention, but in other instances, especially when the disease is protracted, it is large. In a case reported by Dr. Moorman in the *Amer. Journ. of Med. Sci.* for Oct. 1866, it is stated that about three pints of turbid serum escaped from the cranial cavity in attempting to remove the brain, but as there was no measurement the statement may be somewhat exaggerated.

In those who die at an early stage of the disease, the vessels of the brain, like those of the meninges, are hyperæmic, so that numerous "puncta vasculosa" appear upon its incised surface. At a later period the hyperæmia, like that of the meninges, may disappear. If there be much effusion of serum within the ventricles and over the surface of the brain, the convolutions are apt to be flattened, and the pressure may be such that the amount of blood circulating within the brain is reduced below the normal quantity. Thus, in the case of a child of three years, who lived sixteen days, and was examined after death by Burdon-Sanderson, the ventricles contained a large amount of turbid serum, and the brain-substance was everywhere pale and anæmic.

Cerebral *ramollissement* occurs in certain cases. At one of the examinations in Charity Hospital, the patient having been only three days sick, the brain was found much softened. The dissection was made seven hours after death, so that the softening could not have been the result of decomposition. At one of the post-mortem examinations in Bellevue Hospital, softening of the fornix, corpus callosum, and septum lucidum was observed; and in another, softening in the neighborhood of the subarachnoid space. In a case related by Dr. Moorman in the *Amer. Journ. of Med. Sci.* for Oct. 1866, it is stated that portions of the brain, medulla oblongata, and pons Varolii were softened. In a case observed by Dr. Upham, softening of the superior portion of the left cerebral hemisphere had occurred. Occasionally the whole brain is somewhat softened. Burdon-Sanderson, Russell, and Githens, each relate such a case. Moreover the walls of the lateral ventricles are ordinarily more or less softened in these cases, as in the ordinary form of meningitis. In rare instances the brain is œdematous, as in a case published by Dr. Hutchinson in the *Amer. Journ. of Med. Sci.* for July, 1866. In this case the patient was only four days sick, and the whole brain was œdematous, serum escaping from its incised surface.

The ventricles contain liquid, in some patients transparent serum, in others serum turbid, and containing flocculi of fibrin or fibrin with pus. The liquid in the different ventricles, as they intercommunicate, is similar. The choroid plexus is either injected or it is infiltrated with fibrin and pus.

In advanced cases with the abatement of the inflammation absorption commences. The serum obviously disappears soonest, and the pus and fibrin more slowly, by fatty degeneration and liquefaction. Still absorption and the return of the brain and meninges to their normal state are slow, and hence the tediousness of convalescence. An infant, whom I was allowed to examine in the practice of another physician, took the disease at the age of five months, and two months subsequently, great prominence of the anterior fontanelle and other symptoms indicated still the presence of a considerable amount of effusion within the cranium. No post-mortem examinations, so far as I am aware, have yet revealed the state of the brain and meninges in those who have had this disease at some former period and recovered from it, but it is not improbable that some opacity and preternatural adhesions in places may continue for life.

The remarks made in reference to the cerebral, apply for the most part to the spinal meninges. There is at first intense hyperæmia of the membranes usually over the entire surface of the cord, soon followed by fibrinous, purulent, and serous exudation, in the meshes of the pia mater, and underneath this membrane. Thickening and opacity of the meninges, and often adhesions, occur in protracted cases. The exudation is sometimes confined to a portion of the meninges, more frequently that covering the posterior than anterior aspect of the cord, but it may occur in any part, and in severe cases the entire pia mater of the spine is infiltrated with it. The exudation may have the usual appearance of fibrin and pus, but it is sometimes greenish and sometimes bloodstained. Small extravasations of blood almost necessarily occur as a result of the intense hyperæmia, and in one cases related by Burdon-Sanderson it is stated that there was a layer of blood one-eighth of an inch thick over the whole cord below the bronchial swelling. In post-mortem examinations the central canal of the cord has usually been overlooked. Ziemssen relates a case, and Gordon another, in which it was dilated and filled with purulent fluid. The anatomical changes which have been observed in the cord itself have been injection of its vessels in recent cases, and occasional softening of portions. Thus, in a case which was examined in Bellevue Hospital, April 13th, 1872, it is stated that there was softening of the cord in the upper part of the dorsal region. In most of the examinations the only abnormal appearance observed in the cord was hyperæmia, but in a considerable proportion of cases the records state that the substance of the cord appeared normal.

No constant or uniform lesions occur in the organs of the trunk. The most common is congestion of the lungs, especially of the posterior portions, with more or less œdema, and nodules of hepatization or points of extravasation. Effusion of serum, sometimes bloodstained, occasionally occurs in the pleural and other serous cavities. The auricles and ventricles of the heart, as already stated, contain more or less blood, with soft

dark clots in the more malignant and rapidly fatal cases, but larger and firmer in those which have been more protracted. The spleen, liver, kidneys, stomach, and intestines, one or more, are sometimes congested, but in other cases their appearance is normal. The absence of uniformity as regards the state of the spleen, the fact that in many patients it undergoes no appreciable change, is important, since this organ is so generally enlarged and softened in infectious diseases. The agminate and solitary glands have ordinarily been overlooked at post-mortem examinations, but in certain cases they have been found prominent.

TREATMENT. *Preventive.*—Although we do not fully understand the conditions in which cerebro-spinal fever originates, it is certain, from facts observed in epidemics, that we are able to do something to diminish its severity and prevalence and to protect community. Measures to this end must be of a twofold character, namely, such, in the first place, as are calculated to improve the surroundings of the individual, so as to conduce to a better state of health, and, secondly, the regulation of his mode of life. Cleanliness and dryness of streets and domiciles, perfect drainage and sewerage, prompt removal of all refuse matter, avoidance of overcrowding, so as to procure the utmost salubrity of the atmosphere, the use of plain and wholesome food—in a word, the strict observance of sanitary requirements in all the surroundings—cannot fail to reduce the number and diminish the severity of cases ; for, as we have seen, this disease assumes its worst form and numbers the most victims where anti-hygienic conditions most abound. Of scarcely less importance is a strict surveillance of the mode of life, especially of children and young people, during the time of an epidemic. We have seen that this disease not infrequently follows irregularities in the mode of life, excesses of whatever kind, and fatigue, mental or bodily. These should therefore be avoided. A quiet mode of life and moderate exercise, plain and wholesome and regular meals, and the full amount of sleep, afford some, but not complete, security in the midst of an epidemic.

Curative.—It will aid in determining the proper mode of treatment to bear in mind the anatomical characters as ascertained by post-mortem examinations. As the chief danger in the first days is from the intense inflammatory congestion of the cerebro-spinal axis, the prompt employment of measures calculated to relieve this is of the utmost importance. To this end bladders or bags of ice should be immediately applied over the head and nucha, and constantly retained there during the first week. Bran mixed with pounded ice produces a more uniform coldness, and is more comfortable to the patient, than ice alone. Cold produces a prompt and powerful effect in diminishing the turgescence of the cerebral and meningeal vessels. A hot mustard foot-bath or general warm bath with mustard, should also be employed as early as possible, since it acts so powerfully as a derivative from the hyperæmic nerve-centres, tends to

calm the nervous excitement, and prevent convulsions. An enema to open the bowels is also proper.

Should bloodletting be employed, especially in the more sthenic cases? Even in the commencement of the present century, when it was customary to bleed generally or locally in the treatment of inflammatory and febrile diseases, a majority of the American practitioners whose writings are extant discountenanced the use of such measures in the treatment of this disease. Drs. Strong, Foot, and Miner, though under the influence of the Broussaian doctrine, were good observers, and they soon abandoned the use of the lancet and leeches in the treatment of these patients for more sustaining measures. Strong, who published a paper on spotted fever in the *Medical and Philosophical Register*, in 1811, states that certain physicians employed venesection as a means of relieving the internal congestions, but finding that the pulse became more frequent after a moderate loss of blood, they soon laid aside the lancet. Some experienced physicians of that period, however, continued to recommend and practise depletion, general as well as local, as, for example, Dr. Gallop, who treated many cases in Vermont in the epidemic of 1811.

No physician at the present time recommends venesection, but some of the best authorities, as Sanderson and Niemeyer, approve of local bleeding in certain cases. It may be stated, as a safe rule, that leeches or other modes of local depletion should not be prescribed in a large majority of cases, and if prescribed in any case it should be on the first day, for on the first day the maximum of inflammatory congestion is attained, and in no case should more than a very moderate quantity of blood be abstracted. The abstraction of blood in small quantity, may perhaps be permitted in the more sthenic cases, in which, after the prompt employment of the other measures recommended, the stupor becomes more and more profound, and the patient appears already in incipient coma. But in allowing this it must not be forgotten that the disease is in its nature asthenic, and in its subsequent course will require sustaining measures. It is apparent, however, that the abstraction of blood, if once allowed, is likely to be practised too frequently in the treatment of this disease by those who have had but little experience with it, for the state of most patients in the commencement seems so critical, and the stupor so great, that the most energetic measures seem to be required. But if the blood of patients be spared, and they are promptly and properly treated otherwise, it is surprising to see how many emerge from the stupor and finally recover. For example, in a case related to me by Dr. Griswold, the patient seemed to be comatose for three days, being apparently unconscious and the pupils scarcely responding to light, but he recovered without losing blood. In only one case have I recommended the abstraction of blood, and this was so instructive that I will briefly relate it.

M., a female, 4 years old, was seized at 2 A.M., March 7th, 1873, with vomiting, chilliness, and trembling, followed by severe general clonic convulsions lasting about fifteen minutes. On visiting her early in the morning, I found her semi-comatose, with a pulse of 132, which in a few hours rose to 156; temperature 101¼°, respiration 44 ; eyes closed; pupils moderately dilated and responding feebly to light ; surface presenting a dusky mottling ; constant tremulousness, and frequent twitching of limbs. Four grains of bromide of potassium were ordered to be given every hour to two hours, with the usual local measures, namely, ice to the head and nucha, and a hot mustard foot-bath, followed by sinapisms to the extremities.

8th. Pulse 136 ; is partly conscious when aroused, but immediately relapses into sleep ; head considerably retracted ; bowels constipated ; vomits occasionally ; temperature 102°. Treatment, a leech to each temple, on account of the extreme stupor ; other treatment to be continued.

9th. The leech-bites bled, though slowly, nearly five hours ; pulse 180, and so feeble as to be counted with difficulty ; temperature 101½°. The patient is evidently sinking. Treatment, a teaspoonful of Bourbon whiskey in milk every two hours, beef-tea and other nutritious drinks frequently, also the bromide at intervals. Evening, pulse 172, still feeble.

10th. Pulse 180, barely perceptible ; great hyperæsthesia ; temperature of axilla 100°, of fingers and hand below 90° ; axes of eyes directed downward.

11th. Pulse still very feeble, varying from 160 to 228 ; temperature 102¼°. There has been no intermission in the use of the stimulants or nutriment night or day ; pupils moderately dilated and somewhat more sensitive to light.

After this the patient gradually rallied for a time, so that the pulse became stronger and less frequent, but death finally occurred after nine weeks in a state of emaciation and extreme exhaustion. Slight convulsions occurred in the last hours.

It is seen that, after the loss of blood from two leech-bites, this patient passed into a state of extreme exhaustion, so that for three days I did not believe that she would live from one hour to another, and death finally occurred. Although the loss of blood may have been useful in relieving the stupor, yet a worse danger resulted. Experience like this, which I believe corresponds with that of other observers, shows how seldom and with what caution the blood of the patient should be abstracted.

The employment of the bromides is indicated, in ordinary cases, in order to diminish the intense cerebral hyperæmia, allay the excitement of the nervous system, and prevent convulsions. They should be given in decided doses as soon as the symptoms indicate the nature of the disease. In the New York epidemic, we commonly prescribed the bromide of potassium in five or six grain doses, every second hour to a child of five years, but more frequently if convulsions occurred or were imminent. It can be given in frequent and large doses for a few days without ill effect ; but its long-continued use, unless there are clear indications for it, is to be deprecated, since it produces now and then, when employed for many days, symptoms (bromism) which can with difficulty be discriminated from those of cerebro-spinal meningitis, such as muscular

weakness, dilated pupils with perhaps impaired vision, unsteady gait, nausea or vomiting, with abdominal pain. Frequent and large doses should as a rule be prescribed only in the first week, after which this remedy should be discontinued entirely, or given sparingly, but its use may be resumed from time to time, during periods of recrudescence, which are very apt to occur.

The intense headache and consequent restlessness which characterize many cases require, in addition to the bromide, either the hydrate of chloral or an opiate. An opiate is, I think, in most instances preferable, and a moderate dose suffices. A patient of six years, in my practice, was quieted by one thirty-second of a grain of sulphate of morphia.

Another remedy scarcely less useful than the bromide is ergot, from its known effect in contracting arterioles, and diminishing the arterial supply to the cerebro-spinal axis. It can be administered in the tincture, fluid extract, or wine. The alkaloid, ergotin, is sometimes employed in pill or solution, or given hypodermically in water, with a little glycerine. I prescribed a one-grain pill of ergotin to be taken every six hours to a child of three years. The efficacy is most marked during the first or second week, when the congestion of the nervous centres is greatest. At a more advanced stage, when there is less congestion, and the danger arises more from the inflammatory products and structural changes, as softening, the time for the use of ergot is past, or if still of some service, it is less urgently required than at first.

The similarity of the lesions to those in sporadic meningitis, in the treatment of which iodide of potassium is in common use, suggests the employment of this agent; it probably aids in the removal of the liquid portion of the exudation. I have prescribed it in combination with the bromide, and alone when the bromide was suspended.

Quinia does not seem to exert any marked controlling effect either on the course of the disease, or the pains, although the severe pains are apt to be paroxysmal, so as to indicate the need of this agent as an anti-periodic. I have employed it in large and small doses, in one instance giving fifteen grains daily to a child of thirteen years, but do not know that I have derived any benefit from it, except as a te[illegible]

Sustaining measures are indicated from the first. The diet must be nutritious during the entire course of the malady, consisting of the animal broths, milk, etc. After the violent initial symptoms have abated, alcoholic stimulants are needed, and they should be prescribed in all cases, however early, in which the pulse is feeble, and there are evidences of marked prostration. When the danger from the intense cerebro-spinal hyperæmia has been averted, tonics, especially the ferruginous, may also be employed to aid in arresting the profound blood changes. Laxative enemata should be prescribed to relieve constipation, and rectal alimentation should be resorted to in those cases in which frequent vomit-

ing prevents proper nutrition in the natural way. Dry cupping should be employed along the spine, two or three times daily, or if for any reason the use of the cups be not satisfactory, a stimulating embrocation, as that of equal parts of turpentine and camphorated oil, should be prescribed. Visitors should be excluded, and the room should be dark and quiet, for anything that annoys or excites the patient, whether loud noises or talking, or a bright light, or the use of indigestible food, has, in my opinion, a tendency to aggravate the malady.

CHAPTER V.

ACUTE RHEUMATISM.

Rheumatism is a constitutional disease with a local manifestation, to wit, inflammation of the sero-fibrous tissues, chiefly in and around the articulations, but occasionally in the heart. It was formerly supposed to be rare in children, but more accurate observations show that it is scarcely less common during childhood than in adult life. In young patients, especially under the age of six or eight years, it is very apt to be overlooked, for the articular inflammations in such patients are commonly slight. In the last ten years, during my connection with the children's class in the Bureau for the Relief of the Out-Door Poor, I have examined many children with rheumatism or the cardiac lesions resulting from rheumatism, and ordinarily I found that few joints were affected, and that there had been but little swelling of them, or redness, and that the patients were almost never confined to bed, or even to the sitting posture, but had been able to walk about, though with restraint and complaint of pain or soreness. The parents in many instances supposed that their children were suffering from "growing pains" as they designated them. At the same time, with this mildness of symptoms, the heart was becoming seriously and permanently crippled, by endocarditis. Those who have attended my clinics will recollect that on some days as many as three or four children with cardiac lesions have been present whose histories showed an overlooked rheumatism of this mild type. Cases like the following are very common among the city poor :

In January, 1871, a little girl, three years old, was presented, having distinct aortic direct, and mitral regurgitant murmurs. The mother was not aware that she had had rheumatism, but at the age of twenty months she had for several days pretty active febrile symptoms, which the physician attributed to some other ailment. In April, 1871, another girl, of the same age, was brought to the clinic, having a distinct mitral regurgitant murmur. The mother stated that she had been well till a month pre-

viously, when she was confined to her bed for a few days, having a high fever. She was attended by a homœopathic physician, and the exact character of her sickness the mother was not able to state. Further medical advice was sought, as the child remained delicate, though her health was better than at first. There can be little doubt that the obscure fever in this case had been rheumatic. In another child treated elsewhere, not old enough to relate the subjective symptoms, there was, in addition to an intense fever, evident pain in one foot or leg, when the limb was moved. Still, the nature of the disease was not diagnosticated till some time after recovery, when a valvular murmur was accidentally discovered. Such histories, which I do not think are rare, show that rheumatism may occur not very rarely in young children, even infants, for which purpose they are here introduced, but they inculcate the important practical lesson, that the disease at this age may be so obscure, or latent, as to be overlooked even by good diagnosticians.

Some observers, meeting cases of valvular disease in children, without the history of rheumatism, have concluded that rheumatism is not the chief cause of endocarditis at this age (Dr. A. Steffen, *Jahrbuch für Kinderk.*, 1870) ; but the explanation which I have given seems to me more in consonance with the facts. Scarlet fever not infrequently causes endocarditis, but this exanthem is not apt to occur without detection, and it has been as often absent as has rheumatism from the histories as given by the parents of young children with valvular disease, whom I have examined. Moreover, the endocarditis of scarlet fever is in many cases associated with, if it do not result from, scarlatinous rheumatism.

Rheumatism in children is primary or secondary. The secondary form occurs chiefly in the declining stage of scarlet fever and variola. It is stated, also, to occur occasionally in new-born infants during epidemics of puerperal fever, but I have not observed such cases.

Causes.—An inherited rheumatic diathesis is universally recognized as an important predisposing cause of this disease, so that it is apt to occur in different members of the same family. When the family history shows a strong predisposition to rheumatism, it occurs in the child from a slight exciting cause ; if no such predisposition exist, it only occurs through unusual circumstances of exposure. The ordinary exciting cause is the same as in most idiopathic inflammations, namely, exposure to cold ; but a strong rheumatic diathesis appears to be sufficient in itself to produce an outbreak of the disease. Children who have had one attack are especially liable to another.

The morbific principle in the blood, which produces the phenomena and lesions of rheumatism, is supposed to be lactic acid, a theory which originated with Prout, and is strengthened rather than weakened by observations since his day. According to this theory, lactic acid sustains the same causative relation to acute rheumatism as uric acid to gout, and, as

Prof. Austin Flint states, it receives support from the fact that the lactic-acid treatment of diabetes is apt to produce rheumatic inflammation of the joints.

Symptoms.—The commencement of acute idiopathic rheumatism is in most cases sudden ; occasionally fever, and a degree of soreness or stiffness, precede the articular affection for a few hours or days. The inflammation, slight at first, increases gradually, attaining its maximum intensity within one or two days. The joint is painful, red, hot, and swollen. The swelling is due to inflammatory œdema of the tissues surrounding the joint and effusion within the joint. As in all inflammations, the vascularity of the parts involved is increased, the synovial membrane loses, more or less, its lustre, and the effused fluid, which is mainly serum, has been found, in most of the cases in which an opportunity was presented to examine it, to contain, like the pleuritic exudation, a few globules of pus. Rarely, in a reduced state of the system, so much pus is produced within the joint as to constitute a true abscess, and rarely also fibrin is exuded, producing a rubbing sensation when the joint is moved, and endangering permanent adhesion of the articular surfaces. Fortunately, however, in the vast majority of cases, the substance exuded both without and within the joint is mainly serum, and hence the rapid subsidence of the swelling when the inflammation ceases. The pain is commonly not severe when the child is quiet, but it is greatly increased if the joint be pressed or the limb moved.

The joints of the extremities are most frequently the seat of rheumatic inflammation, but occasionally those of the trunk, as the intervertebral, the symphysis pubis, etc., are involved. As the inflammation abates in the articulations first affected, it reappears in others, unless the materies morbi have been eliminated from the system. It is seldom that more than two or three of the joints are in a state of active inflammation at the same time.

The temperature in acute rheumatism is elevated two or three degrees above that of health, and the pulse varies from 120 to 140, its frequency depending on the age of the patient, as well as the gravity of the disease. Perspiration is a common symptom. The appetite is impaired, the tongue slightly coated, and the bowels constipated. The watery element in the urine is diminished, as in most febrile diseases. There is no corresponding reduction in the solid elements, so that the urine is rendered more dense, and its specific gravity is high. The amount of urea and coloring matter excreted from the kidneys is augmented during the active period of rheumatism, and the urine, when it cools, deposits urates. In ordinary cases there is no prominent symptom referable to the nervous system, with the exception of pain in the affected joint.

Acute rheumatism, if only the articulations were involved, would be a disease of little danger, however painful, but unfortunately, in its prone-

ness to produce specific inflammation of the sero-fibrous tissues, the heart frequently becomes involved, less frequently the lungs and pleura, and in rare instances the cerebral or spinal meninges. Endocarditis is the most frequent of the heart inflammations occurring in rheumatism; pericarditis, though less common, is not infrequent, while in rare instances myocarditis occurs, usually associated with the other inflammations. Endocarditis is limited to the left side of the heart, and seldom continues long without engaging the valves, aortic or mitral, or both, causing their infiltration, fibroid degeneration, with consequent thickening, and sometimes adhesion. The valvular lesion thus produced is in most instances permanent, so impairing the action of the valves as to obstruct in greater or less degree the flow of blood through the orifice and allow its regurgitation.

The mitral valve is more frequently affected than the aortic, at least *bruits* produced by this lesion are more frequent in the mitral than aortic orifice, and when they are heard in both orifices they are commonly loudest in the mitral. This fact, noticed by different observers, I have repeatedly verified by observations in this city.

While the articular affection pertains to the clinical history of rheumatism, the internal inflammation, whether of the heart, lungs, pleura, or meninges, though similar as regards its pathological character, is properly considered as a complication. Acute rheumatism is so frequently complicated by one or the other of these affections, that any disproportionate severity in the general symptoms, as compared with the inflammation of the joints, or any sudden and unexpected increase in the symptoms, should always lead the physician to examine thoroughly the condition of those organs which are most frequently affected.

Inflammatory complications occur, as a rule, during the active period of rheumatism, when the inflammation is passing from joint to joint. If the general symptoms begin to improve, and no new joints are involved, the liability to complications is greatly diminished. Secondary rheumatism, occurring in most instances in connection with certain eruptive fevers, especially scarlatina, commonly affects only a few joints, often only one or two, as the wrist, and, though painful, is attended by slight swelling and redness.

Duration—Prognosis.—With proper treatment and without complication the febrile action in a few days begins to abate, and the disease commonly terminates within two weeks. Its duration is ordinarily shorter than in rheumatism of the adult. Fluctuations, however, are liable to occur. The disease may appear to be abating, and the articular inflammations nearly cease, when they return for a time, often without new exposure and without appreciable cause. The prognosis, even when cardiac inflammation has supervened, is in most cases favorable, except so far as the lesion resulting from this inflammation is concerned, which being permanent may entail much subsequent suffering, and occasion death after

months or years. Indeed, what is most to be dreaded in cases of acute rheumatism is valvular disease or pericardial adhesion with its remoter consequences, namely, hypertrophy of heart, congestion and œdema of the lungs, dropsies, etc.

Secondary rheumatism occurring in scarlet fever is sometimes also complicated with, or rather coexists with, cardiac inflammation, pleuritis, or pneumonitis, rendering the prognosis more unfavorable.

In rare instances the acute symptoms of rheumatism abate, but the joints remain stiff and more or less swollen, and painful when moved. The acute has lapsed into a subacute or chronic rheumatism. Such a case, represented in the accompanying figure, was brought to the children's class in the Out-Door Department at Bellevue Hospital, in February, 1871. E. H., female, 3½ years old, had intermittent fever from the age of nine to fifteen months. From this time she remained well till the age of two years, when she was taken with acute rheumatism, commencing in her ankles and extending to other joints. The knee and hip joints on both sides have only partially recovered their mobility, and both legs and both thighs are permanently flexed, so that the gait is slow and unsteady. It is impossible to straighten either limb without causing great pain, and attempts to straighten the thigh produce the arch in the back very similar to that in coxalgia.

FIG. 16.



DIAGNOSIS.—This is not difficult in ordinary cases, if a proper examination be made. In the commencement, if the affection of the joints be slight, rheumatism might be mistaken for remittent, typhoid, one of the eruptive fevers, or meningitis ; but, on careful examination, tenderness will be observed of one or more of the articulations, and probably some swelling. This tenderness is readily distinguished from the hyperæsthesia which is common in the first stage of the essential fevers, and which is observed when pressure is made upon the chest or abdomen as well as upon the limbs, and is more marked between the joints than in them. Any doubt which may at first exist, whether the patient may not have one of those diseases, is soon dispelled, since their clinical history presents notable differences from that of rheumatism.

I have known scrofulous arthritis, or scrofulous ostitis near the joint, present so close a resemblance to acute rheumatism as to be at first mistaken for it. In one instance this inflammation commenced nearly simultaneously in three joints, rendering the diagnosis at first very difficult. But scrofulous inflammation, as well as that from pyæmia, can be diagnosticated from rheumatic disease of the joints, by its greater persistence, less

induration and symmetry in the swelling, and by the history of the case. Chronic rheumatism may produce deformity similar to that from chronic scrofulous inflammation, as in the case mentioned above, but the rheumatic history, number of joints affected, bilateral character of the inflammation, good general health, etc., are sufficient to establish a clear diagnosis, when the disease has been observed for some days.

Treatment.—The theory of the pathology of a disease determines the mode of treatment, and the theory that rheumatism is due to an acid in the blood, probably lactic, though not established, has been widely received, and has led to the extensive employment of alkalies, as tartrate of sodium and potassium, acetate of potassium, etc. The alkaline treatment apparently materially abridges the duration of acute rheumatism ; but lately a new remedy, namely, salicylic acid, has been found to act almost as a specific in a large proportion of cases, quickly relieving the pain, and subduing the inflammation, so that a few days suffice to effect a cure. Speedy cure of this malady is urgently demanded, on account of the imminent peril of the heart. Children seem very liable to the cardiac complication. Although salicylic acid frequently causes the disappearance of all symptoms within a week, they are apt to reappear unless the medicine be continued in occasional doses for some days subsequently, as I have had opportunity to observe. It should be prescribed with an alkali, as in the following formula, which is similar to one employed in the Out-Door Department at Bellevue :

℞. Acid. salicylic., ʒ ij–iij ;
Potas. acetat., ℥ ss ;
Glycerinæ, ℥j ;
Aquæ, q. s. ad ℥ v. Misce.

Give one teaspoonful every three hours to a child of six years.

A new remedy, producing useful therapeutic effects, is apt to be prescribed at first for too many distinct pathological states, till finally its use is restricted to such conditions as it is found to relieve. Salicylic acid has undergone this trial, and, while it has been rejected as a remedy for the infectious diseases, it is recognized as the most useful of all remedies for the disease which we are now considering. An occasional opiate, as Dover's powder, may also be needed between the doses of the acid.

An eligible mode of prescribing salicylic acid is in the salicylate of sodium, which is very soluble and not so unpleasant to the taste as salicylic acid in combination with most other bases. It is used more than any other preparation of salicylic acid in New York, and much more than any other remedy for the treatment of acute rheumatism, and ordinarily with a good result. It may be administered in a formula like the following :

℞. Sodii salicylat., ʒ ij ;
Syr. bal. tolut., ℥ ij ;
Aquæ, ℥ vj.

Dose, a dessertspoonful every two or three hours to a child of five years.

During the declining period of rheumatism and in convalescence quinine or some preparation of cinchona should be employed and the above medicine given less often. This tonic does indeed appear to exert a beneficial effect on the course of rheumatism, and it is employed by some judicious and experienced physicians from the commencement.

If there be a high temperature and a quick pulse, quinine administered in an occasional large dose will be found very useful. Three to five grains may be given to a child of five years.

Rheumatism impoverishes the blood, and the patient often begins to present an anæmic appearance, when he requires iron in addition to the vegetable tonic. The citrate of iron and quinine may then be employed.

Secondary rheumatism requires sustaining treatment from the first. Such cases ordinarily do well without anti-rheumatic treatment, with the general supporting measures employed for the primary disease.

Pneumonitis complicating rheumatism is best treated by moderate counter-irritation and emollient poultices, and the internal use of carbonate of ammonium; or, if there be anæmia, carbonate of ammonium with citrate of iron and ammonium. The other internal inflammations which are liable to arise as complications require iodide of potassium in decided doses. In pericarditis or endocarditis, if, as is commonly the case, the movements of the heart be accelerated, quinia in large doses, or the tincture or infusion of digitalis, is urgently demanded to the extent of reducing the number of pulsations to near the normal frequency. A child of six years can take three or four drops of the tincture or a large teaspoonful of the infusion, to be repeated, if necessary, in three hours, till the required reduction of the pulse is effected. Patients often experience relief, by the use of this agent, from the palpitation and dyspnœa consequent upon the embarrassed movements of the heart. If the heart disease be severe and pulse feeble, quinine is also useful.

The patient should be kept quiet, in a room of uniform temperature, and not exposed to draughts of air. By such precaution the danger of complications is greatly diminished. Repellent applications, as cold or irritants, should not be applied to the joints, as long as the disease is acute, for they also increase the danger of complications. The affected joints should be enveloped in flannel or cotton, and the pain, if intense, may be diminished by applying flannel wrung out of warm water. If the disease become subacute or chronic, if the urates have disappeared from the urine, and the inflammation cease to pass from joint to joint, the tincture of iodine, or moderately stimulating embrocations, applied to the joints, involve no danger and are useful.

CHAPTER VI.

ERYSIPELAS.

The term erysipelas is applied to a constitutional or blood disease, which is characterized by inflammation of the skin and subcutaneous connective tissue, and by a tendency to spread. It is accompanied by pungent and pricking heat, swelling, and subcutaneous infiltration.

In rare instances, in young infants, an inflammation which has been designated erysipelas occurs in and around the umbilicus. It commences about the time of the detachment of the umbilical cord, and is accompanied by redness of the skin, tumefaction, and hardness of the connective tissue surrounding the umbilicus. It usually causes ulceration of the umbilical fossa, and, in fatal cases, pus is sometimes found in the umbilical vessels. This disease does not show any tendency to spread ; the diameter of the inflamed surface is not more than three or four inches, with the umbilicus at the centre. It is generally fatal ; but two favorable cases have been reported to me, in one of which there was considerable ulceration, and after recovery a firm cicatrix occupied the site of the umbilicus. The most reasonable view is that this disease is primarily an inflammation of the umbilical fossa and vessels, induced by uncleanliness, cachexia, or other cause. It lacks the distinguishing feature of erysipelatous inflammations, namely, the tendency to spread, and I shall, therefore, take no further notice of it in this connection. (See Diseases of the Umbilicus.)

Erysipelas seldom occurs in childhood ; the few cases which are met in this period present nearly the same features, and pursue nearly the same course, as in the adult. In infancy, on the other hand, erysipelas is a common disease. The following remarks relate to erysipelas occurring in this period of life. They are based on data derived mainly from the records of cases which occurred in this city, some in my own practice, and others in the practice of physicians known to be good observers. The points of chief interest in forty-one cases are embraced in the following table :

Cases of Infantile Erysipelas.

No.	Sex.	Age.	Point of commencement	Parts affected.	Duration.	Result.
1	M.	5 months.	Right knee.	Entire surface, except face and scalp.	5 weeks and 3 days.	Recovered.
2	M.	2 years.	Left knee.	From a little above the knee to the ankle.	7 days.	Recovered.
3	M.	10 months.	Elbow.	Whole arm and forearm.	... .	Recovered.

Cases of Infantile Erysipelas (Continued).

No.	Sex.	Age.	Point of commencement	Parts affected.	Duration.	Result.
4	F.	20 months.	Below right knee.	Entire leg, thigh, and trunk to the umbilicus.	7 days.	Recovered.
5	F.	9 months.	Vulva.	Abdomen, chest, and all the extremities.	18 days.	Recovered.
6	M.	9 days.	Genitals.	Both lower extremities, abdomen to the umbilicus.	6 days.	Died.
7	F.	1 year.	Vulva.	Entire surface, except face.	6 weeks.	Recovered.
8	F.	6 weeks.	At or near the ear.	Forehead and side of face.	1 week.	Died in tetanic spasms.
9	..	9 months.	Epigastric region.	Trunk and lower extremities.	2 weeks.	Died in tetanic spasms.
10	F.	10 months.	At angle of mouth.	Entire face and scalp.	10 days.	Recovered.
11	F.	4 weeks.	Vulva.	Entire surface, except face.	3 weeks.	Died.
12	F.	3 months.	Vulva.	Surface of abdomen to umbilicus and right lower extremity.	2 weeks.	Recovered.
13	F.	4 to 5 mos.	Vulva.	All the limbs and trunk, except the chest.	3 to 4 weeks.	Died.
14	F.	5 months.	From syphilitic sores around anus.	Trunk and both lower extremities.	.....	.....
15	F.	3 months.	Vulva.	Entire trunk and both upper extremities.	3 weeks.	Recovered.
16	M.	8 months.	Face near nostrils.	Entire trunk and both upper extremities.	About 2 weeks.	Recovered.
17	F.	4 months.	Vulva.	Entire trunk and all the extremities.	1 week.	Died.
18	F.	7 months.	Knee.	A portion of trunk and both lower extremities.	3 weeks.	Recovered.
19	F.	6 months.	Near the ear.	Entire face and forehead.	10 days.	Recovered.
20	M.	7 days.	Left eyelid.	Left side of face.	3 days.	Died.
21	M.	14 days.	Genitals.	Extended to knees, over abdomen to the chest.	4 days.	Died.
22	M.	3 months.	Under the chin.	Chin, left cheek, neck, left side of trunk, left thigh and leg.	....	.....
23	F.	28 months.	Right shoulder.	Arm and forearm.	1 day.	Died in convulsions.
24	F.	3 or 4 days.	Vulva.	Body and all the limbs.	12 days.	Died.
25	F.	3½ mos.	Under left ear.	Neck, chest, and arms.	About 2 weeks.	Died.
26	..	7 months.	Below right knee.	Trunk, neck, and head, and all the limbs.	2 weeks.	Died comatose.
27	F.	6 months.	Vulva.	Both thighs, and nearly entire trunk.	3 days.	Died comatose.
28	M.	19 months.	Near point of vaccination.	Shoulder, arm, and forearm.	21 days.	Recovered.
29	M.	4 months.	Near point of vaccination.	Chest, and both upper limbs.	2 weeks.	Recovered.
30	F.	2 months.	Near vaccine vesicle.	Trunk and all the limbs.	10 days.	Died.
31	..	3 to 4 mos.	Near vaccine vesicle.	Arm, forearm, and shoulder on one side.	2 to 3 weeks.	Died.
32	F.	4 months.	Near vaccine vesicle.	Arm, forearm, and trunk.	2 months.	Died.
33	M.	2 months.	Near vaccine vesicle.	Nearly entire surface.	1 week.	Died with peritonitis.
34	M.	5⅓ mos.	Near point of vaccination.	Arm and forearm.	.....	Recovered.
35	M.	2½ mos.	Near point of vaccination.	Arm.	7 days.	Died, probably of peritonitis.
36	M.	8 months.	Near vaccine vesicle.	Arm and forearm.	17 days.	Died.
37	.	5 months.	Left foot.	Leg, thigh, and lower part of trunk.	2 weeks.	Died with pneumonitis.
38	.	5 weeks.	At one ear.	Entire surface.	2 weeks.	Recovered.
39	.	2 months.	Left leg.	Trunk, and all the limbs.	2 weeks.	Recovered.
40	.	4 months.	Near point of vaccination.	Trunk, and all the limbs.	2 weeks.	Died.
41	M.	14 months.	Face.	Trunk, and all the limbs.	4 weeks.	Recovered.

Age.—Of the above cases, 27 were under the age of six months ; 9 from six months to twelve, and only 5 above the latter age. A large majority, therefore, of cases of infantile erysipelas occur in the first year of life.

Point of Commencement.—In 58 cases in which I have ascertained the point of commencement, it was in 13 cases the vulva, 17 the arm after vaccination, 7 the leg, 6 the face, 3 the male genital organs, 3 at or near the ear, 1 the elbow, 1 the shoulder, 1 the nates, 1 the foot. In the adult, idiopathic erysipelas commonly commences upon the face, and affects only the face, ears, forehead, and scalp. On the other hand, in infantile erysipelas, statistics show that the rash commences upon the face only in a small proportion of cases, one in nine, and that it rarely extends to the face when it commences in other parts.

Causes.—In erysipelas the first departure from the healthy state occurs in the blood, or the system generally. This undergoes certain changes which predispose to erysipelas, or are sufficient in themselves to give rise to it. Among the causes, which produce this state of system, uncleanliness, residence in damp, dark, and crowded apartments, and defective alimentation, hold a principal place. Hence this disease is more common in the poor quarters of the city than in the country, and in dispensary and hospital than in family practice.

In a large proportion of cases there is a local exciting cause of the erysipelatous eruption, namely, an irritation or inflammation at some point, generally trivial, but which is sufficient to develop the disease in the system already prepared for it. It is very apt to commence at or near a simple ecthymatous or impetiginous eruption, around burns or suppurating sores or syphilitic eruptions ; it frequently commences, as is seen by the above table, near the point of vaccination immediately after vaccination, or when the pock is developed, or again when it has run its course and been detached. In a considerable proportion of cases it commences at a point where the skin is thin and delicate, or where it unites with a mucous surface, probably from some uncleanliness or irritation of those parts. Thus, I have records of cases in which it commenced at the external ear, commissure of the mouth, and at the vulva. Indeed, the frequency with which it commences at the vulva renders female infants more liable to it than males. In some instances erysipelas begins without any local exciting causes, upon smooth and sound skin, even when there are sores upon various parts of the surface.

Vaccination, as an exciting cause of erysipelas, demands particular notice. Often, doubtless, it is the inflammation which necessarily arises from the cut or the vesicle, which operates as an exciting cause of the erysipelatous affection, and not any deleterious property contained in the virus which is employed, so that an equal degree of inflammation occurring in any other way, as from a burn, would be attended by a like result. But facts show that the virus itself occasionally contains a latent noxious prin-

ciple, which, introduced into the system, operates as a cause of erysipelas. Thus, a little girl was vaccinated by me in November, 1860, and about the time when the vesicle began to fill she was seized with severe inflammation of the fauces, attended by tumefaction and infiltration of the submucous connective tissue. The inflammation rapidly subsided, and within a week from its commencement the throat affection had nearly or quite disappeared. I now believe that the disease of the fauces was erysipelatous, although it was not suspected at the time to have this character.

As the girl was otherwise healthy, and the vaccine vesicle passed through its usual stages, and presented the usual appearance, the scab was employed six weeks afterward to vaccinate two infants. Within twenty-four hours after vaccination both these infants were seized with high fever, ushering in severe erysipelas, commencing in one around the point of vaccination, and in the other around syphilitic sores near the anus. In the former case the erysipelatous rash extended from the shoulder over the entire limb, and was obstinate, twice reappearing, and extending over the same surface ; in the latter (a mulatto child) it extended over both lower extremities and a considerable part of the trunk, when the case passed into the hands of another physician, and the result is not known. The instrument with which the vaccinations were performed was clean. The vaccine disease did not appear in either of these cases.

Again, a well-known physician of this city vaccinated three infants, one his own (No. 32 of the table), with part of a scab which had been pronounced good, but was taken from a child that he had not seen, and with whose state he was not familiar. These infants were all affected with erysipelas from the vaccination, his own dying. He had taken the precaution to rub the lancet on his boot before using it. Another physician of this city has informed me that he vaccinated two children in the same family with a scab, with all the precautions that he ever had used, and both were soon after affected with erysipelas of a severe form, extending from the point of vaccination ; the vaccine disease did not appear. I have heard of no case in which the vaccine lymph gave rise to erysipelas, and probably it rarely or never does. In the lymph there is no admixture of foreign substances, whereas in the scab there is a large proportion of animal matter.

There is a form of erysipelas which occurs in the infant immediately after birth, and which is sometimes met in private practice, but is most frequently observed as an epidemic in lying-in-wards. It is associated with severe, and commonly fatal, puerperal or septic fever, or erysipelas of the mother. This form of erysipelas is fatal, almost without exception, and its contagiousness is generally admitted by those who have had an opportunity to observe cases.

A case showing the relation of erysipelas in the newly-born infant to disease of the mother occurred in the practice of Dr. Leaming, of this

city. A woman gave birth to a healthy infant, on the 27th of July, 1860. A few days subsequently she was seized with a chill, followed by erysipelas, commencing on the thighs, and terminating fatally August 17th. As no autopsy was allowed, the state of the internal organs was not ascertained. A few days before her death the same disease commenced on the infant. It extended around the neck, upon the ears, down the arms, and terminated fatally August 24th. But erysipelas in the new-born infant, occurring in connection with erysipelas in the mother, is more rare than its occurrence with puerperal fever. The records of lying-in asylums furnish many examples of epidemics of puerperal fever, in which the infants of affected mothers perish of erysipelas.

The late Dr. Folsom, of this city, furnished me the following sketch of cases which occurred in his practice and that of his partner : " About the year 1840, being then in practice in New Bedford, Mass., I was called to visit a man who complained of pain in the knee. The next morning he was easier, but the following evening his symptoms grew worse, and as I was engaged in a case of obstetrics, my partner, Dr. E. C., now dead, visited him. At my call, next morning, I unexpectedly found the patient dying. The disease was obscure, and at the autopsy next day no lesion was discovered. In making the examination, Dr. C. pricked his finger, and experiencing little inconvenience from it at first, he attended a case of confinement on the following morning. A few hours subsequently he was taken sick, and I took charge of the lady, who died in three days, having the tumid abdomen and symptoms of childbed fever. The infant of the patient was seized, when two days old, with erysipelas, appearing on the face and in spots on the trunk and limbs, and terminating fatally in one day. Dr. C.'s finger became swollen and painful, and the lymphatics of the forearm and arm became inflamed, presenting red lines, and the axillary glands suppurated. Though feverish and much prostrated, there was no appearance of erysipelas in his case. In about two weeks he resumed practice, and as at that time physicians in this country were not fully aware of the danger of communicating puerperal fever, he attended two, three, or four obstetrical cases each week, until the number reached fifteen. All the mothers died with symptoms of metro-peritonitis, and all the infants had erysipelas, commencing on the face or some part of the body, generally on the second or third day after birth, and in all terminating fatally within a week. This sad record was finally ended by the doctor's temporarily retiring from practice."

Dr. Condie, in his *Treatise on Diseases of Children*, says : " Erysipelas of infants very commonly occurs during the prevalence of epidemic puerperal fever. Children of mothers who become affected with the fever are often born with erysipelatous inflammation ; others are attacked almost immediately after birth. Whether, in these cases, the disease is to be referred to a morbid matter applied to the skin in the womb, or to the same

epidemic or endemic influence which gives rise to the disease of the parent, it is difficult to say. According to M. Trousseau, infantile erysipelas is principally observed when puerperal fever prevails in the wards of the lying-in hospitals at Paris." In private practice it is rare that we meet erysipelas of the infant associated with erysipelas or with puerperal fever in the mother. Some of the oldest physicians of this city, with whom I have conversed, and who are engaged in extensive general practice, state that they have never met a case in which there was this relation. Cases like those observed by Drs. Folsom and Leaming only occur when epidemic erysipelas or puerperal fever is prevailing.

Premonitory Symptoms.—Infantile erysipelas in certain cases has no premonitory stage, or, if present, it escapes notice. In other instances there are well-marked precursory symptoms, as drowsiness, or restlessness, febrile movement, oppressed respiration, with perhaps vomiting, and starting or twitching of the limbs. In Cases 28 and 37 of the table, which occurred in my practice, the febrile movement, restlessness, and oppressed respiration were so great for three days before the appearance of the eruption, as to cause much anxiety. In the adult, pharyngitis often precedes the occurrence of the rash upon the skin. The same inflammation may be present in the premonitory period of infantile erysipelas, as well as during the period of erysipelatous eruption. The hurried and difficult respiration, which is present in the commencement of some cases, is probably due to an erysipelatous turgescence of the bronchial mucous membrane.

Symptoms.—The patient with this disease is usually restless, in consequence of the burning pain which accompanies the eruption. In severe cases there is little sleep, night or day, except from medicine. The sleep is short, and is often interrupted by sudden starting, or twitching of the limbs. Convulsions may occur, but are not common.

Febrile movement is constant, and is proportionate to the extent and gravity of the erysipelas. I have notes of cases in which the pulse was more than 200 per minute, although other symptoms did not indicate immediate danger. The skin not affected by erysipelas is dry and hot, though not possessing the pungent heat of the inflamed portion ; face often flushed ; tongue moist, and covered with a light fur ; stomach usually retentive. The state of the bowels varies ; sometimes they are regular, sometimes variable, while in other cases the stools are green, and more frequent than natural. I have records relating to the state of the bowels in twenty cases, as follows : in seven, regular ; in nine, loose ; in two, constipated ; in one, constipated, then loose ; and in one, constipated, then regular. Diarrhœa, when present, is usually mild, requiring little or no treatment. The erysipelatous redness is not in all cases so pronounced as in the adult, but otherwise there is nothing peculiar in its appearance. In feeble infants, with an impoverished state of the blood, its color is pink,

instead of the deep red which characterizes the inflammation in the robust. Points of vesication may occur where the inflammation is most severe, as in the adult, and subsequently the same desquamation and œdema.

If the infant be debilitated, there is great danger of the formation of abscesses, around which the inflammation lingers after it has disappeared from every other part of the body. Sometimes also, in very young infants gangrene occurs, especially in the genital organs in the male. Several of these cases have been related to me, all under the age of a month or six weeks, and all fatal. Occasionally the sloughing is so great as to denude the testicles. A noteworthy feature of erysipelas in infants is its proneness to return. When it has been progressively subsiding, and hope is entertained of its speedy disappearance, it not infrequently is suddenly relighted from some unknown cause, travelling again over the same, or parts of the same, surface. In one case the disease, arising from vaccination, extended three times over the arm and forearm ; and in another case, a second time over both legs and a considerable part of the trunk.

The internal inflammations, which most frequently complicate erysipelas, and give rise to symptoms which are superadded to those pertaining to the erysipelas, are pharyngitis and peritonitis ; and more rarely bronchopneumonia or enteritis. In a case which I examined after death, in the Nursery and Child's Hospital, and in which, the erysipelatous inflammation having extended over the abdomen, the lesions of peritonitis were present, it seemed probable, from the thinness of the abdominal walls, that the inflammation had extended through the parietes from the external to the internal surface.

Prognosis.—Erysipelas is much more fatal in infancy than in adult life. In the death statistics of this city for three years, I find eighty deaths from erysipelas of infants under the age of one year, to eighty-three deaths from this disease above that age. Age greatly influences the prognosis. Infants under the age of three weeks usually die ; from the age of three weeks to six months the result is doubtful ; while above the age of six months a majority recover with correct treatment. It will be seen by the foregoing table that seven infants under the age of six weeks had erysipelas, and six died ; from the age of six weeks to six months, six recovered and nine died ; and above the age of six months, nine recovered and four died.

With the exception of a case of the so-called umbilical erysipelas, the youngest child who recovered, of whom I have obtained information, was three weeks old. In this case the rash extended nearly over the entire surface, beginning with the face. Case 38 of the table, treated by myself, was very similar as regards the extent of the erysipelatous eruption and the result. This infant was five weeks old.

It is scarcely necessary to state that erysipelas is more favorable when it affects the limbs than when it invades the head, neck, or body ; when it

spreads slowly than rapidly ; when it is superficial than when phlegmonous. In those cases in which the connective tissue is much involved, the infant is not always safe after the disease has run its course ; he sometimes dies exhausted from the discharge of abscesses ; I have records of two such cases.

Duration.—In sixteen cases that recovered, the erysipelas terminated within the first week in two, the second week in six, the third week in five, fourth week in one, and in two cases it lasted five and six weeks. The average duration was fifteen days. In nineteen fatal cases, ten died within the first week, five the second week, three the third week, and one in the fourth week. The average duration of fatal cases was about ten days.

Modes of Death.—Death occurs in different ways ; in clonic or tonic convulsions followed by coma, from exhaustion, and from internal inflammation ; that from exhaustion being probably the most common.

Pathological Anatomy.—The blood doubtless in this disease undergoes certain pathological alterations previously to the occurrence of the eruption, but the exact changes are not known. Our knowledge of the morbid anatomy of erysipelas relates chiefly to the local affections, which, with the exception of the inflammation of the skin, are not constant, and may, therefore, be regarded as complications. The cutaneous inflammation affects all the structures of the skin, and in greater or less degree also the subcutaneous connective tissue. The inflammation is accompanied by more or less serous effusion or œdema.

The not infrequent occurrence of peritonitis in connection with erysipelas has long been known. In Heberden's *Epitome Morborum Puerilium*, the anatomical character of erysipelas is expressed in one sentence : " When the body has been opened after death, the intestines have been found glued together and covered with coagulable lymph." Since Heberden's time, nearly all who have written on diseases of infancy and childhood have mentioned peritonitis as one of the most common complications. Underwood says : " Upon examining several bodies after death, the contents of the body have frequently been found glued together and their surface covered with inflammatory exudation, exactly similar to that of women who have died of puerperal fever." Similar remarks in reference to the frequency of peritonitis in this disease are made by recent writers.

The statistics in reference to erysipelas as well as peritonitis show that in infants in hospital practice, and in those affected by erysipelas during epidemics of puerperal fever, peritonitis is a not infrequent complication. On the other hand, as we commonly meet cases of infantile erysipelas occurring sporadically in private practice, there are not sufficient abdominal distension and tenderness to indicate peritonitis. In only one of the cases embraced in the foregoing table was a post-mortem examination made, and in that there had been no peritonitis. The occurrence of pharyngitis in connection with erysipelas has been already mentioned.

Enteritis has been alluded to as another complication in infants. Diar-

rhœa has been stated to be a symptom in certain cases ; it has been found to be dependent on enteritis of a mild grade. Billard made post-mortem examinations of sixteen infants who died of erysipelas, and "found in two gastro-enteritis, in ten enteritis, in three pneumonia complicated with enteritis and cerebral congestion, and in one pleuro-pneumonia."

Treatment.—On this side of the Atlantic great uniformity prevails as regards the treatment of erysipelas. Sustaining measures are prescribed, and the tincture of the chloride of iron is the tonic generally preferred. Whatever the intensity of the febrile reaction and the stage of the disease, if there be no intestinal complication, ferruginous or other tonics should be administered. The largest doses of the tincture of the chloride of iron given in any of the cases in the above table were in case No. 4, namely, ten drops every two hours, and this patient recovered in seven days from a pretty severe attack. Probably, however, nothing is gained by such large doses, and they may irritate the intestinal surface, and increase the liability to enteritis, which, we have seen, complicates a certain proportion of cases. Four drops may be given every three hours to a child from one to two years of age. Instead of the iron, or in addition to it, one of the preparations of cinchona may be prescribed. Beef-tea, and wine-whey or other alcoholic stimulant, are required.

The depressing measures recommended by certain writers cannot be too strongly censured. One author says : "We should endeavor from the first to allay the inflammation of the skin by energetic treatment. . . . Local abstraction of blood, by means of one or two leeches applied at the circumference of the primary seat of the erysipelas, should be put in force, provided the power of the constitution of the children permits." Such treatment may explain one of this author's aphorisms, namely, *the erysipelas of infants is a fatal disease.*

Local treatment may be employed to arrest the extension of the inflammation, but the result in most cases is not encouraging. Solid nitrate of silver was employed in two cases, of which I have records, and in both the result was pernicious. Troublesome sores were produced, from which blood escaped, and in one of the cases, at least, death was attributed by the parents to this treatment, rather than to the disease.

Tincture of iodine is a better remedy for arresting the extension of erysipelas. It should be applied from the margin of the inflammation, over the sound skin, to the distance of about two inches. It may be ineffectual, but it does not produce any unfavorable result. Soothing applications, like rye flour, or a lotion of sugar of lead, may be made to the inflamed surface, as in erysipelas of the adult. I prefer, however, for local treatment, the constant application of vaseline or glycerine and water, to which a few drops of carbolic acid are added.

PART III.

SECTION I.

DISEASES OF THE CEREBRO-SPINAL SYSTEM.

Diseases of the brain and spinal cord are less frequent than those of the respiratory and digestive systems. They are also less amenable to treatment, and are much more fatal. They largely increase the aggregate of deaths. They contrast with the diseases of the other systems in their greater relative frequency in infancy and childhood than in adult life. This is explained, as regards the brain, by the rapid development and active molecular change in this organ in early life, its great impressibility by the emotions, and the thinness of the covering which protects it from external agencies.

Some of the most interesting of the cerebro-spinal diseases which are to engage our attention, are peculiar to early life, as tetanus infantum. The diseases of this system also contrast with other local affections in their greater obscurity, especially in their commencement ; for, while maladies of the thorax can be readily ascertained by auscultation and percussion, or those of the abdomen by the nature of the evacuations or the degree of tenderness or distension, our means of conducting examination through the bony encasement of the cerebro-spinal axis are meagre and unsatisfactory. The condition of the brain and spinal cord must be determined, chiefly, by the study of symptoms, and not by direct examination. The condition of the anterior fontanelle in young infants, however, enables us to determine the presence or absence of active congestion of the brain. If there be an excess of arterial blood, it is convex. Prominence of the fontanelle is common in inflammatory and febrile diseases, and is a sign of considerable diagnostic and prognostic value.

Within a few years, the ophthalmoscope has been employed as a means of diagnosis in cerebral diseases, and although the employment of this instrument for such purpose is but recent, enough has been elicited to prove its value as an aid in determining the state of the brain. Prof. H. D. Noyes remarks on this subject : . . . . " The argument for making ophthalmoscopic examination in all cases of brain disease, becomes irresistible. Indeed, a moment's reflection would lead to this conclusion without any considerations drawn from pathology. The optic nerve is only an

outlying portion of the brain ; its extremity is fully exposed to view. Situated within about two inches of the brain, it is the only nerve in the body which we can inspect ; it contains bloodvessels which communicate directly with the intracranial circulation. We thus come into relation with the cerebrum, by continuity of nerve-structure and also of bloodvessels."

Structural changes in the optic nerve and retina have been discovered by means of the ophthalmoscope in meningitis, hydrocephalus, phlebitis of the sinuses, apoplexy, etc. Among the lesions which have been observed by this instrument, are hyperæmia, more or less opacity and tumefaction of the optic nerve, engorgement of the vessels of the retina, with serous or sero-fibrinous exudation and ecchymotic points. In certain protracted diseases, as chronic hydrocephalus, in which dimness or loss of sight occurs, the ophthalmoscope discloses a state of atrophy of the optic nerve. Heretofore this instrument has been chiefly employed by oculists, but as it comes into more general use, there can be little doubt that it will be recognized as an important aid in the diagnosis of obscure cerebral diseases.

Still, with all possible aids to diagnosis, the obscurity which attends the invasion of many of the cerebro-spinal diseases must be acknowledged. To the hasty and careless physician, their symptoms are often deceptive. Careful weighing of the phenomena, and thorough and protracted examination, are requisite in order to insure correct diagnosis and proper treatment. Some of the cerebro-spinal affections are, in reality, sequelæ of other diseases, as, for example, spurious hydrocephalus ; and some are, strictly speaking, only symptoms, as convulsions ; but, on account of their importance, and because they require special treatment, it is proper to consider them as diseases *per se*.

The brain presents certain peculiarities in infancy and childhood. In the fœtus, while the other organs are well formed, the brain, especially its cerebral portion, is still diffluent, and at birth it has so little consistence that it must be handled carefully to prevent laceration. This softness is due to the large proportion of water which it contains. The following analyses show the composition of the brain in three periods of life :

	Infant.	Youth.	Adult.
Albumen,	7.00	10.20	9.40
Cerebral fats,	3.45	5.30	6.10
Phosphorus,	.80	1.65	1.80
Osmazome, salts,	5.96	8.59	10.19
Water,	82.79	74.26	72.51

At birth the brain has a nearly uniform white color. The gray substance, in which the nervous power originates, is undeveloped. The date of its appearance corresponds with the first exhibition of emotion or intel-

ligence, and the decided gray color which we observe in the brain of the adult does not appear until the age of full mental activity.

In the new-born the brain is large in proportion to the rest of the body, and its growth during infancy and childhood is rapid. Until the fifth year, as appears from the observations of Dr. Peacock, its weight is about one-seventh or one-eighth that of the entire system, the proportions varying somewhat in different cases.

The brain does not attain its full size, as stated by Dr. West, at the age of seven years, but, according to Dr. Peacock's statistics, it continues to increase till the age of twenty-five or thirty, although its growth is less rapid after the age of seven years than previously.

The membranous covering of the cerebro-spinal axis is scarcely less interesting to the pathologist than the axis itself. I shall speak in the following pages of the arachnoid and cavity of the arachnoid, for convenience of description, although aware of the fact that some eminent authorities, as Virchow and Kölliker, whose opinions in reference to the minute anatomy of the system always command attention, if not assent, believe that there is no arachnoid, but what has heretofore been called by this name is on the one side the smooth surface of the dura mater and on the other of the pia mater.

The dura mater is seldom involved in the diseases of early life, except as it is affected by pressure, while the pia mater and arachnoid are the seat and source of some of the most important diseases, as meningitis, meningeal apoplexy, etc.

The more complicated and delicate the structure of an organ, the more liable it is to errors of nutrition and growth. There is, therefore, no organ which is so liable to irregular development as the brain. It may be entirely wanting; or it may be partially developed, certain portions being absent; or, lastly, its growth may be excessive, constituting an hypertrophy.

CHAPTER I.

ACEPHALUS—ANENCEPHALUS.

Entire absence of the encephalon is not common, but there are many cases of this monstrosity on record. In extreme cases the head and part of the neck, as well as the brain and medulla oblongata, are absent. When there is great deficiency there is often a twin, the presence of which has interfered with the full development of the fœtus. Sometimes the growth of other organs besides the brain is imperfect.

Anatomical Character.—In the ordinary form of anencephalus the brain and sometimes the medulla are absent, with the absence or imper-

fect development of their membranous and osseous covering. The vault of the cranium is absent. There is deficiency of the frontal, parietal, and occipital bones, except those portions which are near the base of the cranium. These portions are very thick and closely united, as if there were the usual amount of osseous substance, but instead of expanding into the arch, it had collected in an irregular mass at the base of the cranium.

The absence of the brain and the cranial arch gives a remarkable appearance. The eyes are prominent, the neck thick and short, while the body and limbs are ordinarily well developed. The physiognomy has been compared to that of some of the lower animals.

Fig. 17.



The base of the cranium is often occupied by a vascular tumor, not large, but of different size in different cases, and continuous below with the spinal pia mater. This vascular tumor is the representative of the cranial pia mater, and its smooth surface is the analogue of the arachnoid. The dura mater and the scalp being absent, the exposed mass resembles very much in appearance, as it does in structure, the placenta, and the sensation which it imparts to the finger pressed upon it is very similar. Sometimes small portions of cerebral matter are found among the vessels of this tumor, but they are so disconnected or isolated that they do not perform, in any way, the function of a brain. Occasionally the vascular tumor is absent, and the medulla or upper extremity of the spine is exposed, or it terminates in a little papilla at the back of the neck.

Those portions of the cranial nerves which lie external to the cranium are well developed, although the intracranial parts may be absent.

Symptoms.—The respiration in anencephalous monsters is irregular. They can be made to cry, but their cry is a sort of sob or hiccough, and occasionally they even nurse. The digestive function is well performed, and regular urinary and fœcal evacuations occur. There is a tendency in anencephalous monsters to convulsions. Blowing upon them, and pressure upon the projecting medulla, if this be present, frequently produce this effect.

Prognosis.—Fortunately these monsters are short-lived. If the medulla oblongata, which is essential to the maintenance of respiration, be absent, extra-uterine life is impossible. Stillbirth is the result. If the medulla oblongata be present, although respiration and circulation are established, death commonly takes place within two or three days, and almost always within the first week. Convulsions sooner or later occur, ending in fatal coma.

CHAPTER II.

IMPERFECT BRAIN.

Between the absent and complete brain there are various grades of deficiency. Parts of the brain may be perfect, while other portions are either absent or imperfectly formed. The deficiency is usually in the superior parts of the brain, especially in the hemispheres of the cerebrum, while the base of the organ is perfect. Both hemispheres may be absent, or one may be absent, while the other hemisphere is shrivelled or rudimentary. Occasionally the cranium preserves its normal shape and size, in consequence of an increase in the cerebro-spinal fluid proportionate to the lack of brain-substance. The imperfect development is not then apparent to the observer. The rudimentary hemispheres in these cases are spread out, forming the walls of a sac inclosing the liquid. The post-mortem examination of the following case was made in the Nursery and Child's Hospital, of this city, in 1862.

Case.—Female ; parentage healthy ; she was plump and well formed at birth, and nothing unusual was observed in her condition, as she nursed and throve like other children, till she reached the age when there is, usually, the first manifestation of intelligence. With her there was no evidence of any intellect, or, if any, it was very indistinct. She nursed, or took food when placed in her mouth, but apparently without relish, as if instinctively. She never reached her hands toward the nurse, or toward playthings. So indifferent and apparently unconscious was she of objects around her, that it was thought for some time that she was blind. She never smiled, except when her hands were gently rubbed or shaken ; and then the smile seemed to be a movement more reflex than emotional. The smile was immediately succeeded by a fixed vacant look. She usually lay quietly, with her arms crossed ; and during the last month of her life she sometimes uttered a scream, like children with cerebral diseases. Her evacuations were regular, and she was not subject to vomiting, before she was attacked with the acute disease of which she died. The size of her head was rather less than usual at her age, but not less than is often seen in well-formed children. The forehead was small in proportion to the rest of the head, but the difference was not such as to attract attention. Fortunately, the existence of this idiot was terminated by an attack of entero-colitis at the age of about ten months.

Sectio Cadav.—The head was measured, but the measurements were lost. They did not seem to differ materially from the normal standard. The sutures were united, and the fontanelles nearly, if not quite, closed. The frontal bone lay a little lower than the plane of the parietal. The meninges of the brain presented nearly their normal appearance, but were distended with transparent serum. The quantity of fluid was estimated at about two-thirds of a pint, and when it was evacuated, the floor of the

lateral ventricles was brought into view. There was almost an entire absence of that part of the brain which lies above the floor of the ventricles. On close inspection, rudimentary cerebral hemispheres were found in a thin layer forming a part of the walls of the sac. The whole amount of brain-substance above the ventricle did not exceed the size of a small egg. The cerebellum, the base of the brain, and cranial nerves presented their usual appearance. The entire brain, after being a few days in diluted alcohol, weighed six and a quarter ounces.

In this case, the fluid was only sufficient to compensate for the deficiency of the brain. In other, and probably the larger number of cases of incomplete brain, the cerebro-spinal fluid is not materially increased. There is then but slight elevation of the frontal bone, the forehead is low, or retreating, or even almost absent. This is that shape of head which is universally regarded as characteristic of idiocy.

Symptoms.—The symptoms in cases of deficient brain relate to the mind. If the cerebral hemispheres are absent, there is no intelligence. The individual, as regards mental endowments, does not rise above the instincts of the lower animals. If the hemispheres are partially developed, there is a degree of intelligence proportionate to the amount of cerebral substance present. If the deficiency be confined to one side, there is no apparent lack of intelligence or mental capacity, since, the brain being a double organ, one side performs the function of both.

Prognosis.—The prognosis as regards life, in cases of imperfect brain, depends not so much on the amount of deficiency as the exact seat of arrested growth. If only the cerebrum be partially, or even entirely absent, the infant may live and thrive. But if those portions lying at the base of the brain, which control the functions of animal life, are lacking, or are imperfectly formed, life is very uncertain, and probably short.

It is evident that no therapeutic treatment can remedy a congenital deficiency. The services of the physician are not required. The philanthropic and patient teacher may impart a degree of intelligence to the idiotic, and the instruction of these unfortunates has of late years been successful.

Microcephalus—Atrophy of Brain.

An abnormally small brain has usually been attributed to premature closure of the sutures and fontanelles by too rapid ossification. But in certain cases which I have met there was no evidence of exaggerated ossification, and the fault seemed to me to be a deficiency in the growth of the brain, while the ossifying process was not exaggerated or was even less than normal. A normal development of the cranial bones, with but little brain-substance to keep them apart, would necessitate early obliteration of sutures and fontanelles. Thus in August, 1878, an infant was brought into the Bureau for the Relief of the Out-Door Poor, with marked

microcephalism. Its age was 19 months, and the bone formation was so slow that only two teeth had appeared; the circumference of its head was 14½ inches; it had had repeated convulsions since the age of five months, and the mother stated that its head had been round and hard from its birth. In microcephalus, death, sooner or later, is the common results; life ends in convulsions and coma.

Again, the brain of the child, when undergoing development, with the cranial bones sufficiently yielding, may not only cease to grow, but may even diminish in size, in consequence of protracted and exhausting diseases. Diminution in the size of the brain occurs especially after fevers and diarrhœal affections of long standing and attended with much emaciation. The waste of the brain corresponds with the general loss of flesh. If the cranial sutures be not united, the occipital and sometimes the frontal bones are depressed, according to the diminished size of the brain, and are overlaid by the parietal. In foundlings of two or three months, this loss of brain-substance is often very striking. In infants of this class who have died of protracted diarrhœa, it is not unusual to observe the occipital bone not only depressed, but extending one, two, or even three lines underneath the parietal.

If the child with shrunken brain, from protracted and exhaustive disease, be old enough to express its thoughts, it often seems foolish, talks but little, and perhaps says the same thing over and over again. In one case in my practice, a little girl, having passed through a long course of typhus, persistently repeated during her convalescence, with a silly smile, the questions addressed to her. This peculiarity continued two or three weeks, although her appetite was good, and her restoration to health rapid. In another case a little boy, during convalescence, was wont to laugh heartily at the appearance of the ordinary articles of furniture in the room. Both showed more impairment of mind during convalescence than in the midst of the fever. The friends of such children are in a state of great anxiety lest their minds be permanently enfeebled, but, as the appetite and strength return, the nutrition of the brain is re-established, and the mind regains its former vigor. In cases of wasted brain, with cranial bones united, the deficiency is supplied by serous effusion, which is gradually absorbed as the health of the patient is re-established, and the brain enlarges. This effusion occurs not only over the convexity of the brain, but also at its base, and sometimes in the ventricles. Dr. West states that in atrophy of the brain, from protracted disease, its texture is firmer than usual. I have not noticed this in infants, but my attention has not been directed particularly to this point. It is probable that there is some change in the anatomical character of the brain, aside from mere waste.

Partial atrophy of the brain sometimes, also, occurs from primary disease located in this organ; the affected portion wastes, while the rest retains its normal development.

CHAPTER III.

HYPERTROPHY OF BRAIN.

In contrast with atrophy of the brain is the opposite state, or hypertrophy. The size of this organ within the limits of health varies greatly in different individuals, but sometimes there is so great an increase in volume as properly to constitute a disease. Fortunately hypertrophy of brain is rare in America.

Pathological Anatomy.—The excess of growth which characterizes this disease has been ascertained to be confined to the white portion of the brain, and ordinarily to that part contained in the cerebral hemispheres. Hypertrophy of the brain is attended by induration, which exists in different degrees in different cases. It is in some so slight as to be scarcely appreciable ; while in others it is apparent at once by pressure with the finger, or incision with the scalpel. Rilliet and Barthez state that the induration in some cases resembles in degree and appearance that produced by the action of alcohol. The white substance of the cerebrum is not only resisting and elastic, but its color is unusually pale ; it presents even a brilliant or polished appearance. At the same time the gray substance is more or less faded, and its depth in the convolutions is less than in the normal state of the organ. Rokitansky says : "The cineritious matter is generally of a pale grayish-red color. The medullary is always dazzling white, and remarkably pale and anæmic." An unusual case is related by Burnet, in which the gray substance in the corpora striata retained its usual color, and was indurated like the white substance. In exceptional instances the cerebellum as well as cerebrum undergoes hypertrophy, becoming at the same time more or less indurated. In Burnet's case there was induration of the optic nerves. "The internal structure," he says, "of the optic nerves, especially in their bulbs, had the polish, homogeneous appearance, elasticity, and almost the hardness of cartilage." Rilliet and Barthez state that in two cases the spinal cord presented even more marked induration than the encephalon. Congestion is not a feature of hypertrophy. On the other hand, there is often less vascularity of the brain and its membranes than in the healthy state. If the cranial bones be completely ossified at the time when hypertrophy commences, and firmly united, enlargement of the brain is partially prevented. The convolutions are then thin, much flattened, the sulci more or less effaced, the membranes pale and dry, and the ventricles are small and nearly destitute of serum. At the autopsy of such a case, when the dura mater is incised, the expansion of the brain prevents the proper refitting of the skull-

cap. Occasionally hypertrophy causes more or less absorption of the cranium, and perhaps the sutures already united are pressed apart.

If hypertrophy commence in young infants with the fontanelles and sutures still open, they usually remain open, or are a long time in uniting. The interspaces continue, not only in consequence of the growth of the brain, which tends to separate the bones, but also in consequence of feeble ossification. The shape of the head arrests attention. Hypertrophy usually produces most enlargement between and above the ears, while the frontal portion of the head, though somewhat enlarged, is less developed.

The direction of the eyes is not changed, as is common in congenital hydrocephalus.

Rokitansky says (vol. iii. page 285) : " With regard to the question to be decided by the theory and microscopic examination, as to the nature of the added material upon which the increase of volume depends, I have formed the following opinion from repeated investigations :

" 1. The disease is genuine hypertrophy.

" 2. It consists, as such, not in an increase in the number of nerve-tubes in the brain, from new ones being formed, nor in an increase in the dimensions of those which already exist, either as thickening of their sheaths, or as augmentation of their contents, by either of which the nerve-tubes would become more bulky ; but,

" 3. It is an excessive accumulation of the intervening and connecting nucleated substance."

It is now generally admitted that the views of Rokitansky are correct ; that hypertrophy of the brain is due to an augmentation in the amount of connective tissue, which lies between and unites the tubules.

Causes.—Hypertrophy of the brain results from an error in the nutritive process which sometimes seems to be associated with the rachitic state, or a condition analogous to rachitis. It is not common, is indeed rare, in this country, and is more common in countries like England, where rachitis is more prevalent than with us. Rilliet and Barthez consider frequent congestions of the brain as a common cause. The hypertrophy is most frequently met in hospitals for children, and among the poor of the cities, whose systems are rendered cachectic by residence in damp and dark localities, and by unwholesome diet. In the deep valleys of Switzerland, and in parts of South America and Asia, hypertrophy of the brain is common, under the name cretinism. It is associated with rachitis and stunted growth. The abnormal development which occurs in cretinism begins in infancy or early childhood, and the unfortunate subjects of it are short-lived. Cretinism has been attributed to a residence in localities wet and deprived in great measure of solar light, and to general disregard of the laws of health on the part of those affected as well as their parents.

The observations of different physicians also establish a connection between some cases of hypertrophy and the saturation of the system by lead.

In what way lead-poisoning leads to hypertrophy is obscure, but the concurrent testimony of different observers is so strong, that we cannot doubt that it does sometimes have that effect. But in a considerable proportion of cases, as in the one presently to be related, the cause is obscure.

Symptoms.—The symptoms, as is the case with most organic diseases of the brain, vary considerably in different patients. Sometimes there is, at first, more or less depression or languor. If the child be old enough to speak, he may complain of pain in the abdomen or limbs, evidently neuralgic, or of headache. After a variable time vomiting succeeds, and finally convulsions, affecting the muscles of the face, as well as extremities ; the convulsions are usually clonic, but sometimes, as regards at least the extremities, of a tonic character. The pupils may be contracted or dilated ; there is restlessness alternating with drowsiness, and finally coma succeeds.

Hypertrophy may continue a considerable time before serious symptoms arise ; but when once developed, these symptoms ordinarily continue with more or less severity till death. Death commonly results within a week after their commencement, but sometimes not till several weeks have elapsed. When death occurs at an early period in the disease, there is usually firm ossification and union of the cranial bones, and, therefore, but moderate enlargement of the cranium.

If hypertrophy commence at a period not far removed from birth, the bones, of course, yield more readily to the pressure, and acute symptoms do not occur so soon. After a time, however, in all or nearly all cases, convulsions supervene. These indicate the gravity of the disease, and are prognostic of its fatal termination.

In a patient observed by Burnet, violent convulsions, followed by loss of consciousness, marked the commencement of acute symptoms. Five days subsequently, the following symptoms were recorded : mobility of the eyes, without expression ; pupils contracted, and directed upward ; divergent strabismus of the left eye ; the senses in their normal state, with the exception of sight ; the limbs move by volition. For a month there was little change. Then occurred drowsiness, and increased prostration, and five weeks later the child succumbed with the symptoms of double pneumonia.

Such is the clinical history of hypertrophy. In cases of firm ossification of the cranial bones, and, therefore, no marked enlargement of the skull, the symptoms are similar to those which occur if the dimensions of the head be increased, but compression and death result sooner.

The following case, in which the sutures were firmly united, I attended in 1864. The head was large, but not so large as to attract attention from its disproportion :

Case.—A boy, aged two years and two months, had, when about one year old, intermittent fever, and since then his countenance was uniformly pallid, and his flesh soft. Weaned at the usual time, he remained well till

the 1st of January, 1864. In the beginning of this month he was observed to be feverish for some days, and his appetite poor. His health then gradually improved, and he was thought to be entirely well.

On the 26th of February he was suddenly seized with convulsions, general at first, but most severe and continuing longest on the left side. The convulsions lasted a little more than three hours. He recovered fully his consciousness by the following day, but his appetite remained poor; he was no longer amused by his playthings, and was very fretful. The surface was pallid; bowels constipated; pulse but little, perhaps not at all, accelerated. He continued in this state till the 6th of March, when he had another slight convulsive attack, and from this time he never fully recovered his consciousness. He was fretful if disturbed, his face generally pallid, while the pulse and respiration were not perceptibly altered.

On the following day, the 7th, the left pupil was somewhat larger than the right, but both were sensitive to light. The difference in size continued till near the close of life. Although vision was imperfect, if not altogether lost, the sense of hearing was not impaired.

When questioned, he uniformly answered, "No," with a drawling voice, evidently not understanding what he said.

As the disease advanced, the respiration became at times sighing; but the rhythm of the pulse was not materially altered. The temperature of the surface was changeable, sometimes cool, sometimes warm, and the congested spots or patches, so common in cerebral affections, were also observed at times on the face, ears, or forehead. Through most of his sickness he took drinks readily, and the urine was freely discharged, probably from the iodide of potassium, which he took in one and a half grain doses every two hours.

He became more and more drowsy, again had slight convulsive movements, and finally died, with much apparent suffering, on the 14th of March. The pulse became more accelerated during the last two or three days. On the day preceding his death, the pupils were contracted, and not affected by the light.

Sectio Cadav.—Body somewhat emaciated, and eyes sunken; occipito-frontal circumference of head nineteen and a half inches; distance from one auditory meatus to the other over the vertex, thirteen and a half inches; convolutions over the surface of the brain much flattened and compressed; brain generally deficient in blood; medullary substance firm, and of a pure white color; meninges healthy; no other abnormal appearances were observed; weight of brain forty-two ounces.

Diagnosis.—The diagnosis of hypertrophy is not always easy. The symptoms are, in the main, such as occur in other pathological states, especially congenital hydrocephalus. There is most danger of mistaking the overgrowth for this disease. Hypertrophy has, indeed, often been treated for hydrocephalus. There are, however, certain signs by which we may distinguish one from the other. In the ordinary form of congenital hydrocephalus, even when the amount of liquid is small, the orbital plates of the frontal bones are pressed in such a way that the axis of the eyes is changed so as to have a downward direction. The white of the eye can be seen between the iris and the upper eyelid. This gives a characteristic and striking expression to the face. The exception to this is in

those rare cases in which the liquid is external to the brain. In hypertrophy this peculiar change in the axis of the eyes does not occur. Moreover, in hypertrophy there is not that uniform expansion of the head which is observed in hydrocephalus, as has been stated above. There are, commonly, greater enlargement, more prominence of the anterior fontanelle, and wider separation of the cranial bones, in hydrocephalus than in hypertrophy. But since in some cases of hydrocephalus the sutures are united, and the fontanelles closed, and there is no change in the direction of the eyes, the reason of the difficulty in making a positive differential diagnosis between these two diseases in certain instances is apparent.

Hypertrophy with consolidation of the cranial bones, and, therefore, little enlargement of the head, may be mistaken for meningitis. The history of the case, and the means by which we diagnosticate the latter affection, which will be described in their proper place, will usually enable the physician to make a correct diagnosis.

Prognosis.—In forming an opinion as to the probable termination of the disease, we must have regard to the age and general condition of the child, as well as to the degree of hypertrophy. If the disease commence at an early age, when the cranial bones are not firmly united, it is probable that there will be no compression of the brain, so as to endanger life, for a considerable period. We may then hope by proper measures to remove the constitutional state which gives rise to the hypertrophy, before the enlargement is such as to cause cerebral symptoms. If the bones have already united when the disease commences, even slight hypertrophy will produce symptoms, and a speedily fatal result is inevitable. Evidently, also, a child in a marked degree rachitic or scrofulous is much less likely to recover than one whose general health and constitution are less impaired.

Treatment.—The treatment in hypertrophy should be directed mainly to the constitution. Measures calculated to improve the nutritive process are those most likely to check the abnormal growth of the brain. As the disease is one of perverted nutrition, and usually coexists with a vitiated or impoverished state of the blood, tonic and alterative remedies are required. The syrupus ferri iodidi is, therefore, useful, as it is both tonic and alterative. This may be given in doses of three or four drops to a child one year old, three times daily. Cod-liver oil, with or without the iron, is beneficial in some cases. Another remedy is iodide of potassium in combination with a tonic, as the compound tincture of bark.

℞. Potas. iodid., ʒj;
Tinct. cinchon. comp.,
Syr. limon., āā ʒij. Misce.
One teaspoonful, three times daily, to a child of three years.

The hygienic treatment is not less important than the medicinal. There

is little hope of a favorable issue in any case, unless the regimen be such as will conduce to a more robust and healthy state of system. The diet should be plain and nutritious, the apartments clean and airy, and all undue excitement should be avoided.

CHAPTER IV.

THROMBOSIS IN THE CRANIAL SINUSES (PHLEBITIS).

The formation of fibrinous coagula within a vein or sinus is designated thrombosis (*thrombus*, clot). Coagulation of fibrin in the cranial sinuses occasionally occurs, constituting a very serious pathological state. This may result from local disease in the sinuses or in their vicinity, or from disease external to the cranium. The immediate cause of thrombosis, whatever its location, is sufficient arrest of the circulation to allow the fibrin to coagulate.

Tubercular and enlarged bronchial glands, compressing more or less the venæ innominatæ, or the descending vena cava, sometimes give rise to thrombosis in the cranial sinuses, the fibrin coagulating in consequence of retardation in the current of blood. I have known thrombosis, in the same situation, also to result from clonic convulsions, occurring in connection with severe spasmodic cough in pertussis, since both the cough and convulsions retard the flow of blood in the veins and sinuses within the cranium. At the post-mortem examination of at least four such cases I found whitish clots in the lateral sinuses.

Thrombosis, in the cranial sinuses, may also occur from inflammation, either in the walls of the sinuses or immediately exterior to them. This is the disease which writers have designated phlebitis of the cranial sinuses, and for a correct understanding of the morbid anatomy of which the profession are indebted to Virchow.

Anatomical Characters.—If a child die with the cranial sinuses and the veins of the brain and of the meninges in their normal state, the blood in these vessels is found at the autopsy dark but liquid, or there are small, dark, and soft clots in the larger sinuses. If there were congestion, but no coagulation, in these vessels in the last hours of life, the clots are more numerous, larger, and longer, sometimes extending from the sinuses into the larger veins which empty into them, but they are still dark and soft, readily falling to pieces when handled. If, again, there have been that degree of congestion and stasis which has resulted in ante-mortem coagulation, or in thrombosis, the clots are, in part at least, whitish, and of a fibrinous or gelatinous appearance ; they were formed while the red corpuscles were still carried along in the circulation.

Most of the clots in thrombosis are free, while others are attached lightly to the internal surface of the sinus ; occasionally they are so large as to distend the vessel. They extend also in many cases into the cerebral veins which connect with the sinuses, producing prominence and firmness, so as to resemble (Rilliet and Barthez) an artificial injection. The clots do not present a uniform character. In parts of a sinus they consist of almost pure fibrin, of a yellowish-white color, while in other portions they present a gelatinous appearance from the large number of white corpuscles, while other portions are more or less tinged from the presence of red corpuscles. The central part of the clot, after a time, if the case be sufficiently protracted, softens, and presents a puriform appearance. This substance, which is only disintegrated fibrin, was supposed to be pus, till the microscope revealed its true character. It is obvious that small clots forming within a sinus, and having no attachment to its walls, are liable to be carried by the current of blood into the general circulation, unless there be complete obstruction. Virchow has also shown how a thrombus may extend, by gradual prolongation, nearer and nearer the heart, so that one commencing in a sinus may, after a time, reach into the jugular vein. Different observers, as M. Tonnelé, and also Rilliet and Barthez, have traced the fibrinous masses as far as the cava. The latter writers relate the case of a girl, four and a half years old, in whom the sinuses on the left side, especially those nearest the petrous portion of the temporal bone, were completely filled with clots of a yellowish-white color, intermixed with central dark spots. Similar coagula were also found in the left jugular vein as far as the brachio-cephalic trunk. Whether the walls of the sinus undergo any change depends on the nature of the disease which causes the thrombosis. If it be phlebitis, the coats are thickened from infiltration and injected, and the internal coat has lost its polish. If it be some obstructive disease in the course of the circulation, or a general cause, the coats of the vessel are unaltered, except that they may be stained by imbibition of the coloring matter of the blood. In an infant who died of this disease in the practice of Dr. West, " the sinuses on the left side were healthy, but the blood was almost entirely coagulated. The posterior half of the longitudinal sinus, the torcular, the left lateral, and the left occipital sinuses, were blocked up with fibrinous coagula, precisely such as one sees in inflamed veins, and the clot extended into the internal jugular vein. The coats of the longitudinal, and of the inner half of the lateral sinus, were much thickened, and their lining membrane had lost its polish, was uneven, and presented a dirty appearance."

The mode in which congestion and coagulation occur within a sinus, in consequence of the pressure of a tumor upon this vessel, or upon a vein into which the blood from this sinus flows, is sufficiently obvious. The mode of the production of thrombosis, as a result of clonic convulsions, or of the spasmodic cough of pertussis, is also apparent. How it results

from inflammation of the walls of a sinus, that is, from phlebitis, was not understood till explained by Virchow.

The fibrinous coagula which fill the sinus are not an exudative product, as was formerly supposed. Inflammation (in most cases otitis, with caries of the petrous portion of the temporal bone) approaches a sinus. The inflammatory products pressing against the walls of the sinus diminish its calibre at that point, and hence the retardation of the current of blood and the coagulation. Or the walls of the sinus may be thickened by inflammatory infiltration, or even by the formation of little abscesses within the coats in consequence of the inflammation, so as to produce bulging inward, and the result, as regards the circulation, is the same. Whether, therefore, the inflammation occur without a sinus, or within its walls, thrombosis equally results, provided that the diameter of the vessel is sufficiently narrowed by the presence and pressure of inflammatory products.

There is no exudation on the internal surface of a sinus or vein when inflamed, as there is upon serous surfaces. "On the contrary" (*Cellular Pathology*, translation, p. 236), "when the wall is inflamed, the exuded matter (exsudatmasse) passes into the wall, which becomes thicker, cloudy, and subsequently begins to suppurate. Nay, even abscesses may form which cause the wall to bulge on both sides like a variolous pustule, without any coagulation of the blood ensuing in the cavity of the vessel. At other times, certainly, phlebitis, properly so called (and in like manner arteritis and endocarditis), is the cause of thrombosis, in consequence of the formation of inequalities, elevations, depressions, and even ulcerations upon the inner wall which favor the production of the thrombus. Still, whenever phlebitis, in the usual sense of the word, takes place, the alteration in the coat of the vessel is almost always a secondary one, and, indeed, occurs at a comparatively late period."

This view of the pathology of thrombosis comports with facts observed at autopsies, and which cannot be explained according to the old theory of phlebitis, namely, smoothness of the internal surface of the sinus; natural color of this sinus, or simple staining from blood; the non-attachment or slight attachment of the coagula, etc.

Causes.—Some of these have been already stated at the commencement of this article. It is evident from what has been said that this disease may be produced by any cause which obstructs the return circulation from the head. I have already alluded to tumors which press upon the sinus, or on the vein below the sinus, as a cause. Among the causes may be mentioned also abdominal tumors, narrowing of the chest from rachitis, or caries of the vertebræ, and, finally, compression of the jugular vein by a retropharyngeal abscess.

Sufficient allusion has already been made to inflammation of the internal ear as a not infrequent cause. Thrombosis is, indeed, one of the dangerous results of chronic otitis. Another cause is a reduced or cachectic state of

system, apart from any local or obstructive disease. It is a noteworthy fact that a large proportion of those affected with thrombosis, even when it is immediately due to obstructive disease, are cachectic. The explanation of this fact is not difficult. In reduced states of the system the action of the heart is feeble, and passive congestion of the vessels within the cranium is apt to occur. Passive congestion of the veins and sinuses in protracted diarrhœal maladies, which is described in our remarks upon another disease, is an example in point. In this state of feeble circulation very slight obstructive disease may be sufficient to cause thrombosis.

Symptoms.—The symptoms of this disease are often obscure. All of them may and do occur in other maladies of the encephalon. In cases related by M. Tonnelé, cerebral symptoms were well marked, such as faintness, dilation of the pupils, strabismus, grinding the teeth, convulsive movements. There may be an almost total absence of such symptoms as would direct attention to the state of the head. This is due to the sudden occurrence of death after the clots have formed in the sinuses. If the clots are large, death soon results in consequence of congestion of the brain and meninges, which is proportionate to the amount of obstruction. Extravasations of blood and transudation of serum not infrequently accompany the congestion and hasten the result.

Dr. West relates the case of a girl who had a mild attack of scarlet fever at the age of eight months, and did not fully recover her health. She continued restless and feverish, and had two violent convulsions two weeks after the scarlatina. In the following months she had anasarca, and when she was nearly a year old another attack of convulsions occurred. Fluctuation was now observed in the abdomen, and in a few days a sero-purulent fluid began to escape from the umbilicus. When this discharge had continued eleven days, symptoms of a liquid in the right pleural cavity were suddenly developed. She grew weak and emaciated, and finally was seized with extreme faintness, with which she died in forty-eight hours, at the age of thirteen and a half months.

At the post-mortem examination a large amount of pus was found in the abdominal and right pleural cavities. On the right side of the cranium, the sinuses were filled with coagula, and their coats seemed healthy. The left lateral and occipital sinuses, the torcular and part of the longitudinal sinus, also contained coagula, which extended into the jugular vein. The walls of the longitudinal sinus and the internal part of the lateral sinus were thickened, and their inner surface had lost its polish and was uneven. There was congestion of the brain, with points of extravasated blood. If, as is probable, the convulsions were due to some other cause, the only symptom which was clearly referable to the thrombosis was the sudden faintness. In the four cases of thrombosis occurring in pertussis, already alluded to, in which I was enabled to ascertain by post-mortem examination the presence and extent of the clots, the symptoms, which were

apparently due to the thrombosis, were those of cerebral congestion. Among these symptoms, stupor, and finally coma were prominent. The convulsions which occurred in both cases were apparently a cause, and not a result, of the thrombosis.

Diagnosis.—It is evident, from what has been said, that thrombosis of the cranial sinuses can rarely be diagnosticated with certainty. The pre-existence of otitis will sometimes lead us to suspect its presence, especially if the otitis have been accompanied by deep-seated pains. Symptoms of cerebral congestion, serous effusion, or apoplexy, occurring in connection with otitis, protracted convulsions, or glandular or other tumors situated so as to compress the vessels which return blood from the brain, indicate thrombosis.

Prognosis.—The prognosis, in any case, is obviously unfavorable. The cause is, ordinarily, permanent, or not readily removed, so that the clots gradually increase. If the cause be a local obstructive disease, death is almost certain, since, in nearly every instance, the obstruction is of such a nature that it cannot be removed by medical or surgical treatment. It is possible that recovery may take place if the clots are few and small, and the cause of the thrombosis is mainly feebleness of circulation in consequence of a state of debility. We know that clots may liquefy, and their elements re-enter the circulation ; but such a result of thrombosis in a cranial sinus, if it ever occur, is rare. The thrombus, by its presence, serves as a point of attachment around which more fibrin coagulates, so that the obstruction gradually increases till death occurs.

Treatment.—Thrombosis should be treated by cool applications to the head, in order to diminish the congestion, by stimulants and sustaining measures in case the systolic movement of the heart is feeble. Tonics, vegetable or ferruginous, are indicated if there be a cachectic state.

CHAPTER V.

CONGESTION OF THE BRAIN.

Congestion of the brain is not peculiar to infancy and childhood, but is much more common in these periods of life than subsequently. This is due, in a great measure, to the fact that in the young the circulation is more readily disturbed by moral as well as physical causes than in the adult.

Congestion of the brain is occasionally primary ; more frequently it occurs as a concomitant or sequel of some other affection. Diseases, whether

constitutional or local, which in the adult have no appreciable effect on the vascularity of the brain, often cause in the child a decided increase of blood in this organ.

Causes.—Cerebral congestion is of two kinds, active and passive. The former results from a cause which directly affects the brain, and increases the flow of blood toward it, or from a cause operating primarily on the heart, and increasing the frequency and force of its systolic movement; the latter is due to some obstruction in the course of the circulation, or to feeble propelling power on the part of the heart.

Among the causes which most frequently produce active congestion of the brain in the child, may be mentioned blows or falls on the head, excessive fatigue or excitement, heat, perhaps sometimes dentition, and also various inflammatory and febrile affections, especially in their first stages.

Cerebral symptoms occurring in the course of an essential fever are no doubt often due, in a great measure, to the irritating effect on the brain of the specific principle, whatever it may be, circulating in the blood. Occurring in inflammatory diseases which are located elsewhere than within the cranium, they are often attributed to functional disturbance of the brain. The brain, it is said, sympathizes with the affected part through the system of nerves which unite them. But observations show that symptoms referable to the brain, arising in the commencement of the essential fevers and of the phlegmasiæ, are in many instances preceded by, and are therefore, doubtless, in greater or less degree dependent on, hyperæmia of this organ.

Difficult as it is to ascertain the state of the brain in many diseases in which it is involved, we may determine whether or not there be congestion in the young child by observing the anterior fontanelle. If it be elevated and tense in an acute disease, hyperæmia is indicated. Now, it is often unusually prominent in fevers and inflammations, especially in their first stages, when cerebral symptoms are present. Its elevation, under such circumstances, is obviously coincident with cerebral congestion.

The acute inflammations which are most likely to be attended by cerebral congestion are those of the mucous surfaces and pneumonia. Severe coryza, tracheo-bronchitis, entero-colitis, and colitis, commencing suddenly with great febrile excitement, are frequently accompanied in their initial stage by active congestion of the cerebral vessels. Cases like the following, which I find in my note-book, are not infrequent. An infant four months old had been sick about two days with coryza and bronchitis, when I was called to see it; the pulse numbered 156; respiration 64; it nursed, and was somewhat restless; cough frequent and dry; bowels moderately relaxed. The mucous membrane of the fauces was injected, and coarse mucous râles were present in the chest. The anterior fontanelle rose above the level of the cranium, and pulsated forcibly. Soon after convulsions occurred, which were relieved by appropriate measures, and on the follow-

ing day the fontanelle had subsided. The patient gradually recovered without any untoward symptom.

Cerebral congestion and convulsions often mark the initial stage of active intestinal phlegmasiæ. This is especially true of dysentery. The little patient, perhaps from the very inception of the colitis, is drowsy ; its surface hot ; pulse full and rapid. There is sudden and momentary starting or twitching of the limbs. The anterior fontanelle, if still open, is elevated, and it is not till the lapse of several hours that the cause of these symptoms is apparent from the occurrence of bloody stools.

The causes of passive congestion of the brain are very different from those of the active form. A common cause is obstruction in a sinus or vein by a fibrinous concretion, or by a tumor or abscess external to it.

I have occasionally met cases in which this form of cerebral congestion appeared to be plainly referable to obstruction to the return of blood from the brain by the pressure of bronchial glands, enlarged by hyperplasia in tubercular disease, these bodies diminishing by external pressure the calibre of the venæ innominatæ or the descending vena cava. Rilliet and Barthez have called attention to such cases in the clinical history of tuberculosis. The following case may be cited as an example ; it occurred in the infants' service of Charity Hospital, in this city, in April, 1866.

An infant, about one year old, affected with tuberculosis, both bronchial and pulmonary, was observed, during the ten days preceding its death, to bore the pillow with its head almost constantly, so as to wear the hair from the occiput. This movement of the head was the only prominent cerebral symptom. Nothing abnormal was noticed in the appearance of the eyes, nor was the stomach irritable. A spasmodic cough and progressive emaciation attracted attention, but these were referable to the tubercular disease. At the autopsy we found the cerebral sinuses, veins, and capillaries greatly congested. On tracing the veins which return blood from the brain, an inflamed and enlarged bronchial gland was discovered in the angle formed by the convergence of the right and left venæ innominatæ. This gland, which contained but a single point of cheesy degeneration, had attained such a volume by proliferation of its cells that it pressed upon both vessels, so that it had obviously retarded the circulation in each, and given rise to cerebral congestion.

Passive congestion often occurs in the infant at birth, either from tediousness of the labor or delay in the expulsion of the body after the birth of the head. If it be simple congestion, and not congestion with hæmorrhage, it soon passes off. Passive congestion of the brain also occurs in severe paroxysms of hooping-cough, in which return of blood from this organ is temporarily retarded. All are familiar with the congestion which occurs in parts external to the cranium, from the severity of the cough ; producing epistaxis, extravasations under the conjunctiva, etc. The extracranial obviously indicates the presence and degree of cerebral congestion.

Those who practise in malarious regions sometimes meet cases of dangerous passive congestion of the brain, the result of malaria, occurring especially in the cold state of intermittent fever. In these cases the surface is pallid, its temperature reduced, and the pulse feeble. The blood, leaving the peripheral vessels, collects in undue quantity in the internal organs, producing congestion of the brain, as well as of the thoracic and abdominal viscera. In the child with malarial disease, in whom there is less vigor of constitution than in the adult, death not infrequently occurs in this passive congestion. Two such cases have occurred in my practice, although in this latitude the malarial maladies are mild in comparison with the type which they present in many parts of the United States.

Symptoms.—The symptoms of active congestion of the brain are stupor, great heat of head, throbbing of carotids, restlessness when aroused, twitching of the limbs, and perhaps convulsions. There is also sometimes intolerance of light, and the anterior fontanelle, if open, pulsates strongly. In passive congestion many of the symptoms are the same as in the active form. Stupor, twitching of the limbs, and fretfulness or irritability when the patient is disturbed, are common, ordinarily without increase of temperature ; the surface may, indeed, be cool, and the face is not flushed nor the eyes injected. The strong pulsation and elevation of the anterior fontanelle, so conspicuous in active congestion, are—the former always, the latter often—lacking. In both forms there is tendency to constipation.

In many cases the symptoms of congestion of the brain are associated with others which proceed directly from the cause of the congestion, but it is not difficult, unless in exceptional instances, to determine which are due to the congestion, and which to the antecedent and coexisting pathological state.

Anatomical Characters.—In active congestion there is an excess of arterial blood in the brain and its membranes. The arteries, to their minutest branches, are seen to be full, presenting the bright hue of oxygenated blood. In passive congestion the sinuses and veins are distended. The pia mater, choroid plexus, and the vessels of the brain, have a darker appearance than in active congestion. In both forms of congestion, if they continue for a little time, other anatomical changes occur. If there be great distension of the capillaries, these vessels are apt to give way, and we find here and there little patches of extravasated blood. In other cases the over-distension is relieved by the transudation of the serous portion of the blood through the coats of the vessels. The cephalo-rachidian fluid is then found in excess external to the brain and in the ventricles.

Prognosis.—The duration and the result of congestion of the brain depend, in great measure, on the nature of the cause. If the cause be trivial, as mental excitement, fatigue, exposure to heat, there is usually prompt relief if the condition of the patient be understood and properly treated.

If the cause be general or constitutional, as one of the essential fevers or hooping-cough, or if it be local, but its seat external to the cranium, the prognosis, so far as the congestion is concerned, is not unfavorable, if there be a timely and judicious use of remedies. The most unfavorable cases are those in which the cause is seated in the encephalon, and those in which there is some obstructive disease in the course of the circulation. Congestion occurring from a structural change within the cranium is, from the nature of the cause, without remedy, and ordinarily fatal. Obstructive diseases of the circulatory system, wherever located, being for the most part permanent, give rise, as a rule, to incurable congestion.

Congestion of the brain, if it be not relieved in a few hours, becomes less and less amenable to treatment. It soon passes beyond the resources of our art, and ends in coma ; it is seldom protracted beyond a few days. Extravasations of blood, common in active congestion, and serous effusion, common in the passive form, diminish the chances of a favorable result.

Treatment.—The indication for treatment in *active* congestion is plain. Measures should be employed which produce derivation from the brain. Unless there be an asthenic primary affection, in the course of which the congestion is developed, active purgation is required. A saline purgative is ordinarily preferable. If the stomach be irritable, there is no better purgative than calomel. In all cases of active congestion, whatever the cause, the bowels should be kept open. It is often better not to wait for the tardy action of a cathartic, but to give at once an enema of soap and water or salt and water. External derivative agents are also indicated. A warm mustard foot-bath, sinapisms to the back of the neck or chest, and to the feet, and cold applications to the head, are measures which should never be neglected.

This treatment, if employed early, will relieve the congestion in a large proportion of cases ; but if there be no improvement, if the child be robust, and if the primary affection be such as does not contraindicate loss of blood, leeches should be applied to the temples or some part of the head. If after the lapse of some hours cerebral symptoms continue, apoplexy or serous effusion has probably occurred. Congestion is then no longer the prominent lesion, and it is proper to designate the disease by another name.

The treatment appropriate to *passive* congestion is somewhat different ; cold applications to the head, and those of a derivative nature to the extremities, are useful. As this form of the disease is not primary, but is dependent on some antecedent pathological state, it is evident that it can only be treated successfully by removing or obviating so far as possible the cause. But the nature of the various obstructions to the intracranial circulation is such that our ability to accomplish this end is very limited.

If the cause be constitutional, or if it be some disease in the neck or

chest, it may sometimes be partially or even wholly removed, but if seated within the cranium it is beyond our control. In general, it may be said that depletion is not required or tolerated in passive congestion, and stimulants are often needed.

CHAPTER VI.

INTRACRANIAL HÆMORRHAGE (MENINGEAL HÆMORRHAGE. CEREBRAL HÆMORRHAGE).

Hæmorrhage within the cranium is not very infrequent in infancy and childhood ; and there is no part of the encephalon, whether the meninges or brain, in which it does not sometimes occur. If the blood be extravasated upon the surface of the brain or between the meninges, the disease is designated by writers meningeal apoplexy ; if in the substance of the brain, cerebral apoplexy. Extravasation may also occur in one of the lateral ventricles. This may, for convenience, be described as a form of meningeal apoplexy.

Causes.—Apoplexy is usually (there is an exception) preceded by congestion. If the congestion increase to a certain degree, the distended capillaries give way and extravasation of blood results. Therefore the causes of congestion which have been enumerated in the preceding article are, in great measure, those of apoplexy. Recent microscopic examinations have demonstrated that the corpuscular elements of the blood may escape from capillaries without rupture. While, therefore, it is probable that intracranial hæmorrhage in early life commonly occurs from a rupture, its occasional occurrence through the walls of the capillaries must be admitted.

Intracranial hæmorrhage is not infrequent in the new-born. It results in them from tediousness of the birth and severity of the labor-pains. At first there is extreme congestion of the meningeal and cerebral vessels corresponding with that of the scalp and face. This congestion, continuing, soon ends in extravasation of blood. In some of these cases forceps have been used to effect the delivery, but it is doutful whether the use of instruments materially increases the congestion or the amount of extravasation. Certainly, in a large proportion of intracranial as well as supracranial hæmorrhages of the new-born, instruments have not been used. An additional cause of the hæmorrhage is, in some instances, the use of ergot, which, by producing strong and continuous pains, interrupts the placental circulation and increases the congestion of the fœtal veins and the capillaries.

In infants a few days old intracranial hæmorrhage may result from

that rapid and fatal disease, tetanus infantum. The hæmorrhage is preceded by intense passive congestion, which the tetanic rigidity and spasms produce by obstructing respiration and circulation. Few cases of tetanus infantum occur without more or less extravasation of blood, either meningeal or cerebral. Another cause of this disease is obstruction in the vessels which return the blood from the brain. The various structural changes which produce this obstruction, in different cases, have been sufficiently described in our remarks on cerebral congestion and thrombosis.

The congestion which precedes hæmorrhage, when occurring under the conditions described above, is passive.

Among the causes which produce hæmorrhage through the intermediate state of active congestion may be mentioned great mental excitement, of which M. Legendre relates a case, and lengthened exposure to the sun's rays, an example of which Rilliet and Barthez have seen. It is also said that compression of the aorta by an enlarged liver or an abdominal tumor has sometimes produced meningeal or cerebral hæmorrhage, by causing an increased afflux of blood to the head. A very important cause to which I have not alluded, is that general state of the circulatory system which is designated by the term purpura hæmorrhagica. This sometimes results from the anti-hygienic conditions in which the child is placed. In other instances it results from some antecedent disease, protracted and debilitating, which has produced a profound alteration in the state of the blood and the vessels. The capillaries become less firm and elastic, and easily give way, so that in such patients ecchymotic points are ordinarily found in different parts of the system. The diseases which occasionally end in this hæmorrhagic diathesis are numerous. I have known it to occur after measles, scarlet fever, and smallpox. It is also an occasional sequel of chronic diarrhœa, of intermittent and typhoid fevers, and of rachitis.

Anatomical Characters.—Hæmorrhage in or upon the brain, in infancy and childhood, differs in important particulars from that occurring in adult life. In the adult, and more so as life advances, the arteries become less distensible and more brittle, so that when hæmorrhage occurs it is usually from one of these vessels. In early life, on the other hand, the blood does not ordinarily escape from an artery, but, as has been stated, from the capillaries. The extravasation is not, therefore, so rapid and violent, and is not attended with such laceration and injury of surrounding parts, in infancy and childhood, as at a subsequent age. In the adult the hæmorrhage commonly occurs in the substance of the brain. The flow of blood from the ruptured artery separates the brain-substance, producing a cavity in which a clot forms. This constitutes the usual form of apoplexy in the adult. In the first years of life, on the contrary, the extravasation is commonly from the meninges, and the symptoms to which the effused fluid gives rise are for the most part due to its mechanical

effect. Cases of hæmorrhage in the substance of the brain constitute a small minority, unless during the days immediately succeeding birth. In early life, therefore, on account of its greater frequency, meningeal hæmorrhage is a disease of more importance than cerebral, and its anatomical character should be carefully studied.

In *meningeal hæmorrhage* the extravasation may be between the cranium and dura mater, upon the visceral layer of the arachnoid, in the meshes of the pia mater, or in a lateral ventricle, from rupture of the capillaries in the choroid plexus. Much the most common seat is external to the pia mater in the so-called cavity of the arachnoid ; the blood escaping in this situation spreads uniformly in all directions. It soon separates in two portions, the solid and liquid. The solid portion, or the clot, is free or but slightly attached to the adjacent membrane. The meninges in the vicinity of the extravasated blood preserve their normal appearance, or are but slightly injected ; the clot gradually becomes extended on all sides, so as to form a lamina at the seat of the extravasation, thinner at its circumference than centre, and at first of a dark-red color. The color gradually fades, and the lamina, becoming smooth and polished, and at the same time more and more attenuated, finally resembles the arachnoid in appearance. Its diameter varies in different cases from a few lines to two or three or more inches. M. Tonnelé relates two observations in which the adventitious membrane extended over the superior surface of both hemispheres, and in one of them, also, over the falx cerebri.

The extravasation may occur at any part of the surface of the brain, but its usual seat is the vertex. The next most frequent locality is the base of the brain. The subsequent history of the delicate membrane into which the clot is gradually transformed is interesting. It often extends so as to cover more space than was occupied by the extravasated blood, and its edges are then scarcely distinguishable, in consequence of their extreme tenuity, and their close resemblance to the arachnoid. The attachments of this membrane, so far as it forms any, are usually to the parietal surface of the arachnoid. Sometimes a portion of the membrane is attached, while the rest lies free, bathed on either side by the liquid portion of the blood which still remains from the extravasation. According to M. Legendre, in the most favorable cases, the serum is absorbed, and the membrane which has resulted from the clot, and which I have described, becomes intimately adherent to the internal surface of the dura mater. It forms an integral part of this membrane, and there only remain a little thickening and increased opacity, indicating the seat of the extravasation. The health is fully re-established.

But the result in other cases is as follows : The serum is not absorbed, and the newly formed membrane, uniting at points with the inner surface of the dura mater, or its arachnoidal covering, incloses the fluid so as to produce a circumscribed hydrocephalus.

Sometimes there is only one cyst ; in other instances the membrane, especially if large, unites in such a way as to give rise to more cysts than one. The size of the cyst varies, according to the quantity of fluid, which may be only a few drachms or several ounces. Rilliet and Barthez report a case in which there was a pint of fluid lying over each hemisphere, there being two cysts. If the cranial bones are not united, so that they yield to the pressure, the size of the cranium is increased, and if the extravasation be confined to one side, an inequality results, and the symmetry of the head is destroyed. The fluid which causes the enlargement of the head in such cases is in part the serum of the extravasated blood, and in part a subsequent secretion.

Various writers relate cases of ventricular hæmorrhage. Valleix met it in an infant that died at the age of two days. In the *Edin. Journ. of Med. and Surg.*, October, 1831, an interesting case is related. A boy nine years old died of hæmorrhage in both ventricles, and also at the base of the brain and in the spinal canal. In the Nursery and Child's Hospital of this city, the post-mortem examination was made of an infant who died at the age of one month. In the posterior cornu of the left lateral ventricle were two clots, elongated and black, one larger than the other. In the corresponding cornu, on the opposite side, was a smaller clot. A similar post-mortem appearance was observed at the autopsy of a young infant in the infant service of Charity Hospital. A dark crescentic clot lay in each posterior cornu. The clot, if remaining a long time, undergoes degeneration. In the case of an adult, in which a year had elapsed after the extravasation, I found it to contain crystals of cholesterin and carbonate of lime.

Cerebral Hæmorrhage, or hæmorrhage in the substance of the brain, may occur at any time in infancy and childhood. The blood is sometimes extravasated in points, here and there, over the entire organ, or a part of the organ ; in other cases it is extravasated in one or perhaps two cavities, as in the ordinary form of apoplexy in the adult. In the first form of cerebral hæmorrhage, or that in which the blood escapes from numerous points through the brain, there is evidently little laceration or injury of the organ. The brain-substance surrounding the hæmorrhagic points sometimes preserves the usual appearance. It is white and firm. In other cases it presents a reddish or yellowish appearance, and is softened to the depth of a line or two. If the hæmorrhage occur in a cavity, as in apoplexy of adults, the nerve-fibres are evidently torn and separated, and there is more or less compression of the surrounding brain-substance. Unless the disease be of long standing, the cavity contains a dark and soft clot bathed with serum, which has a reddish or a yellowish-red appearance. The brain in the immediate vicinity of the cavity is sometimes softened. Rilliet and Barthez state that they have seen eight cases of cerebral hæmorrhage of the capillary form ; ten cases in which the

hæmorrhage was in cavities ; and in two of the eighteen both forms were present. In five of those in which the form was capillary the disease was limited to portions of the brain, while in the remaining three the hæmorrhagic points were found in nearly every part of the brain.

Apoplectic cavities are seldom seen in the cerebellum, and, whether the hæmorrhage be capillary or in a cavity, there is, in most cases, as previously stated, more or less congestion of the vessels of the brain.

The proportion of cases of cerebral to other forms of hæmorrhage is believed by some to be greater in the new-born than at any other period of life. Valleix relates four cases of intracranial hæmorrhage occurring at this age, two of which were cerebral, one ventricular, and in the other the extravasation was in the cavity of the arachnoid. Mignot has published eight cases occurring in the new-born, in two of which the hæmorrhage was in cavities in the cerebrum ; in three, in the lateral ventricles ; and in three, external to the brain. If the same proportion be observed in other statistics, one in three of the cases of intracranial hæmorrhage occurring in the new-born is cerebral.

Symptoms.—The symptoms in intracranial hæmorrhage are not uniform ; they vary according to the seat as well as the quantity of the effused blood. In some cases the extravasation occurs without such symptoms as would direct attention to the brain. When the hæmorrhage occurs at the time of birth, in consequence of the strong and long-continued labor-pains, the infant is often born apparently dead. This is due partly to the hæmorrhage, partly to the great congestion of the brain which precedes and accompanies the hæmorrhage. Resuscitation is gradual and difficult. The infant's features are livid, and perhaps swollen ; its respiration is gasping, and both pulse and respiration are slow. Its cry is feeble, with but slight movement of the facial muscles, and the lungs are but partially inflated ; the eyelids are closed, and the limbs almost motionless. By artificial respiration and by friction, the pulse and breathing may be rendered more frequent, but the latter remains irregular and gasping. Finally, the limbs grow cold, the surface, from a state of lividity, becomes pallid, and death occurs in profound coma. M. Cruveilhier made many observations at the "Maternity" in reference to the death of new-born infants, and he believes that one-third of those who die in birth, at the full period, die of apoplexy. I have made post-mortem examinations in a few cases, when death had occurred from this cause, and in all the hæmorrhage was meningeal. One of these was born on the 30th of December, 1864. The birth was delayed by unusual projection of the promontory of the sacrum, so that finally the application of forceps was necessary. The infant was apparently still-born, but by persistent efforts on the part of the physician who assisted it was resuscitated so as to live several hours, though with constant embarrassment of respiration and with lividity. At the autopsy a large extravasation of blood was found in the cavity of the arachnoid,

over a considerable part of the convexity of the brain, and the substance of the brain was deeply congested.

Apoplexy in the new-born does not always terminate fatally, or, when fatal, in the sudden manner which I have described. Valleix relates the case of an infant who died of pneumonia at the age of three and a half months. Its birth had been protracted and difficult, but was completed without the use of instruments. It had had during its entire life paralysis of the right side. At the autopsy a clot was found near the base of the right thalamus opticus, evidently existing from birth. Around the clot the brain was softened to the depth of some lines, and was of a bluish-red color. A very similar case is related by M. Vernois. An infant lived forty-nine days with paralysis of the left side, and died of pneumonia. At the autopsy a hæmorrhagic excavation in the process of cicatrization was found behind the right corpus striatum and the thalamus opticus.

Intracranial hæmorrhage occurring from accidents of birth is generally attended by marked symptoms, such as have been described. But when it occurs subsequently to birth, whether in infancy or childhood, the symptoms vary greatly in different cases, and are generally obscure. I will briefly state the symptoms which have been observed in both the cerebral and meningeal forms of this disease. First, the cerebral. Sédillot relates the case of a child seven and a half years old, whose bare head had been exposed several hours to the sun's rays. Suddenly, after a paroxysm of anger, it was seized with great pain, corresponding with the posterior and inferior fossæ of the cranium. It uttered piercing cries, and died in a quarter of an hour. A clot was found in the right lobe of the cerebellum. Richard Quinn (Rilliet and Barthez) gives the history of a boy nine years old, who in playing with a hoop suddenly stopped, carried his hands to his head, and fell backward unconscious. Three or four hours afterward when examined, he was found pale, surface cool, respiration slow and at times stertorous, pulse 50 to 60 per minute ; the left arm was flexed, the left leg paralyzed ; the right leg and arm convulsed ; right pupil strongly dilated, the left contracted. He died seven hours after the commencement of the attack, and a large clot was found in the centrum ovale on the right side.

Rilliet and Barthez relate the following case from Campbell. A boy with good previous health was suddenly seized about 7 A.M. with repeated vomiting, and in an hour and a half with violent convulsions ; he rolled his eyes and uttered inarticulate cries ; pulse frequent and hard ; pupils contracted ; trunk and lower extremities cool. In the afternoon he presented symptoms of compression of the brain, such as dilatation of the pupils, frequent and feeble pulse. Death occurred in the evening, and a hæmorrhagic cavity was found occupying the right middle lobe of the cerebrum. Guibert relates a case of extravasation in the superior part of the right hemispheres of the brain in a boy fourteen years old. The principal symp-

toms were feebleness of the limbs, inability to walk, cephalalgia, involuntary evacuations, fever, grinding of the teeth, rigors severe and prolonged, lividity, loss of intellectual faculties, dilatation of the pupils, insensibility to light, stertorous respiration. Death occurred in about an hour.

Rilliet and Barthez narrate the history of a girl two years old, who, after an attack of measles, was taken with convulsions accompanied with fever and prostration. The convulsive movements affected especially the eyes and upper extremities ; the right leg was immovable ; the left pupil dilated. These symptoms resulted from hæmorrhage in the corpus striatum and opticus thalamus. The same authors relate also the case of a girl, seven years old, who died with a large apoplectic cavity in the left thalamus opticus. The symptoms were headache, convulsive movements, loss of consciousness, delirium, vomiting and constipation, and convergent strabismus. These symptoms nearly disappeared, but in a few days the headache returned, with strabismus and a slight drawing of the face toward the left ; on the twenty-seventh day convulsive movements of the right eye were observed, with paralysis of the arm. Finally contraction of the arms occurred, with acceleration of pulse, irregular breathing, dilated pupils, paralysis, and retraction of the head, followed by death on the forty-eighth day.

These cases, and those from Valleix and Vernois, which have been related in our remarks on hæmorrhage of the new-born, are sufficient to show the character of the symptoms in that form of cerebral hæmorrhage in which the extravasated blood forms a cavity in the interior of the brain.

If the amount of extravasation be large, and the substance of the brain be much lacerated and compressed, death may occur almost immediately, and, therefore, without symptoms, or before it is possible to determine whether or not symptoms are present. If the disease be not so speedily fatal, the symptoms, as appears from the above cases, are headache, confusion of thought, or even insensibilty, cries, sometimes piercing, cold extremities, pallor, slow and perhaps stertorous respiration, convulsive movements followed by paralysis, or convulsions affecting one or more limbs, with paralysis of others, pupils contracted or dilated, sometimes one contracted and the other dilated, strabismus, rolling of eyes, vomiting.

These symptoms have all been observed in different cases, but they are not all present in any one case. Those which are generally present, and on which we mainly rely for diagnosis, are headache, convulsive movements, paralysis, confusion of thought, irregularity in the pupils, and strabismus.

In the CAPILLARY form of cerebral hæmorrhage there is usually some complication, so that it is not easy to determine how far symptoms are due to the hæmorrhage, and how far to the coexisting pathological state.

There are, indeed, but few published observations of capillary hæmorrhage in the substance of the brain uncomplicated with meningeal hæmor-

rhage, hæmorrhage into a ventricle, or some other and distinct disease, but so far as I have been able to ascertain the symptoms referable to this form of extravasation, they are as follows : The child is drowsy ; fretful when disturbed ; it perhaps moans. There are sometimes slight convulsive movements and partial paralysis. If there be considerable extravasation, the respiration is irregular and sighing. Death occurs in coma, occasionally preceded by convulsions. Taupin relates the case of a child nine years old, who died with this form of hæmorrhage, accompanied by softening of the brain. The disease began at night, with delirium, agitation, and piercing cries. In the morning the patient lay in bed, drowsy, not complaining of pain, and not replying to questions ; pupils dilated, and insensible to light ; left eye half open during sleep, and its axis changed ; eyebrows contracted ; face pale ; mouth open ; had no convulsions, but transient stiffening of the limbs, during which the thumbs were firmly compressed by the fingers ; senses unimpaired, but the face drawn to the right ; deglutition difficult ; pulse small, irregular, and feeble ; respiration 32, sighing. In the evening he had rigidity of the limbs and back, and, finally, was taken with general convulsions, in which he died at eleven o'clock. The hæmorrhagic points in this case were numerous. A boy five years old, whose case is described by Rilliet and Barthez, died of this disease, pneumonia, and white softening of the intestine. During the last five days there were cerebral symptoms, the chief of which were drowsiness, fretfulness when disturbed, and moaning without apparent cause. Another child, whose case is described by Rilliet and Barthez, died at the age of four years, with cerebral capillary hæmorrhage, accompanied by yellow softening. Six months before death he had general convulsions, followed by spasmodic movements of the left side. These subsided, but the left side remained feeble.

In Meningeal Hæmorrhage there are often convulsions, general or partial, in some patients tonic, in others clonic. When partial, the convulsive movements may only occur in the muscles of the face and eyes. With the spasmodic muscular action is a degree of drowsiness and irritability. Paralysis, so common in the apoplexy of the adult, and not infrequent, as we have seen, in the cerebral form of early life, is sometimes, but not ordinarily, present in meningeal hæmorrhage. Instead of paralysis, there are vomiting, some febrile action, thirst, and loss of appetite. The symptoms are different, however, according to the exact seat of the hæmorrhagic extravasation, and the duration of the disease. If the extravasation end in the formation of a cyst, the symptoms are those of hydrocephalus. The following condensed history of cases which I have selected as typical, will give us a clearer idea of the history and course of the various forms of meningeal hæmorrhage than can be imparted by a narration of symptoms :

M. Tonnelé relates the case of a child who was taken with faintness and

convulsive movements. On the following day the trunk and inferior extremities became rigid ; deglutition was painful ; the pupils were largely dilated, immovable ; face pale ; pulse feeble and intermittent. Death occurred the same day. The dura mater was distended. A layer of coagulated blood, of great thickness, extended over the convexity of each hemisphere. The veins ramifying in the superior portion of the cerebrum were distended with coagulated blood. The hæmorrhage was in the meshes of the pia mater. Drs. Lombard and Panchard, of Geneva, relate a somewhat similar case. A child, thirteen months old, was convalescing from inflammation of the bronchial and intestinal mucous surfaces, when it was seized with general convulsions ; the mouth and eyes were open, and the eyes directed upward ; pupils contracted ; pulse frequent and irregular. The convulsions abated somewhat ; but soon reappeared with violence. The patient became insensible, and died nineteen hours after the commencement of cerebral symptoms. The extravasated blood covered the upper surface of both hemispheres. From the above cases we see the symptoms and the course of meningeal hæmorrhage, when the extravasation is so large that death speedily results. In protracted cases of meningeal hæmorrhage, there is either a gradual disappearance of symptoms and return to health, or, circumscribed hydrocephalus occurring, the symptoms of that disease arise.

Diagnosis.—It is evident, from what has been stated, that the diagnosis of intracranial hæmorrhage is attended with unusual difficulty, since the symptoms of this disease occur also in other and distinct pathological states. The history of the case, and especially the character of the cause, if ascertained, will aid in diagnosis. If there have been an obvious determination of blood to the brain, or some known obstruction to the return of blood from that organ, the persistence of cerebral symptoms would justify us in concluding that either serous or sanguineous effusion had supervened on a state of congestion. The points of differential diagnosis between apoplexy and meningitis are the sudden and full development of symptoms in one case, the gradual commencement and gradual increase of symptoms in the other ; differences also of symptoms in certain respects ; for example, as regards febrile reaction, constipation, etc.

There is one symptom in cerebral hæmorrhage which is of great diagnostic value, namely, paralysis. Its presence affords strong evidence that there is extravasation of blood, and probably in a cavity in the substance of the brain. If the extravasation end in the formation of a cyst, the symptoms and appearances of hydrocephalus, which, after a time, arise, throw light on the nature of the disease.

Prognosis.—There can be no doubt that many cases of intracranial hæmorrhage occur and terminate favorably without the nature of the disease being suspected. In such cases the amount of extravasated blood is small or moderate. In several published cases in which the accuracy of

the diagnosis was shown by post-mortem examinations, the patients were convalescing from the hæmorrhage when they succumbed to intercurrent diseases. If, however, the amount of extravasated blood be such as to give rise to those symptoms which have been described, the prognosis is unfavorable. Recurring convulsions, and persistent stupor from which it is difficult to arouse the patient, are unfavorable symptoms. If the convulsions cease, and consciousness return, even if there be paralysis, the result may be favorable.

Treatment.—The proper treatment in intracranial hæmorrhage depends on the state of the patient, the time which has elapsed since the extravasation, and the degree of it, as shown by the nature and severity of the symptoms. If, as is often the case, the patient be robust, and be visited soon after the commencement of the attack, cold applications should be made to the head, mustard to the back of the neck and perhaps chest, and derivation should be produced by mustard pediluvia. In many cases, especially in active congestion, it is advisable to apply leeches to the temples, and the bowels should be opened by a stimulating enema. In active congestion, also, prompt purgation by salines or other cathartics is sometimes of great importance. The object of such treatment is to relieve congestion of the cerebral and meningeal vessels, and thereby prevent further extravasation of blood. If the congestion be active, the pulse continue full and frequent, and the face be flushed, it is proper in many cases to control the action of the heart by a sedative. For this purpose the tincture of aconite root may be given in doses of one drop to a child five years old, repeated in three hours if necessary, or veratrum viride may be used. If the stupor or convulsions continue after sufficient time have elapsed for the patient to receive the full benefit of the above remedies, more active counter-irritation is required. Cantharidal collodion should be applied behind each ear. If the hæmorrhage occur from passive congestion, or in a cachectic state of system, active depressing remedies should not be employed. External derivatives are of service, as well as cool applications to the head, and we should attempt, so far as possible, to remove the cause of the congestion and hæmorrhage. If it depend on a cachectic state, tonic or other remedies calculated to relieve this state are indicated. The hæmorrhage from such a cause is apt to be in points in the substance of the brain, or in moderate quantity over the surface of this organ, and by a timely use of constitutional remedies possibly we may prevent further extravasation of blood and increase the chance of the patient's recovery.

If a cyst result from the hæmorrhagic effusion, the treatment which is proper is that described in the chapter on Acquired Hydrocephalus.

CHAPTER VII.

CONGENITAL HYDROCEPHALUS.

Congenital hydrocephalus consists in an excess of the cerebro-spinal fluid, lying either external to the brain, or more frequently in its interior. It is due to some vice in the development of the brain or its membranes, or to a pathological state occurring in them during intra-uterine life. This disease is ordinarily apparent from the symptoms and appearances at birth, but not always. Occasionally nothing unusual is observed in the shape of the head or aspect of the infant till after the lapse of some weeks, when the characteristic physiognomy begins to appear. In these cases the disease is still congenital, since there is every reason to believe that the abnormal state to which the excessive production of fluid is due existed from birth. In cases of arrested or partial development of the brain, as, for example, when a considerable portion of the hemispheres is absent, there is often an unusually large quantity of fluid which serves as a compensation for the lack of brain. I do not regard such cases as examples of hydrocephalic disease, since the effect of the fluid is not injurious, but rather useful. I restrict the term congenital hydrocephalus to those cases in which the brain is complete, or, if incomplete, the quantity of fluid is more than sufficient to supply the deficiency.

Anatomical Characters.— According to M. Breschet, the fluid in congenital hydrocephalus may be—1st, between the dura mater and the cranium ; 2d, between the dura mater and the parietal arachnoid ; 3d, in the cavity of the arachnoid ; 4th, in the ventricles ; 5th, between the arachnoid and the brain.

In a large majority of hydrocephalic patients the seat of the effusion is the ventricles. As the quantity of fluid increases, the pressure from within gradually unfolds the convolutions of the brain, at the same time producing expansion of the cranial arch. When the amount of fluid is considerable, and it becomes so in the course of a few weeks or months, the hemispheres are spread out in a thin lamina on either side, gradually decreasing in thickness from the base of the cranium to the vertex, where the brain-substance is sometimes so thin as to be scarcely perceptible. Complete absence of brain in this situation, namely, at the vertex, even in extreme cases of expansion and flattening of the hemispheres from the pressure of the liquid, is rare, though the brain-substance at this point is sometimes almost as thin as either of the membranes, so that the wall of the sac is translucent. The membranes which surround the brain do not usually undergo any alteration, except such as arises from the distension.

The falx cerebri sometimes disappears, and sometimes the meninges present a whiter hue from maceration than in health. The distension also causes such an expansion of the pia mater that it becomes very thin, and in places scarcely visible, but its presence in every point can be demonstrated.

The accompanying woodcut represents congenital hydrocephalus as it ordinarily occurs. I saw this infant when it was a few days old, and examined it from time to time till its death. The parents are healthy and have other healthy children. This infant when nine days old began to

FIG. 18.



have clonic convulsions of a mild form in the muscles of the face, neck, and limbs, which recurred almost daily till the age of six weeks, and sometimes every five or ten minutes. When the convulsions ceased in the sixth week, the head was observed to enlarge, and its excessive growth continued till death, which occurred at the age of seven months and one week. While the volume of the head progressively increased, the trunk and limbs emaciated. At death the occipito-frontal circumference of the head was nineteen and a half inches; the vertical from auditory meatus to meatus thirteen and a half inches.

The changes which the cranial bones undergo, both in their chemical character and in their shape, in hydrocephalic patients, if the amount of fluid be considerable, are interesting and remarkable. The base of the cranium undergoes little change, but those portions of the frontal, parietal, and occipital bones which constitute the arch are expanded in all directions, while they become much thinner. There is deficiency of lime in their constitution, so that the organic elements are greatly in excess.

This renders them flexible and semi-transparent. Notwithstanding the expansion of the bones, there are usually interspaces between them, of greater or less size, according to the amount of fluid.

The scalp, being stretched by the pressure underneath, becomes tense and thin, and is scantily covered with hair. The veins which ramify in it are unusually prominent and large, and the head is elastic on pressure, from the amount of liquid beneath. In the common form of congenital hydrocephalus, namely, that in which the liquid is in the interior of the brain, the shape of the orbital plates of the frontal bone is often changed, so that the eyeballs have a downward direction. This change in the axis of the eyes occurs at an early period, and it continues through the entire disease, becoming more and more marked as the quantity of liquid increases. If the amount be large, the lower part of the cornea is buried under the under eyelid, while the conjunctiva is visible between the cornea and the upper eyelid. The persistent downward direction of the eyes is characteristic of this disease, and, in connection with enlargement of the head, is an important diagnostic sign. Nevertheless, hydrocephalus even of the ventricular variety, sometimes occurs without change in the direction of the eyes.

If we examine the interior of the cavity after the fluid is evacuated, we will find at its base the parts which lie in the floor of the lateral ventricles, but changed in appearance in consequence of pressure. The cornua are enlarged, and the thalami optici and corpora striata are flattened. In the early stages of the disease, when the amount of fluid is small, there is probably no absorption or destruction of parts in the interior of the brain. The various portions of this organ retain nearly their normal relation to each other. As the quantity of fluid increases, the foramen of Monro, which unites the lateral ventricles, becomes enlarged, the septum lucidum which separates them disappears, and the two ventricles form a common cavity. In most fatal cases we find this single large cavity. The surface which surrounds the cavity occasionally presents a whitish or semi-opaque appearance, which has led to the belief, that at a period antecedent to birth there was subacute inflammation of this surface, and hence the effusion.

The bones of the face are ordinarily less developed than in healthy children of the same age, so that the disproportion between the head and face becomes a marked peculiarity. The shape of the forehead and face is nearly triangular.

The foregoing remarks in reference to the anatomical characters of congenital hydrocephalus refer in the main to cases which have continued for a considerable time, so that their characteristic features are well marked. In very young infants, in whom the disease is still recent, similar anatomical characters are present, but in less degree.

Congenital hydrocephalus is often associated with other vices of conformation, especially with spina bifida. The two, when coexisting, are

only parts of the same disease; the large quantity of cerebro-spinal fluid preventing the spinal canal from closing during fœtal development.

The fluid in congenital hydrocephalus consists largely of water, in the proportion even of 99 parts in 100. In addition to this element, there are traces of albumen, chloride of sodium, phosphate and carbonate of sodium, and osmazome.

I have had an opportunity to witness only one post-mortem examination in a case of congenital hydrocephalus in which the liquid was exterior to the brain. This case was under observation in the children's service of Charity Hospital, in 1866. Full notes and measurements of the head were taken, which, unfortunately, were mislaid or lost. The infant had congenital syphilis, and had a pallid, strumous appearance. The shape and relative size of the head are seen in the accompanying figure, from a photograph. While the whole head was enlarged, there was a relative excess of development in the part between and above the ears. The axis of the eyes was not at all changed, and the vision was good. The appearance corresponded so closely with descriptions of hypertrophy of the brain that this was supposed to be the anatomical state. Antisyphilitic treatment was employed, and the syphilitic eruptions had nearly disappeared, when diarrhœa supervened, followed by death. At the autopsy a quantity of transparent or light straw-colored liquid, estimated at six or seven ounces, was found exterior to the brain, in the great cavity of the arachnoid, lying mostly over the superior surface of the organ. There was no excess of liquid in the ventricles, and the brain, though of good size, was not abnormally large, nor did it possess the firmness which is present in true hypertrophy.

FIG. 19.



All cases of congenital hydrocephalus may be embraced in two groups, namely, that in which the liquid is in the interior of the brain, and that in which it lies exterior to the organ. Liquid primarily in the arachnoidean cavity permeates the meshes of the pia mater, and lies in part underneath it, or this delicate membrane may be ruptured. Four of the groups, therefore, described by Breschet, may properly be reduced to one, namely, those groups in which the liquid lies under, between, or external to the meninges. It is probable that some of the cases which led to Breschet's classification were examples of acquired circumscribed hydrocephalus, the result of extravasation of blood. In this form of hydrocephalus, as is stated elsewhere, an adventitious membrane forms external to the liquid, becoming in time thin and delicate, and often bear-

ing a close resemblance to the normal membrane (especially the arachnoid), for which it is sometimes mistaken.

Symptoms.—If there be a considerable amount of hydrocephalic fluid prior to the birth of the child, so that the head is abnormally large, parturition is seriously interfered with. The scalp and meninges may become ruptured by the severity of the pains so that the fluid escapes. If this do not occur, the labor is often necessarily instrumental. Whether the liquid be present before birth or accumulate subsequently to it, the tendency is to an increase of the quantity, and a corresponding enlargement of the head.

The digestive function in this disease is at first well performed. The infant nurses readily, and has its evacuations with the regularity of other children. Not many weeks, however, elapse, in the majority of cases, before defective nutrition is apparent.

While the volume of the head increases, other parts are imperfectly nourished and stunted in their growth. Emaciation is common of the neck, trunk, and limbs, associated with progressive feebleness. In the last stages of this disease there is more or less vomiting, with constipation. If there were previously the ability to support the head, it is now lost and the erect position is no longer possible. In marked cases, when there is great disproportion between the head and the rest of the system, there is frequently not even the ability to rotate the head on the pillow. As long as the cranial bones yield readily to the pressure from within, and there is no compression of the brain, the function of this organ is not seriously impaired. The child recognizes its mother or nurse, and it can be amused like other children, though easily fatigued. The state of the senses is different in different cases, and sometimes at different stages of the same case. The sight and hearing in some are perfect, in others impaired; while in others still they are good at first, but gradually become obscured and lost. It is said that the sense of smell may be perverted, so that agreeable odors are unpleasant, and *vice versâ*. Many, reaching the age at which children begin to walk, cannot walk, or, if they do, it is with a tottering, unsteady gait.

When the liquid increases to that extent, and it usually does sooner or later, that the brain begins to be compressed, dangerous cerebral symptoms arise. The child becomes drowsy, and takes less notice of objects. Spasmodic muscular contractions and finally convulsions occur. The pupils act feebly or irregularly by light, or one is more dilated than the other. Strabismus also occurs. As death approaches, eclampsia, partial or general, becomes more frequent, and is succeeded by stupor from which the patient cannot be aroused.

The following case, which I copy from my note-book, is an example of the common form of congenital hydrocephalus. It will give an idea of the ordinary course of this disease, and show the difficulty which we meet

with in its treatment. Female, born November 9th, 1859, with the aid of forceps. At birth the fontanelles were unusually large, the cranial bones separated, and the aspect in a marked degree hydrocephalic. She nursed at first, but, the mother's milk failing, she was afterward bottle-fed. At the age of four months her head, which had increased faster than her general growth, measured from one auditory meatus to the other, over the vertex, seventeen inches ; the occipito-frontal circumference, twenty-three inches. At this time she manifested considerable intelligence, being able to distinguish her mother from other persons, though the head was so large that it was necessary to support it constantly on a pillow. From the age of four to six months the operation of tapping was performed six times with a small hydrocele trocar, by Prof. Stephen Smith, at a point near the coronal suture, and from one inch to one inch and a half from the sagittal. At each operation an amount of fluid varying from twelve ounces to one pint was removed, and the head then covered with strips of adhesive plaster, so as to form a complete cap. It was necessary, however, within the twelve hours succeeding each operation, to loosen the dressing on account of either the occurrence of convulsions or symptoms premonitory of them. The head, within a week subsequently to each operation, regained its former size, and, as there was no permanent benefit, this treatment was discontinued. She finally died of entero-colitis at the age of ten months and five days.

At the autopsy the distance from one auditory meatus to the other was twenty and a quarter inches ; the occipito-frontal circumference, twenty-six and a quarter inches. The anterior fontanelle measured antero-posteriorly four and three-fourths inches ; transversely, seven and three-fourths inches. The parietal bones were separated from each other to the distance of two or three inches, and they measured in length nine and one-half inches.

On opening the cranial cavity, seven pints, by measurement, of transparent fluid escaped, exposing a vast open space, at the bottom of which were the parts which constitute the floor of the ventricles, somewhat changed in shape, and from them, on either side, the hemisphere was spread in a lamina, so as to cover the internal surface of the cranial bones. The laminæ near the base of the brain measured in thickness from half an inch to one inch, and they gradually became thinner on approaching the vertex, at which point the brain-substance was exceedingly thin, so as to be scarcely demonstrable.

The brain had its normal vascularity and consistence, and the cerebellum, medulla oblongata, the base of the brain, and cranial nerves presented their usual appearance. On folding the brain together, it had the size, shape, and aspect of this organ in its ordinary development. Nothing unusual was observed in the membranes except their great expansion. The above case corresponds in its general features with most cases met in practice.

Diagnosis.—The ordinary form of congenital hydrocephalus, that in which the liquid occupies the interior of the brain, can, in most cases, be readily diagnosticated. If there be only a moderate amount of liquid, it may be confounded with hypertrophy of the brain. In hydrocephalus there is commonly more rapid growth and greater expansion of the head; moreover, the enlargement occurs equally on all sides, while in hypertrophy, though all parts of the cranial vault are expanded, the enlargement is more at the vertex than elsewhere. The hydrocephalic head yields more readily to pressure than the hypertrophied, and often communicates a fluctuating sensation. Moreover, in the ordinary form of hydrocephalus, the change in the axis of the eyes described above is an important diagnostic sign. In rachitis the volume of the head is often considerably enlarged, due sometimes, in part at least, to a deposit of calcareous matter on the exterior of the cranial bones. The differential diagnosis is based on the shape of the head, round in one, square or with prominences in the other, on palpation, direction of the eyes, etc. The smaller the amount of liquid, the greater the liability to error of diagnosis; but if the amount be inconsiderable and not increasing, little treatment is required, except hygienic and tonic, which is also proper in both hypertrophy and rachitis. If the liquid be exterior to the brain, as in the case represented on page 516, diagnosis may be difficult, but such cases are infrequent.

Prognosis.—This is unfavorable. The amount of liquid in congenital hydrocephalus, as already stated, commonly increases. The most favorable result is no increase, or but slight, in the quantity, while the natural growth of the infant continues, and thus the disproportion between the head and the rest of the system gradually disappears. This result is exceptional. Ordinarily, while the quantity of fluid increases, the nutrition of the body and limbs is more and more deficient. The patient, if not cut off by some intercurrent disease, finally succumbs with cerebral symptoms produced by pressure of the fluid. The majority of those affected with congenital hydrocephalus die in infancy, but some enter childhood, and occasionally one reaches even adult life. Cases of recovery have been reported, but if they were genuine, the disease was evidently mild, and the amount of liquid small or moderate.

Treatment.—It is a proper question, in many cases, whether anything should be done to relieve the hydrocephalic infant besides attending to its general health. The anxiety of parents, however hopeless the nature of the case if left to itself, reported recoveries, and the fact that we have medicines which in many instances diminish the amount of liquid in the internal cavities, incline us to the use of therapeutic measures.

We may attempt to diminish the quantity of fluid by the use of diuretics. Digitalis, squills, nitrate and acetate of potassium, have been used. Probably the most efficient diuretic in these cases is iodide of potassium. This may be given in doses of one to two grains every two hours to an infant of

six months. Constipation, if present, should be relieved by an occasional purgative. If it be tolerated, we may partially prevent the expansion of the head by a close-fitting cap. For this purpose strips of adhesive plaster about one-third of an inch in width, should be applied so as to cover the entire head. The proper way of applying these is as follows : First, one strip from each mastoid process to the outer part of the orbit on the opposite side ; secondly, from the back of the neck, along the longitudinal sinus, to the root of the nose ; thirdly, over the whole head, so that the different strips will cross each other at the vertex ; and, lastly, a strip long enough to pass three times around the head should be applied, passing above the eyebrows, the ears, and below the occipital protuberance. Too tight an application should be avoided, as it may give rise to convulsions or other cerebral symptoms. If the cap can be tolerated, and the general health be good, the prospect is more favorable ; but usually, from the increase in the quantity of fluid, it is necessary in a few days to remove or loosen the plasters in order to prevent convulsions. If this treatment be not successful, we may finally resort to tapping. The mode of performing this operation has already been indicated in the case which I have detailed. No appreciable good result has followed the use of irritating or sorbefacient applications to the head. Nutritious diet and attention to the general health are requisite.

CHAPTER VIII.

ACQUIRED HYDROCEPHALUS.

Hydrocephalus, or dropsy of the brain, may also occur in those who at birth are well formed and free from disease. Pathologists call this acquired hydrocephalus. It is in nearly all cases the result of disease, which is located sometimes within the cranium, but often in other parts of the system.

Causes.—The diseases within the cranium which most frequently produce serous effusion are the meningeal inflammations, both simple and tubercular, tumors or other causes which obstruct the venous circulation, and hæmorrhagic effusion ending in the formation of cysts. Prolonged passive congestion often ends in transudation of serum through the coats of the capillaries. Therefore, all those causes of congestion, except such as have a transient or momentary effect, may be regarded as causes of serous effusion.

Among the diseases external to the cranium which produce serous effusion within or upon the brain, may be mentioned retropharyngeal abscess, tuberculization or inflammation of the bronchial glands, scarlet fever, and certain affections of an exhausting nature, especially protracted diar

rhœal maladies. In at least five cases which have fallen under my notice, and in which post-mortem examinations were made, the cause was enlarged tubercular bronchial glands, which, by pressure on the venæ innominatæ, so retarded the flow of blood from the brain as to cause congestion and effusion. The causative relation of these glands to cerebral congestion is more fully described in our remarks in reference to this disease.

Dropsy of the brain is common in protracted infantile diarrhœa, as in advanced cases of intestinal catarrh of the summer months in the cities. It is preceded and accompanied by passive congestion of the cerebral veins and sinuses, due in part to feebleness of circulation in consequence of the exhausted state of the patient, and in part to the wasting of the brain, which always gives rise to more or less passive congestion, unless in young infants, in whom the cranial bones become depressed and override each other. Dropsy of the brain resulting from scarlet fever, and that peculiar circumscribed dropsy which results from hæmorrhagic effusions, are described elsewhere.

A few cases have been related by different observers, Abercrombie among others, in which dropsy of the brain seemed to be essential. Nothing abnormal was observed, with the exception of serous effusion. But the reports of such cases are, for the most part, meagre ; and, as Barrier has well said, we are not to accept such cases as examples of essential dropsy of the brain, unless the post-mortem inspection be so complete as to render it certain that there was no pathological state which might cause the dropsy.

Anatomical Characters.—Acquired hydrocephalus usually occurs after the cranial bones are firmly united, and, therefore, the shape of the head is not materially altered. If it occur at an early age, before there is firm union, there may be expansion of the cranial arch, as we sometimes observe in the circumscribed hydrocephalus resulting from hæmorrhage. The effusion in acquired hydrocephalus occurs over the surface of the brain, in the subarachnoid space, or in the lateral ventricles. In the dropsy of protracted diarrhœal maladies, I have rarely failed to find the liquid over the whole superior surface of the brain as well as at its base.

The quantity of fluid in this disease is not large. In the majority of cases it does not exceed four ounces, and is often much less. It is transparent, or it has a slightly yellowish tinge. The membranes of the brain sometimes present their normal appearance, but in other cases they are injected. The brain itself, in some instances, has an injected appearance from passive congestion of the veins and capillaries ; but in others, when there has been more or less compression of the brain, there is no more than the ordinary, or even less than the ordinary vascularity, and the convolutions are somewhat flattened.

Symptoms.—The symptoms of the pathological state, which gives rise to the dropsy, precede and accompany those which are referable to the

dropsy itself. The dropsy declares itself by symptoms which are alarming from the first.

In children old enough to speak, or manifest intelligence, there may be at first complaint of headache. The child is irritable, its mind confused or wandering at times, or there is actual delirium. After a time drowsiness occurs. The head seems too heavy for the body, and is buried in the pillow. In fatal cases the features become pallid, the pupils sluggish, and perception and consciousness are gradually lost. The child lies in profound sleep, which increases. There are now often convulsive movements partial or general, and these soon end in coma, in which the patient dies.

The following was an interesting case of acquired hydrocephalus, which seemed to result from subacute meningitis. The patient was seen by several physicians, and the diagnosis was for a long time doubtful.

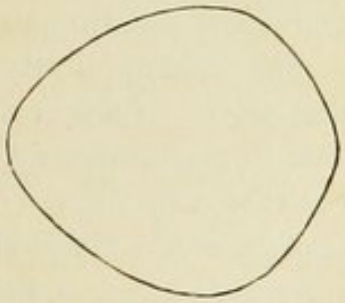
Harry R. L., of healthy parentage, was well till the summer of 1876, when he was nearly at the close of his third year. At this time he was observed to be feverish and fretful and his features were flushed at times. He also complained almost daily of pain in the top of his head, which pain was intermittent, and these attacks of headache occurred for at least six months, perhaps longer. There had been no backwardness in dentition, and no symptoms of rachitis or struma, and his nutrition was good even after the commencement of the present malady.

In February or March, 1877, his stomach became irritable, so that he vomited often during the following months, and about the same time he began to lose the use of both legs—a progressive paralysis—and his bowels became constipated. Both urination and defecation were sluggishly performed.

In July, 1877, he ceased to walk, and he has not been able to stand since.

On March 29, 1878, the following records were made : No improvement, but gradual increase of most of the symptoms ; lies constantly ; moves his limbs slowly, and infrequently, but completely, and sensation appears to remain in all of them ; his eyes are clear and pupils moderately dilated, but without vision—how long his sight is lost is not known ; axis of eyes not depressed or otherwise changed, and parallelism retained ; the cranium, which during the first year of his sickness underwent little change, has expanded rapidly during the last six months ; the enlargement is most marked above the ears ; the occipito-frontal circumference is represented in the accompanying diagram ; this circumference measures twenty-one and a half inches, of which nine and three quarters are in front of ears, and eleven and one-third inches posterior to ears ; distance over vertex from one auditory meatus to the other, fifteen and one-quarter inches. The anterior fontanelle is observed to be open, though

Fig. 20.



small, the diameter being about one-fourth or one-third of an inch; it is not elevated, and the surrounding edge of bone is flexible.

This patient lived till near the close of 1880, without material change in symptoms, and with moderate but progressive increase in the size of the head. At the autopsy measurements were again made, but they have been mislaid. The enlargement was found to be due to the presence of about three pints of straw-colored serum in the lateral ventricles, which had been changed into a large cavity. There was nothing to indicate any other disease. From the history and appearances we inferred that the hydrocephalus had been due to a mild meningitis occurring in the third year. The appearance and state of the encephalon was precisely like that in the ordinary congenital hydrocephalus.

Prognosis.—Acquired hydrocephalus commonly ends unfavorably. The prognosis depends not only on the quantity of liquid, but on the nature of the cause. If the cause be venous obstruction within the cranium or thorax, as we have no means of removing it, death is inevitable. If it be an exhausting disease, as entero-colitis or scarlet fever, although the case is not absolutely hopeless, the prospect is still unfavorable. It is only favorable when the quantity of effused fluid is small, the system not much reduced, and the primary disease mild. When acquired hydrocephalus arises from meningeal apoplexy, the case is apt to be chronic. The symptoms and termination of this form of the disease are very similar to those in congenital hydrocephalus.

Treatment.—The treatment in acquired hydrocephalus must vary somewhat in different cases, according to the nature of the disease on which it depends. I shall indicate the treatment, in part at least, in the description of these diseases. Occasionally the condition of the patient is such that there is little to encourage us in the employment of any remedial measures. In vigorous children, if acquired hydrocephalus occur in connection with symptoms which indicate too active a circulation, moderate abstraction of blood from the temples at an early period may be useful, but cases requiring such depletory measures are rare. These cases require cold applications to the head; the bowels should be opened, and derivatives should be applied to the feet and back of the neck.

If the congestion be of a passive character, as when the circulation is obstructed by tumors or otherwise, benefit may still be derived from cold applications to the head, and derivatives to other parts. In most cases of suspected dropsy of the brain, unless the patient be in such a hopeless state that all treatment is obviously futile, vesication should be produced behind the ears. I prefer cantharidal collodion for this purpose. In addition to this treatment, diuretics should be employed, unless there be too great prostration, or the course of the disease be so rapid that no benefit can result in consequence of the tardy action of these agents. The best diuretics are the acetate of potassium and iodide of potassium.

CHAPTER IX.

MENINGITIS, TUBERCULAR AND NON-TUBERCULAR.

The most interesting and important disease of the cerebro-spinal system in early life, is that which is now designated meningitis. It is not infrequent. The mortuary statistics of this city show that it is the cause of death in from one in twenty-five to one in fifty of the entire number of deaths, the proportion varying somewhat in different years.

In 1768, the attention of the profession was particularly called to this disease by Dr. Whytt, of Edinburgh. This observer, and the pathologists succeeding him, forming their opinion of meningitis from its most prominent anatomical character, namely, serous effusion, believed it a dropsy. They accordingly designated it acute hydrocephalus. During the last thirty years the profession have come to regard the disease as inflammatory, and hence the name by which it is now known, and which is believed to express its true pathological character.

Sometimes meningeal inflammation in children occurs without tubercles. In other instances it results from the presence of tubercles, and in most, if not in all such patients, there are tubercles in or under the meninges, which excite the inflammation in the same manner as in the lungs they cause pneumonitis or pleuritis. Therefore two forms of meningitis are recognized, namely, tubercular and non-tubercular.

Prior to 1868 I had preserved records of forty-five fatal cases of meningitis, some occurring in my private practice, and the remainder in institutions of this city with which I have been connected. Post-mortem examinations were made and recorded in thirteen of them. Twenty-five were under the age of one year, of which fifteen were apparently well when the meningitis commenced, belonging for the most part to healthy families ; three were feeble and cachectic, but apparently without tubercles ; and five had miliary tubercles in various organs, as shown by post mortem examination. The condition of the other two, as regards the probable presence of tubercles, was not recorded.

Of the twenty who were over the age of one year, the majority, namely, thirteen, presented a decidedly cachectic or a strumous aspect before the meningitis occurred, and a considerable number had symptoms of pulmonary tubercles. These statistics, as far as they go, show that non-tubercular meningitis predominates under the age of one year, and I may add eighteen months, while over that age the tubercular cases are in excess.

M. Bouchut, speaking in reference to tubercular meningitis, says

as follows: "Up to this period it was not believed that this disease existed in young children, for no mention is made of it in the works of Denis and Billard. Still its existence at this age is, nevertheless, incontestable. MM. de Blache, Guersant, Rilliet and Barthez, and Barrier have observed several examples of it, and I have collected six cases of this disease in the practice of M. Trousseau. The youngest child was only three months old, and the eldest had arrived at the end of his second year. No statistics can be based on so small a number of facts; the only value they have consists in their overruling an opinion falsely accredited in medical science." I have witnessed the post-mortem of five cases of tubercular meningitis occurring in children under the age of one year, as is seen from the above statistics, and the age of one of these was only four months. In two, perhaps I should say three, of the five the presence of tubercles in the meninges was not positively demonstrated; but in all of the five cases miliary tubercles were present in the lungs and other organs, so that I did not hesitate to consider the meningeal inflammation of a tubercular character.

In patients over the age of eighteen months, although the proportion of tubercular to non-tubercular cases is larger than under this age, the excess is not so great, according to my statistics, as the remarks of some observers lead us to suppose. There can be no accurate statistics of tubercular meningitis without careful post-mortem examination of the state of the brain and other organs in each supposed case, and this examination sometimes shows the meningitis to be non-tubercular, when the symptoms and signs had indicated its tubercular character. As an example, may be mentioned a case which occurred in the children's service of Charity Hospital, in March, 1868. The infant died at the age of twenty months, having had a cough of moderate severity at least three weeks before death, and symptoms of meningitis about four days. It was considerably wasted, and was supposed to have tuberculosis. At the autopsy, no tubercles were found in any part of the body, but parts of both lungs were hepatized. A fibrinous deposit, varying in thickness, was found over the pons Varolii, the optic commissure, along the fissures of Sylvius, over the superior surface of the anterior half and also upon the superior lobe of each cerebral hemisphere. As the examination failed to discover any tubercles, the meningitis was considered non-tubercular. Those who make these examinations, failing to find tubercles in the lungs and other organs in which they usually occur, should examine the lymphatic glands, since cheesy glands may be the cause of the formation of tubercles in the meninges, while the organs of the trunk remain unaffected. The presence of cheesy glands in the absence of visceral tubercles, and with granulations upon the meninges, small, covered with fibrin, and of a doubtful character, goes far toward establishing the tubercular nature of the meningitis. Since the cases which furnished the above statistics were

observed, now more than thirteen years, I have been led by a more extended experience, and especially by the observation of cases in the New York Foundling Asylum, where there is ample material, to regard not only the presence or absence of tubercles, but also of caseous substance, as the proper test of the form of meningitis. Not a few that seem at first to have non-tubercular meningitis will be found, on more thorough examination, to have caseous substance in some part, the result of a pre-existing inflammation ; and if we regard the inflammation of the meninges occurring under such circumstances as tubercular, the relative proportion of tubercular cases would be considerably augmented. The following is an example : When on duty in the asylum in August, 1881, an infant about one year old died of meningitis. No tubercles were observed in the fibrin at the base of the brain, and along the fissures of Sylvius but one inflammatory nodule (cerebritis) as large as a chestnut, with suppuration inside, was found at the summit of one hemisphere. No tubercles could be detected in any of the organs of the trunk, unless a few whitish spots in the spleen were of this nature, but the bronchial glands were cheesy and softened, and the middle lobe of the right lung also contained cheesy substance. It seemed to me probable that some of this degenerated product taken up by the vessels had lodged in the meninges and produced the tubercular neoplasm there, which was hidden under the fibrin. (See article Tuberculosis.)

Age.—The following table gives the age in meningitis, tubercular and non-tubercular, in forty-two cases in my collection :

Cases.	Age.
1	2½ weeks. (Autopsy.)
2	2 months.
20	From 3 to 12 months.
10	" 1 year to 2 years.
5	" 2 years to 5 "
4	Over 5 years.
42	

Rilliet and Barthez have also published statistics of the age in meningitis. Their cases were observed chiefly in hospital practice, and the result is somewhat different.

In thirty-two cases of non-tubercular meningitis observed by these authors, eight were under the age of one year, six from two years to five, and eighteen over the age of five years. In ninety-eight cases of tubercular meningitis, two were under the age of one year, fifty-one between the ages of one year and five, thirty-eight between the ages of five years and ten, and seven between ten and fifteen years.

Pathological Anatomy.—This differs considerably in different cases. The dura mater is usually unaffected or is affected secondarily. In many cases it retains its normal appearance, its internal surface remaining

smooth and polished, while in others it is more or less injected, and its internal surface dim or lustreless. The free surface of the pia mater, formerly designated the visceral arachnoid, is in a great part of its extent unchanged, but is often hyperæmic, or dry and cloudy, or opaque, over the seat of the inflammation. Exudation does not occur upon the free surface of the pia mater, however intense the inflammation.

In meningitis, tubercular and non-tubercular, the inflammatory action occurs in the pia mater. In its meshes, or underneath them, those lesions result which characterize the disease, and to which other lesions are secondary. Tubercular meningitis is most frequently basilar, or is basilar chiefly and primarily, although the inflammation may extend along the sides of the hemispheres. The meningitis is ordinarily most intense around the pons Varolii in the subarachnoid space and along the fissures of Sylvius, for the tubercular neoplasm occurs chiefly at the base of the brain and along the vessels. In non-tubercular meningitis, the inflammation may also occur at the base. It may in young infants be quite diffuse, and of little intensity in any one place, producing, in addition to hyperæmia of the pia mater, slight cloudiness and a moderate or slight escape of leucocytes from the blood, these (pus-cells) being perhaps visible only under the microscope. In meningitis, due to extension of inflammation from an otitis media, the inflammatory action is intense, confined to the portion of the meninges nearest the ear, and is often attended by inflammation of adjoining brain-substance, with perhaps the formation of an abscess. If the cause be exposure to the sun's rays, the meningitis is apt to be at the summit of the brain.

The exudation of fibrin is greatest along the course of the vessels, and in the depressions between the convolutions, and the opacity is most marked in these situations. Pus, when present, is often semi-solid, from the small proportion of liquor puris which it contains, even in recent cases. If the disease have continued several days, the liquor puris may be mostly absorbed, and the pus-cell becoming shrivelled, irregular, and aggregated, may resemble closely the cheesy transformation of tubercle-cells.

The fibrinous exudation presents features of interest. It does not usually attain much thickness, but by its opacity it conceals from view the brain underneath. If it occur in the fissures of Sylvius, the anterior and middle lobes are united by it. It is usually infiltrated through the substance of the pia mater. Sometimes little masses of variable size, often not as large as a pin's head, appear at the point of inflammation. These masses are firm, of a whitish color, or a light yellow, and their number varies in different cases. They consist of a firm, homogeneous substance, containing granular matter, and cells which often bear a close resemblance to tubercle-corpuscles, but are distinct. These corpuscular bodies are plastic nuclei or plastic cells, often shrunken. It is seen, then, that there are two morbid products which may be mistaken for tubercle ; one,

pus which has been in great measure deprived of its liquid element, and which may resemble cheesy tubercular matter, the other, plastic nuclei collected in little bodies, so as to resemble the ordinary form of crude tubercle. I once carried to one of the best microscopists and pathologists of this city some of the exudation from a case of meningitis, the cellular element in which could not readily be distinguished from shrunken tubercle-corpuscles. The exudation was from a child two years and eight months old, with good health previously to the meningitis ; without tubercles in any part of the body, with parents healthy, and with no predisposition to tubercular disease. This microscopist, not knowing the history of the case, or character of the family, and ignorant, like all of us at that time, of the true tubercle-cell, pronounced the exudation tubercular after a careful examination with the microscope. Bouchut says : " The whitish miliary granulations which are observed on the surface of the pia mater have a certain consistency and tenacity which render them difficult to tear with the needles used for the preparation for the microscope. These bodies are formed : 1. Of fibro-plastic elements, whether nuclei or fusiform fibres ; oval-shaped cells are generally present, but not always. The nuclei are oval or spherical, generally very small—that is to say, they hardly exceed in diameter 0.008 mm. to 0.009 mm. The presence of these little spherical nuclei must be insisted on, because, with a less power than 550 diameters, it would be sometimes impossible to establish the differences which separate them from the elements of tubercles ; the fusiform fibres are small and rare. 2. There exists a considerable quantity of amorphous homogeneous matter, in which minute granulations are scattered ; it is very dense, and keeps the other elements strongly united together, so that it is difficult to isolate them completely. 3. Vessels are very rarely observed ; the fibres of cellular tissue are also rare, or altogether wanting."

There being two microscopic elements which are distinct from tubercular formations, but are liable to be mistaken for them, namely, shrivelled pus-cells and plastic nuclei, more or less altered, it is seen, in part at least, why the old writers, and some of a more recent date, either hold that all meningitis is tubercular, or that there are comparatively few non-tubercular cases.

On the other hand, there are cases of true tubercular meningitis which, even with a pretty careful microscopic examination, might be, and probably often have been, regarded as non-tubercular. In order to an understanding of this subject, I may be permitted to repeat certain facts already stated in the article on tuberculosis. The views of pathologists in reference to what is the primary form of tubercle, and what is and what is not tubercular matter, have recently undergone a great change. It is now known that the tubercle-cell is a round, pale, slightly granular cell, identical in appearance with the normal cell of the lympathic glands, being in the

average somewhat smaller than the white corpuscle of the blood ; that it is produced mainly from the nuclei of the connective tissue by proliferation ; that it is vitalized like other cells, and, of course, has functional activity ; that the true, the living cell, is found only in the so-called gray, semi-transparent tubercle. It is furthermore known that what has heretofore been considered the tubercle-cell, namely, the irregular, sometimes angular, sometimes oval cell—without, indeed, any typical form—may be a dead, shrivelled, and altered tubercle-cell, or a dead, shrivelled, and altered pus or other cell. If, therefore, such cells are found in the meshes of the pia mater, we cannot determine from the microscope their true character. We can only form our opinion in reference to their nature from concomitant circumstances, or from discovering in connection with them the true tubercle-cell. Those products which have been designated crude tubercle and tubercular infiltration, contain these shrivelled cells, or shrivelled nuclei ; and they may have a tubercular origin, or, on the other hand, an inflammatory origin, without either the tubercular product or diathesis.

In the tuberculosis of young children I have found, in a large proportion of cases in which I have had an opportunity to make post-mortem examinations, miliary tubercles disseminated through the lungs, and perhaps other organs, in small masses, many of them not larger than a pin's head, and some occurring as mere specks scarcely visible. These minute tubercular formations have ordinarily been semi-transparent, and sometimes even transparent like minute drops of water, and containing the true and unchanged tubercle-cell. Now if in such a case meningitis occur, we may find the tubercle-cell in or with the fibrin at the base of the brain. But failure to find it, even with protracted microscopic examination, does not prove its absence from this locality, for I consider it almost impossible to discover in the midst of the fibrinous exudation such minute points of tubercular matter as are seen in the lungs, liver, or elsewhere.

The pia mater is often firmly adherent to the brain at the seat of inflammation, so that on raising it a portion of the brain may be detached and removed with it. The extent of the inflammation varies much in different cases. There may in extreme cases be pretty general inflammation of the pia mater. In cases of such extensive meningitis, the symptoms are apt to be severe and the course of the disease rapid. Thus, in the month of April, 1866, a girl eleven years of age, in the Protestant Episcopal Orphan Asylum of this city, had complained occasionally of dizziness, but was otherwise in good health, cheerful, and with excellent appetite, till Thursday, when she was affected with vertigo, more persistent than previously, and with headache. At 2 P.M. on the following day she was seized with general convulsions, and continued insensible or nearly so, with occasional convulsive movements, till Monday, when she

died comatose. The pia mater at the vertex, sides, and base of the brain had a cloudy appearance, and underneath it, in places, was a thick, creamy substance in small quantity, which, examined by the microscope, proved to be pus, the largest amount being near the pons Varolii. There was no tubercle under the meninges or elsewhere, and no appreciable fibrinous exudation. The inflammation in this case was obviously intense.

The only additional lesions noticed were moderate congestion of the brain and an increase in the quantity of the cerebro-spinal fluid.

If the disease be protracted three or four weeks, which is rare, or even less time, the exuded substance may undergo further changes, such as occur in simple exudations in other parts of the system. Thus, on the 30th of April, 1860, we made the post-mortem examination of an infant at the Nursery and Child's Hospital, who had symptoms of cerebral disease, it was stated, for several weeks, but the exact time was not ascertained. Prominent among the symptoms referable to the cerebro-spinal system toward the close of life were the hydrocephalic cry and rigidity of the neck. The appearance at the autopsy was remarkable. The anterior half of the brain was completely encased in a deposit which had nearly the appearance of lard. It filled the fissures of Sylvius, and appeared slightly on the anterior aspect of the cerebellum. Examined under the microscope, this substance was found to contain numerous cells, among which could be distinguished some resembling pus-cells, but nearly all had undergone more or less fatty degeneration. Here and there was seen a large cell containing numerous small oil-globules, the compound granular cell of pathologists.

The brain itself in meningitis is usually hyperæmic. On making an incision through it, red points are seen upon the cut surface, which indicate the seat of the congested vessels. The inflammation rarely extends to the walls of the ventricles, but the choroid plexus is injected. In exceptional instances pus or fibrin is found in the lateral ventricles. In the infant, two and a half weeks old, whose case has already been alluded to, about two ounces of purulent fluid escaped on opening the left ventricle. A small amount of liquid of a similar character was contained in the right ventricle. The distension of the lateral ventricles with serum is one of the common results of meningitis. This fluid is clear or straw-colored, or it is turbid in consequence of being mixed more or less with the softened brain-substance. The quantity does not exceed two, three, or four ounces, and is often not more than one ounce or an ounce and a half. The distension of the two ventricles is ordinarily uniform, as they are united by the foramen of Monro, but now and then one ventricle is found more distended than the other. If there be considerable effusion, the brain is compressed and the convolutions have a flattened appearance, unless the cranial bones are still separated so as to yield to the pressure. If the sutures and fontanelles be open the cranial arch is expanded, some-

times quite perceptibly to the eye. From the same cause the anterior fontanelle, if open, is elevated. The foramen of Monro is enlarged according to the amount of effusion, and the portions of the brain which separate the ventricles are sometimes lacerated. In many cases the cerebral substance surrounding the lateral ventricles is softened. The softening is found in all degrees, from the least appreciable deviation from the normal consistence to a state of diffluence so that the brain presents the appearance of cream. Hypotheses have been advanced to explain the cause of this change in consistence, which are not entirely satisfactory. Whatever the explanation, the fact is attested by all observers, though there are exceptional cases. Thus Dr. West has records of the condition of the brain in fifty-nine cases, in thirty-seven of which there was considerable softening, and in the remaining twenty-two the consistence was normal.

Since a majority of the cases of meningitis in children are basilar, and portions of all the cerebral nerves lie at the base of the brain, it is easy to understand why the functions of these nerves are so seriously impaired in this disease. Compression of these nerves, or extension of inflammation to their sheaths, affords explanation of many of the symptoms, as the sighing respiration, abnormalities of the eye, etc.

Although the above remarks relating to the anatomical characters of meningitis are applicable to a large majority of the cases, I must confess that I have sometimes been disappointed at the autopsies of young infants who died with all the symptoms of meningitis in not finding more lesions. Moderate hyperæmia of the pia mater, its slight opacity or cloudiness at the base of the brain or elsewhere, with the presence of a few wandering white corpuscles, without any fibrinous exudation, with no increase of liquid external to the brain, but a considerable increase of it in the lateral ventricles, and hyperæmia of the choroid plexus, with nearly natural appearance and consistence of the brain, have in some instances been the only lesions when I had expected to find marked anatomical changes.

I am fully convinced from my own observations that, in some instances, physicians who supposed that they were treating tubercular meningitis, and at the autopsies discovered within the cranium tubercles, without any inflammatory lesion, but with a larger increase of the cerebro-spinal liquid, have been treating cases in which in addition to the meningeal tubercles, which were latent, the bronchial glands were tubercular and cheesy, so that by their increased size they compressed the venæ innominatæ within the thorax, thus preventing the free flow of blood from the brain, and causing, as I have elsewhere stated, cerebral and meningeal congestion, with more or less transudation of serum, but with no meningitis.

Causes.—The causes of non-tubercular meningitis are not fully ascer-

tained. Active cerebral congestion frequently occurring, however produced, appears to be one of the common causes in young infants. In at least three instances I have known meningitis occur in infants between the ages of four and eight months, after severe and protracted bronchitis, which had been attended with the usual heat of head. The disappearance of eruptions upon the scalp, at or immediately before the commencement of the meningitis, has often been observed. I have witnessed it at the commencement of non-tubercular meningitis, as well as of meningitis which, if not tubercular, occurred at least in a decidedly scrofulous state of system.

The direct effect of the solar rays upon the head, and the prolonged action of a high atmospheric temperature, even without direct exposure of the head to the sun, are common causes during the summer months in New York City. I once attended a child with this disease who had been much exposed bareheaded to the direct rays of the sun in August and September, and at his death, which occurred toward the close of the hot weather, found hyperæmia, opacity, and fibrinous exudation in the pia mater at the summit of the brain, while the base of the brain seemed nearly or quite normal.

In the *Jahrbuch f. Kinderkrankh.* for October, 1875, Dr. Soltmann, of Breslau, reports three cases, in which intense cerebral hyperæmia, and probably meningitis, occurred from solar heat. In all three children the attack was sudden, the febrile movement and heat of head intense, and the progress rapid. The first had convulsions, the second automatic movements, and the third, the oldest, aged four years, when able to speak, complained of violent headache.

The statistics of New York City show that congestive and inflammatory maladies of the brain and its covering are more common during July and August, which are the months of maximum atmospheric heat, than in other months of the year. For example, in July and August, 1875, one hundred and sixty-seven died of these maladies, or one in every nine and eight-tenths who died from local disease, while during the entire year only seven hundred and ten died from the same, or one in every fifteen who perished from local diseases.

July, 1876, in New York City, was characterized by excessive and long-continued atmospheric heat, the temperature in the Central Park Observatory in the shade never falling below 61°, though never above 98°, and having a mean of 82.9°. There was also unusual dryness of the atmosphere, since during the entire month prior to July 30th, there were only fourteen hours of rain, with a rain-fall of .77 of an inch, and the average atmospheric humidity was represented by 65, saturation being denoted by 100. During this month I treated in my private practice four fatal cases, all between the ages of two and seven years, which I diagnosticated meningitis, none of them presenting any symptoms of otitis or tuberculosis. It would seem that the atmospheric heat had much to do with

the development of the disease in these cases. One died in two days, but in the others there was the usual duration.

A not infrequent cause, especially among the strumous families of the cities, is otitis media, and caries of the petrous portion of the temporal bone, the inflammation extending to the meninges. Since tubercular meningitis is due to the irritating effect of tubercles in or under the pia mater, it usually occurs where tubercles are most abundantly developed, that is, at the base of the brain, and along the course of the vessels in the inter-gyral spaces. The inflammation is commonly excited when they are still small, even minute.

Premonitory Stage.—Meningitis is usually preceded by symptoms which, if rightly interpreted, are of the greatest value. In most cases of this malady, which I have seen, there was a prodromic period, varying from a few days to several weeks. The symptoms of this period are obscure, and are apt to be mistaken for those of other and distinct affections.

The child in whom meningitis is approaching loses his accustomed vivacity and cheerfulness. He has a melancholy and subdued appearance, being quiet for a few minutes, and then fretful, without apparent cause. He can sometimes be amused by his playthings or companions for a brief period, when he turns from them with evident displeasure. Unexpected and loud noises and bright lights are evidently painful. If old enough to describe his sensations, he complains of transient dizziness, and at other times of headache. His ill-humor, if his wishes are not immediately gratified, or if they are denied, is often scarcely endurable on the part of friends, who are ignorant of the cause. There is great difference, however, in different cases, as regards this symptom. Some are inclined to be taciturn and quiet, while others are almost constantly fretting. The appetite is capricious ; at one time it is pretty good, at another it is poor or even entirely lost. The patient may take a few mouthfuls of food, or, if an infant, nurse for a moment, when his hunger appears satisfied, and he will take nothing more. The bowels are regular or inclined to constipation. The pulse is natural, or it has times of acceleration, especially in the latter part of the day and toward the close of the premonitory stage. The duration of this stage is very different in different cases. Upon an average it is perhaps about two weeks, but it is often longer. In tubercular meningitis the symptoms, both during the inflammation and previously, are apt to be complicated by those which arise from tubercles in other parts of the system.

Unless the prodromic period be of short duration, the effect of imperfect nutrition is obvious before it closes. The flesh becomes soft and flabby, or there is actual emaciation, though generally slight. The patient loses his strength, becoming less able to stand or to walk, and more easily fatigued. Occasionally, especially in the non-tubercular form, premonitory symptoms are absent, or are slight and of short duration.

Symptoms.—Dr. Whytt, living in the last century, when the tendency was toward refinement rather than simplicity in classification, divided meningitis into three stages, according to the symptoms, especially the pulse. Many subsequent writers, following Whytt's example, have recognized three stages, based not upon the anatomical characters of the disease, but upon the succession of symptoms. Such division of meningitis is in great measure arbitrary, since in one case the same symptom occurs at an earlier period than in another.

When the premonitory stage has passed, and inflammation is developed, some of the symptoms which were previously present remain and are intensified, and other new and more characteristic symptoms appear. There are now fewer intervals of apparent improvement. The child is quiet, often lying with his eyes shut. If aroused, he has a wild expression of the face, and is irritated by attempts to engage his attention or amuse him. He rarely smiles, or takes his playthings, or he notices them for a moment, when he turns away with disgust. During sleep there is often at first a placid expression of countenance, but when aroused he has the aspect of real sickness ; the eyebrows are sometimes contracted, as if from headache ; the features wear a melancholy look, and are turned away to avoid the gaze of the observer or to shun the light. If the anterior fontanelle be open, it is observed to be prominent and pulsating forcibly. If consciousness be not lost, and the patient be of sufficient age, he complains of headache, or of pain in some part of the body. The tongue is moist, and covered with a light fur ; the appetite is lost or poor ; there is seldom much thirst ; more or less nausea and constipation are present. As the inflammation continues, and usually within three or four days from its commencement, symptoms arise which dispel all doubts, if there were any, as to the nature of the disease. The vital powers are now evidently beginning to yield. The surface generally is more pallid, and there is the curious phenomenon of the sudden appearance, and, after some minutes, disappearance, of spots or patches, or even streaks of active congestion upon the face, forehead, or the ears. These, having a bright red color, contrast strongly with the general pallor. Ordinarily they are irregularly circular or oval, and from one inch to an inch and a half in diameter. A red spot or streak is also produced if the finger be pressed upon the surface or drawn forcibly across it. It continues a few minutes and then gradually fades. Trousseau calls attention to this fact as a diagnostic sign.

Another curious phenomenon is the variation in temperature. The face and limbs at one time feel quite cool, and after some minutes, without any excitement or other appreciable cause, the temperature rises, so that the surface is warm to the touch.

Consciousness, in severe cases, may be lost at an early period. On the other hand, I have known it in a case of moderate severity to remain,

though partially obscured, till within twenty-four or thirty-six hours of death. The patient will usually open his mouth for drinks, which are placed to his lip, when there is no other evidence of intelligence, and when sight and hearing are evidently lost.

The loss of the senses constitutes an interesting but melancholy feature of the disease. Among the first unequivocal symptoms, and frequently the very first, are such as pertain to the eye. This organ should be watched from day to day when the diagnosis is uncertain. Deviation from its normal state affords evidence of meningitis. The pupils are seen to dilate or contract sluggishly by variations in the intensity of the light, or they are not of the same size with those of another individual to whom the same amount of light is admitted. Sometimes the first perceptible deviation from the normal state is an inequality in the size of the pupils; while in others oscillation of the iris is observed. At a later stage, not generally till convulsions have occurred, the parallelism of the eyes is lost, and in most patients they have an upward direction. After effusion has occurred, the pupils are commonly dilated. As death approaches, the eyes become bleared, and a puriform secretion collects in the inner angle of the eye and between the eyelids. This secretion is not abundant, but it is sometimes sufficient to unite the lids. The sense of hearing is probably lost as soon, or nearly as soon, as that of sight, but the sense of touch continues longer. The tongue is covered with a moist fur, unless near the close of life, when it is sometimes dry. The appetite is gradually lost, but often drinks are taken with apparent relish, even when there is no other evidence of consciousness. There are two symptoms pertaining to the digestive system which are rarely absent, and which possess great diagnostic value; one is vomiting, the other constipation. In some patients, irritability of stomach begins at so early a period that it is really prodromic; it is rarely absent. Barrier collected the records of eighty patients with meningitis, and in seventy-five of these this symptom was present. It is due to the intimate relation existing between the stomach and brain, through the ganglionic system of nerves. The vomiting occurs without effort, and usually at intervals, for several days. It is a sudden ejection of the contents of the stomach, apparently without preceding or subsequent nausea. It contrasts, therefore, with the vomiting due to an emetic, which is attended by distressing symptoms. With some it occurs frequently, with others not more than two or three times daily. Commencing in the first stages of meningitis, or even prior to it, it occurs less often as the drowsiness becomes more profound, and finally ceases. Constipation is also present, usually from the commencement of the meningitis. It is one of the most constant and persistent symptoms, continuing through the entire sickness, unless relieved by medicine, or unless there be a coexisting diarrhœal affection. Often, when diarrhœa precedes the meningitis, it ceases the moment the latter com-

mences. The constipation in this disease is easily overcome by purgatives. Several writers speak of retraction of the abdomen as a sign of meningitis. A hollow or sunken appearance of the abdomen, according to Gölis, aids in distinguishing meningitis from fever. The anterior abdominal wall approaches the spine, so that the pulsations of the abdominal aorta are distinctly felt. Rilliet and Barthez, who have rarely observed this retraction except in cerebral diseases, attribute it to the state of the intestines rather than to the action of the abdominal muscles.

The pulse in the first stages of meningitis is accelerated, or it is nearly natural during certain hours and afterward accelerated. When the disease has continued a few days, often not more than three or four, the pulse undergoes a marked change. It becomes slower, and at the same time irregular. The irregularity usually consists in an intermittence of the pulse after each six or eight beats. Sometimes the force of the pulse varies, so that a feeble pulsation is succeeded by one of greater volume and strength. The decrease in the frequency of the pulse cannot fail to arrest attention. From 110 or 120 beats per minute in the first stage of the inflammation it often descends to a frequency even less than the normal adult pulse. At an advanced period, as death approaches, the pulse again becomes accelerated and feeble.

The change in respiration is as decided as that of the pulse. In the beginning of the meningitis respiration is sometimes moderately accelerated, but in other cases it is natural. When the disease has continued a few days, the time usually varying from three or four to more than a week, a marked alteration occurs in the respiratory movements. Their rhythm, like that of the pulse, is disturbed. The breathing is irregular, intermittent, and accompanied by sighs. This change in pulse and respiration corresponds with the loss of consciousness, and shows that the brain is becoming seriously involved.

When the pulse and respiration undergo the changes which have been described, another prominent and grave cerebral symptom is often present, namely, convulsions. Its occurrence diminishes greatly the prospect of a favorable issue. The severity and extent of the convulsive movements vary in different cases. They may be partial or general. Their duration is often brief, but they recur three or four times through the day. They are preceded by cephalalgia in those old enough to express their sensations, and often by drowsiness. Each convulsive attack ends in still greater drowsiness.

With this group of symptoms another should be mentioned. I refer to the hydrocephalic cry. At intervals the patient, without being disturbed, and without any change in symptoms, utters a scream or sharp cry, and immediately relapses into his former state. This cry is more common in the commencement of the meningitis than subsequently, and in many it is absent or is not a marked symptom. The glandular system participates

in the general loss or derangement of function. Tears are seldom shed, even when the child is much irritated, and the urinary secretion is diminished. The small amount of urine passed sustains an important relation to the progress of the disease and the therapeutics.

The patient usually lingers several days after the pulse and respiration are changed in the manner stated. The drowsiness becomes more profound, the vomiting ceases, as well as the convulsive attacks, and sensation and consciousness are entirely lost. But even in this state, if nutriment and stimulants be administered with regularity, the child often lives several days longer than the friends believed to be possible. At length increasing feebleness and rapidity of pulse and coldness of the face and limbs indicate the near approach of death, which occurs in a state of coma.

The symptoms described above are such as we observe in ordinary cases of meningitis, and in the order which I have indicated. But he will be disappointed who expects that the above description will apply to all cases.

Meningitis may be so violent and rapid that both the character and succession of symptoms are different from those which have been stated. Thus, I have related the case of a girl, who, with no prodromic symptoms excepting occasional dizziness and slight headache, was taken sick on Thursday, had convulsions on Friday, and from this time continued either in convulsions or coma till her death on Monday. Again, even in cases of the usual duration and anatomical character, some of the most prominent symptoms upon which we rely for diagnosis may be lacking. The following was a case of this kind :

Case.—On the 5th of April, 1862, I was asked to see a boy two years and eight months old, of healthy parentage, and who, during the preceding year, had been in uniform good health, but previously had had two or three severe attacks of sickness. His head was unusually large, and whenever much indisposed he often had symptoms premonitory of convulsions, which were always, however, prevented.

One night, in the latter part of March, his parents noticed that his sleep was restless, but on the following day he seemed entirely well, and the restlessness at night was attributed to a late and hearty supper. On succeeding nights, however, he was restless, and, when questioned, complained of pain in the abdomen. In a few days he was observed to be drooping in the daytime, and his appetite was not quite so good as previously. He had continued in this way about a week when my first visit was made.

The abdominal pain had at this time become more constant, but was never severe or accompanied by moaning. When asked where he felt sick, he placed his hand upon the epigastrium, pressure upon which was sometimes tolerated, but at other times painful. The following symptoms were noted : tongue slightly furred, anorexia, thirst, constipation, scantiness of urine, no headache or unusual heat of head during any part of his sickness. He vomited at intervals from about the 7th to the 10th

of April, when the irritability of stomach ceased, and there was no return of this symptom.

About April 7th, the respiration was first observed to be irregular and sighing, and the pulse intermittent. These symptoms, so tardily developed, were the first which indicated cerebral disease. He now lay most of the time in bed, with eyes closed, surface commonly pallid, with occasional rose-colored spots or patches upon the cheek or forehead. The pupils responded to light in the usual manner till near the close of life, but bright lights were painful ; the last two or three days of his life the left pupil was more dilated than the right. He had no convulsions or any spasmodic movement, and was conscious till within a few hours of death ; the mother states that there was unequivocal evidence of his recognition of her on the last day of his life. He died April 17th, nearly three weeks after the commencement of the disease, and ten days after the commencement of symptoms which were distinctly referable to the brain.

Autopsy. —Abdominal organs healthy, though epigastric pain had been so constant and prominent a symptom ; brain and its membranes somewhat injected. The meninges covering the base of the brain from the most prominent part of the pons Varolii to the first pair of nerves presented evidences of inflammation. There was such opacity of the pia mater in places as to conceal the brain from view. The anterior and middle lobes of each hemisphere were glued together by fibrinous exudation, and on the left side, along the fissure of Sylvius, was a thick deposit of the same character. The lateral ventricles contained about an ounce of clear serum, and about half an ounce escaped from the base of the brain. The foramen of Monro was considerably enlarged, and the brain-substance surrounding the lateral ventricles was somewhat softened, but not in a notable degree.

In this case it is seen that the prominent symptom, and, indeed, almost the only marked symptom in the first stages of the disease, was pain in the abdomen, and yet the abdominal organs were healthy. At the very moment when it was highly important that a correct diagnosis should be made, the evidences of cerebral disease were lacking. This case is, therefore, interesting on account of the variation in symptoms from those in the usual form of meningitis. There were no convulsions, and consciousness was retained as well as vision till near the close of life, and yet the lesions were such as are commonly present in meningeal inflammation. It is in such cases that a wrong diagnosis is apt to be made, to the injury of the patient and the reputation of the physician.

Occasionally meningitis may continue so long as to almost justify its being called chronic, even when there is a large amount of exudation upon the pia mater. In the few cases which end favorably, the symptoms abate gradually. I shall describe more fully the termination in speaking of prognosis.

Diagnosis.—It is of the utmost importance to diagnosticate meningitis in its first stages, since treatment, to be successful, must be commenced early. Certain writers describe at length the means of diagnosticating the simple from the tubercular form of the inflammation. Differ-

ential diagnosis is often difficult, and sometimes impossible ; but it matters little, practically, whether the form of the disease be ascertained. On the other hand, it is very important, in order that the treatment be appropriate, to diagnosticate the premonitory or initial stage of meningitis from certain other affections not located within the cranium. Sometimes remittent or continued fever, or constitutional disturbances arising from irritation in the digestive system, simulate closely incipient meningeal disease, so that the greatest care and discrimination are required in order to make a correct diagnosis. Within a comparatively recent period I have known, in three different instances, experienced physicians of this city mistake commencing meningitis for fevers, not aware of the serious error they had made till the inflammation had reached a stage from which recovery was impossible. In order to avoid error in the diagnosis in the premonitory or initial stage of meningitis, the physician should take time to observe the physiognomy, and note every symptom. More than one protracted visit is often required to remove doubt as to the exact pathological state.

Meningitis is usually preceded and in its commencement accompanied by greater restlessness, fretfulness, intolerance of light, and greater variation of symptoms than most other maladies. One familiar with the physiognomy of infancy and childhood, will discover in the features indication of greater suffering, of more serious sickness, than is commonly present in other maladies which simulate this.

Sometimes the sudden disappearance of a chronic eruption upon the scalp will aid in the diagnosis. This is a sign of importance, taken in connection with the symptoms. Headache and vomiting, symptoms of early occurrence, should especially arrest attention, or, in absence of headache, pain of a neuralgic character in some other part. But we may repeat that familiarity with the symptoms of meningitis will not protect from error if the visits of the physician are hasty, and his examinations imperfect. When the eyes become affected, the respiration and circulation irregular, and especially when convulsive attacks begin, diagnosis is easy. In fact, an incorrect diagnosis would then be unpardonable ; but, unfortunately, if proper treatment have not been commenced till this period, it will be of little service.

Prognosis.—Meningitis is one of the most fatal maladies of early life. Whether the form be tubercular or not, if the initial stage have passed without proper treatment, death may be considered inevitable. Tubercular meningitis, however early recognized, is rarely amenable to treatment. M. Guersant (*Dic. Med.*, t. xix., p. 403) believes that recovery from the first stage of this form of meningitis is possible. " In the second stage," says he, " I have not seen one child recover out of a hundred, and even those who seemed to have recovered have either sunk afterward under a return of the same disease in its acute form, or have died of

phthisis. As to patients in whom the disease has reached its third stage, I have never seen them improve even for a moment." The very few reported cases which resulted favorably may have been, as M. Guersant has intimated in the context, cases of the non-tubercular form. Rilliet and Barthez believe that in a few instances tubercular meningitis has been cured in its first stage, but they state also that it is apt to return.

The prognosis in non-tubercular meningitis is not so unfavorable, provided that treatment be commenced at a sufficiently early period. It is now generally admitted that it may not infrequently be averted, when threatening, and even arrested in its incipiency. In many such cases we cannot, from the nature of the disease, be certain that the diagnosis is correct. But when we see children relieved, who present precisely those premonitory and even initial symptoms which occur in meningitis, we must believe that at least some of them would have had the genuine disease if not relieved by the measures employed. That recovery is possible from non-tubercular meningitis in its commencement, is also obvious from the fact that a few recover even in the second stage, when there can be no error of diagnosis.

Although a considerable proportion of patients with epidemic cerebro-spinal meningitis recover, even when the symptoms have been most grave, I have known only two recoveries from sporadic meningitis when it had reached that stage in which the functions of the brain and cranial nerves were impaired. One of these recovered with the permanent loss of sight, the other with the loss of hearing. Both seem to have ordinary intelligence. Another case has been communicated to me, in which the patient, a little girl, recovered completely, but for several months after the attack seemed nearly idiotic.

Sometimes even in the second stage of meningitis, treatment properly employed is attended by amelioration of symptoms. Though such improvement may serve to encourage physician and friends, it should not be the basis for a favorable prognosis unless it continue three or four days.

Apparent improvement during a few hours or a considerable part of a day, is not unusual in those who finally die. Thus, in an infant whose bowels were previously confined, I have known the pulse and respiration to become more regular and the symptoms generally improve, though only for a brief period, by the action of a purgative. Dr. Watson says of the advanced stages of this disease, it is "often attended with remissions, sometimes sudden, and sometimes gradual, deceitful appearances of convalescence. The child regains the use of its senses, recognizes those about him again, appears to his anxious parents to be recovering, but in a day or two it relapses into a state of deeper coma than before. And these fallacious symptoms of improvement may occur more than once."

Most fatal cases of meningitis terminate between the third or fourth

and the twentieth day, the duration varying according to the extent and intensity of the inflammation, and the vigor and age of the patient. But there are cases in which it may continue much longer. It is surprising sometimes how long the patient lives, when the symptoms are such that death seems impending. Sensation and consciousness may be extinguished, convulsions occur at intervals, and the surface have acquired almost a cadaveric aspect, and yet the patient lives on. Rilliet and Barthez say : " Often have we inscribed upon our notes *death imminent*, and been astonished the next day to find still alive children to whom we had scarcely allowed two hours of life." The symptom which I have found to be the most reliable prognostic of the near approach of death, has been a pulse gradually becoming more frequent and feeble, though other symptoms remain as before. This change in the pulse is usually very apparent during the last twenty-four hours of life.

Treatment.—Such remedial measures should be prescribed during the premonitory stage as are calculated to relieve the fretfulness or irritability of temper and quiet the action of the brain, and, at the same time, produce a derivative effect from this organ. To this end the patient should be kept from all causes of excitement, and the bowels should be opened daily, if not naturally, by the use of proper medicines. A mustard foot-bath at night and occasionally through the day is useful, as it produces both a derivative and soothing effect. It will commonly produce a few hours' undisturbed rest, while all other measures except medicine fail. If dentition be taking place, and the gums are swollen, it has been the practice to employ the gum lancet, and still is with some physicians, but I for one have discarded its use for this purpose. Restlessness from dentition or restlessness premonitory of meningitis, requires decided doses of bromide of potassium, which will relieve the symptoms more effectually than the lancet. Three grains should be given to a child of six months, and four grains to one of ten or twelve months, and repeated if necessary in two to four hours. If symptoms indicate the near approach of meningitis, or its incipiency, the head should be kept constantly cool by a cloth wrung out of ice-water, or, better, an india-rubber bag containing ice, and cantharidal collodion should perhaps be applied behind one or both ears, over a space one inch in diameter.

Many children who are threatened with meningitis are scrofulous. They have already shown symptoms of tubercular disease. They are, perhaps, to a certain extent, emaciated, and may have been affected with a cough. The premonitory symptoms in these children indicate the approach of the tubercular form of meningitis, and a more sustaining course of treatment is required than in those who are robust. To such children cod-liver oil may be profitably given, three times daily, together with the syrup of the iodide of iron, and perhaps the bromide. They should also be taken into the open air, with proper precautions, and every hygienic

measure should be employed which will be likely to invigorate the system without exciting the brain.

Loss of blood is not, in general, required during the prodromic period nor in the disease. Those of a strumous cachexia, or those, whether strumous or not, who are under the age of two years, do not, unless in very rare instances, require depletion by leeches, much less by venesection. There is one class of patients in whom the early loss of blood may doubtless be of service, namely, those who in a state of robust health are suddenly seized with inflammation. Leeches may then be applied to the head of the patient, if he be seen at an early period.

Often, notwithstanding the measures employed, the patient grows worse, the symptoms become more continuous, others more alarming arise, and meningitis declares itself. Whatever the cause of the inflammation, and whatever modifications of treatment were required in the premonitory stage, on account of special indications, the purpose now is to subdue the inflammation by every resource in our art, which does not injure or too much prostrate the system. In former days calomel was largely employed as the main remedy in this disease, but when administered daily it has a very depressing effect, and it is to be borne in mind that in meningitis the vital powers progressively fail on account of the loss of appetite, vomiting, etc. In tubercular meningitis depressing treatment is, of course, strongly contraindicated, cases having occurred in which calomel was given at short intervals for several successive days, so as to produce a laxative effect, and though the meningitis seemed to be controlled, death occurred from exhaustion, or from some intercurrent affection, the result of the exhaustion. Thus in one case related to the class by a distinguished professor in New York City, fatal gangrene of the mouth supervened from the mercurial treatment, after the meningeal inflammation had apparently subsided. Although calomel, during these last years, has been properly discarded as the main remedy, and its daily use rejected, nevertheless it is very useful as an occasional laxative in the more robust cases, if not given too near the iodide of potassium, and it is especially indicated as a derivative from the head in children of four or five years, who, previously hearty and strong, have become suddenly affected with meningitis, as from exposure to the sun's rays, or from an injury. But I repeat that, in my opinion, in ordinary cases, calomel should never be employed, except as an occasional laxative.

The two remedies upon which we must chiefly rely are the iodide of potassium and the bromide of potassium, or sodium. While the bromide quiets the restlessness, prevents convulsions, and diminishes, there is reason to think, to a certain extent, the hyperæmia, the iodide is useful as a sorbefacient, and it probably has some control over the inflammation. The iodide or bromide can be given together or separately.

The iodide should, like the bromide, be given early. If by a careful

examination, the absence of any other local disease, or constitutional disease, which might give rise to the symptoms be ascertained, and the symptoms indicate the meningeal disease, the iodide should be immediately prescribed. Obscurity often hangs over meningitis at this early stage, but it is better to give the iodide, even if the diagnosis be wrong, and no inflammation have commenced, than to err on the other side, and withhold it in the initial period of the true disease, for it is not an injurious remedy like calomel, and to exert any marked curative effect it should be given in the commencement of the inflammation. An infant of the age of six to twelve months should take two grains every two hours, and older children a proportionate dose. At the same time the bromide should be given in doses twice as large as that of the iodide, if the indications for its use are present, namely, headache, restlessness, and symptoms which threaten eclampsia. The bromide is a harmless remedy given frequently for a limited time. With the regular and continued use of the iodide and occasional doses of the bromide, the quantity of urine is in most cases largely increased. If the patient's condition do not soon begin to improve with such treatment there is no remedy.

If convulsions occur the bromide should be given every ten or fifteen minutes till they cease. If they be not controlled by the bromide, an injection, *per rectum*, of three to five grains of hydrate of chloral in a teaspoonful of water should be used in addition. Compresses wrung out of cold water frequently applied to the head, or a bladder containing pounded ice, and separated by one thickness of muslin from the head, materially aids in reducing the meningeal hyperæmia. Ergot, recommended by Brown-Séquard for its supposed effect in diminishing the hyperæmia in myelitis and spinal meningitis, has also been employed as an adjuvant in the treatment of inflammation of the meninges of the brain. I have prescribed it in a few instances, but cannot say whether it is useful. I prescribed it in nearly all the cases of epidemic cerebro-spinal meningitis which I saw during the epidemic of 1880–81, but in these cases the spinal disease was present which seemed to require this agent.

In the first stage of simple meningitis the diet should be mild and in moderate quantity, but in the tubercular form it should from the first be of the most nourishing kind, consisting of beef-tea, milk-porridge, etc. At a more advanced stage in both forms of the malady the most nutritious diet should be allowed, but alcoholic stimulants should not be given unless near the close of life when the vital powers are failing. The apartment should be cool and quiet.

CHAPTER X.

SPURIOUS HYDROCEPHALUS.

The disease known as spurious hydrocephalus might with more propriety be called spurious meningitis. It received its appellation at the time when meningitis of early life was believed to be essentially a hydrocephalus, and was so called. Attention was first directed to this malady by London physicians of the last generation, particularly by Drs. Gooch, Abercrombie, and Marshall Hall, and little can be added to their description of its symptoms.

Anatomical Characters.—This disease, though resembling meningitis in certain of its phenomena, is not in its nature inflammatory, nor is it primary. It is the result of some malady often chronic, but occasionally acute, which has produced exhaustion, especially of the nervous system. When it commences, there is usually more or less emaciation, and the symptoms of the primary disease are present. To this disease the lesions pertain which are found in other organs beside the brain.

The state of the brain in spurious hydrocephalus is not the same in all cases. In some there is no appreciable anatomical alteration in this organ. There is no apparent difference, either in the meninges or the brain itself, from the condition which we often observe in those who have died of diseases which do not affect the cerebro-spinal system. In such cases the pathological state is simply deficient innervation, or if there be a structural change in the minute anatomy of the brain, pathologists have not yet discovered it.

The following case, which occurred in the Child's Hospital of this city, is an example of this form of spurious hydrocephalus :

Case.—A female infant, six months old, died on the 24th day of April, 1862, with the following history : It was wet-nursed, fleshy, and apparently well, till six days before death, when symptoms of gastro-intestinal inflammation were suddenly developed. The vomiting, especially, was severe, continuing forty-eight hours. When it ceased, drowsiness supervened, and continued till the close of life. The face during the four days of stupor was pallid and cool ; eyes partly open, pupils sluggish, but of equal size ; bowels rather torpid ; anterior fontanelle depressed. When aroused, the infant noticed objects for a moment, and immediately relapsed into sleep ; pulse accelerated and not intermittent, the day before death numbering one hundred and fifty ; respiration accelerated, without sighing, numbering on the same day thirty. There were no convulsions, and death occurred quietly. The brain weighed twenty and a half ounces, and its appearance was perfectly healthy, both as regards consistence and vascularity. The amount of cerebro-spinal fluid

in the ventricles and at the base of the brain was not notably increased. The stomach, small and large intestines, were vascular in streaks and patches.

In this case the cerebral symptoms were obviously due to exhaustion occurring at an early period, in consequence of the severity of the gastro-intestinal malady.

In a majority of cases, however, of spurious hydrocephalus, according to my observation, there is an anatomical alteration in the state of the brain and meninges. This consists in passive congestion of the veins, often with transudation of serum. At the same time the cranial sinuses are congested, and are found at the post-mortem examination to contain larger and more numerous clots than are present in those who die of diseases which do not affect the encephalon. Cases might be cited as examples. The cause of this congestion and effusion is, in great measure, feebleness of the circulation due to the general exhaustion of the patient. But there is another cause. In protracted diseases, especially those of a diarrhœal character, there is more or less wasting of the brain as well as of other parts. This naturally, by way of compensation, gives rise to congestion of the cerebral and meningeal veins and capillaries and to transudation of serum.

The transudation commonly occurs in this malady over the superior surface of the brain and in the subarachnoidal space, perhaps also more or less in the lateral ventricles. So common is it in the last stage of infantile entero-colitis, the summer epidemic of the cities, that this stage, which is really spurious hydrocephalus, has been called the stage of effusion. I shall relate in another place examples which show the anatomical characters of this intestinal disease.

Symptoms.—Spurious hydrocephalus most frequently results from protracted diarrhœal complaints. It may, however, result from any disease which is attended by great prostration. As it ordinarily occurs, the patient has for days or weeks been gradually losing flesh and strength. Finally drowsiness supervenes, or before the drowsiness there is sometimes a period of irritability.

Marshall Hall describes two stages of spurious hydrocephalus. In the first he says : "The infant becomes irritable, restless, and feverish ; the face flushed, the surface hot, and the pulse frequent ; there is an undue sensitiveness of the nerves of feeling, and the little patient starts on being touched, or from any sudden noise ; there are sighing and moaning during sleep, and screaming ; the bowels are flatulent and loose, and the evacuations are mucous and disordered." The second stage he describes as that of torpor. The first stage often, however, does not present those prominent symptoms which have been described by Dr. Hall, and this stage may even be absent, or not appreciable, especially in young infants.

Whether or not commencing with the stage of irritability, the disease, if not checked, gradually increases. The child soon becomes drowsy. He may be aroused for a moment, but, unless constantly disturbed, immediately relapses into sleep. He is sometimes fretful when aroused, but in other instances is quite indifferent, observing without apparent interest objects employed for the purpose of amusing him. Often there are indications of cerebral pain or distress, as contraction of the eyebrows, etc., but many of those affected are too young to make known their sensations. Convulsions sometimes occur toward the close of life, but they are not so common in this disease as in meningitis. When they do occur, they are generally partial and often slight. The pulse is accelerated in most patients prior to and in the commencement of spurious hydrocephalus. As the disease advances it becomes irregular and intermittent, and toward the close of life it is progressively more frequent and feeble. The respiration at first is not much disturbed, but at length it becomes irregular, like the pulse. It is feeble and accompanied by sighs. Occasionally there is slight cough. The eyelids are partly open, the pupils no longer respond to light, and in advanced cases they have a bleared appearance. The diarrhœa, which in most instances precedes and causes this malady, continues till the stage of stupor arrives, when the evacuations become less frequent or cease altogether. In infants the stools are frequently green, in older children brown and sometimes slimy. The febrile heat of surface, which preceded the disease and was present in its commencement, disappears ; the face and hands become cool, the features pallid, and the anterior fontanelle, if open, is depressed. Death finally occurs in a state of coma, or if the disease be recognized and proper remedial measures employed, the result may be favorable, even when the symptoms are such that if meningeal inflammation were the malady we would consider the case necessarily fatal.

The following case is an example of spurious meningitis as we often meet it in practice :

Case.—On the 13th day of March, 1859, I was asked to see a male child twenty-two months old, the records of whose case are as follows :

" Was well till about three weeks ago, since which time he has had diarrhœa, with febrile symptoms ; pulse 162, respiration 52 ; has a slight cough, with a few mucous râles ; resonance on percussion of chest good ; is somewhat emaciated, and appears languid ; tongue moist and slightly furred. Has all the incisor and three anterior molar teeth, and the gum is swollen over the remaining anterior molar and two canine teeth."

" From the 14th to the 18th there was no material alteration in his symptoms, with the exception that the diarrhœa was partially restrained by Dover's powder in one and a half grain doses. On these five days the stools numbered daily from one to six. The pulse was uniformly frequent, varying from 124 to 156, and the respiration on two days, when its frequency was ascertained, numbered 56 and 46.

" March 19th, pulse 124 ; has become drowsy since yesterday, and

when aroused is fretful. Omit Dover's powder. Treatment, cold applications to the head, mustard pediluvia.

"Evening, pulse 136; eyes constantly closed and head reclining; surface generally warm; tongue dry and furred; he vomited at first, but has not in three or four days. Apply cantharidal collodion behind each ear, and continue the local treatment.

"20th, pulse 130; is constantly sleeping, and when aroused is very fretful and soon relapses into sleep; no unnatural heat of head, and no dejection since yesterday. Treatment, a dose of castor oil, nourishing diet.

"21st, drowsiness as before; cheeks sometimes flushed, sometimes pallid; pupils sensitive to light; margins of eyelids covered with secretion. The bowels have been opened by the oil."

On the 22d and 23d there was no material change in the symptoms. He was constantly sleeping, except for a moment when shaken. More active stimulation was now employed. Brandy was prescribed, to be given every two hours; beef tea and milk porridge frequently.

On the following day, the 24th, he was more fretful, and less drowsy. Brandy and beef tea were continued.

On the 25th, with the same treatment, there was still further improvement; drowsiness nearly gone and less fretfulness than yesterday; rolls the head occasionally and does not appear to see distinctly; has a slight cough; stools nearly regular; pulse 100; respiration natural; surface warm, and no unnatural heat of head. The same treatment was continued, and he rapidly and fully recovered.

This case is interesting on account of the long duration of marked drowsiness, which continued five days, and yet the patient recovered entirely in the space of two or three days under the use of brandy and beef tea.

In May, 1860, I was called to treat a very similar case. A child, twenty months old, had diarrhœa for two weeks, the stools being of a dark-brown color, thin and offensive. He was at first very irritable. The pulse was constantly above 130, and the respiration was correspondingly increased. The stage of drowsiness finally supervened, and for two days he was constantly asleep unless aroused by being shaken. During the somnolent stage the pulse numbered 140, respiration 36. The face and extremities were cool, and he finally had a slight convulsion. By stimulants and nutritious diet he began immediately to improve, and was soon out of danger.

In the following case the result was unfavorable. This case is interesting on account of the anatomical characters of the disease as disclosed by the post-mortem examination. It is an example of that large class of cases in which spurious hydrocephalus is associated with congestion of the cerebral vessels and serous effusion. It is exceptional, however, as regards the long duration of drowsiness. Ordinarily, protracted diarrhœal maladies which end in passive congestion and effusion terminate fatally in three or four days after the drowsy period arrives.

Case.—"Dec. 13th, 1861, called to-day to a German infant eighteen months old. It has had diarrhœa four weeks without regular and proper medical attendance; stools from the first brown and thin; during the last eight or nine days he has been drowsy; when aroused, opens his eyes and is very fretful, but immediately the upper eyelids gradually droop, and, unless disturbed, he remains asleep with his eyes partially open; forehead warm, face cool and pallid, and limbs also rather cool; pulse 164, respiration 32; has had a slight cough about one week, and slight dulness on percussion over the left infra-scapular region; depression of infra-mammary region on inspiration. Treatment: Ammon. carbonat., gr. 1 every two hours; nourishing diet.

"Dec. 20th, has continued drowsy since the last record; pupils moderately dilated; a thick secretion between eyelids; right pupil considerably larger than the left; vision apparently lost during the last three days; pulse over 140; respiration 44 per minute, accompanied by sighing since the 18th; moans much when awake; rolls the head frequently; during the last six days the surface back of the ears has been constantly sore by vesication; takes the most nutritious diet, with brandy. The dejections remain thin and brown, and number three or four daily.

"From this date the diarrhœa continued, except as it was restrained by vegetable astringents. The pulse continued frequent, and a slight cough remained. There was on the 21st and 22d partial abatement of the drowsiness, but on the 23d it was greater than ever. The body was somewhat reduced at the commencement of the cerebral symptoms, but it was now considerably emaciated. The prostration increased daily, and the hands were observed to tremble. The face and hands became more cool, while the head was warm. On the 24th partial convulsions occurred, followed by coma and death.

"The cerebral veins and sinuses were generally congested, except in the anterior portion of the brain, where the appearance was normal. Between the brain and its membranous covering, chiefly at the vertex and the base, was an effusion of clear serum. The whole amount of this fluid was estimated at two ounces. On slicing the brain, numerous 'puncta vasculosa' were seen, both in the gray and white portions. With the exception of the congestion, the substance of the brain presented its normal appearance. No inflammatory lesions were present. We were not permitted to examine the condition of the intestines."

Diagnosis.—The only disease with which spurious hydrocephalus is liable to be confounded is meningitis. The points of differential diagnosis are the history of the case, especially the antecedent diarrhœa or other exhausting ailment, evidence of prostration when the cerebral malady commenced, depression of the anterior fontanelle if it be open, and the cool face and extremities.

Prognosis.—If the pathological state of the brain be simple exhaustion, the disease can often be arrested by judicious treatment. If an incorrect diagnosis be made, and the treatment employed be that appropriate for meningitis, which it so closely simulates, death is almost inevitable. If transudation of serum have occurred, unless slight, the result is apt to be unfavorable, whatever may be the treatment. This disease in child-

hood is more easily managed than in infancy, but is less frequent. The prognosis is better in the cool months than during the heat of summer. It is more favorable if the child be over than if under the age of one year. The occurrence of an irregular and intermittent pulse, of respiration accompanied by sighs, of inequality in the pupils or their sluggish movements, with increasing stupor, indicates an unfavorable issue. The cure of the primary disease, with the pulse and respiration still natural, or accelerated, without change of rhythm, pupils sensitive to light, drowsiness from which the patient is easily aroused to a state of entire consciousness, render recovery probable, with proper medication and alimentation.

Treatment.—The indications of treatment are twofold: first, to remove the primary pathological state which is the cause of the spurious hydrocephalus; and, secondly, to cure the latter. The first is important, since the successful treatment of a disease requires the removal of the cause. The measures employed for this purpose are pointed out in our description of the diarrhœal and other maladies which produce spurious hydrocephalus.

We may here say that as spurious hydrocephalus is due in a very large proportion of cases to the exhausting effect of long-continued diarrhœa, astringents, especially subnitrate of bismuth, and alkalies are required in a majority of cases in the stage of irritability, and sometimes also opiates.

Active sustaining measures are indicated. Exhausted nervous power, as well as passive cerebral congestion, requires this. The diet should be highly nutritious, comprising such substances as milk and beef juice, and should be given frequently. Brandy is required at short intervals. Dr. Gooch was in the habit of giving the aromatic spirits of ammonia, properly diluted, as a quick and active stimulant. Six or eight drops may be given in sweetened water to a child one year old, and repeated every hour in cases of urgency. If, by proper treatment of the cause, and by the use of stimulants and nutritious food, the patient do not within a few hours become less stupid and more conscious, there is that degree of nervous exhaustion or of serous transudation from the engorged cerebral veins, which will render death probable. In some cases it is proper to produce moderate vesication behind the ears.

CHAPTER XI.

ECLAMPSIA.

The term eclampsia is used in a more restricted sense by some writers than by others. It is employed in the following pages to designate those convulsive seizures, clonic in their character, sometimes general, sometimes

partial, which affect the external muscles. Eclampsia is therefore synonymous with clonic convulsions. It consists in rapid, forcible, and involuntary muscular contraction, alternating with relaxation. It is distinguished from chorea in the fact that the latter is a more permanent state, and is characterized by muscular movements which are partially under the control of the will, and are not so violent.

Eclampsia occurs in a great variety of diseases, some of which are located in the cerebro-spinal system, some in other parts of the body, and some are constitutional. It may also be produced by temporary derangements of system, not sufficiently severe to be considered diseases, and by powerful mental impressions, those of an emotional nature, affecting the delicate and sensitive nervous system of the child. Pathologists recognize three distinct forms of eclampsia. The term essential or idiopathic is used when the convulsions have no appreciable anatomical character, that is, when there is no apparent pathological state in the brain or elsewhere, which gives rise to the attack. For example, if a child die in convulsions from fright, and all the organs, including the brain, are found in their normal state, the eclampsia is called idiopathic or essential. If the cause be disease of the brain or spinal cord, it is termed symptomatic. If eclampsia arise from local disease elsewhere than in the cerebro-spinal axis, as from pneumonia, the term sympathetic is employed. This is in the main a good division, but eclampsia may be at the same time sympathetic and symptomatic, as when it occurs in consequence of congestion of brain, which is induced by severe and frequent paroxysms of hooping-cough.

Causes.—Eclampsia occurs at any period of infancy and childhood, but it is much more rare after the period of six or seven years than previously. Some children are more liable to it than others. It is produced in one by an agency which in another has no appreciable effect. There are some, generally those of an impressible nervous system, who are seized with convulsions whenever there is any slight derangement in the digestive or other organs. Eclampsia is frequent in certain families. Thus, Bouchut mentions a family of ten persons, all of whom had convulsions in their infancy. One of them married, and had ten children, all which, with one exception, had convulsions.

The exciting causes of eclampsia are too numerous to be mentioned in full. It is a symptom in nearly all cerebral diseases. It is produced in the nursling by changes in the milk with which it is nourished. These changes are usually due to violent emotions of the mother, as anger, fright, and grief, to the use of acescent or indigestible food, or to derangement, temporary or permanent, in her health. Thus, in a case related to me, the catamenia so affected the milk that the infant was seized with eclampsia at each monthly period. In childhood the most common cause of clonic convulsions is the presence of some irritant in

the primæ viæ. All kinds of fruit, even the mildest, may produce eclampsia, especially when eaten unripe or taken in undue quantity. I have known an infant to be seized with convulsions from eating strawberries, which parents usually regard as harmless, and one of the most violent and protracted cases of eclampsia which I have witnessed, occurred in a child over the age of six years, from swallowing, in considerable quantity, the parenchymatous portion of an orange. Constipation, worms, dysentary, intussusception, and painful dentition are also causes which are located in the digestive apparatus. Inflammation in some part of the respiratory apparatus is a not infrequent cause. Thus eclampsia occurs occasionally in severe coryza, in consequence, according to some, of the proximity of the inflamed surface to the brain, and the consequent afflux of blood to this organ. It is a common complication also of pertussis and pneumonia. It occurs often at the commencement of two of the eruptive fevers, namely, smallpox and scarlet fever, and in the course of the latter disease.

Violent emotions of the child may also cause eclampsia. Bouchut relates the case of a girl, five years old, who was corrected before her companions, and was so affected by anger that convulsions ensued. Residence in close and overheated apartments, or in streets where the air is loaded with offensive vapors and is stifling, is a predisposing cause, so that there is a larger proportion of deaths from convulsions in the cities than in the country.

In young children, burns, even when not very severe, are apt to terminate suddenly in eclampsia, succeeded by coma and death. Urinary calculi, both renal and vesical, frequently produce the same result.

Such are the more common causes of eclampsia. It is seen that they are of two kinds, predisposing and exciting. An excitable or impressible state of the nervous system constitutes the chief predisposition to the disease. Plethora, or its opposite state, anæmia, increases the liability to an attack.

Premonitory Stage.—In the majority of cases there are prodromic symptoms, which the experienced and careful physician can detect, so as to forewarn friends. The child is perhaps more or less drowsy, and, when disturbed, fretful. The eyes often have a wild or unnatural appearance ; occasionally they are fixed for a moment on an object, and yet apparently without noticing it. The sleep is disturbed ; in some there is unusual heat of head, and, if old enough, complaint of headache. At times, especially if the primary disease be febrile or inflammatory, there is incoherence of thought or expression, or even actual delirium. In some children, when eclampsia is threatening, the thumbs are seen to be carried often across the palms. I have observed this especially during the convulsive cough of pertussis. A very important prognostic symptom is sudden starting, or twitching of the limbs. This shows that the nervous

system is profoundly impressed, and but slight additional excitation is required to develop eclampsia. This sudden starting not infrequently precedes the attack several hours, and gives sufficient forewarning.

The prodromic symptoms are often disregarded by friends who do not understand their significance. Even physicians, in the haste of their visits, in many instances do not notice them. The symptoms which precede symptomatic and sympathetic eclampsia are, moreover, blended with those of the primary affection, and hence another reason why they are apt to be overlooked. When the convulsions are about to commence, the child generally lies quiet ; the eyes are open and fixed. If spoken to or shaken, he takes no notice, and does not speak. The direction of the eyes is then changed ; often they are turned up ; sometimes there is strabismus. The face may be pale or flushed, and sometimes, especially in cerebral diseases, the features present patches or streaks of a flushed appearance, while around them the natural color is preserved. Immediately before the spasmodic movements the child occasionally utters a piercing scream, which is probably involuntary, though it seems like a supplication for help. The duration of the prodromic stage is very different in different cases. It may last from a few minutes to several hours, or even more than a day.

Symptoms.—Eclampsia is general or partial. If *general*, the muscles of the face, eyes, eyelids, and of all the limbs, are in a state of rapid involuntary contraction, alternating with relaxation. The features lose their natural expression and are distorted ; the mouth is drawn out of shape, often to one side, by the violent muscular action ; the teeth are pressed together by tonic contraction of the masseters, and may be violently struck together, so as to lacerate the tongue, if it protrude, or are ground upon each other. Unless the attack be of short duration, frothy saliva, perhaps tinged with blood from the injured tongue, collects between the lips. The eyelids are usually open, and in severe cases the eyes are turned so that the pupils are lost under the upper eyelids, or the muscles of the eyes are involved in the spasmodic movements, so that the eyeballs are forcibly drawn from side to side. Occasionally strabismus occurs. While the features are thus distorted, the head is strongly retracted or is turned to one side ; the forearms are alternately pronated and supinated ; the thumbs and fingers are convulsively flexed, so that the thumbs lie across the palms and are covered by the fingers ; the great toe is adducted, the other toes flexed ; and the toes, as well as legs, participate more or less in the spasmodic movements.

In general convulsions, consciousness is usually lost. The head is hot previously to and during the attack—at least in the first part of it—and the face flushed. In exceptional cases, especially in sympathetic eclampsia, the head is cool and the face pallid. The pulse is somewhat accelerated, as well as the respiration, and the latter is rendered irregular if the

respiratory muscles, especially those of the larynx, are involved, as they generally are. The sphincters are relaxed during the convulsive attack, so that in many cases the urine and stools are passed involuntarily.

Partial eclampsia is more common than the general form ; it occurs in the muscles of the face, including those of the eye, of the face and of one or both upper extremities, or of the face and the extremities on one side. The spasmodic movements may be even limited to the muscles of the eye, and they often occur only in these muscles and those of the face. Rarely, if ever, does eclampsia affect the legs without affecting also the muscles of the arms and face. In partial convulsive attacks, sensation and consciousness are in some patients not entirely lost, but in others they are not manifested if present.

The duration of an attack of eclampsia varies in different cases from a few minutes to several hours, with an average of not more than from five to fifteen minutes. The movements do not often continue longer than three or four hours in the severest cases. They are sometimes said to last a much longer time, even for days, but there are in these cases intermissions. Violent attacks are usually short.

When the convulsion ends favorably, the spasmodic movements become less and less strong, and finally cease. The child then takes a deep inspiration, after which it lies quiet, and the respiration remains regular or moderately accelerated. Some fully recover in a few minutes if the eclampsia have been light and the cause transient, and seem to experience no inconvenience except soreness of the muscles and fatigue. Others soon recover consciousness, and their temperature, respiration, and circulation become natural, but they remain dull for a time, their minds are bewildered, and they are perhaps unable to speak. In a few hours these untoward symptoms pass away. In essential, and in a large proportion of cases of sympathetic eclampsia, if properly treated, and if the cause be recognized and removed, there is no recurrence of the convulsion ; with others it is different. In many cases, especially of symptomatic eclampsia and of sympathetic, in which the cause is grave and persistent, the convulsions return after a variable period of a few minutes or a few hours. Six or eight or more convulsions may occur within twenty-four hours. Rarely they occur several times daily for several consecutive days, but severe convulsions, repeated at short intervals for twenty-four or forty-eight hours, usually end in fatal congestion of the brain or serous effusion. I once attended an infant about six months old, who had from four to twelve convulsions daily for eleven days, caused probably by a vesical calculus, as there was dysuria, and, at times, bloody urine. Some days after the convulsions were controlled, while we were deferring exploration of the bladder, death occurred suddenly, and the autopsy was not permitted. This case will be detailed elsewhere. Bouchut has witnessed a case of hooping-cough in which there were daily convulsions for eighteen days.

In severe eclampsia, the respiration is so embarrassed and circulation so retarded that congestion of various organs results. This passive congestion in the respiratory organs is indicated by moist râles in the larynx and bronchial tubes; occurring in the brain, it is indicated by profound stupor. It has already been stated that death may occur from the cerebral congestion, which, continuing, is apt to end in effusion of serum or extravasation of blood. In these cases the convulsive movements cease, but there is no return of consciousness. The child lies quiet, as if in sleep, with pupils not readily acted upon by light, and often somewhat dilated; gradually the limbs grow cool and the pulse feeble, and fatal coma supervenes.

Death does not ordinarily occur from one attack. There are several at intervals, during which the stupor is gradually becoming more and more profound, till, finally, total loss of consciousness and sensation result, terminating in death. Apnœa may occur in the first attack, ending life abruptly and unexpectedly, but in other instances it does not result till after several seizures, when, at length, one more violent than the others interrupts the respiratory function and causes death.

Occasionally, when life is preserved, there is some permanent ill effect of eclampsia. Bouchut says: "The origin of certain permanent contractions which bring on deviation of the head or of other parts, retraction of the limb, paralysis, etc., must be referred to the convulsions of the muscles. I have seen several children in whom torticollis had no other cause. The drooping of the upper eyelid, strabismus, irregularity of the mouth, severe contractions of the limbs, often depend on this influence. These accidents are consequences of essential as well as of symptomatic convulsions."

Anatomical Characters.—The morbid anatomy pertaining to eclampsia is in most cases twofold: first, the pathological states which precede and cause the convulsive movements; secondly, those which result from them. We have seen that in sympathetic eclampsia the diseases which sustain a causative relation are very numerous; some are constitutional, others local, and the latter may have their seat in almost any part of the economy, distinct from the cerebro-spinal axis. In some cases of sympathetic eclampsia the immediate cause is too active a circulation, a state of hyperæmia of the cerebral vessels.

It has already been stated that this hyperæmia may be diagnosticated in young infants in whom the anterior fontanelle is open. Such infants, seized with acute inflammation of the mucous surfaces or of the lungs, often present a full and rapid pulse and a convex and forcibly pulsating fontanelle before the eclampsia begins. In other cases of sympathetic eclampsia the primary disease induces passive congestion of the brain, and this in turn gives rise to convulsions. Eclampsia occurring during the paroxysms of hooping-cough affords an example. In the contagious

diseases, as smallpox and scarlet fever, eclampsia is doubtless often produced by the direct action of the specific virus on the cerebro-spinal system. Therefore, in a considerable proportion of cases of eclampsia due to diseases not located in the cerebro-spinal system—in other words, of sympathetic eclampsia—the primary disease induces a pathological state of the cerebral vessels, or of the blood which circulates through them, which state immediately precedes and accompanies the convulsions.

In other cases of sympathetic eclampsia the convulsive movements are produced by the primary disease acting directly on the nervous system, through the medium of the nerves, without causing any appreciable alteration in the state of the cerebro-spinal axis. Thus Barrier relates three fatal cases of convulsions occurring in pneumonia, in none of which was there anything abnormal in the condition of the brain or its membranes.

The pathological state preceding SYMPTOMATIC eclampsia differs in different cases, since convulsions occur in almost every disease of the brain and its membranes. The immediate cause of this form of eclampsia may be active or passive cerebral congestion, with or without effusion ; it may be compression of the brain from various causes ; it may be a deficiency as well as excess of the cerebro-spinal fluid.

In essential eclampsia the cause sometimes produces congestion of the brain prior to the convulsive seizure. In other cases, as when convulsions occur immediately from the effect of anger or fright, there is no appreciable change in the state of the nervous centres previously to the attack.

Again, eclampsia, especially when severe and protracted, and when occurring in successive attacks, may be the cause of certain lesions. It produces congestion of the brain and membranes, and perhaps of the spinal cord. Sometimes if the congestion be great, there is also escape of serum from the distended capillaries, and the fibrin in the larger vessels, as the sinuses may coagulate.

The congestion resulting from eclampsia may give rise to extravasation of blood and the formation of a clot. If this accident occur, there is often paralysis affecting more or less of one side, permanent or gradually disappearing.

It may be difficult to decide whether the cerebral congestion precedes the eclampsia or is its result ; but in those cases in which it precedes and operates as a cause, it is no doubt increased during the convulsive period. The spasmodic muscular action, by rendering respiration irregular and imperfect, also leads to congestion of the lungs and sometimes of the abdominal organs.

DIAGNOSIS.—The only disease for which there is danger of mistaking eclampsia is epilepsy, but the diagnosis can ordinarily be made by recollecting the following facts: Eclampsia is most common in infancy. If it occur after the age of three years there is some manifest exciting cause, which renders the child seriously sick independently of the convulsions,

and prior also to their occurrence. Eclampsia very seldom occurs in one who has reached the age of three years, even with a strong predisposing cause, unless he have been subject to it as shown by his history during the period of infancy. On the other hand, epilepsy rarely occurs before the age of three years. The first attacks of it are often very mild, the *petit mal* of writers, but in other cases they are tolerably severe from the first, but whether mild or severe, they occur with no previous or coexisting sickness, and with little or no warning.

Having seen a considerable number of epileptic children in the Bureau for the Relief of the Out-Door Poor during the last five years, I have been surprised to learn how few had eclampsia when infants. It was exceptionally the case that a child having epileptic attacks commencing as ordinarily they did, between the third and tenth years, gave the history of infantile eclampsia, and yet the convulsive movements in the two diseases seem to be identical. I cannot agree with some that the phenomena in eclampsia and epilepsy differ, except as the causes of eclampsia produce certain concomitant symptoms, and there is every reason to believe that the spasmodic muscular movements proceed from an irritation of the same portion of the cerebro-spinal axis, to wit, the medulla oblongata. Writers like Neimeyer have given reasons for the belief that spasmodic muscular movements are produced by functional disturbance of this part of the nervous centre. I may state the following, to which I am not aware that any one has alluded. If the exposed medulla of an acephalus monster be pressed or pinched, convulsions like those of eclampsia and epilepsy result. These two diseases, therefore, have a close resemblance anatomically and clinically, but by attention to the above facts they can ordinarily be distinguished from each other.

It is often difficult to ascertain the form of eclampsia, whether essential, symptomatic, or sympathetic—in other words, to determine the cause—till after the convulsions cease. This is especially true when, as is frequently the case, the physician is not summoned till the convulsive movements begin, and it is necessary that he should act promptly, with but little knowledge of the child's previous history. If there be an obvious antecedent disease, as hooping-cough or meningitis, the cause is apparent · but if the previous health have been good, or but slightly disturbed, it may be necessary to make more than one visit or examination in order to ascertain the seat and character of the cause. In the majority of cases of convulsions occurring suddenly in a state of previous good health, the cause is seated in the intestines, but sudden and unexpected attacks may be due to the commencement of some inflammatory affection, as pneumonia, or of a febrile disease, as smallpox. Unless the eclampsia be speedily fatal, the physician, if he examine carefully, will, in most cases, soon be able to ascertain the nature of the cause, and diagnosticate the form of the disease.

Prognosis.—Symptomatic eclampsia is always serious. If it occur in the course of a cerebral disease, it indicates the approach of death, but if at the commencement, some may recover. The recurrence of it, whatever the cerebral disease, is an almost certain prognostic of death.

In idiopathic or essential convulsions the prognosis depends on the severity of the attack, and on the age, strength, and previous condition of the child. If there be predisposing or co-operating causes, as a nervous or excitable temperament, or dentition, the prognosis is less favorable than when such causes are absent.

In sympathetic eclampsia the prognosis varies greatly, according to the nature of the primary disease, and often according to the stage of that disease. If convulsions occur at the commencement of an eruptive fever, they generally subside without untoward symptoms, and the fever pursues a favorable course. Eclampsia, after the appearance of the eruption, is premonitory of a fatal result. I have not yet known a patient with scarlet fever recover who had convulsions after the rash had covered the body, and experienced physicians of this city tell me that their observations correspond with mine. Dr. J. F. Meigs, however, relates one favorable case. If the cause of the eclampsia be located in or upon the mucous surfaces, a majority recover with judicious treatment. In convulsions consequent on pneumonia or a burn, more die than recover.

The prognosis in eclampsia is more favorable if the parallelism of the eyes be retained, the pupils remain sensitive to light, and consciousness soon return. A fatal termination may be predicted, if, after the convulsion, the child remain stupid, without any evidence of returning consciousness, and the pupils do not respond to light.

Treatment.—Fortunately, inasmuch as the physician is often required to treat eclampsia in ignorance of the cause, the same measures are demanded, to a considerable extent, in all cases, whether the form be essential, symptomatic, or sympathetic. As early as possible in the attack the feet should be placed in hot water to which mustard is added, or, if it can be procured with little delay, a general warm bath may be used in place. This has a soothing effect upon the nervous system and promotes muscular relaxation, while it also produces derivation of blood from the cerebro-spinal axis. It is, therefore, useful, especially in those cases in which active or passive congestion precedes the eclampsia ; it is also useful as a preventive of passive congestion and consequent œdema of the brain, lungs, and other organs, which are the most serious results of eclampsia. It should be continued from six to fifteen or twenty minutes, according to the severity and duration of the attack ; at the same time cold applications should be made to the head, until its temperature, which is usually increased, is reduced. The application of a cloth, frequently wrung out of cold water, is the most convenient and ready mode of employing this agent. Cold thus employed acts promptly in con-

tracting the vessels of the brain and meninges, and diminishing the cerebral congestion. It tends, therefore, to remove one of the chief dangers.

Cold applications are also useful for reducing an elevated temperature, if it be present. In most cases of eclampsia, if the temperature reach 103°, the necessity for its reduction is urgent, and the cloths or india-rubber bag containing ice should be applied not only upon the head, but also along the sides of the face, and sometimes over the great vessels of the neck.

As a large proportion of convulsive attacks originate in the condition of the intestines, either solely or in part, it is advisable to prescribe an aperient unless there be previous diarrhœa.

The common enema of soap and water will usually produce a free and speedy evacuation, and will sometimes disclose the cause of the eclampsia in the expulsion of seeds or other indigestible substances or scybala. A cathartic is also often required, especially if the enema fail to produce sufficient evacuations. In those that are robust, and especially in those beyond the age of two or three years, calomel is an excellent purgative, is easily given, and is prompt in its action. If the symptoms indicate intestinal inflammation, the milder purgatives, as castor oil, are preferable, as they also are in young or feeble children. If the recent ingesta of the patient consisted of fruit or of substances of an indigestible character, an emetic is appropriate ; a teaspoonful of the syrup of ipecacuanha, repeated if necessary in fifteen or twenty minutes, may be given to a young child, or this syrup with the syrup. scillæ compositus to one older and more robust. Aside from the ejection of the offending substance which it produces, an emetic has some effect in controlling the convulsive movements. But the cases are rare in which emetics are indicated.

In addition to the local measures mentioned above, and measures calculated to relieve the digestive canal of any offending substance, a safe medicinal agent which will act promptly in relieving the convulsions is urgently demanded, since eclampsia, if severe and protracted, involves great danger. Fortunately such agents have been lately introduced into therapeutics, namely, the bromide of potassium or sodium, and hydrate of chloral. These agents, while they are effectual, are safe, and, therefore, their use has supplanted that of the antispasmodics, assafœtida, valerian, lavender, and chloroform, formerly employed ; no one of which, except the chloroform, exerts any direct controlling influence over the convulsions, and the chloroform is a dangerous remedy unless used sparingly.

The bromide of potassium, which I prefer, should be given every ten minutes, dissolved in cold water, till the convulsions cease, in doses of three grains to a child of one year, and of four or five grains to a child of two or three years. When the convulsions cease, the interval between the doses should be of course lengthened. In one instance an infant of eighteen months was suddenly affected by eclampsia, and the mother in

her fright mistaking the directions, gave thirty grains of bromide at one dose. Two hours afterward, when I was able to attend, I found that the convulsions had ceased at once, and that the patient was playful. Such cases show the innocuousness of a large dose of the bromide, and the safety in administering the medicinal dose often.

In severe cases the bromide does not always act with sufficient promptness and power. The hydrate of chloral should then be employed, dissolved in two or three drachms of water, and given with a small glass or gutta-percha syringe per rectum. If used in sufficient quantity, and retained by pressure with a napkin, it is quickly absorbed, and will usually, in about fifteen or twenty minutes, control the movements. For a child of one year I employ about five grains, and for one of four years ten grains. With the use of the measures indicated above, eclampsia is, in my practice, much more amenable to treatment than in former years. Unless the cause be such that recovery is impossible from the very nature of the case, the convulsions will soon cease with these measures. It is interesting to observe the effect of the chloral enema. In from five to ten minutes the convulsive movements cease in the muscles of the face, a moment later in those of the arms, and lastly in those of the lower extremities.

But additional treatment may be required, according to the pathological state which has brought on the eclampsia. If it be an eruptive fever, as scarlatina, and the eruption have receded, active revulsive measures, as hot mustard baths, are required ; if in dysentery, or other internal inflammation, the flaxseed and mustard poultice should be applied over the parts affected.

In those dangerous cases in which symptoms of cerebral congestion continue after the eclampsia ceases, additional treatment is required. The child remains drowsy, does not speak, or apparently suffer in any way, and the pupils act less readily than in health. If this condition remain after the lapse of a few hours, there is probably serous effusion. All attacks of eclampsia, unless the mildest, are followed by a period of drowsiness, but the persistence of it, with symptoms which indicate hyperæmia, with perhaps effusion within the cranium, calls for the employment of additional measures. Vesication by cantharidal collodion should then be produced behind the ears, mild revulsives be applied to the extremities, the head kept cool, the bowels open, and, in certain cases, a diuretic like iodide of potassium may be advantageously employed. The utmost care should be enjoined in reference to the hygienic management of those who are subject to eclampsia. The diet should be nutritious, but bland, and all causes of excitement be studiously avoided.

CHAPTER XII.

TETANUS INFANTUM.

Tetanus or trismus is one of the most interesting diseases of infancy. It is first, in point of time, in the long catalogue of fatal maladies. It occurs suddenly and unexpectedly in the robust as well as feeble, almost certainly destroying life within a few hours under modes of treatment heretofore employed. It is more frequent in some localities and conditions of life than in others. In New York it is more common than tetanus at any other age, or, indeed, in all other ages, since the mortuary statistics of this city exhibit a larger number of deaths from this disease in the first year of life than subsequently. Infantile tetanus occurs, with very few exceptions, in the new-born.

Interesting and important as is tetanus infantum, it must be confessed that our knowledge of it is much more limited and imperfect than it should be, when we consider what great advancement has been made in pathological inquiries during the present century. Our information in reference to its causation, symptoms, and proper treatment is not much in advance of that of M. Dazille, or Dr. Joseph Clarke, who lived in the latter part of the last century.

Did we better understand the pathology of diseases in the new-born, or could we more accurately ascertain the condition of organs at this age, doubtless we should occasionally consider those phenomena which we now designate as a disease *per se*, under the title tetanus, as symptoms of some other affection. But as tetanic rigidity and spasms in the new-born occur so abruptly, masking all other symptoms, and ordinarily ending in death, without our knowing certainly whether or not there is any antecedent disease, it seems entirely proper that we should recognize the state in which such muscular rigidity occurs with such a rapid result as an independent affection. This explanation is required from the fact that I have added to the accompanying table one case from Billard, which this observer relates under the head of spinal meningitis. In this case, an infant three days old was attacked with convulsions. "His limbs were rigid and violently bent; the muscles of the face were in a continual state of contraction." On the following day "the convulsions continued; . . . the body remained rigid, and the vertebral column, which the weight of the trunk will cause to bend with the greatest ease in a young infant, remained straight and immovable whenever the child was raised." At the autopsy, in addition to meningeal apoplexy, which is often present in those who die of tetanus infantum, a thick pellicular exudation was found

upon the spinal arachnoid. There is, therefore, a strict accordance of the symptoms and history of this case with those which other observers describe as examples of tetanus infantum ; moreover, as a satisfactory reason for including this case in our statistics, certain eminent observers, as we will see, have reported epidemics of tetanus in which meningitis was the principal lesion.

FATAL CASES.

Case 1. Male ; taken when three days old ; lived sixty hours. Labatt, *Edin. Med. and Surg. Jour.*, April, 1819.

" 2. Female ; taken when three days old ; lived forty hours. *Ibid.*

" 3. Taken when five days old ; lived fifty hours. *Ibid.*

" 4. Taken when three days old ; lived one day. *Ibid.*

" 5. Male ; taken when two days old ; lived two days. Billard, *Treatise on Diseases of Children*, Stewart's trans., p. 477.

" 6. Male ; taken when three days old ; lived two days. Romberg.

" 7. Male ; taken when six days old ; lived ninety-three hours. Dr. Imlach, *Month. Jour. of Med. Sci.*, Aug. 1850.

" 8. Female ; taken at five days ; lived four days. Caleb Woodworth, M.D., *Boston Med. and Surg. Jour.*, Dec. 13th, 1831.

" 9. Negro ; taken at seven days ; lived twenty-four hours. P. C. Gaillard, M.D., *South. Jour. of Med. and Phar.*, Sept. 1846.

" 10. Male ; taken when seven days old ; lived one day. Augustus Eberle, M.D., *Missouri Med. and Surg. Jour.*, 1847.

" 11. Taken when seven days old. D. B. Nailer, *N. O. Med. Jour.*, Nov. 1846.

" 12. Male ; taken when three days old ; lived one day. *N. O. Med. and Surg. Jour.*, May, 1853.

" 13. Negro ; taken when three days old ; lived three days. Robert H. Chinn, M.D., *N. O. Med. and Surg. Jour.*

" 14. Taken when two days old ; died in four hours after the doctor's visit. *Ibid.*

" 15. Taken when seven days old ; lived one day. C. H. Cleaveland, *New Jersey Med. Rep.*, April, 1852.

" 16. Negro ; taken when seven days old ; death finally. Greenville Dowell, *Amer. Jour. of Med. Sci.*, Jan. 1863.

" 17. Taken when twelve days old ; lived one day. Thomas C. Boswell, communicated to Dr. Sims, *Amer. Jour of Med. Sci.*, 1846.

" 18. Taken when about five days old ; died at about the age of nine days. B. R. Jones. *Ibid.*

" 19. Taken at or soon after birth ; lived two days. Dr. Sims, *Amer. Jour. of Med. Sci.*, April, 1846.

" 20. Taken at the age of six days ; lived one day. *Ibid.*

" 21. Taken when three days old ; lived two days. *Ibid.*

" 22. Male ; taken at the age of eight days ; died in three hours. Communicated to the writer.

" 23. Taken at the age of twelve hours ; lived two days. Communicated to the writer.

" 24. Female ; taken when seven days old ; lived forty-five hours. The writer.

" 25. Male ; taken at the age of seven days ; lived about forty-eight hours. *Ibid.*

Case 26. Female ; taken at the age of eight days ; lived three days. *Ibid.*
" 27. Female ; taken at the age of five days ; lived three days. *Ibid.*
" 28. Female ; taken when four days old ; lived two days. *Ibid.*
" 29. Taken when six days old ; died next day. *Ibid.*
" 30. Taken when five days old ; lived twenty-four hours. *Ibid.*
" 31. Taken when eight days old ; lived two days. *Ibid.*
" 32. Male ; taken when five days old ; lived one day. *Ibid.*

Favorable Cases.

Case 1. Negro ; female ; taken when three days old ; recovered in a few days. Robert S. Baily, *Charleston Med. Jour. and Rev.*, Nov. 1848.
" 2. Negro ; taken at eleven days ; recovered in fifteen days. W. B. Lindsay, *N. O. Med. Jour.*, Sept. 1846.
" 3. Negro ; taken when ten days old ; recovered in thirty-one days. P. C. Gaillard, *Charleston Med. Jour. and Rev.*, Nov. 1853.
" 4. Male ; taken at the age of eight days ; recovered in twenty-eight days. *Ibid.*
" 5. Negro ; taken at seven days ; recovered in fifteen days. Augustus Eberle, *Missouri Med. and Surg. Jour.*, 1847.
" 6. Taken when eight days old ; recovered in four weeks. Furlong, *Edin. Med. and Surg. Jour.*, Jan. 1830.
" 7. Taken at the age of one week ; recovered in two days. Dr. Sims, *Amer. Jour. of Med. Sci.*, April, 1846.
" 8. Female ; taken at the age of three days ; recovered in five weeks. The writer.

Period of Commencement.—Finckh, who saw cases of tetanus of the new-born in the Stuttgart Hospital, states (*Hecker's Annalen*, vol. iii., No. 3, p. 304) that it began in [illegible]e case on the second day after birth, in eight on the fifth, and in seven [illegible] the seventh.

Professor Cederschjold, of St[illegible]kholm, treated forty-two cases in hospital practice in 1834, and in thes[illegible] cases it usually commenced between the ages of four and six days. C[illegible]land says (*Medical Dictionary*) that it generally commences in the first se[illegible]en or nine days after birth, and rarely later than the fourteenth. Romberg states that it commences between the fifth and ninth days. In two hundred cases observed by Reicke, in Stuttgart, in the course of forty-two years, it was never found to commence before the fifth, rarely after the ninth, and never after the eleventh day. Schneider says that the disease occurs oftenest between the second and seventh, and rarely after the ninth day. In six cases reported by Dr. C. Levy, of Copenhagen, it began in two on the third day, in two on the fifth, and in two on the sixth. Dr. Greenville Dowell (*Amer. Jour. of Med. Sci.*, Jan. 1863), who has seen much of tetanus infantum among the negroes in Mississippi and Texas, says it is almost sure to come on between the fifth and twelfth days after birth. In the forty cases embraced in the above table, the disease began as follows :

Age.	Cases.
One day or under,	2
Two days,	1
Three "	9
Four "	2
Five "	6
Six "	3
Seven "	8
Eight "	6
Ten "	1
Eleven "	1
Twelve "	1

Very rarely, as will be seen hereafter, tetanus begins at or so soon after birth, that it may properly be called congenital.

Frequency in Certain Localities.—Tetanus infantum occurs probably in all countries, but it does not greatly increase the mortality except in certain localities. Some of the British and Continental physicians, whose observations of disease have been ample, confess that they have seen so few cases that they have almost no personal knowledge of this malady. On the other hand, there are, or have been, places in every zone where it is or has been so prevalent as to sensibly check the increase of population. The attention of the profession, more than a half century since, was directed to the prevalence of tetanus in the Island of Heimacy, off the coast of Iceland. On this island scarcely an infant escaped, while on the mainland scarcely one was affected. Heimacy, the product of volcanic action, of small extent and almost destitute of vegetation, supports a scanty population. The inhabitants live chiefly on the flesh and eggs of the sea-fowl, and are filthy and degraded in their habits. About the year 1810, the Danish government deputed the *landphysicus* of Iceland to visit Heimacy, and ascertain the nature of the disease which was so destructive to the infants. Although this gentleman, from his brief stay, saw no case himself, he obtained interesting particulars in reference to the disease from the priests and parents. At this time scarcely an infant escaped. Again, according to Dr. Schleisner, whose report in reference to the same locality was published forty years later, tetanus was still the most fatal of all infantile maladies.

Tetanus infantum is also represented as very fatal in the Island of St. Kilda, off the coast of Scotland. In the temperate regions of America and Europe cases are not frequent, except occasionally in the poor quarters of the cities, in foundling hospitals, and rarely in country towns where the conditions are favorable for its occurrence. The records of the Dublin, Stuttgart, and Stockholm lying-in asylums furnish many cases. In the town of Fulda, Germany, in 1802, Dr. Schneider saw six cases in fourteen days, while a midwife in the same place stated that she had seen more than sixty in nine years.

But the greatest mortality from tetanus infantum is in the warm climates, both of the Eastern and Western Hemispheres. In the West Indies, the southern portion of the United States, the equatorial regions of South America, and in the islands of Minorca and Bourbon, it has, in many localities, been the most frequent and fatal of infantile maladies.

It is an interesting fact that in the warm regions of the United States the victims are chiefly negro infants. L. S. Grier, M.D., of Mississippi, says, in the *N. O. Med. and Surg. Jour.*, May, 1854 : "The first form of disease which assails the negro among us is trismus. The mortality from this disease alone is very great. No statistical record, we suppose, has even been attempted, but from our individual experience we are almost willing to affirm that it decimates the African race upon our plantations within the first week of independent existence. We have known more than one instance in which, of the births for one year, one-half became the victims of this disease, and that, too, in spite of the utmost watchfulness and care on the part of both planter and physician. Other places are more fortunate, but all suffer more or less ; and the planter who escapes a year without having to record a case of trismus nascentium may congratulate himself on being more favored than his neighbors, and prepare himself for his own allotment, which is surely and speedily to arrive." Dr. Wooten (*N. O. Med. and Surg. Jour.*, May, 1846) says : "It is a disease of fatal frequency on the cotton plantations in this section of Alabama." He has, however, never seen a white child affected with it.

In New Orleans, according to the death statistics in our possession, which, however, relate to only one year, tetanus infantum is the most fatal of all diseases except phthisis. Mr. Maxwell says, in the *Jamaica Physical Journal* (copied in the *London Lancet*, April 11th, 1835) : "From observations that I have made for a series of years, . . . I found that the depopulating influence of trismus neonatorum was not less than twenty-five per cent. It scarcely has a parallel within the bills of mortality." This gentleman's observations relate to the West Indies. Similar statements are made in reference to this malady as it occurs in Cayenne and Demerara in South America.

While tetanus infantum prevails in regions wide apart, and presenting very diverse climatic conditions, there is a similarity as regards the personal and domiciliary habits of the people who suffer most from its occurrence. It occurs chiefly among those who are filthy and degraded in their habits, who live, either from choice or necessity, in neglect of sanitary requirements. This fact aids us in an understanding of the—

Causes.—That uncleanliness and impure air are a cause of tetanus is as fully demonstrated as most facts in the etiology of diseases. The attention of the profession was forcibly directed to this cause by Dr. Joseph Clarke in a paper read before the Royal Irish Academy in 1789. This

physician was in charge of the Dublin Lying-in Asylum, and had rightly concluded that the mortality among the new-born infants was due to imperfect ventilation. Through his advice, apertures, twenty-four inches by six, were made in the ceiling of each ward ; three holes, an inch in diameter, were bored in each window-frame ; the upper part of the doors leading into the gallery were also perforated with sixteen one-inch apertures, and the number of beds was reduced. The results of these simple sanitary regulations may be seen from Dr. Clarke's own statement. He says : " At the conclusion of the year 1782, of 17,650 infants born alive in the Lying-in Hospital of this city, 2944 had died within the first fortnight, that is, nearly every sixth child." The disease in nineteen cases out of twenty was tetanus. After the wards were better ventilated, namely, from 1782 till the time of the preparation of Dr. Clarke's paper, 8033 children were born in the hospital, and only 419 in all had died, or about one in nineteen. So impressed was Dr. Evory Kennedy, who at a later period had charge of the same asylum, with the belief that Dr. Clarke had discovered the true cause, and had been able in great measure to prevent it, that he writes in his enthusiastic way : " If we except Dr. Jenner, I know of no physician who has so far benefited his species, making the actual calculation of human life saved the criterion of his improvements." The cases occurring in my own practice have almost all been in tenement-houses, where habits of cleanliness are not observed, and I have not yet seen, in the practice of others, nor heard of a case which occurred in the better class of domiciles. The statement of physicians in the Southern States, who speak from extensive observation among the negroes, are strongly corroborative of the idea that the disease is in great measure due to uncleanliness and impure air.

Dr. Greenville Dowell, of Texas, states that he has been able to trace tetanus infantum to the bedclothes, saturated with excrementitious matters, which are found in the negro cabins. In a paper published in the *Nashville Journ. of Med. and Surg.*, June, 1851, by Prof. John M. Watson, the frequency of this disease among the negroes is accounted for as follows :

" When called to see their children, we find their clothes wet around their hips, and often up to their armpits, with urine. . . . The child is thus presented to us, when, on examination, we find the umbilical dressings not only wet with urine, but soiled, likewise, with fæces, freely giving off an offensive urinous and fæcal odor, combined at times with a gangrenous fetor arising from the decomposition, not desiccation, of the cord."

Another cause is believed to be some irritation in the intestines, as from retained meconium. Observers in the Southern States and elsewhere occasionally mention this as a cause. In one case treated by myself, there was obstinate constipation immediately before the attack, and in another diarrhœa preceded, and was the only apparent cause.

In certain cases the assignable cause is exposure to wet or cold, or to a variable temperature, which, it is known, occasionally causes tetanus in the adult. Prof. Cederschjold attributed the epidemic which he observed in Stockholm to a sudden change of temperature from hot weather in May, to frosty in June. In a case related by Dr. P. C. Gaillard, in the *Southern Jour. of Med. and Pharmacy*, Sept. 1846, the disease commenced as follows : The nurse came in with wet apron and clothes, in the evening ; a short time after she had taken the child into her lap, it sneezed violently two or three times. At 10 P.M. tetanus began. In certain localities on the continent, where there are no parish churches, the frequent occurrence of tetanus has been attributed by the physicians to the practice of carrying the infants to a distance to be christened, thus exposing them to the winds. In this city I have observed tetanus after a similar exposure. The influence of the weather in the production of tetanus of the new-born is also shown by facts observed in the Stuttgart Hospital. In an aggregate of twenty-five cases treated in that institution, all but three occurred in the cold months. In the Island of Cayenne, at a hamlet surrounded by mountains and dense forests, tetanus attacked only one in every twelve or fifteen of the infants. After a great part of the forests had been cut down, so as to allow access to the cold sea winds, almost all the new-born infants fell victims to tetanus. (*Insel, Cayenne.*)

Hein relates that a citizen of Berlin lost, successively, two children with tetanus soon after birth. When the second child fell ill he observed that its cradle was exposed to a current of air. At the third accouchement the position of the cradle was changed and the infant escaped. Exposure to wet and cold has been long recognized as a cause of the disease. According to Sauvages, " Hic morbus hieme et cum aurâ humidâ sæpius advenit quam sicca æstate." (*Nosol. Method*, vol. i. p. 531.)

The causes of infantile tetanus, enumerated above, may be proximate or remote, may produce the disease by their direct effect on the system or indirectly by causing a pathological state which in turn leads to the development of the disease. There are other direct causes, namely, organic affections. In the bodies of the new-born who die of tetanus, lesions are observed which doubtless result from the spasms. Again, others are found which, from their nature, could not be a result, and which, being observed in different cases, are to be regarded as causes. The most frequent of such lesions is inflammation of the umbilicus or umbilical vessels.

Moschion, who lived in the first century of the Christian era, stated in writings still extant that stagnant blood in the umbilical vessels sometimes produced dangerous disease in the new-born infant, and it is supposed, though this is doubtful, that he referred to tetanus. In modern times the attention of the profession was more particularly directed to this cause by a paper published by Dr. Colles, in the first volume of the

Dublin Hospital Reports, in 1818. The observations contained in this paper were made in the Dublin Lying-in Hospital during the period of five years. In each of these years he had witnessed from three to five post-mortem examinations in cases of infantile tetanus, and the lesions, he states, were in all much alike, as follows : The floor of the umbilical fossa was lined by a membrane apparently formed by suppurative inflammation, and in the centre of this fossa was a large papilla. This papilla consisted of a soft yellow substance, apparently the product of inflammation, and in all the cases the umbilical vessels were in contact with this substance and were pervious. In a few instances superficial ulcerations were found near the mouth of the umbilical vein, and occasionally the skin surrounding the umbilicus was raised. The peritoneum covering the vein was highly vascular, often not to a greater distance than an inch above the umbilicus, but sometimes as far as the fissure of the liver. The peritoneum in the course of the umbilical arteries presented the inflammatory appearance in still greater degree, sometimes as far as the sides of the bladder. The connective tissue lying along the arteries and urachus anteriorly was loaded with a yellow watery fluid. The inner surface of the umbilical vein was not inflamed, but its coats, in general, were thickened. On slitting open the arteries, a thick yellow fluid resembling coagulable lymph, was found within their coats, and in all cases these vessels were thickened and hardened as far as the fundus of the bladder.

Dr. Finckh, who observed twenty-five cases in the Stuttgart Hospital, believes that the most frequent cause was suppuration or ulceration of the umbilical cord. In ten of the twenty-five cases the navel was dry and cicatrized ; in the remainder it was either wet or swollen, with a bluish-red inflamed edge at the margin of the navel ; a dirty viscid pus covered the umbilical depression.

Dr. Levy, physician of the Foundling Hospital in Copenhagen, attended twenty-two cases in that institution in 1838 and 1839. Of these, twenty died, and fifteen were examined carefully after death. In fourteen there were decided marks of inflammation in the umbilical arteries, especially those portions lying along the urinary bladder ; in several cases the peritoneum over the arteries was much injected, and in three adherent either to the omentum or intestine by coagulable lymph ; the coats of the arteries were thickened, their cavities dilated and containing dark-reddish brown or greenish puriform matter, always fetid. Sometimes the arterial tunica interna was found ulcerated and absent in places, and there was spongy thickening of the subjacent connective tissue. In two cases the ulcerative process had extended from the tunica interna to the peritoneum, and there was a deposit of thick ichorous matter around the ulcer ; in one case both arteries were so softened that their coats were scarcely distinguishable, and in another these vessels had become gangrenous. The appearance of the umbilicus was unchanged in four cases ; in

ten the fundus was red and filled with puriform fluid, which quickly reappeared when removed, and, in general, shortly before death, the navel presented a greenish color.

According to Romberg, Dr. Scholler made post-mortem examinations in eighteen cases of tetanus infantum, and in fifteen found inflammation of the umbilical arteries. These vessels were swollen near the bladder, in one case to the diameter of four lines, and were found to contain pus. The lining membrane was eroded or covered with an albuminous exudation. Both arteries were not always equally inflamed, and in three cases only one was affected.

Schneeman found minute points of suppuration in the umbilical vein in eight cases (*Holscher's Annalen*, vol. v. p. 484, 1840), and pus throughout the course of this vessel in one.

The observations mentioned above were made, for the most part, in hospitals on the Continent; but similar observations have been made in private practice. M. Borian, of the Isle of Bourbon, says that he has found in every case inflammation around the umbilicus (*Gazette Medicale*, Paris, July 11, 1841). Dr. John Furlonge (*Edin. Med. and Surg. Jour.*, Jan. 1830), who resided at St. John's, Antigua, attributes the disease to improper dressing of the umbilicus. The same opinion is expressed by Mr. Maxwell, who also saw the disease in the West Indies (*Jamaica Phys. Jour.*, copied into the *London Lancet*, April 11, 1855). Dr. Ransom states, in a communication to Prof. John M. Watson (*Nashville Jour. of Med. and Surg.*, June, 1851), that he has never seen a case of tetanus of the new-born in which the umbilicus was healthy. In a case related by Robert S. Bailey, in the *Charleston Med. Jour. and Rev.*, Nov. 1848, there was a hard scab on one side of the umbilicus, and this part was much distended. A discharge followed the removal of the scab and the child recovered. In a favorable case, related by W. B. Lindsay, in the *N. O. Med. and Surg. Jour.*, Sept. 1846, the umbilicus was tumid, and not disposed to heal. Dr. H. O. Wooten (same journal, May, 1846) attributes the disease to the condition of the umbilicus and umbilical vessels, and states that he has found the umbilicus gangrenous. In a case related in the *N. O. Med. and Surg. Jour.*, May 1, 1853, the umbilical vessels were blocked up by purulent matter. Robert A. Chime, M.D., Brazoria, Texas (*N. O. Med. and Surg. Jour.*, Sept. 1854), believes one cause of the disease to be improper tying and management of the umbilical cord, by which a diseased state is produced, which extends to the umbilicus, and thence to the viscera. At a meeting of the Obstetrical Society of Edinburgh, held April 24, 1850, Dr. Imlach related a case in which there was a dark and gangrenous appearance on the integument around the umbilicus, and the peritoneum underneath was also dark but not inflamed; umbilical vein healthy; a little fibrin in the left umbilical artery; right umbilical artery much diseased; its two inner coats

apparently destroyed, and in their place a yellow pultaceous slough, in which pus-globules were discovered with the microscope.

It is evident that the pathological state of the umbilicus and umbilical vessels described above, and which has been noticed by so many observers in different countries, cannot result from the tetanus. It is possible that the puriform substance noticed in the umbilical vessels was disintegrated fibrin, which had coagulated at the time of ligation of the cord, and the cells seen by Dr. Imlach and others may sometimes have been white corpuscles still remaining from the stagnated blood. (*Virchow's Cellul. Pathol.*) Still the evidences of inflammation, in at least a part of the cases related above, were of a positive character.

The belief that umbilical lesions occasionally cause tetanus infantum comports with the well-known traumatic causation of tetanus in the adult. This belief is strengthened by the fact, which will appear farther on in our remarks, that tetanus of the new-born, from being frequent in certain localities, has become infrequent through greater care in dressing and managing the umbilical cord.

But there are cases of tetanus infantum in which there is no disease in or about the umbilicus. Dr. Finckh, of Stuttgart, examined the umbilical vessels in eleven cases without discovering any pathological change. Dr. Samuel B. Labatt, master of the Dublin Lying-in Hospital, published in the *Edin. Med. and Surg. Jour.*, April, 1819, a paper entitled "An Inquiry into an Alleged Connection between Trismus Nascentium and certain Diseased Appearances in the Umbilicus." This paper was designed as a reply to the essay of Dr. Colles. Dr. Labatt relates several cases in which there was no disease of the umbilicus and umbilical vessels, and others in which the disease was so slight that it probably produced no injurious effect on the health of the child. Dr. James Thompson, who spent considerable time in the tropical regions, says (*Edin. Med. and Surg. Jour.*, Jan. 1822): "I have myself examined nearly forty cases of infants that have sunk under this complaint. In many I have looked at no other part but the navel, and have found it in all states; sometimes perfectly healed, especially if the infants had lived several days; at other times a simple clean wound. When death occurred on the fifth or sixth day, the wound was frequently in a raw state. I never yet saw it in a sphacelated condition." This writer concludes from his observations that there are cases in which the cause is located elsewhere than in the umbilicus or umbilical vessels. In the *Dub. Jour. of Med. and Chem. Sci.*, Jan. 1836, Dr. John Breen remarks: "From dissections . . . we have never been able to discover any peculiar morbid appearance which would justify us in offering any explanation of the pathology of the disease." In my own cases there was no evidence of disease of the umbilicus or umbilical vessels so far as could be ascertained by external examina-

tion, and in one (No. 32) a careful post-mortem examination disclosed no lesion of these parts.

The inference from the above observations is that, although umbilical disease may be an occasional, probably not infrequent, cause of tetanus infantum, cases occur in which such disease is not present, and we must look for the cause elsewhere. From the nature of tetanus infantum, the cerebro-spinal axis has been from time to time examined in those who have died of this malady, and occasionally sufficient cause has been found in this part of the system.

I have alluded in another connection to a case from Billard, in which tetanic rigidity occurred in an infant three days old, as the result of spinal meningitis. That tonic spasms not infrequently occur in older children in consequence of meningeal inflammation is well known, and in some of the reported epidemics of infantile tetanus meningitis was really present, and was doubtless the cause of the tonic spasms. Such an epidemic was observed by Professor Cederschjold in Stockholm, in 1834. Within a few months he treated forty-two cases, and, in addition to the lesions which are known to result from tetanus, there was found in the bodies examined a plastic exudation at the base of the brain. Finckh, of Stuttgart, made twenty post-mortem examinations of those who had died of this disease, and in nine found spinal meningeal inflammation.

Meningitis in the new-born is, however, rare, and we must regard it as an exceptional cause of tetanus.

In 1846 there appeared from the pen of Dr. Sims, then practising at Montgomery, Alabama, a paper designed to show that tetanus of the new-born is produced by pressure exerted on the nervous centre, through depression of the occipital bone. In 1848 the same writer published a second paper, also, in the *Amer. Jour. of Med. Sci.*, fully enunciating his theory as follows: "That trismus neonatorum is a disease of centric origin depending on a mechanical pressure exerted on the medulla oblongata and its nerves; that this pressure is the result, most generally, of an inward displacement of the occipital bone, often very perceptible, but sometimes so slight as to be detected with difficulty; that this displaced condition of the occiput is one of the fixed physiological laws of the parturient state; that when it persists for any length of time after birth it becomes a pathological condition, capable of producing all the symptoms characterizing trismus neonatorum, which are instantly relieved simply by rectifying this abnormal displacement, and thereby removing pressure from the base of the brain." In both papers cases are narrated in support of this theory, but there are serious objections to this mode of explaining the occurrence of the disease. In the first place, if this explanation were correct, tetanus ought ordinarily to occur sooner, for the occiput is as much depressed previously, and in the majority of cases more

depressed than at the period when it does actually commence. Pressure on the medulla would certainly be followed by immediate and marked symptoms, instead of an immunity for four or five days.

Again, well-known facts in reference to the causation of tetanus infantum conflict with Dr. Sims's theory, as, for example, epidemics of the disease, its prevalence in one locality and absence in another, although no particular attention be given to the position of the infant, the diminution of the number of cases by greater attention to cleanliness, of which there is abundant proof. Moreover, there are many reported cases of this disease at the commencement of which there was no perceptible displacement of the occipital bone.

The inequality of the cranial bones often observed in tetanus infantum should, in my opinion, be explained as follows : When the new-born infant becomes emaciated the volume of the brain is diminished, like that of the trunk or limbs, and the sinking of the occipital bone simply corresponds with the amount of waste in the cerebral substance. Whatever the disease in the young infant, if there be much emaciation, the parietal bones will usually be found more prominent than the occipital. Now, in fatal tetanus infantum emaciation is very rapid ; those fleshy and plump, if the disease do not speedily end, become pinched and wrinkled. Viewed in this light, the occipital depression should be regarded as a result, and not a cause, of the tetanus.

Although we do not accept the theory which attributes tetanus infantum to occipital depression, there are a few cases on record in which it was apparently due to injury of the head received at birth. Dr. Sims has related one such case, that of a negro infant. The mistress, an observing lady, gave to Dr. Sims the following account of it : Its head was " mightily mashed. . . . The bones seemed to be loose. I got it to take a little boiled milk on the first day ; but it swallowed very little and very badly, for its jaws seemed to be locked. On the next day it took spasms and got stiff all over ; its hands were shut up tight, and its arms were bent up so (she placed her forearms at right angles). Every time I touched it the spasm would get worse all over, screwing up its face till it was the ugliest thing in the world ; and when the spasms wore off it looked as well as any other new-born baby. But then the stiffness never left it, and the spasms kept coming and going till it died." It lived two days.

It is evident, from the description given by the mistress, that this was a case of tetanus commencing at or so soon after birth that it seemed almost congenital. The apparent cause was injury of the head, occurring in consequence of protracted birth, the infant being resuscitated with difficulty after several minutes.

Dr. W. C. Sutton published a similar case in the *Nashville Jour. of Med. and Surg.*, April, 1853. The infant at birth was apparently dead,

but was resuscitated so as to live eighteen hours in a state of tetanic rigidity. In cases in which tetanus begins at birth, doubtless, the cerebro-spinal axis is in some way affected ; but in the absence of post-mortem examinations, the exact nature of the lesion is uncertain.

It is evident, therefore, that in this disease, as in eclampsia, the cause in different cases may be entirely distinct. Dr. James Johnson, many years ago, expressed his belief in the multiplicity of causes, and he had been a careful and intelligent observer in the West Indies.

The causes may be arranged in two groups, one external, the other internal. In the first group should be placed imperfect ventilation, personal and domiciliary uncleanliness, and atmospheric vicissitudes ; in the second group, so far as ascertained, inflammation of the umbilicus and umbilical vessels, meningitis, and, rarely, injury of the cerebro-spinal axis during birth.

The lesions resulting from tetanus infantum pertain chiefly to the circulatory system. In the cases examined by Professor Cederschjold, of Stockholm, already alluded to, the meningeal and cerebral vessels, and those of the spinal cord, the cavities of the heart, and the large vessels connected with the heart, were distended with blood.

Finckh made post-mortem inspection of twenty cases in the Stuttgart Hospital, the bodies at death having been placed on their faces, in order to prevent any deceptive appearance from the gravitation of blood. In four there was no appreciable alteration in the spinal cord or its membranes. In the remaining sixteen there was effusion of blood, in considerable quantity, the whole length of the spinal cord, between the bony walls and the dura mater. It should be stated, however, that there was spinal meningeal inflammation in nine of the sixteen, though the extravasation did not, probably, result from the inflammation, but from the tetanus. The blood in Finckh's cases was very dark, sometimes fluid, at other times coagulated. In one case there was no change in the appearance of the brain or its membranes. In the remaining nineteen, more or less extravasated blood was found on the surface of the brain, or in its interior. The substance of the brain was healthy, as also its membranes, except the congestion. The only abnormal appearance observed in the thoracic and abdominal viscera was strong contraction of some portion of the intestinal tube in five cases. Dr. West says : " The most frequent post-mortem appearances in these cases"—referring to tetanus infantum—" and that which I found in the bodies of all the four children whom I observed, consists of effusion of blood, either fluid or coagulated, into the cellular tissue surrounding the theca of the cord. Conjoined with this there is generally a congested state of the vessels of the spinal arachnoid, and sometimes an effusion of blood or serum into its cavity. The signs of congestion about the head are less constant, though much oftener present than absent, and sometimes existing in an extreme degree ; while

in one instance I found not merely a highly congested state of the cerebral vessels, but also an effusion of blood, in considerable quantity, between the skull and dura mater, and also a slighter effusion into the arachnoid cavity." Dr. Weber, of Kiel, also placed infants who had died of tetanus on their faces, and, without exception, found injection of the capillaries of the cord and spinal meninges, and extravasation of blood. M. Matuszynski, according to Bouchut, "has observed effusions of blood of variable quantity, in the cerebral pia mater, in the ventricles, and in the choroid plexuses, with considerable injection of the membranes of the brain. He has also seen serous infiltration beneath the arachnoid, and serous effusion into the ventricles, accompanied by a diminution of the consistence of the cerebral substance." In two cases examined by myself there was intense injection of the cerebral meninges and of the meninges of the upper part of the spine, but no extravasation was noticed. The spinal canal was not opened. In a third case, in which the spinal canal was opened, there was extravasation in addition to the congestion; this was especially observed along the spinal theca.

Dr. H. O. Wooten (*N. O. Med. and Surg. Jour.*, May, 1846) states that he has made several post-mortem examinations, and has found the pathological appearances as uniform as in any other disease, as follows: "Engorgement of the substance of the brain, and of the meninges lining the base of the brain, the medulla oblongata, and spinal marrow; liver congested."

In a case related by Dr. Imlach before the Edin. Obst. Soc., April 24th, 1850, the upper part of the lungs was healthy, the posterior portion congested, and containing many dark points; heart and liver healthy; small intestines of a light-brown color; stomach and large intestines pallid; there had been umbilical hæmorrhage.

Romberg states that he found in a child, whose death occurred from this disease, such intense congestion of the veins and sinuses of the brain, that a slight touch, and the removal of the cranial bones, produced extravasation of the partly coagulated and partly fluid blood. Dr. Schöller, on the other hand, found actual extravasation of blood in the spinal canal in only one case in eighteen.

It is seen from the above observations, that tetanus of the infant is ordinarily accompanied by great passive congestion, which is especially marked in the cerebro-spinal axis, and that frequently extravasations occur from the distended capillaries. The embarrassment of respiration and the retarded circulation of blood consequent on the tetanic rigidity, afford sufficient explanation of this state of the vessels.

Symptoms.—In many cases premonitory symptoms are absent, or are so slight as to escape notice. Sometimes there is a degree of fretfulness previously, but no more than is often observed in those who continue in good health. The first symptom which alarms the parents, and shows

the grave nature of the commencing disease, is inability to nurse, or evident pain and hesitation in nursing. Commencing with rigidity of the masseters, the disease gradually extends to the other voluntary muscles, and in the course of a few hours the muscles of the limbs, as well as of the trunk, are involved. Persistent muscular contraction, which is the pathognomonic feature of infantile tetanus, is developed not fully in the beginning, but by degrees in each affected muscle, so that it is not till after the lapse of several hours, perhaps even a day, that the greatest amount of rigidity is attained. Therefore, in the commencement of the disease, the limbs can be bent, and the jaws pressed open, more readily than at a subsequent stage, though with manifest pain to the infant.

During the period of maximum rigidity, the jaws are fixed almost immovably, often with a little interspace between them, against which the tongue presses, and in which frothy saliva collects. The head is thrown backward and held in a fixed position by the stiffness of the cervical muscles. The forearms are flexed ; the thumbs are thrown across the palms of the hands, and are firmly clenched by the fingers ; the thighs are drawn toward the trunk ; the great toes are adducted, and the other toes flexed. Occasionally opisthotonos results from the extreme contraction of the dorsal and posterior cervical muscles. The infant can sometimes be raised without any yielding of the muscles, by one hand under the occiput and the other under the heels.

The rigidity is liable to variation in its intensity, even after the full development of the disease. If the infant be quiet, especially if asleep, the muscles are partially relaxed to such an extent sometimes, in the first stages of the complaint, that the features have a placid and natural expression, though only for a short time. There are frequent exacerbations in the muscular contraction, sometimes occurring without any apparent cause, and sometimes produced by anything which excites or disturbs the child. Attempts to open the lips or jaws, or eyelids, or to bend the limbs, blowing on the face, or even the crawling of a fly upon it, occasions the paroxysm.

During the paroxysm the eyelids are forcibly compressed, as well as the lips, which are either drawn in or are pouting ; the forehead and cheeks are thrown into wrinkles, and the physiognomy is indicative of great suffering. The unnatural positions of the trunk and limbs, which result from the muscular contraction, are increased for the moment ; the head is more forcibly thrown back, and the limbs more strongly flexed. The muscular movements which occur during the paroxysms are sometimes described as clonic spasms. There is indeed occasionally some quivering of the limbs, and yet, as I have on different occasions noticed, so far from the muscular action being a clonic spasm, it is clearly tonic, and is intensified during the paroxysm. In fatal cases the paroxysms occur more and more frequently until the period of collapse.

The crying of the child affected by tetanus is never loud, however great the suffering. It is variously described by writers as "whimpering" or "whining." It is of this suppressed character in consequence of the rigid state of the respiratory muscles and their imperfect movement.

During the exacerbation respiration is suspended, or so imperfect, and the circulation so retarded, that the surface becomes of a deep red, almost livid, color. Sometimes epistaxis occurs, affording partial relief to the congestion, and sometimes, though less frequently, the blood forces itself from the congested liver along the umbilical vein, and escapes from the umbilicus. The intense passive congestion consequent on the tetanic spasm is general throughout the system, but extravasation of blood appears to be more common around the brain and spinal cord than elsewhere.

The frequency of the pulse and respiration varies in different cases, and at different stages of the same case. They are often somewhat accelerated, but at other times are natural, or are even slower than in health.

While the appetite of the infant, to appearance, is not diminished, the pain which it experiences in nursing is such that alimentation is necessarily deficient. It can be fed with a spoon for a time after it ceases to take food in the natural way, but artificial feeding soon fails. The milk placed in its mouth is in great part pressed back through the violence of the spasm which is induced by the attempt to feed it.

In consequence of imperfect nutrition, the infant rapidly wastes away. There is no other disease except the diarrhœal affections in which emaciation is so rapid. In a case related by Dr. W. B. Lindsay in the *N. O. Med. Jour.*, Sept., 1846, the record states that "the infant was fat three days before, but was now emaciated." Romberg, who saw tetanus infantum in European hospitals, and Dr. Robert H. Chinn, of Texas (*N. O. Med. and Surg. Jour.*, Sept., 1854), both speak of the rapid emaciation. The trunk and extremities lose their fulness, and the features become pinched. Several observers have noticed the appearance of miliaria in this reduced state of system, especially around the shoulders, and sometimes a decidedly icteric hue appears on the skin.

The condition of the intestines is not uniform. They may be relaxed, particularly if the disease be due to some irritation in them; in other cases the stools are natural or constipated.

It is often difficult to ascertain the state of the eyes, since attempts to open the eyelids bring on spasms and cause firm compression of the lids against each other. According to Sir Henry Holland, one of the first symptoms which occurred in cases on the island of Heimacy was strabismus, with rolling of the eyes. But this statement must be received with caution, since these cases were not seen by any physician, and the information was obtained from the parents and priests. If true, the proximate cause of the disease in Heimacy would seem to be located in the

cerebro-spinal axis. Contraction of the pupils commonly occurs in the stage of collapse.

Mode of Death.—Death in infantile tetanus may occur from apnœa in the paroxysms, from extreme congestion of the cerebral vessels, or apoplexy ; and, lastly, it may occur from exhaustion. The last mode is, probably, the most frequent.

Prognosis.—All writers till recently agree that tetanus of the infant rarely terminates favorably. Cullen attributes the ignorance of physicians in regard to this disease to the fact that it is so little amenable to treatment that they are not usually summoned to attend those affected with it. In the Island of Heimacy, of one hundred and eighty-five cases, occurring during a series of years about the commencement of the present century, not one survived ; and in the same locality, at Westmannoe, a small islet, sixty-four per cent of all the infants born died of trismus. (Report of Dr. Schleisner.) Similar statements in regard to the mortality of tetanus infantum are given by physicians in the Southern States. Dr. H. O. Wooten, of Alabama, says (*N. O. Med. Journ.*, May, 1846) that he has "never seen a decided case of tetanus nascentium that did not prove fatal, . . . and that it is very generally deemed useless to call in medical aid after the initiatory symptoms are well declared." Mr. Maxwell, speaking in reference to the West Indies, says (*Jamaica Phys. Journ.*, copied into the *London Lancet*, April 11, 1835) : "From observations which I have made for a series of years, . . . I found that the depopulating influence of trismus nascentium was not less than twenty-five per cent. It scarcely has a parallel within the bills of mortality." Dr. D. B. Nailer (*N. O. Med. Journ.*, Nov., 1846) says : "About two thirds of the deaths among the negro children are from this disease, and so uniformly fatal is it, that a physician is never sent for."

Yet death does not always result. Eight of the forty cases in my collection recovered ; but a correct opinion cannot be formed from this of the actual ratio of favorable to unfavorable cases, since favorable cases are much more likely to be published. In the history of these eight cases, two interesting facts are noticed, which, when present, may serve as a ground for hope of a successful termination. These were, the age at which the disease began, and fluctuation in the symptoms. With two exceptions, the infants who recovered were about a week old when the initiatory symptoms appeared, and there were fluctuations in the gravity of the symptoms ; whereas, fatal cases ordinarily grow progressively worse. Yet, in favorable cases, the symptoms are never so severe as they become in a few hours in those who succumb.

Duration in Fatal Cases.—Of eighteen cases observed by Finckh in the Stuttgart Hospital, fifteen died in two days, two in five days, and one in seven days. During the epidemic in the Stockholm hospitals, in 1834, where forty-two cases were treated, the disease seldom lasted more than

two days. Romberg says : " It generally lasts from two to four days, but its duration is at times limited at from eight to twenty-four hours, and occasionally, though rarely, it extends from five to nine days."

In thirty-one fatal cases in my collection, in which the duration is mentioned :

One lived	3 hours.
Eleven others lived	1 day or less.
Twelve lived	2 days.
Four lived	3 days.
Three lived	4 days.

Both Underwood, who published a little treatise on diseases of children in 1789, and Dr. Elsässer, at a more recent date, record fatal cases which were unusually protracted. The one described by Underwood was treated in the British Lying-in Hospital, and, although all the others treated in this institution died by the third day, this lived six weeks ; but it is suggested by the author that death was due in part to some other affection. The child treated by Elsässer lived thirty-one days.

Duration in Favorable Cases.—In the eight favorable cases in my collection, the duration of the disease, reckoned from the time when the infant ceased nursing till it began again, was as follows : In one case, two days ; in one, a few days ; in one, fourteen days ; in two, fifteen days ; in one, twenty-eight days ; in one, twenty-one days ; and in the remaining case, about five weeks.

Diagnosis.—To one who has seen this disease in the new-born, or is familiar with its symptoms, diagnosis is easy. The symptoms which possess diagnostic value are more manifest and reliable than in most other infantile maladies. Permanent rigidity of the voluntary muscles, with temporary exacerbations, such as have been described above, which are induced by any cause which disturbs the infant—as attempts to open the mouth or eyelids—is pathognomonic.

Preventive Treatment.—While tetanus infantum, if fully developed, is ordinarily fatal, in spite of any remedial measures heretofore used, there is no doubt of the efficacy and value of preventive measures, when properly employed. This was shown by the great reduction in mortality in the Dublin Lying-in Hospital through the thorough ventilation introduced by Dr. Clarke. Dr. Meriwether, of Montgomery, Ala., says (*Amer. Journ. of Med. Sci.*, April, 1854) : " When the disease appears endemically on a plantation, it may be arrested by having the negro houses whitewashed with lime, inside and out ; by raising the floors above the ground ; by removing all filth from under and about the houses ; by particular attention to cleanliness in the bedding and clothes of the mother ; and in the dressing of the child, so as to prevent any of the matter from the umbilicus lying long in contact with the skin." Many physicians, especially in the Southern States, speak confidently of

care in dressing the cord and attention to the umbilicus, as a means of prevention. In the *N. O. Med. and Surg. Journ.*, July, 1853, Dr. Grafton says that he has "never known the disease to occur in any child whose navel had the turpentine dressing." He uses turpentine as follows: "At the first time, a few drops of the undiluted turpentine are applied immediately to the umbilicus around the cord, and it is anointed at every succeeding dressing, the turpentine being diluted one half or two thirds with olive oil, lard, or fresh butter." This use of turpentine has also been recommended by other practitioners in the warm regions.

Dr. John Furlonge, of St. John's, Antigua, believes (*Edin. Med. and Surg. Jour.*, Jan., 1830) that no case would occur with the following treatment: "The cord, when divided, should be wrapped in clean linen. Every night, for two weeks, one or two drops of tinct. opii and spts. vini, equal parts, should be given, and castor oil, with a little magnesia, every morning. The child must be washed in tepid water every morning, and the funis dressed." If this treatment be attended by the success which is claimed for it by Dr. Furlonge, so great care in dressing the cord is certainly well repaid in localities, as at Antigua, where a large proportion of the infants die of tetanus.

Some experienced observers go so far as to assert that it is possible to ward off tetanus infantum after the occurrence of premonitory symptoms. Dr. Dowell says (*Amer. Jour. of the Med. Sci.*, January, 1863): "Some, with slight twitchings of the muscles, have recovered without any trouble by being put into a mustard-bath, washed clean, and put in a clean and well-ventilated cabin."

Treatment.—In considering the effect of medicinal agents which have been employed in the treatment of infantile tetanus, the great difficulty which the child experiences in swallowing should be borne in mind. Without care, a considerable part of the dose is lost by the spasm of the muscles of deglutition, which ordinarily occurs when the spoon is placed in the mouth, so that, unless special attention be given to this matter, it is uncertain whether the prescribed dose is fully administered.

The treatment employed by different physicians has been very diverse. Antiphlogistic remedies were prescribed by Finckh, but every case so treated was fatal. He states that whenever blood was abstracted, even in small quantities, the symptoms were aggravated. The same result has followed depletory measures in the practice of other physicians.

The internal remedies which have been most frequently prescribed are opiates and antispasmodics. Furlonge, in a favorable case, gave laudanum, in doses of one drop every three hours, alternately with two grains of Dover's powder. Woodworth also gave one-drop doses of laudanum; Eberle, one sixth of a drop hourly. The opiate has generally been given in combination with an antispasmodic. The Dover's powder, given every three hours by Furlonge, was combined with five grains of sulphate

of zinc. The hourly doses of laudanum, by Eberle, were combined with six drops of tincture of assafœtida.

When anæsthetics began to be employed in the treatment of diseases it was believed that they would be especially useful in cases of tetanus. Accordingly chloroform has been used in tetanus in the infant, with the effect of controlling the spasm during the time of its use, but without curing the disease. In Case 7 in our first table it was employed several times, but apparently without delaying the fatal result. The editor of the *New Orleans Medical and Surgical Journal* states, in the May issue of that periodical for 1853, that he has used chloroform in tetanus infantum, with the effect, he believes, of prolonging life. Anæsthetics certainly relieve the suffering of the infant, and on this account, even if they do not prolong life, their judicious employment seems proper.

The remedy which, in my opinion, is far preferable to all others, is hydrate of chloral. Since the introduction of this agent into therapeutics, it has been employed by several physicians in the treatment of this disease with so good a result that it will probably supersede all other medicines for this purpose. Dr. Widerhofer, of Vienna, states that he has saved six out of ten or twelve by the use of chloral (*London Lancet*, March 18, 1871). He prescribes it in doses of one to two grains by the mouth, or, if there be great difficulty in swallowing, two or four grains by the rectum. Dr. F. Auchenthales relates a case (*Jahrb. f. Kinderheil.*, N. S., IV.) in which he gave even six-grain doses, and in nine days the disease had entirely disappeared. I have recently employed hydrate of chloral in a case of tetanus, giving it in half-grain doses, every two hours, except when there was profound sleep. The disease was fully developed, and the symptoms severe when I was called. I did not believe that the infant with the old remedies would live more than two days, but by the chloral life was prolonged nearly one week. Moreover, by the use of chloral the suffering of the infant is greatly diminished. The frequent inhalation of sulphuric ether also aids materially in controlling the spasms.

The administration of alcoholic stimulants is required at short intervals on account of the rapid emaciation and great prostration.

Local treatment directed to the umbilicus in those cases in which there is evidence of inflammation of the umbilicus or umbilical vessels should not be neglected. The application of an emollient poultice to the umbilicus has been followed by apparent improvement, if we may believe the statement of some physicians who have made use of this treatment. Dr. Merriwether, of Alabama, says, if there be no improvement from the medicine which he orders, he applies a blister, larger than a dollar, to the umbilicus, and with this treatment the child generally improves ; a remarkable statement, since so few improve at all.

A warm foot-bath, repeated at intervals of a few hours, and stimulating embrocations along the spine, are proper adjuvants to the treatment.

CHAPTER XIII.

INTERNAL CONVULSIONS.

(*Spasm of the Glottis, Laryngismus Stridulus.*)

Young children are liable to temporary suspension of respiration, induced by violent emotions, especially by anger. In the midst of their excitement, while they are crying or screaming, their breath is suddenly held, as if from tonic spasm of the respiratory muscles. In a few seconds respiration returns and is natural. There is no stridulous inspiration or other unusual sound, and there is no apparent ill effect, unless occasionally a degree of languor. External convulsions, which seem to be threatening, seldom occur, and when they do, are ordinarily mild. Some writers consider dentition the predisposing cause of this arrest of respiration, by inducing a sensitive state of the nervous system. Such an effect of dentition is possible, but certainly many infants are affected in this manner before the age of dentition.

A much more serious state, and one which is recognized as a true disease, is that variously designated by writers as internal convulsions, spasm of the glottis, child-crowing, laryngismus stridulus, etc. Manifest difficulties attend the investigation of the pathological state in this disease. There can be little doubt that it is not precisely the same in all cases. That there is, during the paroxysms, tonic or clonic spasm of more or fewer of the respiratory muscles is inferred not only from the symptoms pertaining to the respiratory apparatus, but from the fact that in severe cases there are often spasms of the external muscles, as those of the limbs and face. Usually, also, the movements of the eyeballs indicate spasmodic contractions of the motor muscles of the eyes. The fact of spasmodic muscular action in parts that are visible justifies the belief that it occurs in other parts which are concealed from view, especially as the characteristic symptoms cannot be readily explained except on this supposition. Trousseau says: "Internal convulsions consist, then, principally in a spasm of the diaphragm and of the respiratory muscles of the abdomen and chest; but it occurs, also, that the muscles pertaining to the larynx are affected with spasm at the same time with these." Rilliet and Barthez conclude from the symptoms that the "heart is not always a stranger to this internal convulsion, which, perhaps, prolongs itself even to the intestines." The muscles of the pharynx appear to be involved, in some cases, as well as those of respiration, rendering deglutition difficult. In one form of internal convulsions, namely, that which is princi-

pally referred to by writers, there is not complete arrest of respiration, but the inspirations, during the paroxysms, are difficult and are attended by a stridulous noise. Again the respiration may cease entirely, but when it commences it is stridulous, and difficult for a few inspirations. In still another form of the disease respiration ceases, but there is no symptom or sign indicative of glottic spasm or of an obstacle to the ingress of air ; the inspirations which succeed the paroxysm are easy and noiseless. It has been suggested that, in these cases, there is paralysis rather than spasmodic contraction of the respiratory muscles, but the symptoms may be explained in accordance with the commonly accepted opinion, namely, that there is spasm of the diaphragm and, perhaps, of certain muscles of the chest and abdomen, while the laryngeal muscles are not affected. M. Herard, indeed, who has written one of the best monographs on internal convulsions, describes three forms of the disease, according to the supposed location of the spasm, namely, laryngeal, diaphragmatic, and another, which consists of a blending of the two.

Internal convulsions are not frequent in this country ; they are rare in France, more frequent in Germany, and quite common in England. They occur, with few exceptions, before the age of two years. Dr. West observed thirty-one cases under the age of two years, and only six above that age.

Causes.—The causes of internal convulsions are not fully ascertained. Most observers have remarked the relative frequency of the disease during the period of dentition, and it is probable that dental evolution does operate as a cause, by rendering the nervous system more impressible.

Spasm of the glottis has been attributed to enlargement of the thymus gland, and also to enlargement of the cervical and bronchial glands. It is presumed that this effect is due to the pressure of these glands on the par vagum, or the recurrent laryngeal nerve. It is certain, however, that there is no such enlargement of the thymus gland which could possibly produce glottic spasm, or any other form of internal convulsion at the age at which these convulsions commonly occur. This gland is largest in the new-born, and having no function after birth, it gradually becomes atrophied. If an enlarged thymus could produce glottic spasm, it would certainly occur most frequently in the new-born. Abnormal development of the thymus gland was the only assignable cause of atelectasis in two infants who died soon after birth, but I have never seen a case in which a convulsive attack was referable to this cause. M. Herard examined the thymus gland in six children who died of internal convulsions, and in sixty who died of other affections, and was not able to discover in its condition any causative relation to this disease. Indeed, cases have been reported in which the thymus had undergone more than its usual atrophy at the time when the convulsions occurred (Hasse). Enlargements of the lymphatic glands in the vicinity of the pneumogastric or recurrent laryngeal nerve

may possibly give rise to glottic spasm, but this is doubtless an infrequent cause, if it be a cause at all, since these glands are often greatly enlarged in strumous and tubercular diseases without such a result. According to Dr. Jacobi (*N. Y. Jour. of Med.*, Jan. 1860) : "In some cases, described by Dr. Friedleben, a congenital hypertrophy of the thyroid gland has probably been the cause of laryngismus. The patients were new-born infants of normal development, and born by normal labors. There were no constitutional causes of the disease, but a remarkable vascular swelling of the thyroid gland. Whenever the swelling increased, the veins of the face and head increased in size also, the face grew livid, and the extremities and spinal column exhibited slight tonic convulsions. The recurrent nerves were entirely surrounded by the glandular tissue, their neurilemma looked unusually red, and their functions were probably injured during the occasional swelling taking place during lifetime."

The cause is occasionally located in the cerebro-spinal axis. Thus Dr. Coley relates a case in which an exostosis arising from the internal surface of the occipital bone pressed upon the cerebellum, while nothing abnormal was discovered in other organs. There are also striking examples in which the cause was located in the spinal cord. Thus Marshall Hall relates the following case communicated to him. A child with spina bifida was attacked with croup-like convulsions, whenever it lay so as to press on the tumor.

Internal convulsions also frequently occur in rachitic softening and absorption of the calvarium, since, when this is present, undue pressure occurs upon the brain, even by the weight of the head of the child upon the pillow.

In some patients there is evidently an hereditary predisposition to this disease ; those affected belonging to families in which there is a tendency to convulsive maladies. Thus Toogood relates that five infants of the same family were affected with spasm of the glottis ; and Reid relates, on the authority of Powel, that of thirteen infants of the same parents only one escaped internal convulsions.

The common predisposing cause is an excitable state of the nervous system, often associated with impaired general health. Hence the disease is more prevalent in cities, where anti-hygienic conditions abound, than in the country. Hence, too, the frequent improvement when the patient is removed to the pure and bracing air of the country. The use of insufficient food, or food of a bad quality, must for the same reason be considered a cause, as it leads to impoverishment of the blood, and renders the nervous system more impressible. Facts mentioned by Reid and others show conclusively the influence of premature weaning, and the use of indigestible or otherwise improper aliment, in the production of this disease.

The causes enumerated above are for the most part predisposing ; occasionally they are the only apparent causes, since this disease sometimes occurs when the child is perfectly tranquil, even in the midst of quiet sleep, or when it is at rest in its mother's arms. In other cases, and more frequently, there is an exciting cause, often trivial. Anything that requires exertion on the part of the infant, or that excites strong emotions, may be a direct cause, as anger, or any of the violent passions ; so may even coughing, or, in rare instances, attempts to swallow. One author has known it to occur from excitement produced by examining the throat with a spoon. In a case in my practice, hereafter related, it occurred whenever the infant cried violently. It appears from the above facts that the etiology of internal convulsions is very similar to that of eclampsia. The same spasmodic muscular contraction may occur from a variety of causes.

Anatomical Characters.—While, therefore, structural changes in various parts of the system may give rise to internal convulsions, this disease, so far as ascertained, presents no anatomical characters, and must consequently be considered one of the neuroses. The lesions of the respiratory apparatus, which are seen at post-mortem examinations, are due to the convulsions or are coincidences. Emphysema has sometimes been observed as a result, it is believed, of the spasmodic and irregular respiration. It was present in all of Herard's cases, and Rilliet and Barthez consider it common in those who die of this affection, although they did not observe it in any of their cases. Slight emphysema in the upper lobes is, however, a common lesion in feeble infants, whatever the disease of which they die. Therefore its occurrence in internal convulsions is probably more due to molecular change in the lungs, since these patients are cachectic, than to the irregular breathing, which is only momentary.

In fatal cases of internal convulsions the blood is darker than usual, from an excess of carbonic acid ; the cavities of the heart and large vessels are sometimes engorged with blood ; but in other cases they contain no more than the normal amount. More or less passive congestion occurs in the internal organs ; and congestion of the cerebral vessels is sometimes such that transudation of serum occurs.

Symptoms.—I have said that the symptoms vary according to the seat and function of the muscles which are affected. There is generally previous ill-health. The child is drooping, and is sometimes restless for days before the disease appears. Finally, if the muscles of the glottis become affected, the peculiar crowing sound is heard now and then during inspiration. It is observed especially when the child is crying or is agitated. It may be loud and well-defined from the first, but in most patients it comes on gradually, so that several days elapse before its full stridulous character is developed. The attacks are more frequent and severe at night, in or after the first sleep, than in daytime.

Under favorable hygienic conditions, the malady may pass off without becoming more serious. In other cases the paroxysms gradually increase in frequency and severity. The dyspnœa in the attack is such that the features are livid, the head forcibly retracted, and death seems imminent from apnœa. In these severe paroxysms respiration often ceases entirely for a moment. When the spasm ends, a deep stridulous inspiration occurs, after which the breathing is natural. I have stated above that internal convulsions are often associated with those, usually tonic, but sometimes clonic, of the external muscles. In the tonic form, the thumbs are flexed across the palms of the hands, and sometimes are grasped by the fingers ; the great toes are adducted, and the other toes flexed. In severe cases, the hands, forearms, feet, and legs are also somewhat flexed and rigid. At first, the contraction of the external muscles is temporary, either corresponding with the internal spasm, or it is most intense at the time of the spasm, though commencing sooner and subsiding later. After a while, however, if the disease continue, the spasmodic action of the external muscles becomes more persistent. In severe cases, nearly every inspiration is accompanied by the wheezing sound, and the paroxysms of dyspnœa are excited by trifling causes. Anything that suddenly disturbs the mind or body may bring on the attack, as anger, the impression of cold, or currents of air. Dr. West calls attention to the fact that an anasarcous condition is sometimes present, accompanied by albuminuria.

If the convulsions affect other muscles, as the diaphragm or the pectoral and abdominal muscles, which are concerned in the respiratory function, while those of the larynx escape, respiration is irregular, or even suspended for a moment, but the stridulous laryngeal sound is absent, as there is no obstacle in the larynx to the entrance of air. In this form of the disease, the infra-mammary region may be strongly retracted during the paroxysm from tonic contraction of the diaphragm. In severe paroxysms, whether the spasm be laryngeal or diaphragmatic, consciousness is nearly or quite lost, the features may be pallid, or, if respiration be suspended, may be more or less livid. There is no fever in simple cases. In the paroxysm there is often relaxation of the sphincters of the bowels and bladder, with involuntary evacuations.

The duration of the paroxysm may be a quarter, a half or even a whole minute. Total suspension of respiration for even half a minute involves danger. In mild cases there may be but few paroxysms, and they slight. In other instances they occur in a severe form, almost daily for several weeks or even months. In the following case the muscles of the larynx were apparently not involved. The patient was scrofulous, and has since had scrofulous periostitis, with necrosis and exfoliation of the surface of the tibia. At the time of the internal convulsions there was also a scorbutic or hæmorrhagic cachexia.

Case.—On the 28th of August, 1858, a German female infant, four-

teen months old, nursing, and having eight teeth, was suddenly seized with clonic convulsions. Uniformly delicate and pallid, she had been in her usual health till the age of twelve months, when she had a single convulsive attack, and from that date had remained well till August 27th, when, without any premonitory symptom, she had a stool consisting of almost pure blood, black and offensive. On the morning of the 28th a similar evacuation occurred, and another in the afternoon immediately preceding the convulsion. Pulse 128, after the convulsion ; surface cool and pallid ; flesh soft, but no emaciation. Turpentine was prescribed in two-drop doses every two hours, and laudanum in one and a half drop doses, repeated sufficiently to insure quietude.

On the 29th the pulse was 152. At 1 P.M. she had a general convulsion, lasting about five minutes ; in the evening she had an evacuation similar to those passed on the preceding day. The record for August 30th states : " Pulse from 150 to 160 ; up to this time has been playful, but is now drowsy, and, when disturbed, fretful ; manifests no desire for solid food, as before her sickness, but still nurses ; has taken up to this time thirty-two drops of turpentine. When she cries or frets, she has a spasmodic attack." This was the commencement of internal convulsions, with which this child was affected for several months. An opportunity was afforded of observing their character, for her excitement, when she was examined, was usually sufficient to produce them. After a succession of short expirations, respiration ceased ; for a moment she was apparently insensible ; eyes closed ; face pallid ; no frothing at the mouth. The return of consciousness and respiration was without any laryngeal râle ; and after the attack she seemed as well as before. No external convulsion and no evacuation of blood occurred after August 31st.

There was gradual improvement in her health, but she continued for many months pallid and irritable, and subject to attacks of internal convulsions. On the 11th of April, 1859, when twenty-two months old, she had another attack of general convulsions. The record made on that day is : " Has had internal convulsions (one or more paroxysms) almost every day since last August, brought on usually by crying when she is corrected in any way, or her wishes are refused." Again, on December 1, 1859, it is stated : " Has grown considerably since the last record, and appears to have recovered, except that at long intervals the spasms still occur." She took a preparation of iron, but her recovery seemed to be due more to the growth and development of the body and to hygienic than therapeutic measures.

The general health in internal convulsions is more or less impaired, except in mild forms of the disease, in which the convulsive attacks soon cease. Pallor, or a sickly and cachectic aspect, irregular, usually constipated bowels, poor appetite, and moroseness or irritability of temper, are common symptoms of severe and protracted cases.

DIAGNOSIS.—This disease is easily diagnosticated, unless when its symptoms are masked by those of external convulsions ; it may then escape notice. Spasm of the glottis may be mistaken for spasmodic laryngitis, and *vice versa*. In some of the published cases this mistake appears to have been made. Spasmodic laryngitis is, however, so different not only in its nature, but in its clinical history, that a differential

diagnosis is not difficult. It is an inflammatory disease, and is attended with febrile reaction and a sonorous cough; it commences at night after the first sleep, and from exposure to cold—particulars in regard to which it contrasts with true spasm of the glottis.

Prognosis.—Modes of Death.—Statistics show great mortality in this disease. Dr. Reid, in a monograph on "Infantile Laryngismus," states that of 289 cases which he collated, 115 died. Rilliet and Barthez met with one favorable case in nine unfavorable; and Herard, one in seven. If the paroxysms be mild, infrequent, and dependent on a cause which can be easily removed, recovery is probable with proper treatment. The cause may, however, be such, even when the spasm is mild, that the case is necessarily unfavorable; as when it is due to disease of the cerebro-spinal axis. We should not, however, in any case consider the patient entirely safe, since grave symptoms may suddenly arise, so as to change entirely the prognosis. Long and severe paroxysms, with lividity of the face, and symptoms of suffocation, indicate an unfavorable result. The same should be predicted also if the infant gradually waste away, losing appetite and strength, especially if the face be pallid and the pulse feeble.

There are three modes of death in internal convulsions. The first is apnœa. The infant dies suffocated in the attack. Respiration is first arrested, and then the pulse ceases, and at the autopsy the lungs and the cavities of the heart are found engorged with dark blood. Death may also result from the state of the brain. In such cases, passive congestion of the brain occurs from obstruction to the return of blood from this organ to the heart and lungs; and if this congestion be not soon relieved, serous effusion also occurs. Death results from the congestion, and consequent œdema or dropsy.

The third mode of death is from exhaustion. Repeated and severe attacks undermine the constitution; the infant gradually grows pallid and thin, and dies of inanition, or of some disease which this state induces.

Treatment.—The treatment of internal convulsions has varied according to the theories which physicians have held in reference to its cause. Glandular enlargement is no longer regarded as a common cause, and therefore treatment directed to its removal is less frequently employed than formerly. The causes of internal convulsions are in part very similar to those of eclampsia, and the remedies employed in the one affection are, in a measure, appropriate in the other. That dentition is sometimes a cause, is usually admitted; and two cases, one of which occurred in my practice, and the other was reported to me, appeared to show that it may have a causative relation. The effect of dentition is especially observed in weakly infants, when several dental follicles are undergoing active evolution. Thus, in one of the cases to which I refer, five teeth pierced the gums in the course of two weeks; after which no convulsive attack occurred. If, therefore, the gums are swollen, the propriety of scarifi-

cation should be considered, especially if the convulsions be so severe as to endanger life.

In all cases of internal convulsions a careful examination should be made, in order to detect any appreciable source of nervous excitation. The condition of the digestive organs should be ascertained, and evacuants or other remedies prescribed if there be evidence of their derangement.

Sometimes the alimentation of the infant is in fault. It is, perhaps, bottle-fed, and the stools have an unhealthy appearance. Attention should be given to the preparation of its food and the times of its feeding; or, if it nurse, the mother or wet-nurse who suckles it should have plain but nutritious diet, live with regularity, and give the breast to the infant at regular intervals. If there be a torpid state of the intestines, Dr. Meigs recommends "castor oil and aromatic syrup of rhubarb rubbed up together, three parts of the former and five of the latter." A simple enema answers well in such cases, and, in debilitated infants, this is preferable to medicine administered by the mouth. If diarrhœa be present, and it persist after the requisite changes are made in regard to the diet, remedies calculated to relieve it, and which are detailed elsewhere, should be employed. Marshall Hall states that he has ordinarily succeeded in curing the disease by attending to the condition of the gums and digestive organs.

Since rachitis is a not uncommon cause, the child should be examined in reference to the rachitic manifestations, and if they appear the treatment appropriate for rachitis is required.

In pallid and cachectic infants, tonics are indicated. The elixir of Calisaya bark in half-teaspoonful doses, three or four times daily, to an infant of one year, is an eligible preparation. The compound tincture of bark, or of gentian, or the two mixed, may be given instead of the Calisaya bark. The preparations of iron are sometimes to be preferred, as the citrate of iron and bismuth, citrate of iron and quinia, the syrup of iodide of iron, or the wine of iron. To an infant of one year the syrup may be given in doses of three drops, the citrates in one-grain doses, and the wine in doses of one teaspoonful, every four hours. If the child be old enough, it may take iron in lozenges, as those of chocolate and iron.

Antispasmodics, as assafœtida, valerian, and oxide of zinc, are often prescribed in this malady, but they are less efficacious than the general tonic measures which I have indicated. The salutary effect of bromide of potassium in eclampsia, and certain epileptiform attacks, certainly justifies the trial of this agent in internal convulsions, if they persist after the employment of invigorating measures.

Hygienic measures are of the utmost importance. The infant should reside in dry and airy apartments, and should be kept much of the time through the day in the open air. Remarkable success sometimes attends this simple expedient, when medicines have entirely failed. In the *Lon-*

don Med. Gazette, Jan. 14, 1865, Mr. Robertson, of Manchester, relates five severe cases in which this malady was cured by exposure of the infants several hours daily to a cool atmosphere. These cases were treated in the winter months, and were kept out-door, even during strong winds. Mr. Robertson has records of forty cases, all occurring between December and April, while he has seen no case in the summer months. As the result of such extensive experience, this writer recommends "the free exposure of the infant out of doors, for many hours daily, to a dry, cold atmosphere, and if the air be dry, the colder the better." Dr. Marshall Hall's experience was similar. Says he: "The curative influence of change of air, and especially of the sea-breezes, is not less marked in this affection than in hooping-cough." Mr. Robertson recommends also, as part of the tonic treatment, "free sponging of the body every morning with cold water." In February, 1867, I attended a nursing infant, five months old, with internal convulsions, the paroxysms being attended with lividity of the face, and, at times, tonic convulsions of the limbs. Among the remedies employed was bromide of potassium, but more benefit obviously accrued from keeping the infant much of the time in the open air, than from the medicines employed. The disease passed off in six or eight weeks.

Unless the cause be of such nature that it cannot be removed, the above hygienic and therapeutic measures will, in a large proportion of cases, be followed by a satisfactory result.

The mother or nurse may abridge the paroxysm by raising the infant, blowing upon it, sprinkling water in the face, or gently stroking it. Dr. Hall recommends tickling the nostrils with a feather, to produce respiration, or the fauces, to occasion vomiting, and thereby interrupt the paroxysm. Anything which produces a sudden and profound effect upon the system may abridge the attack. This was effected in one case, in the practice of Dr. C. D. Meigs, by applying a cloth wrapped around ice over the epigastrium and the lower part of the sternum. The chief danger during the attack is from congestion of the brain, with effusion of serum or extravasation of blood. If the attack be severe, and the features congested, so that there is evident danger of such a result, cold applications should be made to the head, derivatives used for the extremities—as sinapisms, or mustard foot-baths—and the bowels should be speedily opened by enemata.

CHAPTER XIV.

CHOREA.

Chorea, or St. Vitus's or St. Guy's dance, is a neurosis, which is characterized by irregular and involuntary muscular movements, without loss of consciousness. The movements occur in the muscles of volition,

and there is probably no one of them that may not be engaged, though some are more frequently affected than others. It is not known that any involuntary muscle is ever involved, though Sir William Jenner has expressed the opinion that occasionally the papillary muscles of the heart are, so that, by their spasmodic contractions, they produce insufficiency of the mitral valve. This, according to him, affords explanation of the fact that, in certain instances, a mitral regurgitant murmur is heard, which disappears about the time that the external movements cease. It is rare, however, that a mitral regurgitant murmur, heard during chorea, ceases when the latter terminates, and it is not improbable that in such cases there is, after all, a lesion of the valve, due to recent endocarditis, whether of a rheumatic or other origin. For a valve may be so thickened by recent inflammation as to cause a murmur, and after a few weeks or months the infiltrating substance be so absorbed that the murmur is no longer audible. If we admit the fact that cardiac bruits occasionally appear and disappear with chorea, this explanation seems to me more plausible than that of Jenner. Hillier says, in reference to this subject: "My own experience leads me to doubt the existence of dynamic apex murmurs in chorea, that is to say, murmurs produced in hearts entirely free from organic change. If such murmurs ever occur, they are certainly rare. Organic murmurs of the heart, on the other hand, are common in chorea, and I am inclined to believe that organic disease of the heart often exists in chorea when there is no murmur." We shall see that this opinion is correct, by a case presently to be related. Hillier also calls attention to the fact that choreic movements are irregular; but a cardiac bruit occurring regularly and uniformly, if not due to organic disease, would require rhythmical contractions of the papillary muscles to produce it.

In the class of children's diseases in the Bureau for the Relief of the Out-Door Poor in New York City, 6986 children were treated in the two years and three months ending with March 31st, 1877. Of these cases 82, or one in every 207, had chorea. The patients were all under the age of fifteen years. Statistics published by observers in Europe show that the relative frequency of this disease is probably about the same in the large European cities as in New York. Thus, according to Hillier, amongst 122,621 out-patients treated at the Hospital for Sick Children, in London, 406, or 1 in 322, had chorea; while of the in-patients 174 in 5585, or 1 in every 32, were choreic. In the Parisian Hospital for Sick Children, of 84,968 admitted in twenty one years, 531 had chorea, or 1 in every 161.

Age.—Chorea may occur at any period of life, but a large majority of the cases are in childhood. It is rare in infancy, and it rarely begins after puberty. Under the age of five years the proportionate number diminishes, as we approach the time of birth. The youngest in the statistics of Hillier was three months. In 1870, in the Bureau for the Out-Door Poor,

a child was presented for treatment, who the mother said had had chorea from birth, and in 1877 I treated a young woman with severe general chorea, who, repeatedly questioned, uniformly said that she had had the disease, without any assignable cause, from the first week of her life, and her friends corroborated the statement. The following table exhibits the relative frequency of chorea at different ages :

	6 years and under.	6 to 10 years.	10 to 15 years.
Children's Hosp., Lond., Hillier, none over 12 years admitted,	81	237	104
M. Rufz,	10	61	118
Bureau for Out-Door Poor (prior to 1875),	2	26	16

	Under 3 years.	3 to 5 years.	5 to 10 years.	10 to 15 years.
Bureau for Out-Door Poor (since January 1, 1875),	0	13	51	14

M. Sée collected the statistics of 531 cases occurring in the Children's Hospital, Paris, and from them concludes that the maximum frequency of chorea is between the sixth and tenth years. Only twenty-eight of his cases were under six years, the remainder, 503, occurring between the sixth year and puberty.

Causes.—The profession are nearly agreed in regard to certain causes of chorea, while there is a diversity of opinion in reference to others. It is admitted that in a large proportion of cases there is a neuropathic state, which antedates and predisposes to chorea. This state is often manifested in the family history by a proneness to affections of the nervous system, and in the individual by a highly excitable state of the emotions, so that he evinces joy, grief, or anger, from slight causes.

All writers admit that there is often an inherited predisposition to chorea. In 27 of 48 cases, Radcliffe found that father, mother, brother, or sister had been or was the subject of one or other of the following disorders : paralysis, epilepsy, apoplexy, hysteria, or insanity. The children of parents who when young had chorea, or who exhibit proneness to ailments of the nervous system, are more liable to chorea than other children. Hence the fact sometimes observed, of different children in the same family becoming affected with chorea when they attain the age at which this disease ordinarily occurs. In one family in my practice, three girls at different times were affected.

Sex.—The emotions are strong in girls, since in them the nervous system predominates, while the muscular power is weaker than in boys. Hence a partial explanation of the fact which statistics fully establish, that the proportion of choreic boys to girls is about in the ratio of one to two and a fraction. I have remarked, in this city, the large proportion of cases in school-girls between the ages of six and twelve years ; the severe discipline and confinement of the public schools no doubt increas-

ing the strength of the emotions, and weakening the control of the will over the muscles.

Proportion of Males to Females.

27	to	73.	Hughes's Digest of Cases in Guy's Hosp., 1846.
138	to	393.	M. Sée.
50	to	94.	Out-Door Department, Bellevue.
276	to	499.	Children's Hosp., Lond. West (Lumleian Lect.).
481	to	1059	= 1 to 2.15.

Uterine Irritation.—The peculiar changes occurring in the female at puberty constitute an important cause. Hence another reason of the excess of female cases. Dysmenorrhœa and pregnancy are causes of a large proportion of cases in the first years of puberty. In the male, on the other hand, the changes of puberty do not appear to increase the liability to the disease, directly or indirectly, and male cases, after the age of twelve years, are comparatively rare. Radcliffe states (*Reynolds's System of Med.*) that after the ninth year, females are more liable to chorea than males, in the proportion of 5 to 2 ; while before the ninth year, the two sexes are equally liable to it. Carefully prepared statistics, however, notwithstanding the high authority of Radcliffe, show a preponderance of girls under the age of nine years, though not so great as over that age. In the Out-Door Department at Bellevue, of 35 patients under the age of ten years, 22 were girls, while of 20 from the age of ten years to sixteen, 15 were girls.

According to West (Lumleian Lect.), in 775 children with chorea, under the age of ten years, treated in the London Children's Hospital, 64 per cent were girls.

Anæmia.—Among the most common predisposing causes of chorea is anæmia. It is present in so large a proportion of cases, exhibiting itself by pallor of the countenance and other characteristic signs, that medicine designed to improve the quality of the blood are among the most valued remedies. The peculiar neuropathic state already alluded to, which needs only a slight additional cause for the development of chorea, is, no doubt, largely dependent on impoverishment of the blood, if it be not sometimes due entirely to it. Among the poor of a large city like New York, or in hospital practice, the proportion of anæmic cases of chorea is, for obvious reasons, much larger than would appear from general statistics.

Rheumatism.—Dr. Copeland, M. Bouteille, and afterward M. Germain Sée, in a more extended monograph, directed the attention of the profession to rheumatism as a cause of chorea. Subsequent observations have established the fact that rheumatism, or the rheumatic diathesis, is so frequently present that it obviously sustains an important relation to chorea, though in what manner is not fully ascertained. This relation between the two is more frequently observed in some countries than in

others. In England and France, so large a proportion of choreic patients present the history of rheumatism either in themselves or family, that certain physicians of these countries believe that rheumatism is the most common cause of the disease. In Germany, on the other hand, according to Romberg, in the majority of cases no relation can be traced between chorea and rheumatism. Probably the largest number of choreic cases treated in one institution in this country is in the Bureau for the Relief of the Out-Door Poor, in this city ; and it has been our practice during the last few years to examine each patient for heart disease, and question the parents as regards rheumatism. Without referring to the exact statistics, I should say that perhaps half gave the history of rheumatism in themselves or parents or had unequivocal signs of heart disease, so that all the physicians of the class fully accept the theory of the frequent causative relation of rheumatism and valvular disease to chorea.

Various theories have been promulgated in explanation of the relationship of the rheumatic and choreic diseases. It has been suggested that chorea is due to rheumatism of the brain or spinal cord. This is simply an hypothesis, the truth or falsity of which can only be ascertained by carefully conducted necropsies ; but the theory appears improbable in view of all the facts. Another theory attributes chorea to the state of the blood which is present in those having rheumatism or the rheumatic diathesis, as well as in certain other conditions. This theory is enunciated by Dr. Ogle, as follows: " Recognizing the frequent existence of these fibrinous deposits or granulations on the heart's valves in chorea, I should be much inclined to look upon these post-mortem appearances rather as results of some antecedent general condition of the blood, common also to the choreic condition. It is very freely recognized that this affection is frequently, in some way or other, connected with that condition of blood which obtains in what we call anæmia, or that existing in rheumatic constitutions. In both of these states we know that the fibrin of the blood is much in excess (as also it is in pregnancy, another condition looked upon as obnoxious to chorea) ; and in these states we know that the fibrin with which the blood is surcharged is very prone to be readily precipitated, either owing to its superabundance, or from other obscure and acquired properties . . . upon the heart's walls or valves. May not this hyperinosis be the explanation of the coincidence alluded to ?" (*British and Foreign Med. Chir. Rev.*, January, 1868)—namely, the occurrence of chorea in those affected with rheumatism. Others still hold that chorea is the result of the heart disease, and not directly of rheumatism, occurring when the heart is affected from other causes, as well as when the lesion has a rheumatic origin. This theory is plausible, and probably to a certain extent correct. Heart lesions, observed in children, result from scarlet fever in a considerable proportion of cases, though it is true that the endocarditis and pericarditis of scarlet fever are believed often

to have a rheumatic origin, occurring, in some instances, from scarlatinous rheumatism, but in other cases from scarlatinous uræmia. Occasionally, also, the heart disease appears to have occurred independently of both rheumatism and scarlet fever. Thus in a fatal case of chorea with valvular disease, related to the London Pathological Society, April 6, 1869, the child was always healthy up to the present illness (chorea), and there was no history of rheumatism in the family. The more observations accumulate, the more important does heart disease in itself appear as a cause of chorea. In nearly all recorded cases of fatal chorea, which were supposed to be due to rheumatism, and in which post-mortem examinations were made, endocardial and usually valvular disease has been found. We shall see that certain eccentric causes of irritation aid in producing chorea, and may not the valvular disease, or the endocarditis which causes the valvular lesion, operate in a similar manner as a cause ? We know that in the adult severe cardiac disease often profoundly affects the nervous system, perhaps in consequence of the irregular and embarrassed circulation ; and certainly in the child a similar cause would be likely to produce a more decided effect.

But there is an ingenious theory which attributes chorea to minute emboli detached from vegetations on the valves, and arrested by capillaries in the corpora striata, or other portion of the cerebro-spinal axis. Since attention was directed to this matter, emboli have been found in one case in the medulla oblongata, although this portion of the spinal axis appeared healthy to the naked eye. Further observations are necessary in order to determine how much truth there is in this theory ; but it seems probable, for reasons to be stated, that if capillary embolism do cause chorea, it is only in a limited number of cases, and that therefore those British observers who regard it as the common cause, have been led into error by the large proportion of choreic cases which are complicated by valvular lesions in their climate.

That embolism is not a common cause, if indeed a cause at all, appears probable from the following facts : First. In many cases of chorea there are no vegetations, or other appreciable lesions, which could give rise to emboli. Secondly. Most patients recover, and some speedily, by treatment, which we would not expect if the cause were embolism. Thirdly. Embolism is not infrequent in the cerebral vessels of the adult, without the occurrence of chorea. Indeed, the conditions which produce embolism are much more common in adults than in children, while the reverse is true as regards the liability to chorea. Fourthly. Dogs sometimes have chorea, but the injection of minutely divided fibrin or other substance in the veins of the dog is not followed by chorea as one of the phenomena. Fifthly. Were capillary emboli the cause, we would expect to find an occasional embolus in the larger vessels of the brain, so as to be appreciable to the naked eye ; but I find no examples of this in all

the recorded autopsies which I have been able to consult. Moreover, it seems improbable that capillary embolism, when producing no lesion appreciable to the naked eye, would so arrest the circulation, and disturb the function of the brain or spinal cord, as to cause chorea, for the ill effects of such an obstruction would be likely to be obviated by the numerous anastomoses.

In 1877 the unusual opportunity occurred, in my asylum practice, of determining whether there are any fixed anatomical characters in the cerebro-spinal axis in chorea ; in other words, whether chorea is a neurosis, as we have designated it in our definition, and the case is so interesting in other respects that I will relate it entire.

Charles, a foundling, born Oct. 15, 1874, was received in the New York Foundling Asylum soon after his birth. When two weeks old he was removed to a family in the city to be wet-nursed. His health continued good till the age of three months, when he had bronchitis and keratitis, the former mild, and lasting only a few days, but the latter continuing nearly two months, being attended by moderate injection of the conjunctiva, with some purulent discharge, which caused adhesion of the eyelids during sleep. From this time he remained well, with the exception of a slight attack of dysentery, till the age of about nine and a half months, when he began to have febrile symptoms. In the morning hours he seemed in tolerable health, but at midday, or a little later than midday, of each day, he was observed to have slight irregularity or embarrassment of respiration, and lividity, with coolness of the extremities, which state, supposed at the time to be the algid stage of a somewhat irregular intermittent fever, lasted from one to two or three hours, and was succeeded by febrile movement, which continued during the remainder of the day ; sometimes the fever abated in perspiration.

On August 4, 1875, a few days after the commencement of these irregular febrile symptoms, Charles was brought to the dispensary of the institution for treatment, and Dr. Reid, who was on duty that day, carefully examined the case, and prescribed the sulphate of quinia. This medicine continued a few days relieved the symptoms, but every four to six weeks, for more than a year, these febrile attacks returned, and were uniformly relieved by the same medicine. In other respects the patient had the usual health.

On or about February 1, 1878, the nurse noticed that Charles had what she designated "spells of trembling," in which he seemed excited and feverish, and which were sometimes attended by or followed by perspiration. In the course of another week the irregular muscular movements became more marked and constant, and they increased in severity till near the time of the admission of the patient into the asylum, about March 1st. The nurse had noticed in February slowness and some difficulty of micturition, and Dr. Reid examined him with a catheter for calculus, and also his prepuce for any source of irritation, but nothing abnormal was discovered, either in the condition of the bladder or the external organs. In the latter part of April, the chorea had become so severe, that irregular muscular action occurred in all the limbs, and in the muscles of the eyes, producing such grimaces and contortions with strabismus, that the

woman with whom he was boarding became alarmed, and returned him to the asylum, stating that he had become crazy.

On March 12th my attention was first called to this child, when I made the following entry in my note-book : " Family history unknown ; no history of rheumatism in patient's case, he may and may not have had it ; heart sounds normal ; pulse 104 ; all the limbs and the muscles of the face, eyes, and eyelids involved in choreic movements, which continue constantly except during sleep. The patient cannot walk or stand without support ; appetite good, apparently better than in health, for he eats every kind of food handed to him, and carries the food with his own hand to his mouth, although these movements are very irregular and jerking. Three drops of Fowler's solution ordered after each meal.

March 17th.—Condition not much changed, but perhaps slight improvement ; in addition to other choreic movements the eyes twitch spasmodically ; pulse 84 ; temperature 98½° ; bowels regular ; no cough ; appetite good. Increase medicine to five drops.

30th.—The urine examined since the last record was found very pale and abundant ; its specific gravity low, 104, without albumen. When an equal quantity of nitric acid was added to it, after twelve hours crystals of nitrate of urea occupied about one half of the volume of the urine. The patient's sleep is quiet, but the choreic movements recommence as soon as he awakens, but in a milder form ; is able to walk without support, but with unsteady gait. My term of service ended March 31st. On the following day, laryngo-tracheitis was suddenly developed, ending fatally in forty-eight hours, at the age of two years five and a half months.

Autopsy, April 4th. Slight œdema about the aperture of the glottis ; general and intense redness of mucous membrane of larynx, trachea, and bronchial tubes, as far as they can be traced, posterior portions of lungs greatly congested. The heart, lungs, brain, with one eye attached to it by optic nerve, and the entire spinal cord were sent to Prof. Francis Delafield, for microscopic examination. They were, as soon as removed, placed in a solution of bichromate of potassium. The following is a brief statement of the examination, which was thoroughly made.

Microscopic Appearances. By Prof. Francis Delafield. *Brain*—presented no change apparent to the naked eye, except a considerable degree of congestion. It was hardened in bichromate of potassium and chromic acid. Minute examination of the convolutions of the brain, the large ganglia, the cerebellum, the pons Varolii, and the medulla oblongata showed nothing except a uniform filling of the vessels with blood; as if they were injected. There were no apoplexies, no changes in the walls of the vessels.

Spinal cord—appeared to be entirely normal.

The Heart.—The auricles and ventricles were of normal size. The aortic valves were atheromatous, and somewhat rigid ; the mitral valves were thickened and insufficient ; the endocardium of the left ventricle was thickened.

The Lungs.—The capillaries in the walls of the air-vesicles were dilated, and there was an increase of epithelial cells within the air vesicles.

In this case there seemed to be no lesion associated with the chorea except the organic disease of the heart, and the changes in the lungs, secondary to this condition of the heart.

The above microscopic examination was made with sufficient minute-

ness, and it is seen that no emboli were discovered, and no lesion of the cerebro-spinal axis except congestion, which was attributable to the mode of death, namely, by obstructed respiration. Moreover it will be recollected that there were no cardiac *bruits*, and apparently not sufficient roughness of the edge or surface of the valves to cause precipitation of fibrin, which would be necessary in order that emboli should form.

Fright.—A not infrequent exciting cause of chorea is sudden and profound emotion, especially fright. All statistics give fright as the cause of a certain proportion of cases, though there are usually other potential co-operating causes, as anæmia or valvular disease. Fright was stated as the cause of chorea in 31 of the 100 cases occurring in Guy's Hospital, reported by Hughes, or in nearly one in three. But the statistics of other observers do not give so large a proportion of cases originating in this way. Chorea may commence within a few hours after the fright, or not till the lapse of several days (eight or ten). If several weeks have passed since the fright, as in some reported cases, the chorea is probably due to other causes. In rare instances, chorea is said to have been caused by sudden and excessive joy.

Imitation.—Under unusual circumstances, especially in a state of great mental excitement, imitation has been known to cause a form of chorea. Hecker describes an epidemic of it, occurring in the middle ages, and spreading through villages. In modern times it is rare that chorea originates from this cause, nevertheless occasional examples have been recorded.

But the disease which occurs from imitation differs from the ordinary form, and has been termed chorea major ; while the chorea which is the subject of this article is sometimes designated, in contradistinction. chorea minor.

In chorea major the patient leaps, dances, or whirls like a top. It has its origin commonly in religious excitement, and spreads by imitation almost in the manner of an infectious disease. The epidemic of the middle ages was a chorea major. I have not been able to find any account of cases spreading by imitation, in modern times, which were not examples of the same form of chorea. Thus in the *Edin. Jour. of Med. and Surg.*, for July, 1839, there is a clear description of chorea major, occurring successively in five children in the same family. Dr. Dewar, the attending physician, states that one of the children whom he was called to see was sitting near the fireplace, when her head dropped on her chest, and she appeared to doze some minutes. In the meantime the respiration became a little accelerated, the face altered and flushed, the eyes wild. In less than one minute she bounded from one extremity of the apartment to the other, leaping over chairs, a chest, and then throwing herself upon the floor ; she attempted to stand upon her head, rolled upon the floor, and then, rising, ran with extreme swiftness in the room,

till she finally fell again on the floor, where she remained motionless some minutes. Then, recovering, she noticed those who surrounded her, and asked of her sister a toy, which she had allowed to fall. The whole paroxysm lasted twenty minutes.

Obviously, the symptoms of chorea major differ materially from those of chorea minor, and it is a question whether it should have the same generic name. It is a curious and interesting disease in its psychical and pathological aspects, but it is so rare in modern times that a knowledge of it is of little practical importance.

Intestinal Irritation.—In rare instances intestinal worms cause chorea, though in these cases there have usually been some co-operating causes. The following is an example, related by Mr. Ogle (*Lond. Medico-Chir. Rev.*, Jan., 1868) : "Ellen L., 9 years old, had been under treatment about a month with chorea, rheumatism, and worms. She had not slept in four days, and there was constant spasmodic movement of the body and face. Her general condition was very unpromising. As she had passed portions of a tapeworm at intervals during the last three months, one drachm of the oleum filicis maris was administered in mucilage, which caused the expulsion of the entire worm. From that time she fully and rapidly recovered from the chorea, though a mitral murmur remained."

Lesions of Brain and Spinal Cord.—Although we reject the theory that cerebral emboli are the common cause of chorea, and believe that in a large majority of cases there are no cerebro-spinal lesions, nevertheless experiments, and also occasional cases, establish the fact that if not true chorea, at least choreiform movements now and then result from a structural affection of the nervous centres.

Experiments on certain of the lower animals demonstrate that irregular muscular movements may be produced by traumatic injury of certain portions of the cerebro-spinal axis, as the corpora quadrigemina, crura cerebri, pons Varolii, crura cerebelli, thalami optici, parts of the medulla oblongata, and the upper portion of the spinal cord. Pressure on the projecting part of the medulla oblongata of an acephalous monster also causes convulsive movements. At the meeting of the New York Academy of Medicine, April 20, 1871, Professor Post related the case of a child who was struck with a billet of wood, over the occiput, and chorea followed, due, in all probability, to the injury of the brain which resulted.

If irregular muscular movements, choreic or choreiform, result from traumatic injury of certain portions of the nervous centres, may they not also occasionally occur from lesions of the same parts produced by disease? Sir Benjamin Brodie relates the case of a choreic girl, dying in St. George's Hospital (London *Lancet*, Dec. 19, 1840), in whom, after a careful post-mortem examination, the only morbid appearance observed

was a tumor the size of a hazel-nut, connected with the pineal gland. Dr. Broadbent described another case before the London Pathological Society (vol. xiii. page 246, *Transactions*), in which a tumor was found arising from the centre of the spinal cord ; and Chambers one in which tubercles were imbedded in the cord. Romberg quotes from Frerichs a case in which the medulla oblongata was pressed upon by an enlarged odontoid process ; and Dr. Aitken (*Glasgow Med. Jour.*, vol. i.) one in which the specific gravity of the thalamus opticus and corpus striatum was greater on one side than on the other. Rilliet and Barthez relate other similar cases, and add : "We may conclude, from these different cases, that there exist two species of chorea : the one essentially a simple neurosis, while the other depends on an alteration of the encephalo-rachidian system. In a word, it is of chorea as of convulsions, that it is sometimes idiopathic, sometimes symptomatic." Still, the cases in which it is symptomatic are so few, that it is proper to consider chorea, as it ordinarily occurs, one of the neuroses until the microscope detects some anatomical cause in the cerebro-spinal system of which we are now ignorant.

Anatomical Characters.—We have seen that chorea has no certain anatomical characters. Lesions are sometimes present, which probably sustain a causative relation to the disordered muscular action, and others are sometimes observed which are neither a cause nor result, their presence being a coincidence. But there are two lesions which, though often absent, have been observed in so large a proportion of fatal cases that they are justly regarded as an occasional result when chorea is severe. Dr. Hughes, of London, collected records of the post-mortem appearances of 14 cases, with the following result as regards the cerebro-spinal axis : Brain, 14 cases : healthy, 4 cases ; only congested, 3 cases ; softened in part or entirely, 6 cases (some of these also congested). In some of these cases those occasional results of congestion, namely, transudation of serum and extravasation of blood, in greater or less quantity, were also observed. Spinal cord : healthy, 3 cases ; congested, 2 cases (one slightly, in the other the engorged vessels were large and numerous) ; softening in medulla oblongata, 1 case ; softening opposite fourth and fifth vertebræ, 12 cases. In one there was soft, in another firm adhesion of the spinal meninges, and in one it is stated that the rachidian fluid was opaque. Of sixteen fatal cases of chorea occurring in St. George's Hospital, "congestion (more or less complete) of the nervous centres (brain or spinal cord, or both) was met with in six cases." There was softening of certain parts of the brain in one case, and of the spinal cord in another. (Ogle, *Brit. and For. Medico.-Chir. Rev.*, Jan., 1868.) Other statistics of the anatomical character of fatal chorea correspond, in the main, with those of Hughes and Ogle. These lesions are probably not present in ordinary cases, occurring only when the choreic movements

are so severe that the patient is deprived of needed repose, and the important functions of the economy, as the circulation and nutrition, are seriously disturbed.

The post-mortem examination of other parts besides the cerebro-spinal axis furnishes a negative result, if we except such affections as have been ascertained to act as causes of chorea. What portion of the nervous centre is chiefly involved in chorea is uncertain. Some, as Sir Benjamin C. Brodie (*London Lancet*, Dec. 19, 1840), consider chorea a disease of the nervous system generally, while others have attributed it to disease or disorder of a certain part, as the corpus striatum, cerebellum, etc. Finally, it is stated that, in late experiments on choreic dogs, the movements do not cease when the spinal cord is severed from the brain, nor also on division of the posterior roots of the spinal nerves. (Legros et Onimus, Rech. sur les mouvements choreiformes du chien, Acad. des Sci., 9 Mai, 1870, *Lyons Med. Jour.*, June 5, 1870.) In these cases, therefore, the part of the axis which is in fault would appear to be solely the spinal cord.

Symptoms.—Chorea is partial or general. It is partial when it affects a few muscles, or groups of muscles, as those of one arm, the face or neck, or of one eye. It is designated general, when all the limbs, and certain of the muscles of the face and trunk, are involved. Statistics show that partial chorea occurs more frequently on the left than on the right side, and in general chorea the movements on the left side are apt to predominate. The commencement is usually gradual. Even when finally chorea becomes general, certain muscles only are affected in the commencement in ordinary cases. The child in whom this disease is about to begin is observed to be fretful and impatient from slight causes, and the irregular muscular action at first is apt to be misunderstood by the parents, who reprimand him for his supposed fidgety habit. In exceptional instances, especially when the cause is a sudden and profound emotion, the commencement is abrupt, and the disease is severe and general from the first.

In a majority of cases the muscles which are primarily affected are those of the face, neck, fingers, or hand on the left side. Sydenham erred, unless the clinical history of chorea has changed during the last two centuries, when he stated as the common fact that a tottering gait is its first manifestation ; but now and then such a case does occur. Wherever the choreic movements first appear, other muscles are soon involved, so that in the course of a few weeks, sometimes of a few days, all the muscles that participate are engaged.

A muscle affected by chorea alternately contracts and relaxes, but less forcibly and rapidly than in eclampsia, and the movement is partly controlled by volition. This produces an unsteady and tremulous action of the part, whether a limb, the neck or face ; which at once arrests atten-

tion, and indicates the nature of the disease. The result is similar, as regards the muscular action, whether the patient wills a movement, or attempts to control those which chorea produces.

If the case be of ordinary severity, the movements continue with but momentary intermissions, except during sleep, when they ordinarily cease. In grave cases patients are often deprived of the proper amount of sleep, in consequence of the severity and persistence of the muscular action, and in exceptional instances, especially when the result is fatal, the movements continue in sleep, but the sleep is not sound, and is frequently interrupted. In profound sleep, the muscles are probably always in repose.

The older writers have left us graphic descriptions of those diseases which have striking external manifestations, though often with somewhat of exaggeration. Sydenham says of chorea : " The patient cannot keep it (his hand) a moment in the same place ; whether he lay it upon his breast, or any other part of his body, do what he may, it will be jerked elsewhere convulsively. If any vessel filled with drink be put into his hand, before it reaches his mouth, he will exhibit a thousand gesticulations, like a mountebank. He holds the cup out straight, as if to move it to his mouth, but has his hand carried elsewhere by sudden jerks. Then, perhaps, he contrives to bring it to his mouth, and if so, he will drink the liquid off at a gulp, just as if he were trying to amuse the spectators by his antics !"

In severe general chorea a similar description is applicable to the movements of the legs and features. Grimaces and distortions of the features occur, while the gait is halting and unsteady, or it is impossible to walk, and the patient lies or sits. The speech is slow, thick, and indistinct, in consequence of the muscles of the tongue and larynx becoming engaged, and even mastication and deglutition are rendered difficult. The imperfect speech in chorea is attributed partly, however, to the mental state in severe protracted cases. Chorea, except when mild, is accompanied by other symptoms referable to the nervous system. More or less impairment of the mental faculties occurs in chronic cases when severe, exhibiting itself in dulness or apathy. The countenance sometimes presents in aggravated cases almost the appearance of idiocy. The muscles, instead of becoming hypertrophied, and more powerful by their frequent contraction, grow softer, more flabby, and weaker. Indeed, a partial paralysis sometimes results, so that a degree of numbness is experienced in the affected part, and the limb when raised cannot be sustained. Pain is not a symptom of chorea, but fugitive rheumatic or neuralgic pains are sometimes experienced. Derangement of the digestive function, exhibited by a poor or capricious appetite, constipation, etc., are common.

The urine of choreic patients has been examined by Drs. Walsh, Ford, Bence Jones, Handfield Jones, Radcliffe, and others, and its elements have been found in most cases to vary from their normal quantity. Dr.

Handfield Jones read a paper before the Clinical Society of London, in 1871 (*London Lancet*, July, 1871), on two cases of chorea in which he had made careful chemical analyses of the urine, with the following result: During the height of the disease the amount of the urine was much in excess of what it was when the disease had ceased; the amount of urea excreted during the choreic period was enormous; the amount of phosphoric acid excreted when the choreic symptoms were at their maximum was excessive, but the quantity was less than the average during convalescence; a moderate amount of uric acid during the disease, but none upon recovery.

Prognosis—Course.—Chorea, though obstinate and often incurable in adults, usually terminates favorably in children in three or four months. Bouchut considers its ordinary duration at from thirty to fifty days, which is certainly shorter than the average duration in this country, except as the disease is materially abridged by treatment. The same author states that it may continue only a few days, as he has observed in cases which occurred during convalescence from scarlet fever. But tremulousness of the muscles occurring in the state of weakness following a grave disease, and abating as the general health is restored, I should not consider as properly choreic, any more than that occurring from over-fatigue. As the choreic movements gradually increase in the initial period till a certain maximum is reached, so their decline is gradual. There are temporary variations also throughout the disease as regards the extent of the movements, which are aggravated by mental excitement, bodily fatigue, certain functional derangements, especially of digestion, and sometimes from causes which are not apparent.

Though, as a rule, chorea in children ordinarily terminates favorably under different, and even injurious modes of treatment, there are exceptional cases. Romberg relates the history of a patient who died at the age of seventy-six years, having had chorea since the age of six years. In chorea limited to a few muscles, or a group of muscles, the prognosis is more doubtful than when it affects a large number, since in the former case the cause is more apt to be some lesion of the cerebro-spinal axis. Thus chorea involving only certain muscles of the neck or of the eyes is sometimes due to this cause, and is then very obstinate.

Again, observations demonstrate that chorea, when at first in all probability strictly a neurosis, but of a protracted and grave character, may give rise to a central organic disease. This is the course of most of the fatal cases, congestion, softening, or other lesion occurring over a greater or less extent of the nervous centres. Radcliffe has known cerebral meningitis to supervene in two instances. With the occurrence of a lesion of the cerebro-spinal axis new symptoms arise, such as headache, convulsions, delirium, and paralysis, and the choreic movements cease or continue, according to the nature of the lesion.

Chorea, like certain other diseases, either of a nervous character, or having a nervous element, is more or less modified by intercurrent inflammatory and febrile affections. The oft-quoted expression from Hippocrates, *febris accedens solvit spasmos*, observations show to be founded in fact, the most frequent example of which occurs in pertussis. In chorea the movements, as a rule, are either rendered milder or they cease as long as the febrile excitement continues ; but there are exceptions, and the subsequent course of the disease is not modified.

Diagnosis.—That is not difficult in ordinary cases. The irregular movements, with consciousness preserved, enable us to make a diagnosis at sight. In its commencement, and when it continues in an unusually mild form, chorea might be overlooked by the physician, as it often is by the parents, the movements being attributed to a fidgety habit ; but medical advice is seldom sought till the movements are so pronounced that it is impossible to err, except through gross ignorance or carelessness.

It is important to determine when chorea merges in an organic disease, and also whether there is a local cause of the chorea. A careful and intelligent study of the symptoms and history of the case is requisite in order to a correct diagnosis in these particulars.

Treatment. *Regimenal.*—As chorea in a large proportion of cases occurs in a state of anæmia, and the vital forces are ordinarily more or less reduced, obviously the regimen should be such as invigorates the system. Fresh air and outdoor exercise, active or passive, according to circumstances, with the avoidance of undue excitement, are requisite ; and the diet should be nutritious, but plain and unirritating. The various functions should be preserved so far as possible in their normal state. In exceptional instances, when the choreic movements are violent, the patient should lie in bed, and the muscular action, if so constant and excessive as to deprive him of the requisite sleep, should be restrained by light and well-padded splints.

Medicinal.—Sometimes among the co-operating causes is one of a local nature, which is susceptible of removal, as a carious and painful tooth, intestinal worms, etc., and measures calculated to effect this are obviously required. Allusion has already been made to a case in which the employment of the oleo-resina filicis and the expulsion of a tapeworm effected a speedy cure.

The remedy which has been most employed in chorea, and which in consequence of the anæmia is plainly indicated in a large proportion of cases, is iron. It does not interfere with the employment of other remedies which have a more specific effect. Nearly all the ferruginous preparations have been prescribed in different cases with benefit. Radcliffe gives the preference to the iodide of iron, believing that iodine, as well as iron, exerts a curative influence. I have of late inclined to the use of the

ammonio-citrate, as it is easy of administration in simple syrup, and is well tolerated.

But iron must not be regarded as the main remedy, but rather as an adjuvant. Observations during the last few years in both continents have more and more established the claims of arsenic to be regarded as the most efficacious of all medicinal agents in the treatment of chorea. Properly administered, it abridges, in my opinion, the duration of this disease more certainly than any other agent, and within a few days begins to modify the choreic movements in the severest cases. It is conveniently given in Fowler's solution. It is better tolerated by children than adults, and should be administered to them in a larger proportionate dose. A child of eight years can take five drops, diluted in water, three times daily after eating, and the dose may be increased if needed to eight drops. I have seldom observed any gastric irritability or other unpleasant effect from its use, but if such occur, it should, of course, be suspended for a time.

While not hesitating to recommend iron and arsenic as superior to all other medicines in the treatment of chorea, it is not proper to ignore the opinions of other members of our profession, who have had ample experience and recommend other agents instead.

Trousseau gave the preference to strychnine, increasing the doses in some cases until it began to produce its poisonous effects.

Professor Hammond (*Diseases of the Nervous System*, page 617) says : " My main reliance is on strychnia, which, I think, should be given in gradually increasing doses, somewhat after the manner recommended by Trousseau. . . . This plan of treatment certainly shortens the duration of the disease very materially, and causes great improvement in the general health of the patient. Sometimes the effect is so well marked, and is so immediate, that it is not necessary to increase the doses to the extent of causing muscular cramps, but generally the full therapeutical effect of the drug is not obtained till the calf of the leg or the nucha has slight tonic spasm. I have never seen the slightest ill-consequence follow this mode of treatment, and the doses are increased so gradually that, with careful watching, danger need not be apprehended." Dr. Hammond has treated thirty-two children with this agent without a single failure.

But as chorea terminates favorably with smaller and safe doses, even if the time required be longer, it does not seem proper to recommend its employment to the extent of producing physiological effects for general practice. Bouchut, speaking upon this point, says : " But, with these precautions, strychnia is extremely dangerous, for I have seen, at the Hôpital des Enfants Malades, a young girl of thirteen years die in tetanus," produced by an increased dose of this drug (article on Chorea). Dr. West, in his Lumleian Lectures, also says : " I have seen one instance in which its employment, while it failed to benefit a somewhat severe case of

chorea, was followed by two attacks of violent tetanic convulsions, which nearly proved fatal ;" and he adds, " The twitching of the limbs of itself prevents our becoming aware of the dose being excessive, and a child's inability to describe its sensations deprives us of another." For such reasons, Dr. West does not favor the employment of this agent. Still, any agent may be given in an overdose, and it is not difficult to prescribe strychnia in a dose which will be efficient and yet safe for children at the age at which chorea ordinarily occurs. I have employed bromide of potassium in a few cases, but with so little benefit that I am not inclined to continue its use for this disease. Others have not been more successful. However efficacious the bromide may be in epilepsy, it does not appear to be a remedy for chorea.

Cimicifuga, first employed by Jesse Young of this country, is highly esteemed by Philadelphia physicians in the treatment of chorea. I have employed the fluid extract in doses of half a drachm, increased to one drachm, for a child from six to ten years of age, and though it benefits some cases, it has no appreciable effect either in moderating the movements or abridging the duration of others.

Ether, asafœtida, valerian, musk, the oxide and sulphate of zinc, turpentine, tartar emetic, opium, and numerous other remedies, have been recommended, and some of them have seemed useful in certain cases. In this city sulphate of zinc has been frequently employed as a remedy for chorea, and in gradually increasing doses till more than twenty grains were administered three times daily, but it has not appeared, so far as I have been able to ascertain, to exert any marked influence either on the severity or duration of the choreic movements. Justice, however, requires us to state that Dr. West, who has written recently on the nervous disorders of children, thinks that it has been beneficial in certain cases in which he has employed it, and regards it on the whole as the best remedy.

Radcliffe, who has had ample experience in the treatment of nervous affections, writes : " In an ordinary case of chorea the plan of treatment which I have now adopted as a rule for some time is to give cod-liver oil, in conjunction with hypophosphite of soda, making the draught containing the latter salt the vehicle for the administration of the cod-liver oil." Sometimes camphor or the sesquicarbonate of ammonia is added. Of more than thirty cases treated in this way, the average duration was under three weeks. Radcliffe began to prescribe these remedies on theoretical grounds, believing that phosphorus and cod-liver oil were required to restore " nerve tone," and the result of this treatment has certainly been such as to commend it to the profession. To children he gives from five to eight grains of the hypophosphite of soda three times daily.

In those severe cases in which the choreic movements prevent the proper amount of sleep, a moderate dose of hydrate of chloral may occasionally be advantageously administered.

Electricity has been many times employed in the treatment of chorea, and though some, chiefly electricians, believe that it has a curative effect, others, and the majority, fail to see any material benefit from its use.

Cold general baths, the shower-bath, frictions along the spine, etc., have been employed ; but the local treatment which has so far been most successful, and which promises to supersede all others, consists in the application of ether spray over the spine. About two ounces of ether are employed at each sitting, the spray being applied from an atomizer up and down the whole length of the spine if the chorea be general. The operation, which occupies from ten to fifteen minutes, should be repeated daily or every second day. A considerable number of cases have been reported, in which the spray has apparently had a good effect in controlling the disease. But I repeat my belief, from the large number of cases seen in the Bureau for the Relief of the Out-Door Poor, that the arsenical and ferruginous treatment will give more satisfaction than any or all other measures.

CHAPTER XV.

INFANTILE PARALYSIS.

Paralysis in young children, especially infants, is in most instances due to causes which seldom produce it in adults. The principal cause of it in the adult, namely, cerebral apoplexy, is indeed rare in children. Paralysis in children has the following recognized causes : 1st. A change in the blood, not fully understood, induced by certain grave diseases, as diphtheria, typhoid fever, measles, scarlet fever, etc. 2d. Reflex influence. The function of some part of the system is in some way disturbed, and paralysis occurs in certain muscles, maybe at a distance from the cause, and it disappears when that cause is removed, unless it have continued too long. The only rational explanation is found in the fact of a continuous connection between the local cause and the paralyzed muscles through the afferent and efferent nerves, and the nervous centres. 3d. Compression or injury of a nerve-trunk. These cases are rare. Pressing of the portio dura by the blades of forceps during birth, described in the next chapter, is an example. 4th. An anatomical alteration in the muscular fibres, the nerves and nervous centres remaining unaffected. This has been designated myogenic paralysis. This form of paralysis is probably often of a rheumatic nature. Paralysis of the face or other portions of the surface, which sometimes occurs in children and adults from prolonged exposure to cold winds, is of this nature. 5th. Some anatomical change in the nervous centres, as congestion, hæmorrhage, inflammation, emboli, compression and laceration of brain, whether by tumors, inflammatory products, or other causes, etc. If there be hemiplegia the presumption is that the disease causing it is cerebral ; if paraplegia, that it is spinal. The

following is an interesting example of hemiplegia. The case was related by me, and the specimen presented to the New York Pathological Society.

Maggie, aged 2 years 8 months, was admitted into the Catholic Foundling Asylum about the 1st of September, 1874. She seemed to be in good health and was plump and well developed, and her mother stated that she had had no serious sickness. After her admission she continued well, having the usual appetite, amusing herself through the day, and presenting no symptoms to attract attention till December 6th. On the evening of December 5th she ate her supper as usual, and was placed in her crib, *apparently in perfect health.* At 3 A.M., the sister who was in charge of the ward found her in severe general eclampsia. Immediately, in addition to the usual local treatment, she administered five grains of bromide of potassium, and this was repeated at intervals till six or seven doses were administered. Nevertheless, the spasmodic movements continued, with more or less violence, till 1½ P.M., and in the muscles of the leg somewhat longer.

On my arrival at the asylum, at about 6 P.M., I found her lying quietly, rather stupid, but easily aroused. Her vision was evidently good, and she was conscious ; the pupils responded to light, and the direction of the eyes was normal ; pulse 104, no cough, and respiration natural ; temperature, as ascertained by the thermometer in the axilla, also normal. There was no apparent paralysis of the muscles of the face, but the right arm and leg were paralyzed, though the paralysis was not complete. The great toe flexed on tickling the sole of the foot, but the foot itself had little or no motion, and on my attempting to flex the leg, which was extended, some rigidity of the muscles was observed. At times the patient produced slight movement of the thigh upon the trunk. The muscles of the right upper extremity were more flaccid than those of the leg, and below the elbow motion seemed to be totally lost, while a little movement remained of the arm on the trunk. I think that during the two or three days succeeding the convulsions sensation in the right limbs was not entirely lost, though greatly enfeebled. Subsequently paralysis in the right limbs, both of the nerves of sensation and motion, was nearly or quite total, and continued so till death. Nevertheless, tickling the sole of the foot caused some movement of the great toe. On the left side sensation and motion were perfect.

The record of December 9th runs : Has vomiting to-day for the first time ; apparently sees well, and appearance of the eyes normal ; has no retraction of head, or rigidity of muscles of neck, or along the spine ; pulse 96, temperature in the axilla normal ; lies quiet and with eyes shut ; is stupid, but not particularly fretful when aroused ; the bowels move regularly.

December 11th, continues to vomit at intervals ; pulse 68. Dec. 16th, pulse 80, temperature 100° ; vomited once yesterday, none to-day ; lies in a constant doze ; takes bromide of potassium gr. iv three times daily. Dec. 18th, moans at times, as if in pain ; pulse 180, temperature 100° ; takes the bromide gr. iv every four hours.

Dec. 19th, pulse 180, temperature 103° ; there is convergent strabismus, and the eyes have a wild, almost insane look, but she sees, grasping hurriedly a percussion hammer presented toward her ; paralysis of nerves of motion and sensation in the right extremities nearly complete ; slight movement is still produced in the great toe by titillation ; the vom-

iting has ceased ; tongue covered with a thick fur ; movements of the bowels pretty regular ; has a slight cough, such as is common in cerebral disease.

Dec. 22d, lies quietly on her side in perpetual slumber, with eyes constantly shut ; pulse 118, temperature 101½° ; the bowels still move nearly normally ; the pupils, exposed to the light, are seen to oscillate, but are constantly more dilated than in health ; the urine passes freely ; circumscribed flushing of the features at intervals ; a rash like lichen over abdomen and chest, possibly due to the large quantity of bromide of potassium administered. 24th, pulse intermittent ; pupils dilated.

Dec. 25th, died in profound stupor to-day, having lived nineteen days from the commencement of the malady.

Autopsy.—About thirty hours after death ; weather cool. On removing the calvarium and dura mater, which presented no unusual appearance, the vessels of the pia mater were found rather more injected than usual, but not more so than we sometimes observe in those who die of diseases which do not involve the brain. The cerebro-spinal fluid was scanty, and the surface of the brain rather dry. The vertex of the left hemisphere was unusually prominent, rising perhaps half an inch higher than that on the opposite side. At the highest point, which was about one and a half inches from the median line, was a circular yellowish spot upon the surface of the brain about one and a half inches in diameter. Pressure upon this spot, made lightly, so as not to produce rupture, communicated the sensation of a large cavity underneath filled with liquid, and approaching to within two or three lines of the surface. There was no adhesion or exudation over this spot ; and the surface of the brain appeared entirely normal, except a little cloudiness of the pia mater over a space which could be covered by a five-cent piece, a little posterior to the optic commissure. The incised surface of the brain, at a distance from the abscess, showed no increase of vascularity. The right hemisphere appeared in every way normal, except that its lateral ventricle was filled with pus, but not distended.

On the left side, occupying the centre of the hemisphere, was an abscess as large as the fist of a child of two years, extending from within two or three lines of the vertex, where its site corresponded with the yellow spot on the surface of the brain, to the roof of the lateral ventricle. Through this roof the abscess had burst, filling and distending the ventricle with pus, and thence making its way into the lateral ventricle of the opposite hemisphere. The whole amount of pus contained in the abscess and the two ventricles was, perhaps, two ounces. The walls of the left lateral ventricle were much softened, the upper part of the corpus striatum and thalamus opticus being nearly diffluent ; the walls of the right lateral ventricle were slightly softened, but to less depth. The parietes of the abscess, which extended from the roof of the ventricle to the vertex, as already stated, were indurated to the depth of one and a half lines in consequence of proliferation of the connective tissue, except at the base of the abscess, which corresponded with the roof of the ventricle, where softening had occurred. The spinal cord, so far as it could be examined from the cranial cavity, had the usual vascularity, and seemed nearly or quite normal.

The cause of the encephalitis from which the abscess resulted was obscure. This inflammation, so far as can be ascertained, was idiopathic, which is known to be a rare disease. There was no history of otitis,

which is one of the most frequent causes of cerebral abscess, nor of heart disease, so as to produce embolism. It seems probable, since there was no fever till about the fourth day after the convulsions, that an abscess had primarily occurred in the hemisphere between the roof of the ventricle and the vertex, possibly weeks previously. The bursting of this into the lateral ventricle, and the constitutional disturbance, inflammation, and softening to which this would inevitably give rise afford sufficient explanation of the history of the case after the commencement of the convulsions.

Paralysis occurring as a symptom, or sequel of some obvious local or general disease, as diphtheria, lesion of the nervous centres, etc., and which may occur at any age, need not detain us. It is described in connection with the primary diseases on which it depends. But there is a form of paralysis which in the present state of our knowledge we must consider an idiopathic malady, and which is peculiar to the first years of life, or is so rare at other periods that it is proper to regard it as strictly a malady of infancy and early childhood. It occurs between the ages of six months and three years. The following description relates to it :

Symptoms.—The previous health of the patient is usually good. The paralysis does not always commence in the same manner. In a few instances it begins suddenly in the daytime when the child is apparently in perfect health. In some it begins abruptly, after sound sleep. The child goes to bed well, sleeps through the night, and awakens in the morning paralyzed. I have known it to occur in one instance after sleep in the middle of the day. In these cases there has sometimes been an exposure, before the sleep, to wind or rain, or from sitting upon a cold stone. In other and the majority of cases the paralysis is preceded by a very decided febrile movement, which comes on suddenly, without appreciable cause, and after a few days the power of motion is found to be lost in one or more of the limbs. There is no symptom during the febrile movement to indicate any affection of the brain : consciousness is retained, and there is no more headache or apparent liability to convulsions than occurs in other pathological states accompanied by an equal amount of fever. Several other modes of commencement have been described by writers, but it is not improbable that they have embraced other forms of paralysis in their statistics, as, for example, those cases which are hemiplegic or which occur in the course of a lingering disease or a hæmorrhagic disease, or with cerebral symptoms, as vomiting. Such cases should not in my opinion be included in the statistics of infantile paralysis, since their nature is uncertain, nor indeed should any cases in which there is doubt as to their genuineness. In whatever way the paralysis begins, it is at its maximum in the commencement. Occurring as by a stroke, the full extent of the paralytic state is exhibited at once, and so far as there is any subsequent change, it is an improvement, as regards the number of muscles affected, and the degree of the paralysis. Most frequently the muscles of one or both lower extremities are affected. Occasionally one of the upper

extremities is also paralyzed in addition to the lower, but paralysis of an upper extremity is less in degree, and disappears sooner, than that of the lower. The bladder and lower bowels remain unaffected, since only the muscles of volition are involved. Sensation is unimpaired in the affected limbs, and in the commencement there is even in some cases a state of hyperæsthesia (West). The febrile movement, which precedes and accompanies the paralysis in certain cases, gradually abates, and in a few days nothing abnormal remains except the loss of power in the affected muscles. These muscles are in a flaccid and relaxed state, so that the limb falls by its weight when unsupported, and they are usually free from pain. The number of muscles paralyzed varies greatly in different cases. Only one muscle or a single group of muscles may be affected, or, on the other hand, both the extensor and flexor muscles of two or more limbs. In the opinion of Mr. Adams, the following table exhibits the groups of muscles and single muscles most frequently involved, and in the order stated :

Groups.

1. Extensors of toes, and flexors of the foot.
2. Extensors and supinators of the hand.
3. Extensors of leg, and with them usually the first group.

Single Muscles.

1. Extensor longus digitorum of toes.
2. Tibialis anticus.
3. Deltoid.
4. Sterno-mastoid.

The following is an example of infantile paralysis, as it not infrequently occurs when the result is favorable : A. K., German, female, aged 3 years 4 months, fleshy ; had been in the habit of sitting on the ground near the house and on the door-sill. On July 2, 1871, she had a sound sleep in the afternoon, having been entirely well previously, and awoke trembling and with a high fever at 3½ P.M. At 8 P.M., the febrile excitement continuing, general clonic convulsions occurred, lasting about ten minutes. At this time I was called to see her, and found her face flushed, surface hot, and pulse about one hundred and thirty. Consciousness returned after the convulsion. Her intelligence was good, tongue moist and slightly furred, bowels rather constipated, and the urine freely passed. The febrile excitement continued two days, when it gradually and entirely abated, but before it ceased paralysis of the left lower extremity was observed. No weight at first could be sustained upon this limb, and it hung powerless when we endeavored to make her walk. The attempt caused her to cry, as if in pain, and pressing upon the thigh, or moving it, had the same effect. The thigh of this limb did appear slightly

swollen on inspection, but measurement did not indicate any notable enlargement. The difference in circumference was certainly not more than one eighth to one fourth of an inch. There was no appreciable increase of heat in the thigh over the general temperature of the body. Sensibility remained in every part of the limb, and the loss of power was not complete, for on the first day, as soon as the paralysis was observed, slight and imperfect movements could be produced by pinching the limb. In three weeks the use of the limb was fully restored, by mildly stimulating liniments, and simple medicines to regulate the bowels. The tenderness which was observed in this case is only occasionally present. It has been attributed to hyperæsthesia, but those who hold to the peripheral origin of the paralysis, would probably attribute it to the anatomical change occurring in the terminal nerve-fibres.

Prognosis—Progress.—The paralysis in nearly all cases soon begins to abate. The power of motion returns little by little, and whatever improvement occurs is permanent. There is no retrogression in the convalescence. The sooner improvement commences, the more favorable is the prognosis. In the most favorable cases there is complete restoration in from three to four weeks. In other patients, while certain of the muscles regain the power of motion, other muscles, oftener those of the lower extremity than upper, do not recover their function, and, unless proper remedial measures be employed, and even with them in certain instances, atrophy soon commences. The temperature of the paralyzed limbs falls three, five, or even eight degrees, and the amount of blood which circulates in it is diminished so that the pulse of the limb is feebler and its vessels smaller than in health. With the atrophy the contractility of the muscular fibres by the electric current diminishes, and in unfavorable cases after a time powerful induced and even primary currents have no appreciable effect. The nutrition of a paralyzed limb is always imperfect, and if the paralysis occur in a child, its growth is retarded. Therefore in cases of protracted or permanent infantile paralysis of one limb a disproportion occurs both in diameter and length between it and that on the opposite side. If the paralysis continue, the ligaments of the paralyzed limb become relaxed and lengthened. West mentions a case of paralysis of the deltoid in which the humero-scapular ligaments were so extended that the humerus dropped from the glenoid cavity, so as to increase the length of the limb three fourths of an inch. In the paralysis of certain muscles of the lower extremity, and continuance of the contractile power in others, we have the conditions which give rise to club-feet, and accordingly this deformity is the common result of the paralysis when it is not cured.

Etiology.—As infantile paralysis is not a fatal malady, opportunity for a post-mortem examination in a recent case seldom occurs. Hence the difficulty in determining the exact anatomical change in the nervous sys-

tem which produces the paralysis. There are now in medical literature records of a considerable number of cases in which autopsies have been made, but death occurred so long after the commencement of the paralysis, usually months or years, that it is difficult to determine whether lesions which have been observed were a cause or consequence. In a majority of these autopsies a spinal lesion of some sort was detected, but none could be discovered in a few instances, the most important of which were the following :

Mr. Adams, in his treatise on club-foot, relates a case in which the spinal cord, carefully examined, probably only with the naked eye, seemed normal. Robin examined the spinal cord microscopically in one case, but discovered nothing abnormal, and Elischer made two autopsies in cases of this paralysis which had succumbed in variola, but with a negative result as regards any lesion in the nervous system (*Jahrbuch für Kinderk.*, 1873). The examinations by Robin and Elischer, since they were microscopic, have been justly regarded as important, and they have been related by certain writers in order to sustain the theory that infantile paralysis is peripheral, and not centric. But may there not have been a spinal lesion which caused the paralysis, and abated, leaving no trace, although its effects as regards the muscles continued ?

Very little was effected, prior to 1863, in determining the cause or causes of infantile paralysis by post-mortem examinations, because the microscope was so little used, and because in most of the cases reported the clinical history or microscopic lesions were such as to show or to render it highly probable that the paralysis was not such as is designated and understood by the term infantile. Thus Beraud reported a case in which tubercles were found in the spinal cord. Hutin, a case in which there was atrophy of the lower part of the spinal cord, but the paralysis commenced at the age of seven years. Hammond, a case in which a clot was found in the spinal cord ; and Jaccoud, one of spinal arachnitis, with thickening of the meninges. Since 1863, seventeen autopsies have been recorded in which the spinal cord was carefully examined, and upon these we must chiefly rely for our data by which to determine what are the anatomical changes in the nervous system which probably cause this paralysis. The reader will find these cases tabulated in a lecture by E. C. Seguin, M.D., published in the *N. Y. Med. Record*, January 15th, 1874, and the most important of them narrated in a paper on infantile paralysis, showing great research, published by Dr. Mary Putnam Jacobi, in the *N. Y. Obst. Journ.* for May, 1874. It is true that all but three of these post-mortem examinations were made many years after the occurrence of the paralysis ; but in the three cases which were reported by Roger and Damaschino, only two, six, and thirteen months had elapsed. The following were the chief lesions observed in these cases as regards the spinal cord :

	Cases.
1. Atrophy of motor-cells in anterior cornua,	10
2. Nerve-cells, normal,	2
3. Atrophy (variously recorded) of anterior columns, or cornua, or part of cord, or roots of anterior nerves,	8
4. Sclerosis,	9
5. Myelitis, recorded as diffused, central, or slight,	7
6. Central softening (the three most recent cases),	3
7. Small clot in cord (Hammond's case),	1
8. Sciatic neuritis,	1

It is seen that the most common lesions in these cases were those of inflammation of the spinal cord, or such as are known to result from this inflammation, to wit, atrophy of the nervous substances and sclerosis.

With the data furnished by these post-mortem examinations and the clinical histories of cases, we are the better prepared to consider the theories regarding the etiology of this malady. The views of MM. Roger and Damaschino are entitled to great consideration, since the autopsies which they made were in cases of shorter duration, and therefore nearer the date of the commencement of the paralysis than those which have been reported by other observers. Roger and Damaschino published a series of papers on this malady in the *Gaz. Méd. de Paris* in 1871, which they conclude with the following propositions : " 1. The alteration peculiar to infantile paralysis is a lesion of the spinal marrow, which causes the atrophy of muscles and nerves. 2. The seat of this lesion is the anterior part of the gray substance of the medulla, where softened portions of spinal substance are seen. 3. This softening is of an inflammatory nature—in fact, a simple myelitis. 4. Infantile paralysis should, therefore, be called spinal paralysis of children, and be classed among the affections of the spinal marrow, as depending on myelitis."

To determine the exact character and limitations of the cause of infantile paralysis is difficult ; but the views of Roger and Damaschino, as expressed in the above propositions, seem to harmonize more closely with, and to afford a more satisfactory explanation of, the symptoms, history, and lesions, thus far observed in ordinary or typical cases, than does any other theory. Suddenly occurring, active congestion of the anterior cornua, many neuropathists regard as the cause of infantile paralysis ; but there is that close affinity between active congestion and inflammation that they may be regarded as having the same pathological effect in this instance, and therefore the two theories of a spinal congestion and spinal inflammation may be considered as one. It is not improbable that in some of the cases which more speedily recover there is simple congestion ; while in the more obstinate cases, and those with inflammatory symptoms, the congestion has passed into an inflammation, or inflammation was present from the first. According to this theory, the atrophy so generally observed in the twelve cases in which autopsies were made, must be considered a

degenerative change resulting from the inflammation or from the paralysis. That so accurate an observer and so excellent a microscopist as Robin could detect nothing abnormal in the case which he examined, was probably due to the fact that the inflammation or congestion abated without producing any degenerative changes in the nervous substance.

Professor Charcot considers atrophy of the motor cells as the cause of the paralysis, but it is much more in consonance with the facts to consider the cellular atrophy a result than a cause. For how could atrophy, which always occurs gradually, and by progressive increase, be the cause of a disease which begins abruptly, and is most intense in the very commencement? Besides, atrophy does not occur without some antecedent disease to cause it.

In a report to the International Congress at Amsterdam, Drs. Damaschino and Roger give the following summary of the result of their recent study of the pathology of infantile paralysis (*Le Progrès Medical*, No. 39, 1880):

1. The anatomical lesions are situated in the motor regions of the spinal cord.

2. They consist of a central myelitis, with a stadium of softening, and atrophic destruction of the cells of the gray substance, together with sclerosis of the lateral columns, and considerable atrophy of the anterior roots and the nerves leading to the paralyzed muscles.

3. Atrophy of the cells is not—as Charcot is of opinion—the whole process, as it is in progressive muscular atrophy.

4. The opinion of Leyden, that there is a circumscribed and a diffuse myelitis in children, is worthy of consideration.

5. It remains for future examination to decide whether the myelitis begins as interstitial or parenchymatous, in the cellular tissue or the nerve-cells.

It would be a waste of time to consider in full the various theories regarding the cause of infantile paralysis. No one at the present time, of those who are competent to express an opinion, believes it to be a reflex paralysis, and the expression dental paralysis once applied to it is no longer heard. There is one theory, however, which should receive more than a passing notice, and which was earnestly and ably advocated by Barwell, of London, in lectures published by him in 1872, in the London *Lancet*, to wit: "That this paralysis is purely peripheral; a malady affecting the ultimate fibrillæ of distribution of the nerves among the muscular elements. . . . Its essence," says he, "lies probably in some subtile derangement in relationship between the ultimate muscular and terminal nerve fibres, perhaps from some inflammatory, perhaps from some chemical or nutrient change." This theory has much to commend it. Those who advocate it believe that the atrophy of the nerves which supply the paralyzed limbs and of the motor nerve-cells which connect

with the roots of these nerves in the anterior cornua occurs in consequence of the paralysis, just as atrophy of the optic nerve can be traced even into the brain when the eye is destroyed. Nor does it dispose of this theory to state, as has been stated, that in order that paralysis occur in this manner, it is necessary that there should be the action of a poison, analogous to the woorari, for we observe something similar to this supposed peripheral cause in facial paralysis from exposure to cold, in which there can be no poisonous influence. This theory therefore rises up most strongly in conflict with that which attributes the paralysis to congestion or inflammation of the anterior cornua, and it is necessary to decide between them, or to admit that the paralysis may sometimes have one and sometimes the other cause. But the fact that there is in many cases of infantile paralysis a decided febrile movement, and much constitutional disturbance, when there is no evidence of any morbid action going forward in the affected limbs sufficient to cause these symptoms, and the fact that only one set of nerves is affected, namely, the motor, which have a distinct origin in the spine from the sensitive nerves, but are intimately associated with them in their distribution, comport best with the theory of a central lesion. Therefore, the theory of spinal congestion or inflammation appears the best established. Nevertheless, all past experience shows that medical theorizers are apt to be too exclusive, and that in many diseases there is not a simple uniform cause, but that the cause may vary, especially when, as in the present instance, the symptoms also vary; possibly, therefore, we may yet find that there are cases, especially those in which there is little constitutional disturbance and a known exposure to cold, in which the cause is peripheral instead of centric. The brain and cerebral meninges may be excluded as sustaining any causative relation to the paralysis. There is no symptom which indicates that they are involved. The mind remains clear, and convulsions are no more frequent than in any other disease which is attended by an equal degree of febrile reaction.

Anatomical Characters.—All muscular fibres which are in a state of disuse, begin in a few weeks to atrophy, and undergo fatty degeneration. The transverse striæ in the primitive muscular fasciculus gradually disappear and are replaced by granules of fat, and later still by small oil-globules. If we examine with the microscope the fibres from a muscle which has been a considerable time paralyzed, but which has still some electric contractility, we will find in places the striæ remaining, but numerous opaque granules of a fatty nature within the sarcolemma wherever the striæ are absent, and in other places, where the degeneration is most advanced, oil-globules occur, always small. If the paralysis be more profound, the striæ have all disappeared. At a later stage, usually after some years in cases of complete and incurable paralysis, the fatty matter may be to a considerable extent absorbed, and the fibrous network of the

muscle which remains presents a tendinous appearance. There is a great difference, however, in different cases, as regards the rapidity with which these changes occur. Hammond states that he found the striæ remaining in two cases after the lapse of more than four years of decided paralysis. The nerves of the paralyzed part also undergo atrophy.

Diagnosis.—This is easy as soon as the attention of the physician is directed to the state of the limbs. In a large proportion of cases the mother or nurse first observes the paralysis, and calls the attention of the physician to it. A knowledge and recollection of the facts in relation to infantile paralysis should lead the physician to examine the state of the limbs in all cases of marked febrile excitement in young children, occurring without apparent cause.

Prognosis.—It may be confidently predicted, if the child be seen early, and correctly treated, that the paralysis will diminish, if it cannot be entirely cured. If the paralysis have continued a considerable time, and there be no electric contractility of the muscles, there is poor prospect of any improvement. The induced current will fail, sometimes, to cause muscular contraction, when the direct current may produce it; but if there be no response to the direct current, there is no therapeutic agent which can restore the use of the limb.

In cases seen soon after the paralysis commences, and before the stage of atrophy, the prognosis is most favorable, when there is still slight voluntary motion, and improvement commences early. In most instances, even when the paralysis has been mild, and of comparatively short duration, the limb, although its motion be fully restored, is for a long time weaker than the limb on the opposite side.

Treatment.—A physician called at the commencement of the paralysis should endeavor to remove every cause which might increase the irritability of the nervous system. Some advise to scarify the gums, if much swollen and tender from dentition, the bowels should be kept regular, worms, if present, expelled by appropriate medicines, and the diet be plain and unirritating. As the cause of the paralysis is, in the commencement, still operative, measures are appropriate which are calculated to remove it.

Local treatment is very important at all periods of the paralysis. In the first days cold applications, as by an india-rubber bag containing ice, should be made along the spine. Stimulating embrocations along the spine, and upon the paralyzed limb, are appropriate at a later date. Benefit may also in some instances be derived from the application of dry cups along the spine after the cold has been discontinued. Ergot, the bromide and iodide of potassium, which may be administered variously combined, or singly, are the appropriate remedies for the first twelve or fourteen days. Administered every three or four hours in proper dose, they are the most effectual of all internal remedies for diminishing spinal

congestion, and preventing effusion, and permanent structural change in the cord.

If the paralysis continue, or if it do not progressively diminish, we should not delay more than two weeks from the commencement of the disease before employing appropriate measures to restore the use of the limbs, and prevent atrophy of the muscles. The expectant plan of treatment which is proper in many diseases of children is unsuited to this. Muscular atrophy may commence in three weeks, and the farther it has advanced, the more difficult and tedious will be the cure. Therefore, by the close of the second week if the paralysis continue, or be not rapidly disappearing, iron as a tonic with strychnia should be prescribed. There is probably no better formula for the exhibition of these agents than the following from Professor Hammond :

℞. Strych. sulphat., gr. j ;
Ferri pyrophosphat., ʒ ss ;
Acidi phosphorici dilut., ℥ ss ;
Syr. zingib., ℥ iijss. Misce.

One third of a teaspoonful, or one ninetieth of a grain of strychnia, is sufficient for a child of two years, administered three times daily. Hillier, Barwell, and others have employed subcutaneous injections of strychnia, with, it is stated, a good result. While in the first and second weeks the child has been allowed to remain quiet, he should now be encouraged to use his limbs. Frequent muscular contraction must, if possible, be produced, and the voluntary movements, when not totally lost, aid greatly in promoting the nutrition of the muscles and restoring their function. Immersing the limb for half an hour in water at a temperature of 110 or 115 degrees, rubbing the limb with a coarse towel, and kneading the muscles, aid also in restoring nutrition and tone to them.

But, fortunately, we have an invaluable agent in the subtle electrical fluid, which can be made to penetrate the muscles and cause their contraction when every other measure has failed. The induced current should be employed upon the limb every day, or second day, if it cause the muscles to act, but if the loss of power be of long standing, or complete, so that the induced current is not sufficiently powerful, the direct current should be used instead. It is not regarded as important which way the current passes, provided that the muscles contract.

In a large proportion of cases a cure cannot be effected until the lapse of several months, so that the patience of the physician and friends may be put to the test ; but if muscular atrophy can be prevented, and the limb kept at nearly the normal temperature, this mode of treatment will ordinarily in the end be successful. The primary affection which caused the paralysis will, with some exceptions, be removed by the treatment indicated above, after which the state of the muscles and their nervous

supply demand the whole attention. Observations show that by treatment perseveringly employed, fatty degeneration of the muscular fibres can be not only arrested, but the fat which has already been deposited within the sarcolemma may be absorbed, and the muscular striæ restored. In those cases in which it has been necessary to employ the direct current, the induced should be employed, whenever by the improvement of the case it is found sufficiently powerful.

CHAPTER XVI.

FACIAL PARALYSIS.

Causes.—Facial paralysis, in the new-born, commonly occurs from pressure of the blade of the forceps upon the portio dura, at a point external to the stylo-mastoid foramen. It may also occur in children of any age, as it is known to be in the adult, from exposure of the face to a cold wind. The pressure of a tumor upon some part of the portio dura, or even of the fist of the child placed under the face during sleep, may cause it. It may also result from disease of the temporal bone, producing pressure on the nerve, as caries, periostitis, suppuration, or hæmorrhage into the aquæductus Fallopii, and also from intracranial disease affecting the pons Varolii or the medulla oblongata.

Symptoms.—The portio dura, which is a nerve of motion, supplies the muscles of the face, and therefore its loss of function is at once manifest in distortion of the features. The eye of the affected side remains open in consequence of paralysis of the orbicularis palpebrarum, the upper lid being raised by the levator muscle, which is not paralyzed, as its nerve is derived from the third pair. From the inability to wink, the eye becomes irritated by dust and constant exposure, and, in children old enough to have an abundant lachrymal secretion, the tears are apt to flow over the cheek. On account of the paralyzed and relaxed state of the facial muscles the mouth is drawn toward the healthy side, while the affected side presents a swollen appearance. Movement of the eyebrow and of the anterior portion of the scalp on the paralyzed side is also impossible, since the occipito-frontalis and corrugator supercilii are supplied by the portio dura. If the cause of the disease be located above the origin of the chorda tympani, the flow of saliva, and consequently the taste, on the affected side are impaired. If the injury be posterior to the gangliform enlargement, those symptoms are superadded which are due to paralysis of the petrosal nerves.

The accompanying wood-cut represents a case which was under observation in the New York Infant Asylum. Its age at admission was about five months, and its previous history was unknown. The paralysis was per-

manent. Death occurred some months later from an intercurrent disease, and no cause of the paralysis could be discovered in a careful examination.

Prognosis.—This depends on the cause. If the cause be peripheral, as from the pressure of the forceps or from cold, the prognosis is favorable. In cases of deep-seated lesion, unless syphilitic, the prognosis is usually unfavorable. A syphilitic lesion can often be removed by appropriate remedies, and the paralysis cured.

Fig. 21.



Treatment.—In the paralysis of the new-born, from pressure of the forceps, all that is required is occasional rubbing or gentle kneading over the affected muscles. In those who are older, the nature of the cause, so far as ascertained, must determine the treatment. If there be glandular swellings, and discharge from the ear from scrofula, cod-liver oil and the syrup of the iodide of iron are required internally, with appropriate external treatment of the glands and ear. If syphilis be the cause, mercurials and the iodide of potassium should be employed. If the patient do not soon begin to improve, the treatment recommended for infantile paralysis, modified somewhat on account of the difference in location, is appropriate. Iron and strychnia may be administered internally ; friction, kneading, hot applications, and the electric current employed. The current should have only moderate intensity, for a high degree of it might injure the vision. It should be applied every second day, with one pole over the mastoid foramen, and the other moved slowly over the muscles.

Paralysis with Pseudo-Hypertrophy.

This is a rare disease. It was first described by Duchenne in 1861, and since the attention of the profession was directed to it, cases have been observed on the Continent, in Great Britain, and in this country. Though our acquaintance with this disease is so recent, it has been fully and accurately described by various writers in our language. The *Transactions of the London Pathological Society* for 1868 contain a translated paper relating to it, communicated by M. Duchenne, with photographic views, remarks by Lockhart Clarke, and also the histories of two cases occurring in London, and exhibited to the Society by Adams and Hillier. In this country an elaborate paper has appeared on this form of paralysis, from the pen of Dr. Webber, of Boston, who succeeded in collecting the records of forty-one cases (*Boston Med. and Surg. Journ.*, Nov. 17,

1870) ; and more recently Dr. Poore, physician to the New York Charity Hospital, collated the records of eighty-five cases, which furnish the material of an excellent monograph published in the *New York Medical Journal* for June, 1875.

Weakness of the legs, and a peculiar waddling gait, are the first observable symptoms, and by them we are able to ascertain approximately the date of the commencement of the paralysis. In 27 of the cases collated by Dr. Poore, the malady began so early in infancy that they were never able to walk like other children ; in 5 there is no record in regard to the time when the peculiar gait was first observed, or whether they ever could walk. Fifty-two, or about two thirds of the cases, walked well at first, having no symptoms of the paralysis till after the age of two years. In 15 of these weakness of the legs and the peculiar gait were first observed between the ages of two and a half and five years ; in 23 between the ages of five and ten years ; in 6 between the ages of ten and sixteen years, and in 8 over the age of sixteen years. It is seen, therefore, that this malady is pre-eminently one of infancy and childhood.

The gait, which is unsteady and waddling, has been compared to that of a duck. The child stands with the legs wide apart, and from the weakness of the legs, and unsteadiness of the gait, frequently stumbles and falls. In many cases this muscular weakness and difficulty in walking occur before there is any perceptible enlargement of the muscles beyond the normal size.

The hypertrophy occurs without tenderness, pain, or other nervous symptoms, and without fever or constitutional disturbance. Occasionally the patient complains of stiffness or aching in the limbs, especially after exercise, even before the enlargement is observed, and exceptionally there is pain, even acute, in the legs. The hypertrophy is ordinarily observed first in the calf of one leg, and then in the opposite calf. In a case related by Niemeyer, the muscles of the gluteal region were first affected. In nearly all cases the gastrocnemii are hypertrophied. There were only two exceptions in the 85 cases collated by Dr. Poore ; but almost any of the other muscles, or groups of muscles, may also be involved. The muscles which are most conspicuously affected, and which produce the characteristic deformities, are those of the extremities and posterior aspect of the trunk. Spinal curvature, which is attributed to the weakened state of the erector muscles of the spine, appears early, and is seldom absent. The bending is such that a plumb-line, falling from the most posterior of the spinous processes, falls behind the plane of the sacrum, which is a means of distinguishing this disease from certain other spinal affections. The woodcut represents a case which came to the children's class at Bellevue, in April, 1872. The boy was two years old, and the mother stated that the peculiar gait and the enlargements had only been observed from four to six weeks, and yet the curvature of the spine was quite marked.

He did not return to the class, and his subsequent history is therefore unknown.

Of the muscles in the upper extremities the deltoid and scapular are the most frequently enlarged. Hypertrophy of the temporals has been observed in three cases, of the masseters in two, of the tongue in three, and of the heart in four (Poore).

Fig. 22.



We shall see presently that atrophy occurs in the muscular element of the muscles which are affected, and that the hypertrophy is due to hyperplasia of the connective tissue. Now occasionally this hyperplasia does not occur or is tardy in occurring, while the atrophy has taken place. Therefore, certain muscles may have less than the normal volume, which, from contrast with those which are hypertrophied, increases the deformed appearance. In ordinary cases the enlargement advances more rapidly and continues greater in the gastrocnemii, which are, as we have stated, the muscles first affected, than in other muscles, and therefore there is more prominence and hardness of the calves of the legs than elsewhere. In advanced cases walking is impossible, and the patient is obliged to remain in a reclining posture. Sometimes from the unequal muscular action the feet become extended and the toes flexed, so that the child in attempting to walk steps on the anterior part of the sole of the foot, as in talipes equinus.

In the first stages of the disease the electric contractility of the muscles is nearly normal, but in advanced cases response to the galvanic current becomes more and more feeble, according to the degree of atrophy of the muscular fibres. The skin retains its normal sensibility, with exceptional instances in which there is numbness either general or in places. Reddish or bluish mottling of the surface of the extremities is sometimes observed, which is attributed by some to obstructed venous circulation in the hypertrophied muscles, and by others is supposed to be due to the peculiar neuropathic state. The bladder and rectum are not involved. The mental faculties are more or less blunted and feeble in certain cases, especially in those which commence in early infancy, but in some patients they do not seem to be materially impaired.

Anatomical Characters.—There have been so few post-mortem examinations of those who died having this disease, that it is still uncertain whether there is any centric lesion. Cohnheim examined the spinal cord in one case, and could find nothing abnormal. Recently, Mr. Kesteven has examined the brain and spinal cord from a case, and found dilatation of

the perivascular canals, both in the brain and spinal cord, and also spots of granular degeneration chiefly in the white substance, "caused by loss of cerebral tissue replaced by morbid matter." (*Jour. of Mental Sci.*, Jan., 1871.) As this child was imbecile, it is not improbable that these lesions were connected with the mental state, and not the muscular disease.

Professor Charcot (*Archiv. de Physiol.*, March, 1872) reports a careful microscopic examination of the spinal cord and of the nerves in a case which had continued ten years. He could discover no deviation from the healthy state. More recently Dr. J. Lockhart Clarke examined a case and found the encephalon healthy, but in the spinal cord there was more or less disintegration of the gray substance in each lateral half, and in places dilatation of vessels, and commencing sclerosis (*Medico-Chir. Trans.*, 1874).

It seems, therefore, that central lesions are not essential, and are sometimes absent. When they do occur, it is probable that they are consecutive to the paralysis.

The essential lesions in this malady are atrophy of muscular fibres and hyperplasia of the connective tissue which surrounds these fibres. The hyperplasia of the one element in the muscle is greater than the atrophy of the other, and hence the increase of volume above the normal size. The atrophy is probably a primary lesion, for muscular weakness ordinarily occurs for a considerable time before there is any evidence of the enlargement, and, as we have seen, certain muscles may undergo the atrophy without the hyperplasia. Still the mechanical effect of the newly-formed connective tissue, doubtless, increases the atrophy in those muscular fibres which this tissue surrounds, and the comparatively quiet state of muscles in consequence of paralysis not only tends to promote the atrophy and degeneration of these muscles, but also of contiguous healthy muscles.

The muscles which are involved in this paralysis present a pale yellowish hue, resembling, says Niemeyer, the appearance of lipoma. Examining by the microscope, we find in addition to a large increase in the fibrous tissue and atrophy, and in some places disappearance of the muscular element, more or less fatty matter, granular and globular, occupying the interstices. Mr. Kesteven describes as follows the appearance of the muscles in the case which he examined: "The muscular substance is pale, almost white, and very greasy. The superabundance of fat is evident to the naked eye. The muscular fibres present the ordinary striation, but less distinctly than usual. The ultimate fibres are pale, and separated by a large increase of areolar and fibrous tissue."

Causes.—Why there is this strange perversion of nutrition, so that there is an exaggerated development of the intermuscular connective tissue, and atrophy of the muscular fibres, is unknown. Boys are more apt to be affected than girls. Of the eighty-five cases embraced in the statis-

tics of Dr. Poore, seventy-three were boys, and there was a similar excess of males in the cases collated by Dr. Webber.

There is in a considerable proportion of cases the record of hereditary transmission, and in almost all the instances the predisposition is acquired from the mother's side. Thus in thirty-seven of Dr. Poore's cases "two or more belonged to the same family." In some instances three and even four maternal relatives had this form of paralysis. In one case observed by Duchenne, and in a few others subsequently observed, this malady seemed to be congenital, for the limbs at birth were unusually large, and the patients, when they came under observation, were unable to walk. No relation has been observed between this paralysis and syphilis, scrofula, or other diathesis diseases.

Prognosis.—This disease is in most instances progressive, terminating fatally after a variable period. It is in its nature chronic, rarely ending in less than five or six years. A considerable proportion live longer, some even attaining adult age. The paralysis may be stationary for a time, but afterward continue to increase. Duchenne has reported one case of recovery. In two or three other instances patients appeared to improve somewhat under treatment, but the writers admit they may have become worse afterward. Death is apt to occur, not directly from the paralysis, but from some intercurrent disease, especially of the lungs.

Treatment.—The treatment thus far employed has been chiefly local, consisting in the use of electricity, and kneading or shampooing over the affected muscles. Both the primary and induced electrical currents have been employed, but, unfortunately, without any appreciable benefit in most cases. Benedikt, who claims a better result from electrization than any other observer, applied the copper pole over the lower cervical ganglion, and the zinc pole along the side of the lumbar vertebræ by means of a broad metallic plate.

CHAPTER XVII.

DISEASES OF THE SPINAL CORD AND ITS COVERINGS.

The diseases of the spinal cord, and of the parts which cover and protect it, are important, but they are less understood than are those of any other portion of the body. This is partly due to the fact, that in many cases the spinal disease coexists with a similar pathological state of the brain or its meninges, the symptoms of which predominate and mask those which pertain to the spine, partly to the fact that the chief symptoms of spinal disease are often located in organs or parts which are at a distance from the spine, and, lastly, to the fact that it is difficult, for

obvious physical reasons, to determine the exact state of the spine at the bedside ; while post-mortem inspection of the spine, which alone can give accurate pathological knowledge, is less frequently made than of any other organ.

Certain spinal diseases occurring in childhood are the same as in adult life, presenting identical symptoms and lesions in the two periods, and therefore they require no extended notice in this treatise. Others are common to childhood and maturity, but they present peculiarities in the former period which require to be pointed out, while others still are peculiar to childhood.

Spinal irritation is not infrequent in delicate and poorly-fed children. I have from time to time observed marked cases of it in the class in the Outdoor Department of Bellevue, the patients usually being above the age of three or four years, and exhibiting evidences of cachexia. Most of them have been spare and pallid, some affected with a nervous cough or palpitation, and some with neuralgic pains in the chest, abdomen, or elsewhere, which pressure at a certain point upon the spine intensified. These cases recover by better feeding, outdoor exercise, mild counter-irritation along the spine, and the use of tonics, especially of iron.

Primary inflammation of the cord and its meninges is rare in children. Secondary inflammation of these parts is, on the other hand, more common in children than in adults. It is common in caries of the vertebræ, and in cerebro-spinal fever. The preponderance in functional activity of the spinal cord, and the feeble controlling power of the brain, render childhood more liable to convulsions and reflex paralysis than any other period of life. Until within a recent period, most cases of infantile paralysis were believed to be reflex, due to dentition, intestinal irritation, etc., but it is now attributed to myelitis in the motor region of the spinal cord (see remarks in article, Infantile Paralysis). Still there are cases of true reflex paralysis in children, in regard to the etiology of which there can be no doubt. Prof. Sayre of this city has called attention to the fact, that balanitis and preputial adhesions sometimes cause paraplegia, more or less pronounced, in young children, and which is relieved by dividing the adhesions, and restoring the mucous surface of the glans and prepuce to its normal state. Such a case was brought to the children's class in the Out-Door Department at Bellevue, in April, 1875. The child could not walk, or scarcely stand, without support, but after the division of the adhesions, and subsidence of the inflammation, locomotion rapidly improved.* It is well known that masturbation sometimes causes a simi-

* Some months since I requested Drs. Holgate and Bosley, attending physicians in the children's class at Bellevue, to make examination of the state of the prepuce in infancy. They report that they have found preputial adhesions almost daily, in most instances without symptoms, but sometimes with dysuria, and only in rare instances with paralysis.

lar weakness of the lower extremities. Dr. West relates the case of a child "between two and three years old," who began to totter in his gait, and finally almost ceased walking. He was observed to practice masturbation. "This was put a stop to," and he soon recovered his health and his power of locomotion. (*Diseases of Children*, page 146, 4th American edition.)

Congestion of the Spinal Cord and its Membranes.

Congestion of the spinal cord and meninges occurs both as a primary and secondary malady, the latter being more frequent than the former. It may be active or passive. Active congestion, occurring independently of meningitis or myelitis, is in most instances transient, and subordinate to some graver disease, in the course of which it arises. It is probably often overlooked. It is not fatal, and its symptoms are frequently masked by those which are referable to the brain or some other organ. It is believed to be common in the initial period of certain of the fevers of childhood. It is not improbable that the hyperæsthesia observed upon the thoracic and abdominal surfaces and along the thighs, in the commencement of remittent and certain other febrile diseases, have their origin in a congested state of the spine. To this congestion writers attribute the lumbar pain and occasional paraplegia in the initial stage of variola. Active spinal congestion may also result from the sudden impression of cold, and to it, as has been stated above, most neuropathists attribute the so-called infantile paralysis.

Certain anatomical circumstances favor the occurrence of passive congestion of the spinal cord and meninges, to wit, the tortuousness of their veins, and the absence of valves in these veins, the lack of muscular support of the vessels, and the inferior position of the spine in sickness as the patient lies quietly in bed. A common cause of passive congestion of these parts is some protracted and enfeebling disease, which diminishes the contractile force of the heart (cardiac paresis), producing congestion of the spinal cord in the same manner as under similar circumstances hypostatic congestion of the lungs occurs. Severe convulsive diseases, as tetanus or eclampsia, when protracted or occurring at short intervals, commonly produce spinal congestion. In tetanus, this congestion is extreme, so that extravasation of blood is apt to occur from the engorged vessels, especially from those of the pia mater.

Anatomical Characters.—It is often impossible, at post-mortem examinations, to determine how much of the congestion of the spine and its meninges is pathological, and how much cadaveric; since, if the corpse be placed on its back at death, a very considerable engorgement of the spinal vessels occurs from gravitation of blood. If the body have been placed on the side or face, this cadaveric congestion is prevented. Since, in active congestion, the arterioles and capillaries are distended

with arterial blood, the color is a brighter red than in passive congestion, in which venous blood predominates. *Active* congestion of the cord usually coexists with that of the meninges, but it may occur without it. In cases of considerable congestion, the "puncta vasculosa" appear upon the incised surface, both of the white and gray substance. If the congestion be protracted, or if it recur frequently, it may produce permanent dilatation of the arterioles and capillaries, in greater or less degree, and it may also lead to sclerosis of the cord. *Passive* congestion seldom, perhaps never, occurs in the cord, without being equally and often to a greater extent present in the meninges. Continuing for a time it gives rise to transudation of serum into the interspaces over the cord, and even softening of the cord may occur to a limited extent from imbibition of serum. In either form of congestion, extravasations of blood are frequent.

Symptoms.—Spinal congestion is announced by pain in the region of the spine, usually in the lumbar, or dorsal and lumbar portions, and irradiations of pain, and tingling in the legs. In addition, more or less paralysis of the bladder and legs may result. The paraplegia may occur early or not till the lapse of several days. In active congestion, the symptoms are rapidly developed, and they attain their maximum intensity sooner than in the passive form. In passive congestion the development of symptoms is not only more gradual, but they are ordinarily less pronounced, and are attended by more fluctuations than in the active form. The paralysis, if present, comes on slowly after several days and is incomplete. Spinal congestion, especially of the passive form, is apt to be associated with cerebral congestion, as for example in tetanus and severe eclampsia, and the spinal symptoms therefore coexist with those which have a cerebral origin. The duration and the result of a hyperæmic state of the spinal cord and its meninges, depend largely on the nature of the cause. If it be not relieved within a few days, there is strong probability that some other serious pathological state has supervened, as meningitis, myelitis, extravasation of blood, or serous transudation, with softening of the nervous substance.

Treatment.—In the adult, spinal congestion sometimes results from the sudden cessation of the hæmorrhoidal or catamenial flow, and the application of leeches or wet cups along the spine is indicated. But in the child, the abstraction of blood is seldom required. In the acute stage of active spinal congestion, with decided febrile movement, cold applications along the spine are often beneficial, as by an india-rubber bag.

In active hyperæmia, laxatives are useful, and rubefacient applications should be made along the spine, as by mustard, or by friction with a stimulating liniment. In the inflammatory spinal congestion of cerebro-spinal fever, I have employed with a very satisfactory result a liniment containing equal parts of camphorated oil and turpentine. In both active

and passive hyperæmia lateral decubitus should be prescribed rather than dorsal. The use of ergot, in order to diminish the turgescence of the vessels of the spinal cord and meninges, has been advocated by Brown-Séquard, and it is now one of the recognized remedies. Bromide of potassium is also a remedy of value, but it is more useful in certain cases than in others. It is signally beneficial in those cases in which there is also cerebral congestion. When the congestion is increased or produced by clonic convulsions, the bromide is the most reliable remedy which we possess for the removal of the cause. Thus it should be employed in the treatment of the spinal and cerebral congestion in the commencement of variola, in which convulsions are so common, and in the convulsions of pertussis, which cause extreme passive congestion of the cerebro-spinal axis. Passive congestion of the spine, common in exhausting diseases, and due to feebleness of the circulation, is best treated by stimulating and sustaining remedies, and by the lateral decubitus. It is hypostatic, and may be associated with a similar congestion in the posterior part of the lungs.

CHAPTER XVIII.

SPINA BIFIDA.

This is one of the most common of the malformations. In its severe form it is from its nature incurable, admitting only of palliative treatment, while in its milder forms, it may be cured, or so relieved as not to compromise life. The term spina bifida is applied to a hernia of the spinal meninges, which produces a rounded tumor, situated posteriorly over the spine in the median line. It is due to the congenital absence or incompleteness of one or more of the arches of the vertebræ. In exceptional instances, the arch is said to be complete at birth ; but the lateral portions separate, and are pressed outward during the first weeks of life. The tumor contains the cerebro-spinal fluid, and unless it be small, and its walls unusually thick, fluctuation may be detected in it. When the child cries the tumor enlarges, and it is reduced by compression, the fluid re-entering the spinal canal. If the tumor be large, its complete subsidence by pressure is apt to produce dangerous cerebral symptoms. Spina bifida is the counterpart of hydrocephalus, and the two often coexist. If we compress the hydrocephalic head the spinal tumor increases, and *vice versa*. Club-foot is another not infrequent complication. In the case which is represented in the accompanying wood-cut, hydrocephalus, spina bifida, and club-foot coexisted. The child was brought to the children's class in the Out-Door Department at Bellevue, and after a few visits I lost sight of it. It probably died soon after, since the tumor, over

which the cuticle was wanting, presented a deep red appearance as if inflamed, so that ulceration and escape of the fluid seemed near at hand. There is ordinarily but one spina bifida, the common seat of which is the lumbar region, but occasionally there are two or more. If the aperture

FIG. 23.



through which the tumor protrudes be small, it is usually pedunculated, but if large, it is sessile. In some patients it is covered by skin, which may be normal or somewhat indurated ; in others the skin is absent over the entire tumor or its most prominent part, and the dura mater or the connective tissue lying directly over the dura mater is exposed, and is liable to inflammation from friction. If the walls of the tumor be thin the liquid may transude in drops, and they are apt to give way by ulceration or rupture. Sudden escape of the liquid, and collapse of the spina bifida, involve great danger, for convulsions, coma, and death are the probable result.

The relation of the spinal cord or nerves, or of the cauda equina, to the tumor, is a matter of great importance. In many patients the adjacent portion of the cord or cauda equina, is deflected through the aperture, and lies against the interior of the sac. Spinal nerves also not infrequently lie within the sac, some returning into the spinal canal, and others passing through the walls of the sac to their points of distribution. Those which are deflected into the tumor and return into the canal obviously lie lowest. In the most favorable cases, namely, those with a small aperture, or small tumor, or a narrow and long peduncle, neither the cord, cauda equina, nor nerves lie within the sac. It is important to the practitioner to bear in mind that in all probability, unless under the favorable anatomical circumstances stated above, the sac contains nervous elements. In rare instances the liquid, instead of lying externally to the cord, lies within its central canal. The substance of the cord then becomes distended, and it

incloses the liquid like a delicate sac, just as the hemispheres of the brain are unfolded and expanded in the common form of congenital hydrocephalus. As might be expected from the anatomical characters of the more serious forms of spina bifida, paralysis, more or less complete, of the vesical and rectal muscular fibres, and paraplegia sometimes occur in which event the fatal issue is probably not far distant.

Diagnosis.—This is easy in ordinary cases. The congenital nature of the tumor, and the bony edge of the aperture, appreciable to the touch, suffice in ordinary cases to establish the diagnosis. The diminution of the tumor by pressure, and its enlargement when the child cries, are important diagnostic signs. There are various lumbo-sacral tumors located in the median line, from which it is important that spina bifida should be diagnosticated. Sometimes a cyst occurs in this situation which was originally a spina bifida, but obliteration of the canal in the pedicle occurred, just as the canal connecting a hydrocele with the abdominal cavity closes. Solid congenital tumors sometimes also occur in the same situation, among which, as most common, may be mentioned fatty tumors, and tumors containing fœtal remains. The most common seat of tumors which inclose fœtal remains is at the point where spina bifida ordinarily occurs. Physicians have erred in confounding these tumors, as well as those which consist of fat, with spina bifida ; but a mistake in diagnosis can only occur through haste or carelessness of examination.

Prognosis.—This is in most instances unfavorable. Ordinarily the tumor increases slowly, and finally the sac gives way by ulceration or rupture ; the liquid escapes, and death occurs in convulsions and coma ; or, if the escape of the liquid be prevented by pressure, and the aperture closes, a second rupture is probable with a fatal result. In other cases the tumor may not rupture, but the cord is softened, or it is injured by the abrupt bend, so that paraplegia results, and death after a time occurs in a state of emaciation. Rarely the tumor may shrivel away by absorption of the liquid, and the disease is cured, or so nearly cured that it gives no inconvenience, and the patient lives for years. In other rare instances the tumor may remain without any material change, and without giving rise to symptoms. The spina bifida being small and covered with skin, and the aperture leading from it into the spinal canal being also small, the patient lives through the natural period of life with little inconvenience.

Treatment.—It is evident, from what has been stated, that no fixed rule can be laid down for the treatment of the spina bifida. In the most favorable cases, in which no symptoms occur, and there is no indication that the tumor will change or undergo any unfavorable change, surgical treatment is not required, except the application of a soft pad to support the tumor, to prevent its injury by friction. Indications which justify active surgical interference are growth of tumor, absence of skin from it,

with tension of the parietes, so that an early rupture is inevitable, and dangerous nervous symptoms, as convulsions or paraplegia.

From the nature of spina bifida it is evident that operations upon it must be conducted with caution. The usual presence of the spinal cord in the pedicle and in the sac forbid ligation and excision, and render hazardous attempts to obliterate the sac by producing inflammation within it. A safe mode of treatment, but not the most efficient, is to puncture the sac and withdraw a portion of the liquid by a grooved needle or hypodermic syringe. A soft pad should then be applied to produce gentle compression. If no unfavorable symptoms occur, the puncture may be repeated after a day or two. This operation has been employed with a satisfactory result by Sir Astley Cooper among others ; but, simple as it is, it is not devoid of danger, for the removal of the liquid, if carried beyond a certain point, may produce dangerous nervous symptoms, especially convulsions. In performing the operation, the puncture should never be made in the median line, on account of the danger of wounding the cord, which lies against the median portion of the sac. The veins also, should be avoided.

Another mode of treatment is by iodine injections. They are preferable to other methods, if the neck be long and pedunculated, so as to be easily compressed. If the tumor be sessile, and the aperture into the spinal canal be free, these injections involve great danger, and are not to be recommended ; for more or less of the solution will inevitably enter the spinal canal, and give rise to spinal meningitis. Iodine injections have been employed with success by Professor Brainard of Chicago, who states that he "perfectly and permanently cured" three of seven cases ; and by Velpeau of Paris, by whose method five in ten operations were successful, and by many others. Professor Brainard withdrew some of the liquid contents, and then injected half an ounce of water containing $2\frac{1}{2}$ grains of iodine, and $7\frac{1}{2}$ grains of iodide of potassium. In a few seconds this was allowed to flow out, and the sac was then washed out with tepid water. Then a portion of the cerebro-spinal fluid, which had been kept warm, was returned into the sac. When he had withdrawn six ounces of this fluid he returned two ounces. In employing the iodine, or any other irritating injection, it is necessary to compress the pedicle, so that the liquid do not enter the spinal canal. Velpeau employed one part of iodine, one of iodide of potassium, and ten of distilled water.

During a debate in the Société de Chirurgie, M. Debont recommended the evacuation of only a little of the fluid, and the injection of two or three drops of the tincture of iodine diluted with an equal quantity of water. T. Smith, by the injection of one drop of the tincture, produced an amount of inflammation which nearly obliterated the sac (see Holmes's *Surg. Dis. of Children*). Since statistics show so good a result of iodine injections, this mode of treatment seems preferable to any other

for certain cases, and as one drop has produced general inflammation of the sac and nearly obliterated it, it seems safest and best to begin with so small a quantity.

If there be reason to believe, from the small size of the orifice and other anatomical characters, that neither the cord, cauda equina, nor any of the spinal nerves, lie within the sac, it may be thought best to remove the tumor. It has, indeed, been proposed to open the tumor, immersed under warm water sufficiently to observe the relation of the nervous elements, and to press them back gently into the canal if they lie within the sac. If it be decided to remove the spina bifida, a clamp, or elastic band, is placed around the pedicle so snugly as to cause firm adhesion of the walls of the pedicle, and excite sufficient inflammation in them to produce agglutination, but without causing strangulation or suppuration.

After a time, perhaps two or three days, when it is evident that agglutination has occurred from the fact that the liquid cannot be returned within the spinal canal by compressing the sac, the tumor may be removed by the knife or écraseur. Statistics do not show so favorable a result of this operation as of the iodine treatment, and the reason is obvious, for it is only in exceptional cases that the tumor can be removed without injury to the nervous tissue, and excision of a portion of the cord, or of important nerves, either produces death or a condition to which death would be a relief.

Spina bifida has also been treated by opening the sac on its side, pressing back the spinal cord or its nerves into the spinal canal, uniting the edges of the wound, and then applying pressure to prevent protrusion, but the result has not been favorable. Treatment by simple puncture, followed by compression, and if it fail, as it probably will, the cautious use of iodine injections, is the preferable mode of treating ordinary cases of spina bifida, which require surgical interference.

CHAPTER XIX.

VERTEBRAL CARIES.

Vertebral caries, designated also Pott's disease, occurs chiefly in childhood, but now and then adults are affected with it. It is an osteitis of the bodies of one or more vertebræ, ending in their ulceration and a lifelong deformity, if not checked.

Causes.—A reduced state of system, and especially the scrofulous diathesis, strongly predispose to caries. Hence this malady is more common in the city than in the country, where better hygienic conditions

produce a more vigorous constitution. Prolonged anti-hygienic conditions and protracted ill health from whatever cause predispose to caries. In certain cases, there is no apparent exciting cause, while in others there is the history of a fall upon or some injury of the spine.

Vertebral caries may occur in the cervical, dorsal, or lumbar portions of the spinal column, but it is more common in the lower dorsal than elsewhere. With the development of the osteitis, the body of the vertebra which is affected becomes hyperæmic, and the spongy tissue is soon infiltrated with blood and pus. The bone becomes swollen and softened, and, therefore, less resisting than in the healthy state, so that it yields under the weight of the shoulders and head, which it sustains. Therefore, after the osteitis has continued a certain time, there begins to be posterior convexity or rather angularity of the spine, for while the vertebral bodies soften and yield by the weight above them, the arches retain their integrity and firmness, and are unyielding.

Much of the tediousness and suffering of this malady is due to the fact that the inflammation is so deep-seated, and a healthy bony barrier is interposed between it and the surface, so that there is no ready escape of the pus. It permeates the spongy tissue, filling the cavities produced by the softening and absorption of the bone-substance. If the inflammation be of small extent, the amount of pus small, the constitution good, and if the disease be early recognized and properly treated, the child may recover without any fistulous opening, by absorption of the pus, and with little remaining deformity.

In the large proportion of cases, however, the history is different. The disease is not recognized till the stage of deformity, the caries is so extensive and the pus so abundant, that it escapes between the vertebræ, forming an abscess external to them, which connects with the interior of the vertebræ by a fistulous canal. This abscess if in the cervical region may press upon the pharynx or œsophagus, or upon the air-passages, producing dangerous obstruction to the respiration. (See Art. Retro-pharyngeal Abscess.) The pus may point and discharge externally near the seat of the caries, but in a large proportion of instances it takes a long and circuitous route to the surface, or it opens internally. There are instances in which it discharges into the pleural or abdominal cavity, or into one of the abdominal organs. If, as is sometimes the case, it establishes a connection with the intestine and escape in the stools, the result will probably be favorable. In other instances it descends into the pelvic cavity, and finds an outlet by the inguinal ring, or sciatic notch, or it enters the sheath of the iliacus or psoas muscle, and points externally.

When the disease ends favorably, new bone is thrown out around the diseased vertebræ, preventing any further bending, and giving stability to the spine. If the abscess do not discharge, but remain subcutaneous, Billroth says: . . . "While the bone disease recovers most fre-

quently, a large part of the pus, whose cells disintegrate into fine molecules, is absorbed, while the inner walls of the abscess change to a cicatricial tissue, which in the shape of a fibrous sac contains the puriform fluid. Such pus-sacs often remain in this stage for years."

If the pus have escaped externally, the abscesses and fistulæ contract and finally close, their site being occupied by condensed connective tissue. The portions of the diseased vertebræ which have retained their vitality are enveloped and supported by the new bone, so that the part of the spine which was the seat of the disease, though anchylosed and curved, has greater firmness than in health.

The history of unfavorable cases varies; the caries may extend. Pus finding no vent may accumulate in cavities and sinuses, in which detached portions of bone float, or it may make its way in such directions, that it produces alarming complications, and impairs or obstructs the functions of important organs.

Spinal meningitis in the vicinity of the caries, and due to extension of the inflammation, is common, and "the spinal medulla," says Billroth, "may be endangered by participation in the suppuration, or by being so bent by the inclination of the vertebræ, that its function is destroyed." Hence the paralysis of the lower extremities, bladder, and rectum, which occurs in aggravated cases, and which entails a fatal issue. In a certain proportion of cases the blood becomes more and more impoverished from the continuance of the inflammation and suppuration, and death occurs in a state of exhaustion. In such cases post-mortem examination often discloses waxy degeneration of important organs, as the spleen, liver, kidneys, and intestines, for it is well known that chronic suppurative inflammation of the bones is one of the two chief causes of the waxy disease, syphilis being the other.

Symptoms.—Caries of the vertebræ is often preceded by symptoms or appearances which are due to the strumous cachexia. Strumous ailments have probably occurred in the patient, or in members of the family, or without any clear history of struma the child has perhaps for some time been in failing health. In cases which I have observed, one of the chief symptoms, and sometimes almost the only symptom in the commencement of the caries, has been neuralgic pain, usually not severe, intermittent, or more or less constant, at some point in the anterior aspect of the body, most frequently in the chest, epigastric, or umbilical region. This pain has been present in a larger proportion of cases, than pain in the spinal region at the seat of the caries, though Guersant dwells particularly upon the latter as a symptom of caries. Patients with this neuralgia are not infrequently treated for indigestion, or worms, the true nature of the malady not being suspected, and the spine not even being examined. This neuralgia seems to be due to compression of the spinal nerves, by inflammatory exudation at the points where they emerge from the spinal

canal. I can recall to mind a number of cases in which I have on different occasions been asked to prescribe for this neuralgia, which was shown by the sequel to be undoubtedly the result of vertebral caries, and yet with a careful examination of the spinal column could discover no evidences of disease at any point. After a time, tenderness, pain, and inflammatory induration, appreciable to the touch, may occur in or along the spine, but not usually till the malady is well advanced. Lassitude, fatigue after slight exertion, poor appetite, with slight fever, are common symptoms in the first stage of the caries.

As the case advances, if the nature of the disease be not recognized, and no artificial support of the trunk be provided, the child instinctively seeks some way of supporting the head and shoulders. He rests his head upon his hands, or his elbows upon the table. Soon a gibbosity or angularity appears, affording clear and positive proof of the nature of the disease. Even now there is little or no tenderness when pressure is made directly on the spine, but it is observed more when pressure is made laterally upon it. If the inflammation extend so as to involve the meninges and the cord, pricking, tingling, numbness or weakness of the legs may occur, which are symptoms of grave import, for it is probable that the case will end in paraplegia and death. A state of emaciation and general weakness, sometimes accompanied by diarrhœa and œdema of the limbs, precedes death. But a very considerable degree of curvature is not incompatible with a healthy and normal performance of all the functions, and the number who recover, and lived to an advanced age with deformity, is large, as every one knows.

Diagnosis.—This is often from the nature of the disease obscure and uncertain for a time. The long continuance of pain in the chest or abdomen, or perhaps in the thighs, without any cause which we can detect, located at the seat of the pain, should excite suspicion of spinal disease. Such pain may be produced by spinal irritation, but in this malady pressure on the spine is badly tolerated, and when we touch a certain part, the neuralgic pain is intensified. In caries, as we have seen, firm pressure upon the spine is tolerated, and it does not increase the neuralgia. At a later period in caries there may be spinal pain and tenderness, but there is now also spinal deformity, by which alone the diagnosis is clearly established ; stiffness observed in the movements of the spine, pain in the spine, on sudden movement or jarring the body, impaired appetite and general health, and instinctive desire to sit or recline in such a way as to relieve the spine partially of the weight of the head and shoulders, are symptoms which, if they coexist, afford very strong evidence of the presence of caries, although there be as yet no deformity.

The spinal deformity of rachitis is distinguished from that of caries, by the fact that it occurs slowly without pain or tenderness, and is rounded

instead of angular. Moreover, the rachitic diathesis precludes scrofulous ailments, and the scrofulous diathesis rachitic ailments, as the two diatheses do not coexist, or but rarely ; so that if there be in the state of the patient or have been in his history evidences of scrofula, the presumption is that the bending of the spine occurs from caries. In a case of rachitic curvature, we find also enlargements of the ankles and wrists, keel-shaped thorax, prominent abdomen, rachitic head, etc.

Prognosis.—The course of this malady, even when the caries is slight and the symptoms mild, is tedious. In the most favorable cases the general health is but slightly impaired, the caries is confined to one vertebra, and is early diagnosticated and properly treated. On the other hand, if the general health be decidedly poor, the child anæmic and wasted, the curvature great, and an abscess have occurred, the case is very serious. Between these two extremes is every grade. The prognosis is more favorable in the child than in the adult. The few adults whom I have seen with it all died. It is less favorable in the cervical region than in the dorsal or lumbar. A mild case occurring in a good condition of health may become grave and even fatal by neglect and improper treatment. A majority of the patients, if the disease be not too far advanced when recognized, recover if properly treated, but the deformity which results may prove serious in after-life. The incomplete expansion of the lungs in the humpbacked, greatly increases the danger and the dyspnœa in bronchitis and pneumonia, and if the caries have been at a low point in the spine, and the patient a female, the deformity will probable present an obstacle to childbearing.

Treatment.—The treatment must be constitutional and local, hygienic, medicinal, and mechanical. It is of the utmost importance to improve the general health, as it is in all chronic inflammations and scrofulous ailments. Pure air, sunlight, personal cleanliness, and plain but the most nutritious diet are required. Tonic and anti-strumous remedies are indicated. To many patients I have prescribed, three times daily, cod-liver oil, to which the syrup of the iodide of iron was added, giving two drops to a child of one year, and one additional drop for each additional year. The judicious use of alcoholic stimulants will often be found useful, if the appetite be poor and general health seriously impaired, as will also the vegetable bitters.

In all strumous inflammations of the bones, which extend to or involve joints, and which are in their nature chronic, perfect quiet of the parts, so far as it is consistent with the degree of exercise which is required in order to improve the appetite and general health, is indispensable for successful treatment of the case. The patient with this malady should be encouraged to lie much of the time in bed, for the double purpose of preventing movements of the inflamed vertebræ, and of relieving them of the weight of the shoulders and head. But confinement in bed is badly

tolerated, and exercise is necessary for a healthy functional activity of the organs ; therefore mechanical support of the spine is required. The apparatuses which have been invented for the purpose of supporting the spine and rendering it immovable, and of sustaining the head, if the caries be in the cervical region, or the head and shoulders, if it be in the dorsal or lumbar region, are ingenious and effectual. Some of them are rather cumbersome, but others are sufficiently light for the youngest child who can walk. The apparatus should be worn for months, care being taken to prevent excoriation or undue pressure upon any point. It may be removed at night, and reapplied on rising in the morning.

SECTION II.

DISEASES OF THE RESPIRATORY SYSTEM.

CHAPTER I.

CORYZA.

The term coryza is applied to inflammation of the Schneiderian membrane. It is acute or chronic. The acute form is primary or secondary. Acute primary coryza is common in infancy and childhood. Its usual cause is exposure to currents of air, to cold, and especially to sudden changes of temperature from warm to cold. The cause is the same as that in the ordinary forms of bronchitis. These two diseases frequently indeed coexist, occurring from the same exposure. The inflammation in such cases commences upon the Schneiderian membrane, immediately upon the operation of the cause, and soon after extends to the bronchial tubes. Acute coryza may also be produced by the inhalation of irritating vapors, hot air, or dust, and also by the presence of a foreign body, as a button or bean, in the nostril.

Secondary coryza is commonly due to a specific cause. The diseases in connection with which it occurs are hooping-cough, measles, scarlet fever, diphtheria, and constitutional syphilis. In the infant, coryza is one of the first manifestations of hereditary syphilitic taint.

Acute primary coryza ordinarily abates in from one to two weeks. The secondary form gradually declines, in most cases, when the primary affection on which it depends is cured. Syphilitic coryza is more protracted than the primary form, or than that accompanying the eruptive fevers. Some children are so liable to coryza that it occurs whenever they take cold. Occasionally it is so frequently renewed in the winter months that it resembles the chronic form of the disease.

Chronic coryza is commonly dependent on a dyscrasia, usually the syphilitic or strumous. The dyscrasia is often indicated by pallor, flabbiness of the flesh, and liability to glandular swellings. Certain cases take their origin in the nasal catarrh of the exanthematic fevers, the local affection continuing after the constitutional disease has declined. Chronic

coryza sometimes occurs in children, who appear otherwise in good health. It is probable that in such cases there is a dyscrasia of which the coryza happens to be the sole manifestation.

Anatomical Characters.—The alterations which the nasal mucous membrane undergoes when inflamed vary considerably in different cases. In the simplest and most common form of coryza, this membrane is sometimes in patches, sometimes generally reddened, thickened, and softened. Its papillæ are prominent, producing an inequality of the surface. Ulcerations are not common in simple acute coryza, but they sometimes occur in the chronic form.

In diphtheria, and sometimes in scarlet fever and variola of severe type, the coryza is pseudo-membranous, and when it presents this form it is commonly but not always associated with pseudo-membranous angina or laryngitis. A case of pseudo-membranous coryza occurring in measles is related by M. Guibert. The patient was a rachitic boy, three and a half years old. The pseudo-membrane, in grave cases, may cover almost the entire surface of the nostrils, but ordinarily it occurs in patches.

Symptoms.—The constitutional symptoms are mild or severe, according to the gravity of the inflammation. If the coryza be acute and pretty general, there is febrile movement, with thirst and loss of appetite. Frontal headache is common, from the proximity of the inflammation to the head, or its extension to the frontal sinuses. Sneezing is the first symptom in many cases of acute coryza. As the inflamed membrane swells, more or less obstruction occurs to respiration. The breathing is noisy, especially during sleep, and in severe cases the patient is compelled to breathe mostly through the mouth. If there be much obstruction to respiration the suffering of the patient is considerable, from the sensation of fulness in the nostrils, the headache, and the muscular effort required in each respiratory act.

In the commencement of coryza the patient experiences a sensation of dryness in the nostrils, which is soon succeeded by a thin discharge of a serous appearance. In the course of a few hours the secretion becomes thicker. It is muco-purulent, and remains such till the disease begins to decline. Inspissated mucus and crusts are apt to collect within the nostrils and around their orifice in chronic coryza, and sometimes also in the acute disease, if the discharge be not abundant. These crusts increase the difficulty of breathing. Often the acridity of the discharge is such that the skin of the upper lip and around the nostrils is excoriated.

Prognosis. —Uncomplicated catarrhal coryza rarely terminates fatally. It is only dangerous in young nursing infants, in whom it may seriously interfere with lactation. Coryza, accompanying the eruptive fevers, although it may increase the suffering, does not materially increase the danger. Syphilitic coryza subsides when the system is sufficiently affected by antisyphilitic remedies. Chronic coryza is sometimes very

obstinate. It may continue for months or years, giving rise to a constant, but often not abundant, discharge.

Treatment.—Common mild attacks of coryza require little treatment. The bowels should be kept open, the feet soaked in mustard-water, and the body should be warmly clothed. Inunction of the nostrils is a popular remedy, and it seems to give some relief. If coryza commence with symptoms which indicate a pretty severe attack, and there are evidences of extension of the disease toward the bronchial tubes, an emetic of syrup of ipecacuanha, given at an early period, moderates the severity of the inflammation and may prevent the occurrence of bronchitis. Afterward a simple diaphoretic mixture, as the following, should be given :

℞. Syrupi ipecacuanhæ, ʒ ij ;
Spirit æther. nitr., ʒ j ;
Syrupi simplicis, ʒ ij. Misce.

One teaspoonful every three hours to a child of six months. In place of sweet spirits of nitre, acetate of potassium may be employed in the dose of one or two grains for infants ; and if there be decided febrile reaction, from half a minim to two minims, according to the age, of tincture of digitalis, should be added to each dose.

A three to five per cent solution of common salt in warm water injected into the nostrils with a small syringe, aids materially in removing the muco-pus which obstructs the respiration, and in establishing a healthier state of the inflamed surface. I have employed in the same way, with apparent benefit, carbolic acid, glycerine and water, to which the borate of sodium or a few grains of chlorate of potassium have been added. This may also be conveniently used in the form of spray, with the steam atomizer, or thrown up the nostrils with the hand atomizer. The officinal lime-water is also a most useful detergent of the nasal surface.

The treatment proper for pseudo-membranous or diphtheritic coryza is detailed in our remarks on the therapeutics of diphtheria. Chronic coryza, since it depends upon a dyscrasia, of which it is one of the local manifestations, requires remedies appropriate for the blood disease. Scrofula needs the syrup of the iodide of iron and cod-liver oil. The various ferruginous preparations, as wine of iron, tincture of the chloride of iron, iron lozenges, and the vegetable tonics are also more or less useful. The diet should be nutritious and plain, and out-door exercise, and, if possible, country life, should be enjoined.

If the dyscrasia be syphilitic, similar invigorating measures are required, and mild mercurial inunctions to the nasal surface are especially useful. The following, which has been largely employed in the Out-Door Department at Bellevue, is one of the best ointments for such cases, and its alterative effect renders it also useful for strumous coryza :

℞. Ung. hydrarg. nitratis, ʒ ij·
Ung. zinci oxid., ʒ ij. Misce.

To be thoroughly applied to the Schneiderian membrane by a swab or camel's-hair pencil three or four times daily. Recently it has been modified by the substitution of Squibb's five per cent oleate of mercury in place of the citrine ointment. If the coryza have a distinctly syphilitic origin, the application of a two or three per cent oleate of mercury will fully meet the indication and be followed by improvement.

Meigs and Pepper recommend the following ointment in chronic coryza, to be applied at night, after the use of injections through the day :

℞. Unguenti hydrargyri nitratis, ʒ ss ;
Extracti belladonnæ, gr. x ;
Axungiæ, ʒ ss. Misce.

Astringent injections into the nostrils are not often required in the treatment of the various forms of coryza ; but occasionally, if the discharge be protracted and abundant, weak astringent applications may be beneficial, as two to three grains of nitrate of silver, or of alum or tannin, to the ounce of water. It should be borne in mind that washes for the nasal surface should, as a rule, be employed tepid.

CHAPTER II.

CATARRHAL LARYNGITIS.

Acute catarrhal laryngitis occurs at all ages, but it is so common in infancy and childhood, that it is proper to treat of it in a work relating to the diseases of these periods. Like other inflammatory affections of the air-passages, it is most common in the cold months, or when the weather is changeable. Its usual cause is, therefore, exposure to cold. Protracted and violent crying, and the inhalation of acrid vapors are occasional causes. Catarrhal, or as it is sometimes designated simple laryngitis, also occurs in connection with certain constitutional diseases, among which may be mentioned, measles, scarlatina, and variola. Laryngitis is also a common accompaniment of bronchitis, and not infrequently of pneumonitis, though its symptoms are apt to be obscured by those of the graver disease. It often likewise accompanies pharyngitis, due to extension of the inflammation.

Symptoms.—Catarrhal laryngitis produced by the impression of cold, is commonly preceded and accompanied by coryza. The initial symptom is chilliness, followed by sneezing, and the discharge of thin mucus from the nostrils in consequence of irritation of the Schneiderian membrane.

The commencement of laryngitis is indicated by hoarseness, which is apparent when the child cries, or, if old enough, when it attempts to speak. There is often in severe cases complete loss of voice, so that speech above a whisper is impossible. I have noticed this most frequently in the laryngitis which accompanies measles. A cough occurs which is at first dry and husky but becomes loose in the course of a few days. Expectoration is scanty, unless the inflammation have extended to the trachea and bronchial tubes.

This disease is often accompanied by soreness of the throat, noticed in the act of coughing or when the larynx is pressed with the finger. In laryngeal catarrh, when uncomplicated, the respiration remains nearly natural and the pulse is but little accelerated. In mild cases the nature of the disease is often not apparent as long as the child remains quiet, in consequence of the absence of symptoms, but the character of the voice, when it cries or speaks, or of the cough, reveals at once the nature of the affection.

Acute laryngeal catarrh subsides in from one to two weeks. Occasionally it lasts three or four weeks before the symptoms entirely disappear. Death, which is rare, is due to some complication.

Chronic laryngitis is much less frequent than the acute form. Its anatomical characters are similar to those in other chronic inflammations affecting mucous surfaces, namely, thickening and more or less infiltration of the mucous membrane, increased proliferation and exfoliation of the epithelial cells, and increased functional activity of the muciparous follicles.

In the adult, chronic laryngitis is common as one of the lesions of the syphilitic or tubercular disease. In the child syphilitic and tubercular laryngitis is more rare, but the latter sometimes occurs in connection with pulmonary or bronchial tuberculosis. Such patients are emaciated, and have the ordinary symptoms of the tubercular disease. Chronic laryngitis also occurs in young children, usually infants, as one of the manifestations of the strumous diathesis. I have records of several such cases, mostly nursing infants. Some of these patients had mild bronchitis, but it was obviously subordinate to the laryngitis. Their respiration was noisy and harsh, continuing of this character for several weeks and even months. The cough was also harsh and loud, conveying the idea of thickening and relaxation of the mucous membrane covering the vocal cords. Their respiration was not notably accelerated, and the blood was apparently fully oxygenated, though the friends were often alarmed by the noisy breathing and cough.

In this form of chronic laryngitis there is little expectoration, the fever is slight or absent, the appetite remains unimpaired, and the general condition of the child is good. There are from time to time exacerbations, and occasionally improvement is such as to encourage the hope of speedy

cure, but in the cases which I have seen there has not been complete intermission in the disease till the final recovery. Those patients whom I have been able to follow through the disease have recovered in from three or four months to one year.

Chronic laryngitis is to be distinguished from frequent attacks of acute laryngitis, which are due to fresh exposures, and also from the laryngitis which is associated with bronchial phthisis. It is to be distinguished from protracted acute laryngitis, which sometimes does not entirely subside in less than a month or six weeks, by its longer duration, the greater thickening of the inflamed membrane, and more noisy respiration. Often chronic larnygitis results from the acute disease, the inflammation being perpetuated by the struma or dyscrasia of the patients.

Anatomical Characters.—In acute catarrhal laryngitis the mucous membrane of the larynx presents the usual appearance of mucous surfaces when inflamed, namely, redness and thickening. It is also somewhat softened. Ulcerations rarely, perhaps never, occur in primary acute laryngitis. When present in chronic laryngitis, the ulcers are small and situated upon or near the vocal cords. Tubercular and syphilitic ulcers of the larynx are much more rare in children than in adults. The inflammation in simple acute laryngitis usually extends over the whole surface of the larynx, and also to the upper part of the trachea. It may be pretty uniform, or more intense in one place than another, and, like other mucous inflammations, it is accompanied by more or less rapid proliferation and exfoliation of epithelial cells. In most cases of simple laryngitis, whether acute or chronic, the inflammation extends to the pharynx, producing redness and thickening, though generally moderate, of the mucous membrane which covers it. Examination of the fauces therefore aids in diagnosis.

In the adult œdema glottidis occasionally results from laryngitis. In the child there is little danger that this will occur, in consequence of the anatomical character of the larynx. In early life there is but little submucous connective tissue in the larynx, and therefore less submucous infiltration or effusion during the inflammation. The structural changes occurring in catarrhal laryngitis of infancy and childhood relate almost exclusively to the mucous membrane.

Treatment.—Primary and uncomplicated catarrhal laryngitis requires little treatment. Most cases would do well by the employment of suitable hygienic measures, without medicines. Benefit is, however, derived from the use of demulcent drinks and an occasional laxative. A mixture of paregoric and syrup of ipecacuanha, or the mist. glycyr. comp., or a small Dover's powder, will relieve the cough. For restlessness, a warm foot-bath is also useful. Inhalation of the spray of glycerine and water from the atomizer, or of steam, plain or medicated, is also useful. Mildly stimulating embrocations, as by camphorated oil with or without a little

turpentine, also aids. It should be rubbed several times daily over the throat, or a strip of flannel soaked with it may be applied around the neck. Chronic laryngitis dependent on syphilis or tuberculosis requires the constitutional treatment which is appropriate for that disease. Measures not specific have little effect upon this form of inflammation. The chronic laryngitis which I have described as occurring chiefly in infancy, and which appears to be of a strumous character, is apt to be obstinate. The patient should be warmly clothed, and constant care should be taken that there be no exposure which would endanger taking cold, as this would produce an exacerbation of the disease, and tend to counteract what had been gained by remedial measures. This form of chronic laryngitis is most satisfactorily treated by the application of tincture of iodine upon the neck, directly over the larynx, and the internal use of cod-liver oil and the syrup of the iodide of iron. No benefit results in this inflammation from expectorant remedies, as squills or senega.

Spasmodic Laryngitis.

This is a common disease. It is also called false croup, in contradistinction to true or pseudo-membranous croup, and, by some of the continental writers, stridulous angina or stridulous laryngitis. It should not be confounded with spasm of the glottis, which is a form of internal convulsions, and is not inflammatory. It occurs ordinarily between the ages of two and five years. It is commonly a sporadic affection, but Rilliet and Barthez state that "it is incontestable that it may prevail epidemically." They express this opinion, not from their own observations, but chiefly from those of Jurine, made in the commencement of the present century.

Causes.—Children in some families are more liable to false croup than in others, so that an hereditary tendency to it must be admitted. The exciting cause in most cases is exposure to cold. False croup is not uncommon in the commencement of measles. Narrowness of the rima glottidis, and an excitable state of the nervous system, both of which are common in early childhood, are predisposing causes.

Symptoms.—Spasmodic laryngitis is ordinarily preceded for a day or two by a slight cough and fever, by symptoms of mild nasal catarrh, such as all children are liable to on taking cold. In exceptional cases these symptoms are absent and the disease begins abruptly. Singularly, it commences in most patients at night, after the first sleep, between ten and twelve o'clock. The sleep is usually quiet and natural, but the child awakens with a loud, barking cough. There is great dyspnœa, and the respiration is harsh or whistling, on account of the narrowing of the chink of the glottis from the swelling and tension of the vocal cords. The face is flushed and expressive of suffering. The child cries, moves from one

position to another, wishes to be held or carried, seeking in vain for relief. The skin is hot, pulse accelerated, the voice hoarse or even whispering. After a variable period, usually from half an hour to two or three—not more than half an hour with proper treatment—these symptoms abate. The patient is then somewhat exhausted and falls asleep. The face is less flushed or even pallid, the heat abates, and the pulse is less accelerated. The cough, though less frequent, remains for a time barking or sonorous, and the respiration, though greatly relieved, is not at once entirely natural, but it gradually becomes so. Often there is no return of the spasmodic respiration and cough, but sometimes the attack is repeated once or more, especially during the subsequent nights. The symptoms vary greatly in intensity in different patients.

As the attack declines, the disease, losing its spasmodic character, becomes a simple inflammation. In some patients there is immediate return to perfect health, but oftener the inflammation extends not only into the trachea, but also into the larger bronchial tubes, and a tracheo-bronchitis remains, which gradually declines.

The termination is not always so favorable. Spasmodic laryngitis is, in exceptional instances, the precursor of other serious affections, which may prove fatal. It has been stated that measles often begins with spasmodic laryngitis. Bronchitis becoming capillary, may occur in connection with it, as may also pneumonia, and by either of these severe inflammations the prognosis may be rendered doubtful. There are a few cases on record in which it is believed that spasmodic laryngitis was of itself fatal. In some of these the dyspnœa was extreme and persistent, and was the cause of death. In a case reported by Rogery, on the other hand, the respiration became easy before death, and the pulse more and more frequent and feeble. Death apparently occurred from exhaustion. It is not improbable that, had careful post-mortem examinations been made in those cases of spasmodic laryngitis which have ended fatally, other lesions would have been discovered besides those located in the larynx, perhaps tracheo-bronchitis, with an accumulation of mucus in the larynx, producing suffocation, or perhaps in some cases congestion of the brain or lungs and serous effusion.

Anatomical Character—Pathology.—The opportunity does not often occur of determining the anatomical characters of spasmodic laryngitis. I have witnessed but one post-mortem examination. A little girl, nine years old, was taken on Friday night with cough and dyspnœa, indicating a pretty severe attack. The mother, acting through the advice of a friend, gave kerosene oil to her in considerable quantity. This was succeeded by obstinate vomiting and purging, which continued during Saturday and Sunday, and terminated fatally on Monday. At the autopsy we found uniform and intense injection throughout the whole extent of the larynx and trachea and in the bronchial tubes, but there was no pseudo-

membrane on the inflamed surface, and but little mucus and pus. The solitary follicles of the intestines and Peyer's patches were tumefied, and the gastro-intestinal surface was injected in places. The cause of death was obviously the diarrhœa, apparently of an inflammatory character, and probably produced by the kerosene oil. The condition of the mucous membrane of the larynx was that which is ordinarily present in spasmodic laryngitis, though in some cases in which post-mortem examinations have been made the evidences of laryngeal inflammation were slight. Guersant relates a case in which the surface of the larynx seemed to be nearly in its normal state. Death in cases of slight laryngitis is due to causes which are independent of the larynx. In Guersant's case tuberculosis was present.

There is, as has already been intimated, another and an important element besides the inflammation in the pathology of spasmodic laryngitis—an element producing those phenomena which render it a disease distinct from simple laryngitis. I refer to spasm of the laryngeal muscles. This element pertains to the nervous system, so that spasmodic laryngitis is allied both to the neuroses and to the inflammations.

Diagnosis.—The disease for which spasmodic laryngitis is most frequently mistaken is pseudo-membranous croup. The friends, indeed, usually make this mistake in forming their opinion of the case before the physician arrives ; and there can be no doubt that many of the cases which physicians have published in medical journals as true croup were examples of this affection. The points of differential diagnosis are the following : True croup begins with symptoms which at first are slight, so as scarcely to arrest attention, but which gradually increase in intensity. The cough becomes more harsh, and the respiration more difficult, by degrees. This increase in the gravity of the symptoms occurs by day as well as by night. On the other hand, false croup, though preceded by symptoms of nasal catarrh, commences abruptly. The symptoms have from the first their maximum intensity, and the time at which it commences is the night. Again, the cough in spasmodic laryngitis possesses a loud, sonorous character ; while in true croup it is harsh or rough, from the presence of the membrane, and having, therefore, less fulness. The voice in spasmodic laryngitis may be hoarse, but it is not lost, or is lost only for a short time. It afterward becomes natural, or is slightly hoarse. On the other hand, in true croup, the voice, from being natural at first, is gradually extinguished. In fatal cases it soon becomes whispering, and continues such till the close of life ; in those that recover, the voice remains hoarse for several days. These differences are important, and, if fully appreciated, are in most instances sufficient to establish the diagnosis. Besides, in a large proportion of cases of true croup, portions of the pseudo-membrane may be discovered on inspecting the fauces, and the faucial surface is deeply injected, while in spasmodic laryngitis there

is, with rare exceptions, no false membrane upon the surface of the fauces, and but a moderate amount of congestion.

Laryngismus stridulus, or internal convulsions, must not be confounded with this disease. It is not inflammatory, but purely spasmodic, suddenly commencing and abating—identical, it is believed, in character with tonic convulsions of the external muscles, but affecting the internal muscles of respiration. This disease has already been fully described.

Prognosis.—Little need be added, as regards the prognosis, to what has already been stated. While a favorable opinion in reference to the result may ordinarily be expressed, the physician should not forget the fact that death may occur. Symptoms indicating an unfavorable termination are : great and continued dyspnœa, not diminished by the proper remedial measures ; stridulous expiration as well as inspiration ; lividity of the prolabia and fingers ; pallor and coldness of surface ; pulse progressively more frequent and feeble. Convulsions and coma may also occur near the close of life.

Treatment.—The indications of treatment are twofold : first, to relieve the spasmodic action of the laryngeal muscles ; secondly, to cure the laryngitis. To meet the first indication, a warm bath of the temperature of about 100° should be employed as soon as possible after the commencement of the attack. The patient should be kept in it ten or fifteen minutes, in order to obtain its full relaxing effect. In mild cases a warm foot-bath may be sufficient. A second means is the use of an emetic, which should be simultaneous with the bath. To children under the age of three years, syrup of ipecacuanha should be given, in doses of one teaspoonful, repeated in twenty minutes, till vomiting occurs ; or alum and syrup of ipecacuanha, two drachms of the former to one ounce of the latter, may be given in the same dose. The alum and the syrup produce more prompt emesis than the syrup alone. Children over the age of three years, unless of feeble constitutions, are best treated by the compound syrup of squills in teaspoonful doses, or a mixture of this with syrup of ipecacuanha. It is not often necessary to give more than three or four doses, and sometimes one or two are sufficient to produce vomiting.

In most cases, by the use of the warm bath and the emetic, the symptoms are rendered milder, and convalescence soon commences.

In the *American Journal of the Medical Sciences*, April, 1867, Dr. R. R. Livingstone reports a case of laryngitis treated by Squibb's ether. It is stated that portions of pseudo-membrane, from one-eighth to three-fourths of an inch in length, were expectorated ; but the symptoms certainly indicated a spasmodic element as decided as in spasmodic croup, and the benefit from the ether was apparently due to the relaxation of the laryngeal muscles which it produced. The treatment of the patient, who was two years old, was commenced by the administration by the mouth

of half a teaspoonful of the ether, and followed by its inhalation. "In precisely eight minutes from the time the patient commenced the inhalation, the abnormal muscular exertion ceased; a general relaxation took place; the pulse (which had numbered 150) fell to 100." Ether, judiciously employed, will probably prove to be a useful remedial agent in spasmodic forms of laryngitis, whether or not it have any effect on pseudo membranous formations. A large majority of cases, however, recover speedily without its employment, or by the other measures recommended.

Attention should always be given to the state of the bowels in spasmodic laryngitis. If they are not well open, a purgative should be administered. For those that are robust, and with considerable febrile movement, the saline cathartics are ordinarily preferable, as Rochelle salts, or a purgative dose of calomel may be administered. The cathartic should not be prescribed till the nausea from the emetic has subsided. By its derivative effect, it tends to diminish the laryngitis, and, in severe cases, it may obviate the need of depletion by leeches.

Inhalation of the vapor of hot water, and the application of a sinapism over the neck and upper part of the sternum, followed by an emollient poultice, are useful adjuvants to the treatment.

The most convenient and effectual way of employing vapor is, however, by the atomizer, and as the chief danger is that the inflammation may become pseudo-membranous, I am in the habit of using in the atomizer the officinal lime-water.

When the spasmodic element in the disease is relieved, the case becomes one of simple laryngitis, and the general plan of treatment recommended for that malady is proper for this. Small doses of ipecacuanha, or of one of the antimonial preparations, as the compound syrup of squills, not sufficient to cause nausea, should now be given at regular intervals. I have sometimes added to the expectorant one drop of the tincture of aconite root for robust children over the age of three or four years, having a full and rapid pulse, flushed face, and other evidences of active febrile movement. Its effect should be watched, and it should be discontinued when its sedative influence on the circulation begins to be apparent. It should not be given in the spasmodic laryngitis which occurs in the commencement of measles.

If, however, the disease do not speedily terminate by recovery of the patient, or, more rarely, by death, there is nearly always tracheo-bronchitis, or a more serious affection, coexisting with the laryngitis, or following it, so that depressing measures should not be long continued. Expectorants of a stimulating character, as carbonate of ammonium, or syrup of senega, are required in the course of a few days, and in young and feeble children they should be given at an early period.

The mode of treatment recommended above is appropriate for that large class in whom the inflammatory element predominates. In a smaller

number of cases the nervous element predominates over the inflammatory, and the treatment should be in some respects different. Such children are usually pallid and of spare habit, having, indeed, the nervous temperament. They are liable to attacks of this disease, though generally of a mild form, on slight exposure to cold, and with a very moderate amount of inflammation. The treatment in these cases should be directed more to the nervous system. My plan has been, in the treatment of such patients, after perhaps the use of a mild emetic, to give quinine, one grain three or four times daily, to a child from three to five years old, prescribing at the same time a simple expectorant, as syrup of squills, and a mildly irritating application to the throat. The symptoms in these cases are not severe, and active measures are not required, though the peculiar cough continues longer than in the more inflammatory forms of the malady.

The patient with spasmodic laryngitis should be kept in a warm room during the paroxysms, and should inhale an atmosphere loaded with moisture.

Trousseau recommends a mode of treatment of spasmodic laryngitis which was first suggested by Graves, of Dublin. It consists in the application underneath the chin, so as to cover the larynx, of a sponge soaked in water as hot as can be borne ; in ten or fifteen minutes it is repeated. This reddens the skin, producing revulsion from the larynx. The hoarseness, dyspnœa, and cough diminish with this treatment, and some recover without other measures.

Guersant and others speak of the importance of prophylactic management of children who are liable to this disease. Attention should be given to the dress, so that there may be sufficient protection from atmospheric changes, and there should be an equable temperature of the apartments in which they reside. Children of a decidedly nervous temperament, in whom the slightest laryngitis is apt to be spasmodic, require additional prophylactic measures. They are pallid, and in a more or less cachectic state. Such children are benefited by chalybeate and vegetable tonics, and by exercise in suitable weather in the open air.

CHAPTER III.

PSEUDO-MEMBRANOUS LARYNGITIS.

The term pseudo-membranous laryngitis, or true croup, is applied to a common and fatal disease, the essential anatomical character of which is inflammation of the mucous membrane of the larynx, with the formation upon its surface of a pseudo-membrane. It occurs most frequently be-

tween the ages of two and seven years. It is rare in adult life, and also under the age of six months.

Causes.—There is greater liability to this disease in some children than in others, and occasionally the predisposition to it appears to be inherited. The common exciting cause is exposure to cold. Those children, especially, are liable to croup, who live in heated apartments, and are taken into the open air without proper covering, and those who a part of the time are warmly and a part of the time thinly clothed, especially as regards the covering of the neck. This disease is common among the poor of New York, who live in close rooms, overheated through the day and cool at night. Another less common cause is the inhalation of irritating vapors, or swallowing irritating or corrosive liquids. I have known a child to die from swallowing acetic acid, and another from scalding water, both having the dyspnœa and cough of true croup.

This disease is ordinarily primary, but occasionally it is secondary. The secondary form may occur in the declining period of measles. Croup is most common in the winter months, and in times of changeable weather. It is said, also, that it sometimes occurs as an epidemic, but the supposed epidemics were no doubt diphtheritic.

Anatomical Characters.—The inflammatory action in this malady affects not only the mucous membrane, but, in a certain proportion of cases, extends to the submucous connective tissue, causing infiltration or œdema. The mucous membrane itself undergoes similar alteration to that in simple or spasmodic laryngitis, consisting of hyperæmia and thickening, proliferation, and rapid desquamation of its epithelial cells, and an abundant production of muco-pus. Sometimes the redness is found only in patches at the autopsy ; in other cases it extends over the whole surface of the larynx. Exceptionally the redness has disappeared, so that the laryngeal mucous membrane, though thickened and softened, presents nearly its normal color. In all except the mildest cases the inflammation extends further than the larynx, involving not only the surface of the pharynx, but also in greater or less degree that of the trachea and bronchial tubes.

The distinguishing feature as regards the anatomical character of this disease remains to be noticed, namely, the false membrane, which covers the laryngeal and often contiguous surfaces. It has long been supposed that this consists of fibrin, which, exuding in its liquid state from the submucous vessels, becomes fibrillated when exposed to the air, its interstices being filled with a greater or less amount of pus, epithelial cells, and amorphous matter. At a recent date Wagner surprised pathologists by the statements that these pseudo-membranes contain no fibrin, but that they consist of epithelial cells, which, undergoing some form of degeneration as they are pushed forward from the mucous surface, enlarge so as to appear under the microscope as irregular blocks interlacing with each

other. By employing the picro-carminate of ammonium, or a weak ammoniacal solution of carmine, Weber and other microscopists have been able to trace the boundaries of these irregular and interlacing blocks, which have prolongations like the shape of a stag's horns, and they have observed the intermediate forms of transition between these and the normal epithelial cells.

But other and more recent authorities in pathological histology have demonstrated the presence of fibrin in the pseudo-membrane, in addition to the enlarged and degenerated epithelial cells of which it is chiefly composed. Rindfleisch says : " The pseudo-membrane is of a peculiarly stratified structure, since upon a layer of cells at tolerably equal distances there always follows a layer of fibrin, and this sequence is repeated from one to ten times, according to the thickness of the membrane." (*Pathol. Histol.*, translated, page 351.) As lending support to the views that the pseudo-membrane does contain fibrin, the fact may be stated, that while in the ordinary pneumonia of young children there is no fibrinous exudation in the air-cells, this exudation does occur, at least in a certain proportion of cases, in pneumonia occurring as a complication of croup. Thus, recently, in this city, in a pneumonic lung, from a case of fatal croup, occurring at the age of about two years, Prof. Francis Delafield found fibrin in the exudation of the air-cells. The exact nature of the degeneration which the epithelial cells undergo is unknown. Their appearance is so altered by protoplasmic change and infiltration, that they can be recognized as altered epithelial cells only by chemical tests. MM. Cornil and Ranvier state : " We have verified the correctness of the description given by Wagner ; we have separated and colored the cells by means of the picro-carminate of ammonium, and, in consequence of the facility which they present of fixing the carmine, we conclude that they are not filled with fibrin, but rather by a matter resembling mucin. These exudats of true croup are pressed forward and detached in proportion as the globules of pus or new epithelial cells are produced underneath them."

In Virchow's Archiv., Band. lxx., 1877, Dr. Carl Weigert relates very interesting experiments in which he produced pseudo-membranous croup upon the laryngo-trachial surface of the rabbit, by applying to it a weak ammoniacal solution. After two days the animal was killed, and the exudation was carefully examined. The mucous membrane underneath the exudation was found hyperæmic, and denuded of epithelium. Weigert, indeed, concluded from his observations, that the croupous membrane does not form, unless the epithelial layer be first destroyed, a point in reference to which some of the New York microscopists would take issue. The relation of the pseudo-membrane to the mucous surface was simply that of contact. The microscopic examination of the adventitious layer was interesting. Its lowest part contained ill-defined (*informes*) elements, some

of which preserved a resemblance to the epithelial cells. By the addition of strong acetic acid, these elements swelled, took the form of epithelial cells and exhibited nuclei. Free nuclei were found in the interspaces, resembling more pus-cells or white blood corpuscles than the nuclei of epithelial cells. Therefore Dr. Weigert concludes that the undermost part of the croupous layer consists mainly of epithelial débris. Secondly, immediately above this he found a different layer consisting of a network of delicate fibres in the meshes of which were free nuclei. This network evidently consisted of fibrin, as it gave the reactions of this substance. Thirdly, penetrating the upper part of the fibrinous network and overlying it was a layer of mucus containing large cells with large nuclei, and grains of black pigment. From all these examinations which have been made by competent microscopists, we must conclude that the croupous exudation consists largely of altered epithelial cells, and that it also contains a network of fibrin.

The pseudo-membrane varies greatly in amount in different cases. It may occur only in points or small patches, which are generally found in the vicinity of the vocal cords, while in other cases it extends an almost continuous membrane from the epiglottis into the bronchial tubes, and there is every grade between these two extremes. It fills the orifices of the muciparous follicles, and the minute depressions upon the mucous surface, being closely adherent, so as not to be detached by efforts of coughing or vomiting, except in small portions.

As the inflammation commonly extends beyond the larynx, so the pseudo-membrane, in a large proportion of cases, is formed not only upon the laryngeal, but also upon contiguous surfaces. In thirty-three cases of true croup, comprised in the statistics of Dr. Ware, of Boston, pseudo-membranous pharyngitis was also present in all but one ; and in nineteen cases observed by Dr. Meigs, of Philadelphia, in all but three. The formation of a pseudo-membrane in the trachea in connection with that in the larynx is also common, and is not infrequent in the bronchial tubes. M. Guersant has, so far as I am aware, collected the largest number of records relating to the extent of the pseudo-membrane in true croup. In an aggregate of 120 cases it was confined to the larynx and trachea in 78, or about two-thirds, while in the remainder, namely 42, it extended into the bronchial tubes.

In those whose systems are robust, the false membrane is usually firmer than in those whose systems are reduced. In a state of decided cachexia it is sometimes friable and easily detached. If the case continue from four to six days, it begins to soften from commencing decomposition, the minute fibres which attach it to the mucous membrane give way, and, in favorable cases, by the effort of coughing or vomiting, it is thrown off. Separation is aided by muco-pus, which collects underneath. In fatal cases the false membrane, if detached by the efforts of the child, may be

reproduced, so that in twelve to eighteen hours the dyspnœa returns. Pneumonia not infrequently complicates croup. In extreme cases, in which inspiration is difficult in consequence of the obstruction, the lungs are only partially inflated, and imperfect decarbonization of the blood and sometimes collapse of certain pulmonary lobules are the result. Occasionally there is that degree of thickening of the mucous membrane, and submucous infiltration, that the dyspnœa and danger occur more from these than from the presence of the pseudo-membrane.

In the New York Foundling Asylum, in two patients death occurred with all the phenomena of pseudo-membranous laryngitis, and the obstruction was found to be due entirely to the thickening and infiltration of the mucous and sub-mucous tissues largely by newly-formed corpuscular elements.

Symptoms.—In some cases, pseudo-membranous, like catarrhal laryngitis, is preceded by coryza and pharyngitis, while in others laryngitis is present from the first. The commencement of croup is indicated not only by fever, diminished appetite, thirst, and such symptoms as accompany all acute inflammations, but by certain other symptoms which enable us to diagnosticate this from all other diseases, except diphtheritic croup.

The cough is one of the earliest symptoms which distinguish true croup from other laryngeal inflammations. It is hoarse or harsh ; its character may be expressed by the term dry or suppressed. It differs from the cough of spasmodic laryngitis, which is less hoarse and more sonorous. It is much more frequent in some cases than in others ; in many patients, toward the close of life, it nearly or quite ceases. Hoarseness of the voice is also one of the first and most constant symptoms, and it continues throughout. Toward the close of life the voice is usually lost, and the child expresses its thoughts in an indistinct whisper.

The amount of expectoration varies considerably in different patients according to the presence or absence of bronchial inflammation. If the inflammation extend no lower than the upper part of the trachea, the sputum is scanty during the whole course of the disease. In ordinary cases it is scanty at first, then more abundant, and again more scanty if the case be fatal. The scantiness of the sputum toward the close of life is due not entirely to exhaustion of the patient, but in part to obstruction in the larynx above the mucus and pus. By vomiting a much larger quantity is expectorated than by the cough. Frequently small portions of pseudo-membrane are expectorated with the mucus and pus, and occasionally also larger masses, complete moulds, indeed, of the larynx, trachea, or even of the bronchial tubes.

The respiration is accelerated, but not so much as in pneumonia or capillary bronchitis. In the advanced stage it commonly becomes slower than at first. As the obstruction in the larynx increases, the respiration assumes more and more the character which has been designated abdomi-

nal ; the infra-mammary region is depressed in each inspiratory act, while the larynx approaches the sternum, and the alæ nasi are dilated. Patients sometimes have painful attacks of dyspnœa, due to detachment of an edge of the pseudo-membrane, and its doubling upon itself. In the paroxysm, the sufferer throws himself from side to side in the bed, or reaches his arms to his mother or nurse for relief ; his eyes are wild, features anxious, and, in severe paroxysms, fingers and prolabia livid. In the interval there is comparative quietude, though the respiration is constantly embarrassed.

The frequency of the pulse varies according to the extent of the inflammation and the stage of the disease. In the commencement of primary croup it ordinarily ranges from about one hundred and ten to one hundred and twenty beats per minute. In the course of the disease it becomes more frequent, and toward the close of life feeble.

Now and then a patient presents a remission in symptoms due to expectoration of membranous shreds and muco-pus, and the friends may think that the danger is passed. Unfortunately the lull in symptoms is in most cases deceitful, as the cause of the dyspnœa is rapidly reproduced. I once attended a case in which there had been such dyspnœa that an unfavorable prognosis was given. An almost complete intermission, however, occurred in the symptoms, with the exception of the febrile movement, so that a physician who visited the patient at this time diagnosticated an essential fever. Within a few hours, the obstruction being reproduced, the symptoms returned with greater violence than ever, and the child died. So complete an intermission seldom occurs in a fatal case ; and in most patients, during the time of temporary improvement, there is still such dyspnœa, with the characteristic cough, that the nature of the disease is apparent.

If the stethoscope be applied over the larynx in true croup, the loud expiratory as well as inspiratory sound is heard as the air passes by the obstruction. This sound is often transmitted to every part of the chest, so as to obscure the râles which may be produced there. Auscultation over the chest reveals either the vesicular murmur, perhaps somewhat diminished in intensity, or more frequently the sonorous and afterward moist râles due to coexisting bronchitis. In a limited number of cases, dulness on percussion is observed at some part of the chest, with bronchial respiration, indicating pneumonia. Recovery from croup is in most patients gradual ; the voice becomes less hoarse, the cough looser, and the dyspnœa ceases by degrees. The structural changes which have occurred in the mucous membrane of the larynx do not disappear till several days after the last pseudo-membrane is detached.

Fatal cases may terminate in two or three days, but their ordinary duration is from five to fourteen days. Death may result directly from the thickness and firmness of the pseudo-membrane, which obstructs the

entrance of air. Sudden death in a paroxysm of dyspnœa may occur from the detachment of one end of the pseudo-membrane, and its folding upon itself. In many patients, death is not due so much to obstruction to the entrance of air from the presence of the pseudo-membrane, as to the mucus and pus which collect in the trachea and bronchial tubes, and which are not expectorated on account of the presence of the pseudo-membrane and the feeble expiratory efforts of the child. In a case which was examined after death in the Nursery and Child's Hospital of this city, the false membrane was apparently not sufficient to produce a fatal result, but the air-passages below it were nearly filled with muco-purulent matter, which obstructed the entrance of air.

Pathological Characters.—This disease is then essentially a laryngitis presenting the lesions of a simple though usually severe mucous inflammation, but with a superadded element, namely, the false membrane. The coexistence of catarrhal or pseudo-membranous pharyngitis, tracheitis, and bronchitis is also, as we have seen, common. The impediment to respiration, which renders croup so dangerous and fatal, is due not only to the presence of the false membrane, and to the mucus and pus which collect below it, but also to the inflammatory swelling of the mucous membrane and submucous œdema. In addition, there is a neuropathic element which increases the dyspnœa, and which most observers consider a spasmodic contraction of the laryngeal muscles induced by the inflammation, and hence the easier breathing in sleep, and in the general muscular relaxation, which precedes death. Professor Jacobi (*Amer. Jour. of Obstet.*, etc., N. Y., May, 1868), however, holds that the state of these muscles is one of paralysis rather than spasmodic contraction. In his opinion, this paralysis "is secondary. It depends on the œdematous soaking of the posterior crico-arytenoid muscles following the œdema of the mucous membrane of the crico-arytenoid folds."

In several fatal cases which I have had an opportunity to examine after death, I have found the appearance of the lungs quite uniform. They were reduced in volume (semi-collapsed) and more or less congested. Certain parts distant from the bronchi, especially the edges and thin portions, were collapsed completely, and certain lobules also hepatized. I have also observed, though in some of the cases my attention was not directed to it, distension of the right cavities of the heart, with blood, and large thrombi. From the nature of the disease, the blood is less oxygenated, and somewhat darker than in those who die of diseases not involving the respiratory apparatus.

Diagnosis.—The diagnosis of true croup is ordinarily easy. It might be mistaken for spasmodic laryngitis, but more frequently spasmodic laryngitis is mistaken for it. The differences which will aid in differential diagnosis are the following: Commencement abrupt and at night in one, gradual in the other; presence in one, absence in the other, of a

pseudo-membrane upon the surface of the fauces ; fragments of the membrane in the sputum in one ; character of the cough ; course of the disease growing gradually worse in one, in the other, with few exceptions, rapidly improving. Trousseau speaks of the liability to error of diagnosis in those cases in which spasmodic laryngitis is associated with pseudo-membranous pharyngitis. Few physicians hesitate to designate as true croup those cases in which there is a croupal cough in connection with false membrane upon the surface of the fauces, and yet the laryngitis under such circumstances may be merely spasmodic. This coexistence of pseudo-membranous pharyngeal and of spasmodic laryngeal inflammation is, however, probably rare, but its occasional occurrence should be borne in mind.

True croup is readily distinguished from laryngismus stridulus, or internal convulsions. Laryngismus stridulus is a purely nervous affection ; it occurs suddenly, causing great dyspnœa, or momentary suspension of respiration, without the fever and without the hoarse voice and cough of croup. When muscular relaxation occurs, the attack ceases. The difference between the two diseases is therefore obvious.

Prognosis.—The great mortality from true croup is universally known, and those physicians who report a large number of favorable cases have probably mistaken spasmodic croup for this disease. According to the statistics of Dr. Ware, nineteen out of twenty die ; but with the modern mode of treatment, begun early, the proportionate number of recoveries is probably larger than this estimate. Increase of dyspnœa, cough and voice becoming more hoarse, and the pulse more accelerated, indicate a fatal form of croup. The occasional temporary improvement due to the expulsion of a portion of the membrane, may lead, as we have seen, to error of prognosis. However, improvement continuing more than twelve hours is evidence of the decline of the malady. The near approach of death is shown by lividity with great restlessness, or pallor with somnolence. If the patient recover from croup there often remains more or less bronchitis or broncho-pneumonia, which requires treatment, and the laryngitis, when its pseudo-membranous character is lost, persists for a time, causing more or less hoarseness, and increase of temperature.

Treatment.—The importance of early treatment has been sufficiently alluded to, for if croup have continued two or three days, when first recognized, the chance of recovery is greatly diminished. As the danger is from the presence of the adventitious layer, measures should be immediately employed to prevent as much as possible its further formation and remove that already formed.

The use of emetics is suggested from the nature of the disease. The syrup and wine of ipecacuanha and Hive syrup of the pharmacopœia have been much employed as emetics in this malady, and though useful for spasmodic croup they are depressing and should not be employed where diphtheria prevails. In a locality free from diphtheria, so that there is

reason to believe that the patient has no blood-poisoning, which always produces asthenia, and that the disease is strictly local, a membranous and not diphtheritic croup, the emetic treatment is admissible, and will sometimes give partial relief. But diphtheria has at present obtained such a foothold in this country, it is so common both in our cities and rural districts, that a large majority of the cases of obstructive laryngitis which the American physician is called to treat are diphtheritic, and in diphtheria, in whatever way manifested, depressing remedies are injurious. Hence emetics are falling more and more into disuse in this country in the treatment of true croup. Ipecacuanha and antimonial mixtures, so frequently prescribed twenty-five years ago, are now almost never prescribed by the intelligent physician, when he has reason to suspect the presence of a pseudo-membrane upon the laryngeal surface.

An emetic, if it be employed for pseudo-membranous laryngitis, should be one that acts promptly, with little depression, and its use is admissible only at the beginning of the disease, and at an advanced stage when there is great dyspnœa, and more acute measures are required to assist in expelling the muco-pus, and shreds of pseudo-membrane, which the cough cannot expel, and which threaten suffocation. Sulphate of copper, in a dose of two or three grains, is a proper emetic under such circumstances. Several years since, in one case in my practice, in which there were at my first visit dyspnœa, croupy cough, and a pseudo-membrane over each tonsil, and in which I had made an unfavorable prognosis, the parents observing the good effects of two grains of sulphate of copper, with two of pulverized ipecacuanha, repeated the dose, contrary to my directions, every two to four hours till the following day, and the patient recovered. Probably, however, in ordinary cases the best emetic is the yellow sulphate of mercury, prescribed in a powder of two or three grains. The use of this emetic in croup was prominently brought to the notice of the profession in New York City by Prof. Fordyce Barker, who prescribes it immediately on being summoned to a case, and ordinarily with good result.

With or without emesis other measures are urgently demanded if a pseudo-membrane have formed. The profession have long sought for a remedy which, taken internally, might by its effect on the blood and the inflamed surface, prevent or diminish the membranous formation, and also for one which employed locally might liquefy and remove it. Calomel has been largely prescribed in times gone by for its supposed "antiplastic" action, and more recently chlorate of potassium and muriate of ammonium, in formulas like the following :

℞. Potassii chlorat.,
Ammonii muriat., āā ʒj—ʒij;
Syr. simplic., ℥j ;
Aquæ, ℥iij. Misce.
Dose, one teaspoonful hourly.

Larger doses of chlorate of potassium for a child involve danger on account of its irritating action on the kidneys. Calomel has been properly laid aside, and the effect of the potassium and ammonium mixture is slow and uncertain. Our reliance must therefore be chiefly on inhalations, and these are superseding all other remedies. It has long been known that the vapor of slaked lime is an active solvent of pseudo-membranes, but the manner in which it has frequently been employed is inefficient. Many physicians place the unslaked lime in pans or dishes, add water to it, and place the child so that it inhales the vapor as it rises. This is little more than the inhalation of steam, as any one may satisfy himself by holding a mirror or pane of glass over it, when he will perceive only a very slight deposit of lime upon the glass. The proper way to employ it is with the atomizer. But lime is feebly soluble in water, so that the officinal aqua calcis contains but little, and it is necessary to employ a turbid solution or mixture, in order to obtain an active spray. This is apt to clog the glass points of the steam atomizer, though if not too turbid it can be used in the hand atomizer, like Delano's. I have therefore been in the habit of employing the officinal lime-water in the steam atomizer, but increasing its activity by adding the spray from the hand atomizer which can be played through the mouth-piece of the steam apparatus.

Impressed with the importance of ascertaining what is the safest and most efficient solvent of pseudo-membranes, a number of experiments were made by Drs. Chadbourne, O'Dwyer and myself in the New York Foundling Asylum. We ascertained that the officinal lime-water is a quicker solvent than lactic acid in liquid pepsin, thirty minims to the ounce, for which superiority had been claimed, for it dissolved a diphtheritic pseudo-membrane half an inch long immersed in it in half an hour, while the other liquid required more time, and that carbonic acid, added in considerable quantity, did not notably impair the lime's solvent action. These experiments, made with the pseudo-membrane from patients in the asylum, were continued by Dr. Chadbourne with the fibrin of sheep's blood, and he has furnished me with the following statement of the result. The defect in these last experiments consists in the fact that croupous and diphtheritic pseudo-membranes contain something besides fibrin, to wit, altered and interlacing epithelial cells, but if the fibrin can be dissolved away these cells will probably be more readily detached and removed.

In each experiment ten grains of fibrin were immersed in one ounce of the solvent used tepid. Lime-water was first experimented with in the following forms :

1. Officinal lime-water.
2. Lime-water containing much more lime than would dissolve.
3. Lime-water rendered very turbid by passing carbonic acid through it.
4. Lime-water with salicylic acid one half grain to the drachm added to it.

"The action of the first three was so nearly identical that no appreciable difference was perceptible. The solvent action of the mixture No. 2 did not seem to be increased by the superabundance of lime added to it, nor was that of No. 3 appreciably diminished by the carbonic acid passed through it, although it was rendered very turbid by flocculi while its reaction was still faintly alkaline. I ascertained that it required the breath to be exhaled three minutes through two ounces of the officinal lime-water to render it neutral. Mixture No. 4 containing salicylic acid, forming, no doubt, salicylate of lime, condensed, without dissolving the fibrin, producing firm and hard shreds within a few minutes, in which condition it remained permanently. The reaction was decidedly acid.

"Solutions of chlorate of potassium, bicarbonate of potassium, bicarbonate of sodium, and borate of sodium, were used with the result of a very slow and limited action. The liquid pepsin of the U. S. Pharmacopœia in full strength slowly but perfectly digested the fibrin. The most satisfactory results were from the officinal liquor potassæ and liquor sodæ. Strong solutions of these agents dissolved a small percentage of fibrin immediately, while no further action took place. The action was more satisfactory as the strength of the solution was decreased, until the two per cent was reached. Weaker solutions than two per cent acted slowly. The actions of the two per cent solutions of liquor sodæ and liquor potassæ seemed identical. Either one rendered the fibrin a gelatinous mass within ten minutes, and subsequently totally liquefied it.

"There is, in my opinion, no danger of injurious action upon the tissues of the two per cent solution of either liquor potassæ or liquor sodæ, as I have tested them upon myself. It was ascertained by experiment that the Codman and Shurtleff steam inhaler consumes one ounce of water in the boiler to two ounces of liquid in the medicine supply cup with a medium-size point. Therefore while for use in the hand atomizer one teaspoonful of the liquor potassæ or liquor sodæ should be added to fifty of water, one teaspoonful and thirty-three of water should be employed in the steam atomizer." See formula on page 210.

It is to be recollected, in the treatment of croup, that the pseudo-membrane, by commencing decomposition, and by the pus and mucus which collect underneath, is more easily detached after a few days, if the patient live, than at first. Therefore the physician should endeavor to sustain the vital powers, in order that the cough may have sufficient force to separate this substance as soon as its fibres of attachment begin to loosen. A patient with croup rarely takes solid food, but he should be allowed beef-tea, milk, and farinaceous drinks, at short intervals. If signs of exhaustion arise, alcoholic stimulants are proper, and fresh air should also be allowed as far as is compatible with the inhalation of steam.

As regards external treatment of the throat the late Professor Peaslee, of this city, in a series of papers on the pathology of croup, published in

the *American Medical Monthly*, 1854, says of cold applied externally : "We consider this of the greatest value and importance. If cold applications are efficacious in all cases of external inflammation, they are scarcely less so here, where the inflamed surface is so nearly superficial. Cold must, however, be continuously applied to produce the desired effect. Applied at intervals, indeed, it rather promotes than retards the inflammatory process ; since during the intervals the temperature rises above the normal standard, in consequence of the reaction of the chill on the surface.

"Cold water may be constantly dropped from a sponge upon a compress laid over the throat of the child ; and the latter should be of only one or two thicknesses of linen, that evaporation may go on as rapidly as possible."

In ordinary cases, cold applications over the larynx should, in my opinion, be used instead of poultices, especially in the early stages, when the pseudo-membrane is still forming. Muslin frequently wrung out of ice-water, or an india-rubber bag, containing pieces of ice, should be applied along the front part of the neck. The rubber bag or a bladder covered by muslin is better retained and more agreeable to the patient than when used without an intermediate substance. This mode of applying cold will be found more convenient than that recommended by Prof. Peaslee. The temperature of the neck may be kept constantly below the normal standard by ice thus applied. Cold is especially serviceable if the child be robust, with flushed cheeks and full and rapid pulse. In secondary croup, or croup occurring in feeble states of system, or presenting a subacute character, poultices or fomentations to the neck, with moderate counter irritation, sometimes give most relief.

Unfortunately, as I have already stated, true croup is, in a large proportion of cases, a progressive disease. The hoarseness of the cough and voice and the dyspnœa gradually increase. The pulse, becoming more frequent and feeble, indicates the need of the most nutritious food, as the animal broths, and of alcoholic stimulants. The danger is, however, from the dyspnœa rather than asthenia. In the cities where companies provide oxygen, in portable apparatus, prepared for inhalation, this agent will be found to relieve considerably the dyspnœa in extreme cases, and increase the chances of a favorable result. But if the measures detailed above fail to give relief, and death be inevitable, if there be no other resource, the important question arises whether tracheotomy shall be performed.

The published statistics relating to tracheotomy in croup are to a considerable extent unsatisfactory, since we are not informed, as regards most of them, at what stage of the disease the operation was performed, and what were the evidences of a fibrinous exudation. The most valuable and reliable statistics bearing upon this subject, so far as I am aware, are those published by Prof. Jacobi, of this city, in the *American Journal of*

Obstetrics, etc., for May, 1868, and containing the results of the cases which were operated on by himself and Drs. Krackowizer and Voss. These gentlemen are known to the profession of New York as careful and judicious practitioners, not likely to operate when there was probability of success by therapeutic measures, and not likely to mistake simple or spasmodic laryngitis for true croup. I have tabulated the statistics of their operations.

All New York physicians are aware of the difficulty of making a differential diagnosis at the bedside of diphtheritic croup, and non-specific pseudo-membranous laryngitis, or true croup. But during the last twenty-five years the former has been the prevailing type of obstructive laryngitis, and so far as the operation of tracheotomy is concerned the attempt is not made to distinguish the one from the other. The surgical treatment is the same in both. The cases embraced in the following statistics were therefore in the main those of diphtheritic croup, and the results of the operation indicate the degree of success attainable in localities where diphtheria prevails, and modifies the type of the laryngitis.

Age.	Number.	Recovered.	Died.
Under 2 years,	8	1	7
From 2 to 3 years,	29	5	24
" 3 to 4 "	26	4	22
" 4 to 5 "	34	11	23
" 5 to 6 "	9	2	7
" 6 to 7 "	1	1	0
" 7 to 8 "	3	0	3
10 "	1	0	1
Not given,	55	15	40
	166	39	127

Time of death after operation.	Number of cases.	Time of death after operation.	Number of cases.
Within 24 hours,	19	On 5th day,	9
On 2d day,	7	" 6th "	4
" 3d "	16	" 7th "	2
" 4th "	15	" 9th "	1
		From 10th to 31st day,	5
Total,			78

The following were the causes of death, as given in the records of seventy-three cases :

In operation,	1	Pneumonia,	5
Apnœa from too late operation,	6	Broncho-pneumo. and pul. gangrene	1
Apnœa,	3	Pulmonary œdema,	1
Anæmia and exhaustion,	4	Pseudo-membranous bronchitis,	18
Diphtheria,	8	Tuberculosis,	1
Bronchitis	6	Convulsions,	2
Broncho-pneumonia,	15	Emphysema,	2
Total,			73

The following table gives the result of tracheotomy in one hundred cases. It is prepared from the statistics of Güterbach, lately published :

Age.	Result.
Under 1 year,	1 case fatal.
Between 1 and 2 years,	1 "
" 2 and 3 "	$33\frac{1}{3}$ per cent recovered.
" 3 and 4 "	40 " "
" 4 and 5 "	$38\frac{8}{13}$ " "
" 5 and 6 "	$44\frac{4}{9}$ " "
" 6 and 8 "	$14\frac{3}{7}$ " "
" 8 and 9 "	25 " "

From conversations which I have had with surgeons of New York, I am persuaded that the above tables present a more favorable result than could be furnished by the general surgical practice of this city. Most New York surgeons, however, seem to shun the operation and regard it with ill favor, and, did they operate as frequently as those whose names I have mentioned, possibly the result would be better. Statistics in Paris probably give nearly the true proportion of successful and unsuccessful operations of tracheotomy for croup, as it is performed by skilful and careful surgeons. Of 388 cases occurring in the practice of several Parisian surgeons, 346 died and 42 recovered ; while in the Hôpital Sainte Eugénie, of 374 operated on, 310 died. (Bouchut.)

In the *New York Medical Record*, during 1880, Dr. John H. Ripley published an interesting and instructive series of papers on tracheotomy in croup. The statistics of this operation as performed by himself are embraced in the following tables. They show the degree of success attainable by tracheotomy performed by one familiar with the operation, in cases which there was every reason to think would perish without surgical interference. His cases were recent, and of the type of pseudo-membranous laryngitis, which is now prevailing in this country. He makes the remark, which the experience of others fully justifies, that diphtheritic croup is more severe and more quickly fatal if it occur early in diphtheria than at a later period, when the intensity of the poison has diminished. He states also the interesting fact, that the common cause of death in cases operated on is bronchial croup, and not catarrhal bronchitis or broncho-pneumonia, as many suppose, and that it begins from two to four days after the tracheotomy. He alludes also to the fact, that nephritis and consequent uræmia, due to the general disease, and too often overlooked, is an important factor in producing the fatal result in many cases.

Ages.	Number of males.	Number of females.	Number of recovering.	Number of deaths.
Under 1 year,	1	1		2
Between 1 and 2 years,	6	2		8
" 2 and 3 "	8	8	7	9
" 3 and 5 "	10	7	4	13
" 5 and 7 "	8	5	5	8
	33	23	16	40

Causes of Death.	Number.
Bronchial Croup,	22
Uræmia,	4
Toxæmia,	2
Cardiac Paralysis,	3
Accidental plugging of tube,	3
Uræmia and Respiratory Paralysis,	2
Pneumonia,	1
Erysipelas and Bronchial Croup,	1
Acute Tuberculosis,	1
Gangrene of Wound,	1

The facts in reference to tracheotomy in croup are the following : The majority of those operated on do not recover, but some live who without the operation would die. The operation is now more successfully performed than formerly, as the conditions of successful operation are better understood. Those who have operated several times, confess that their last cases did better than their first. Trousseau's experience was striking and instructive in this respect. No one, probably, ever performed this operation for croup more times than he, and, from constantly greater success, he became more and more an advocate of the operation. Tracheotomy, if properly performed, does not in any case shorten life, but it frequently prolongs it several days. It diminishes greatly the dyspnœa, and renders death easy.

The objections to the operation are partly of a moral nature. The parents, already in the extreme of grief on account of the suffering and probable death of the child, consent with reluctance to an operation which promises not cure, but a prolongation of life. Common sympathy with the child and regard for the emotions of the parents should certainly have an influence in deciding for or against the operation. The first case of tracheotomy which I witnessed was such as, if common, would condemn this operative measure entirely. No anæsthetic was given, and, in the midst of the struggles of the child, large veins were severed, from which an abundant hæmorrhage occurred. The trachea was opened, but this was no sooner done than death occurred, partly from the loss of blood, and partly from the obstruction to respiration caused by its entrance into the bronchial tubes. Such cases are, however, quite exceptional. Death rarely occurs during the operation, unless the patient be already moribund, and the possibility of such a result should have little weight in our decision for or against the operation.

Few will deny, in the light of statistics, that tracheotomy is, in certain cases, proper, and that a physician at times would be culpable if he did not strongly urge its performance. There are certain supposed contra-indications. One is age less than two years. It is true that those under the age of two years are less likely to recover after the operation than those above that age ; still, tracheotomy has now and then saved the

lives of the youngest infants who have croup. The possibility, therefore, of success justifies the performance of the operation, however young the infant, when the only alternative is death. In the foregoing statistics it is seen that one of eight recovered who were under the age of two years.

The presence of capillary bronchitis or pneumonia does not positively contraindicate tracheotomy, though it diminishes greatly the chances of a favorable issue. Nor is tracheotomy forbidden by the extension of the false membrane into the bronchial tubes, since it diminishes the amount of obstruction along which the air passes in order to reach the lungs, and the muco-pus as well as pseudo-membrane, lying below the point of operation, may be expectorated through the aperture. A decidedly asthenic state, as after measles or scarlet fever, indicated by feeble pulse and other symptoms of exhaustion, may or may not contraindicate the operation, whether the pseudo-membrane be limited to the larynx and trachea or be more extensive.

The manner of performing tracheotomy and the subsequent treatment pertain to surgery, and are described in surgical works. A skilful surgeon should, indeed, be employed to perform the operation when it is practicable. At what time in the course of the disease tracheotomy should be resorted to is an important practical question. Trousseau at one time recommended it as soon as there were certain evidences of the presence of a pseudo-membrane, but in the latter part of his life he did not operate so early. The correct rule, in my opinion, is not to operate till urgent symptoms arise, such as increasing dyspnœa, marked epigastric and suprasternal depression on inspiration, and especially commencing lividity of prolabia and tips of fingers. When these signs occur, it is unsafe to delay long. The arrangements should be previously made, that no time be lost.

It is an interesting fact that a large proportion of those who die after tracheotomy, die of bronchitis, bronchial croup, or of pneumonia developed after the operation. These diseases seem to be partly attributable to the operation, or, if previously existing, to be aggravated by it. It is believed that the introduction into the bronchial tubes and the lungs of cool air, of air not warmed by the natural circuit through the nostrils and larynx, may be a cause of these inflammatory complications. Sometimes, also, the canula by pressure increases the inflammation of the surface on which it lies. Therefore, not only does the operation require skill in its performance, but much of its success depends on the subsequent management. After the operation, the temperature of the apartment should be kept constantly at from 85° to 90°, and loaded with moisture. This obviates in part, but only in part, the tendency to bronchitis and pneumonia. Constant attention should be given to the canula, to prevent its filling with mucus and pus. Most surgeons use a canula

with two concentric cylinders, which can be readily cleaned by removing the internal cylinder. The nurse, when properly instructed, can remove this cylinder as often as may be necessary in order to clean it. Mr. Lawrence, of London, and, following him, some other surgeons, prefer not to use the canula. The edges of the wound are kept apart by a wire which passes around the neck, or a little of the trachea is removed so as to produce a sufficient aperture. The reader is referred for particulars regarding this mode of operating to recent treatises on operative surgery.

After the operation but little medication is required. The patient should be kept quiet and free from excitement. His diet should be mainly liquid, and of the most nourishing character, with the free use of stimulants which the constitutional disease, diphtheria, requires. In a few days, if the symptoms abate, the aperture may from time to time be closed with the finger after the withdrawal of the canula, in order to ascertain if the larynx be free from obstruction. If bronchitis or bronchopneumonia arise, the oil-silk jacket, with counter-irritation to the chest, is required, and quinine, digitalis, carbonate of ammonium, and alcoholic stimulants should be ordered.

CHAPTER IV.

BRONCHITIS.

Inflammation of the bronchial tubes, or bronchitis, is probably the most frequent disease of early life. It is usually associated with more or less inflammation of the mucous membrane of the nostrils, larynx, and trachea. We designate the disease coryza, laryngitis, or bronchitis, according as one or the other inflammation predominates. Sometimes bronchitis occurs with but slight inflammation elsewhere, and often the coryza and laryngitis abate while the bronchitis is still active.

Bronchitis occurs both as a primary and secondary disease. The secondary form is common in connection with measles, hooping-cough, pneumonia, and pulmonary phthisis, and it is not uncommon in scarlet fever, variola, remittent and continued fevers. Bronchitis is acute, subacute, or chronic, and according to its extent it is mild or severe. If the smallest bronchial tubes are involved, the inflammation is designated capillary bronchitis, a term not well chosen, but which it is convenient to employ in a description of the malady. Bronchitis is commonly bilateral, affecting the tubes on the two sides with about equal intensity. When

due to tubercles, or to pneumonia, it is apt to be unilateral, being confined to those tubes or nearly to those which are surrounded by tubercular or inflammatory product.

Causes.—The causes of secondary bronchitis are obviously the diseases in connection with which it occurs. The cause of primary bronchitis is the same as that of simple acute laryngitis or coryza, namely, sudden change of temperature from warm to cold, exposure to currents of air, the practice of sending children without sufficient clothing from heated rooms into the open air, the throwing off of bedclothes at night, etc. Dentition is also an occasional cause, since some children have attacks which coincide with the eruption of the teeth. The cough of dentition is usually purely a nervous affection ; but in other instances it is accompanied by more or less mucous secretion, and is evidently dependent on a mild catarrh.

Anatomical Characters.—In the most common form of bronchitis the larger bronchial tubes only are affected. They are the seat of the inflammation in most of those cases which are designated "colds" by families, and which are often treated without the aid of the physician. The lining membrane of the bronchial tubes presents the ordinary anatomical characters of mucous inflammations. It is reddened uniformly or in patches, intensely, or in that milder degree known as arborescence, according to the severity of the inflammation.

The secretion of the muciparous follicles is at first arrested, and the surface of the membrane is dry. In the course of a day or two the secretory function is re-established, and the surface is covered with thin and transparent mucus. A day or two later, the secretion becomes thicker, consisting of mucus and pus. Mixed with these substances are epithelial cells, which are exfoliated in abundance from the inflamed surface. At the same time the mucous membrane becomes thickened and more or less softened. If the inflammation be severe, the vessels of the submucous connective tissue are also injected.

Usually, in about a week in the young child, in from one to two weeks in older children, the inflammation begins to abate. Gradually the inflamed membrane returns to its normal consistence, thickness, and vascularity, and with this return to the healthy state the muco-purulent secretion abates.

In this, which is the simplest form of bronchitis, and most common, there is no ulceration, and rarely any pseudo-membranous formation, if the disease be idiopathic. Pseudo-membranous bronchitis is not unusual as an accompaniment of pseudo-membranous laryngo-tracheitis.

Were bronchitis limited to the larger bronchial tubes, it would indeed be a simple affection, but unfortunately it has a tendency to extend downward. Commencing in the larger, it gradually invades the smaller tubes in a similar manner to the extension of erysipelas upon the skin. More

rarely the inflammation commences simultaneously in the larger and smaller tubes. Now the gravity of bronchitis is proportionate to the degree of its extension downward. It may stop at any point in its progress, but if it reach the smaller tubes it is one of the most serious affections of early life.

The mucous membrane of the minute tubes, those next to the air-cells, is delicate, with but little submucous connective tissue, and it frequently, at post-mortem examinations, does not present to the eye those distinct inflammatory changes which are observed in tubes of large diameter. It is sometimes not notably thickened, nor its vascularity much increased, even when there is reason to believe from the symptoms that it was the seat of active phlegmasia. As we pass from these minute tubes to those of larger calibre, the inflammatory lesions become more distinct. The inflammation produces minute and abundant points of redness, and the membrane is evidently thickened ; often it is rough or granular.

The minute bronchial tubes are very small, especially under the age of three years, and since in capillary bronchitis a large proportion of them are inflamed, the source of the danger is apparent. It is with difficulty that the patient with capillary bronchitis can, by the effort of coughing, free the tubes from the secretions which are constantly collecting in them. In weakly children, under the age of two years, expectoration is most difficult, and hence the great and increasing dyspnœa from which such patients suffer.

In severe and unfavorable cases of bronchitis, which are chiefly those in which the small as well as large tubes are inflamed, the following anatomical changes commonly occur : The muco-purulent secretion, which is tenacious, collects more rapidly in the smaller tubes than it is expectorated by the child, whose strength begins to be exhausted. The accumulation of the secretion is chiefly in the tubes which lie in the posterior and inferior portions of the lung. As the obstruction from the muco-pus increases in these tubes, less and less air passes through them into the alveoli with which they communicate, while the quantity of air which passes through the unobstructed tubes into the anterior and superior portions of the lung is proportionately increased. The effect, as regards the state of the lung, is obvious. In cases having a fatal issue, and in which we are therefore able to inspect the lesions, we find that the lower and inferior portions of the organ, from which air was to a greater or less extent excluded, have a diminished crepitation, that they lie a little below the general level, or that certain lobules do, and that they present a congested appearance, for while they contain too little air they have an excess of blood. We shall also find that the upper and anterior parts of the organ, perhaps the entire upper lobe, contain more than the normal quantity of air, so as to rise above the general level. There is distension of the alveoli in these parts, so that they are probably visible to the

naked eye, and may appear to be emphysematous, but this is a state distinct from emphysema. It is merely an inflation of the alveoli to nearly their full capacity.

Here and there, in the portion of lung in which the inflation has been incomplete, lobules may be observed which are entirely collapsed, having a dusky red color and no crepitation ; while in other parts, if the bronchitis have continued some days, there may be nodules of pneumonia. The incised surface of those portions of the lung to which the access of air has been prevented, whether they are collapsed fully, or partially or not, has a reddish color from congestion, and is moist from serum and blood. On compressing the lung, the muco-purulent secretion appears upon the surface in points, having escaped from the divided ends of the tubes. For other facts relating to atelectasis, the reader is referred to the chapter in which this malady is described.

Exceptionally even when not accompanied by laryngeal croup, fibrinous exudation occurs in the bronchial tubes, forming a delicate film, here and there, and readily detached from the surface underneath, while in rare instances it occurs as a firm and continuous membrane, forming a mould of the tubes, increasing greatly the dyspnœa, and constituting a true bronchial croup. If the patient with severe bronchitis survive, the inflammation of the mucous membrane soon begins to abate. The tubes which have been the seat of the disease, and the alveoli which have been secondarily involved, may return to their normal state almost immediately ; but in other instances such anatomical changes occur in them, even when there is no pneumonia, nor atelectasis, that full restoration to their normal state is necessarily somewhat slow. When the function of a lobule ceases, as it does when the tube leading to it is obstructed, not only hyperæmia occurs with or without collapse, as already stated, but its cells and nuclei, and perhaps other parts, begin to undergo fatty degeneration. These elements become granular, somewhat enlarged and opaque, and here and there mixed with them are other large cells filled with oil-globules. These are the compound granular cells of pathologists, and, occurring in this situation, are produced by metamorphoses of the epithelial cells. They are epithelial cells which have progressed more rapidly than others in fatty degeneration, having reached that stage of it which immediately precedes liquefaction. We often with the microscope observe not only these corpuscles, but their fragments as they are dissolving.

Minute abscesses, usually directly under the pleura, have occasionally been observed at the autopsies of those who have recently had general bronchitis, and pathologists are not agreed as to the mode in which they are produced. Some of them, if not all, are evidently connected with the minute bronchial tubes, and the quantity of pus contained in each is not usually more than one or two drops. The most reasonable view of

their causation is that they are produced in the terminal tubes where the mucus and pus collect. The pus acts as an irritant and causes inflammation, and the inflammation increases the quantity of pus. The walls of the tube which is now the seat of an abscess are destroyed by ulceration, and probably, also, some of the contiguous air-cells. The little cavity is soon surrounded by a delicate membrane, the same in character, though less thick and firm, as that which constitutes the walls of larger abscesses. The pus presents the usual appearance of this liquid, or it may be tinged by the presence of blood-cells, or again it may be thick from partial absorption of the liquor puris so as to resemble softened tubercle.

The abscess is ordinarily located in the centre of a collapsed lobule. In certain cases it approaches the surface of the lungs, so as to produce circumscribed pleurisy, with adhesion of the costal and visceral pleura. At the autopsy of such a case, on separating the adhesions and attempting insufflation, the air passes through the aperture, so that the lung on that side cannot be inflated unless the aperture be closed. Occasionally pneumo-thorax results from opening of the abscess into the pleural cavity.

In severe protracted bronchitis dilatation of certain of the bronchial tubes sometimes results. The alveoli in the upper lobes may also be distended beyond their physiological capacity, so as to produce emphysema, but as we have stated above, their maximum distension within physiological limits, must not be mistaken for emphysema. Emphysema in the upper lobes is common in feeble young children, with relaxed and weakened tissues, occurring even without any severe disease of the respiratory organs. It may be vesicular or interstitial. If it be interstitial the sacs of air often attain considerable size, lying as wedges between the alveoli, or like little bladders upon the surface of the lung. It is not difficult to understand how emphysema occurs in severe bronchitis, since the air partly arrested in the tubes leading to the lower lobes enters the upper lobes in increased volume and force.

Symptoms.—It is evident, from the description which has been given of the anatomical characters of bronchitis, that its symptoms vary greatly in severity in different patients. It usually commences with more or less coryza. The symptoms are headache, flushed face, elevation of temperature, acceleration and fulness of pulse. In the mildest cases these symptoms are scarcely appreciable. The child is observed to sneeze and have some defluxion from the nostrils, and this is followed by an occasional mild, almost painless, cough, which declines in the course of a few days. The respiration and pulse are scarcely accelerated, and the appetite is but slightly impaired. There may be a little fretfulness, but the child is not confined to his bed or room, and usually amuses himself with his playthings. Auscultation in these mild cases reveals coarse mucous râles in the larger bronchial tubes, while the smaller tubes are free from mucus. Sibilant and sonorous râles are also observed, especially in the commence-

ment of the bronchitis, at which time the secretion of mucus is suppressed or scanty. The cough in the commencement is for the same reason dry. It becomes looser by the second or third day, the sputum consisting of frothy mucus, with the admixture of pus and epithelial cells. The pus becomes more abundant as the disease continues. Expectoration from the mouth does not usually occur till after the age of four or five years; under this age the sputum is ordinarily swallowed.

The mild form of bronchitis described above, that in which only the larger bronchial tubes are affected, is common to all periods of infancy and childhood, but a severer grade of the disease is also of common occurrence, exclusive of those cases in which the minute branches of the bronchial tree are affected. It has already been stated that there is a tendency in bronchial inflammation to extend downward, and symptoms are proportionate in gravity to the degree of this extension. In severe bronchitis the pulse rises to 120 or 130 per minute, and the respiration is in a corresponding degree accelerated. The cough is frequent and painful, the pain being referred to the sternum, and often there is a steady dull pain in this region. The face is flushed and indicative of suffering, the temperature is considerably elevated, and the appetite is greatly impaired or lost. There is frequently an exacerbation of symptoms in the latter part of the day. Depression of the infra-mammary region during inspiration, and dilatation of the alæ nasi, accompany grave attacks of the inflammation.

Auscultation in severe bronchitis reveals the presence of râles in all parts of the chest, sibilant and sonorous sparingly, coarse mucous and subcrepitant more abundantly.

General bronchitis or suffocative catarrh, the most dangerous form of this inflammation, is less frequent than bronchitis, which is limited to the larger tubes, or to the larger tubes and those of medium size. It may commence quite abruptly, but ordinarily it results from the milder form of the disease. The symptoms at first are such as occur in the common form of bronchial inflammation, but instead of abating or remaining stationary, they gradually increase in severity till, suddenly, marked dyspnœa supervenes. The inflammation has now reached the minute tubes, and what promised to be an ordinary attack of bronchitis becomes one of great severity and danger.

The respiration in severe bronchitis is short and hurried. Sixty to eighty inspirations per minute are not infrequent, while the pulse also is greatly accelerated, attaining as high a number as 140 to 160 or 180 beats per minute. The cough is frequent, and the sputum, which collects in abundance, is expectorated with difficulty. If expectorated so as to be examined, it is found to consist largely of frothy mucus with epithelial cells. After a few days, if the patient live, it becomes more purulent. Sometimes, as in bronchitis of the adult, streaks of blood appear upon the

mucus. In the first days of severe acute bronchitis, the temperature is considerably elevated, the face flushed and breathing oppressed. The patient is restless, moving from one part of the bed to another, seeking in vain for relief. The digestive function is impaired, as in all severe inflammations ; the tongue is moist and covered with a light fur ; the appetite is nearly or quite lost. The nursing infant nurses with difficulty, frequently relinquishing the breast on account of the dyspnœa ; older children take no solid food in consequence of the anorexia and the dyspnœa, and even drinks are swallowed hastily and apparently without relish, since deglutition interferes with respiration. On auscultation in bronchitis, of the minute tubes, sibilant, and after a day or two subcrepitant, râles are observed in every part of the chest. Percussion elicits a good resonance, unless the substance of the lung have become involved. As the disease approaches a fatal termination, the pulse becomes greatly accelerated, the respiration is also in a corresponding degree frequent and panting, the inspiration being accompanied by marked infra-mammary depression and dilatation of the alæ nasi. The face becomes pallid, the prolabia livid, and the tips of the fingers livid and cool. The mucus and pus, accumulating in the air-passages, increase more and more the obstruction to the entrance of air, and, finally, death occurs from apnœa. The nursing infant usually ceases to nurse for several hours before death, and a state of stupor commonly precedes the fatal event, due to the accumulation of carbonic acid in the blood. In young infants, especially those under the age of six months, not only in bronchitis of the minute tubes, but in severe ordinary bronchitis, I have often observed, toward the close of life, intermission in the respiration. It occurs after every six or eight or ten respirations, and equals in duration the time occupied in, perhaps, half a dozen respiratory movements. It is, therefore, an unfavorable prognostic sign, but some recover by stimulation in whom it occurs.

The duration of acute bronchitis varies according to the extent of the inflammation. In the mildest form, the patient is convalescent after three or four days, and, in severer forms that terminate favorably, the disease begins, ordinarily, to decline by the close of the first week or in the second. The progress of bronchitis is somewhat more rapid in young children than in those of a more advanced age. When convalescence is fully established, it is not unusual for the cough to continue three or four weeks, though gradually declining. It is loose and painless, and is scarcely regarded by the patient.

Death sometimes occurs as early as the second or third day in severe general bronchitis. The younger the infant, with the same extent and intensity of inflammation, of course the sooner the fatal result. The ordinary duration of fatal bronchitis is from six to eight days. If the patient pass beyond the tenth day, decline of the inflammation may be confidently expected, and recovery, unless there be a complication.

Occasionally bronchitis becomes chronic, lasting several months before it entirely ceases. The *chronic* form may result from mild, as well as severe, bronchitis. The acute fever and accelerated respiration which characterize the acute affection abate, and the general health is nearly or quite restored ; but an occasional cough continues, and the respiration is often audible, from the mucus which collects in the tubes, or from thickening of the mucous membrane. Sometimes there is moderate febrile movement, especially in the latter part of the day. On auscultation, coarse mucous, with perhaps sibilant and sonorous, râles are observed in the chest.

There is great liability in chronic bronchitis to exacerbations. The disease often seems to be abating, and there is prospect of its speedy cure, when all the symptoms are intensified. The exacerbations are due to the fact that the bronchial surface, when it has been a considerable time inflamed, is very sensitive to the impression of cold. Even when the disease is entirely relieved, it is very apt to return by exposure to currents of air or changes of temperature. Chronic bronchitis occurs most frequently in the winter and in the spring and fall, when the weather is changeable, and is most intractable in these periods of the year. Many cases of chronic bronchitis are associated with dilatation of the bronchial tubes or with emphysema. The general health in this form of bronchitis, when not dependent on a tubercular deposit, ordinarily remains good. Tubercular bronchitis, which is the result of a grave disease, does not require separate consideration. It is attended with emaciation, and is obstinate on account of the nature of the primary affection. It is due to the irritating effect of tubercular matter lying against the bronchial tubes.

Diagnosis.—Bronchitis can ordinarily be diagnosticated by the character of the respiration and cough. The absence of hoarseness, stridulous inspiration, and croupy cough, excludes laryngitis ; and the absence of the expiratory moan and of the stitch-like pain on coughing, which characterize pneumonia and pleurisy, excludes those diseases. Accurate diagnosis, however, can be most readily made by percussion and auscultation. Examination of the chest enables us to state with positiveness, not only the nature, but the extent of the affection. If the inflammation be confined to the larger bronchial tubes, coarse râles are discovered in them, while finer mucous râles are absent. If the bronchitis be in the minute tubes, subcrepitant râles are discovered in them. Percussion gives clear resonance on both sides, except in those instances in which collapse or pneumonia has supervened.

Prognosis.—Bronchitis, limited to the larger bronchial tubes, or to these and those of medium size, terminates favorably in a large majority of cases. Occasionally, severe inflammation, not extending to the smaller tubes, proves fatal in young infants, or those of feeble constitution.

Bronchitis extending to the minute tubes, is, on the other hand, a disease of great danger. It may be fatal at any period of childhood, but the younger the patients and more feeble, the greater the proportion of deaths. Under the age of one year, it is one of the most fatal diseases of early life.

The prognosis, in the commencement of all cases of bronchitis of average severity in the young child, should be guarded, on account of the tendency of the inflammation to extend, as has been already stated in the preceding pages. After five or six days extension ceases, and, if during that time no increase in the severity of symptoms occurs, the prognosis is favorable. Signs which indicate an unfavorable result are increasing frequency of pulse and respiration, difficult and scanty expectoration, restlessness, a countenance expressive of suffering, and a progressively greater accumulation of mucus in the bronchial tubes, as determined by auscultation. Pallor and coldness of the face and extremities, lividity of the tips of the fingers, rapid and feeble pulse, drowsiness, diminution of cough, while the mucus and pus accumulate in the bronchial tubes, and, in young children, intermissions in the respiration, indicate the near approach of death. Cases may, however, recover by proper treatment, although the symptoms are most unfavorable.

It is unnecessary to mention the favorable prognostic signs of bronchitis. This disease, when fully established, continues a certain number of days, whatever remedial measures are employed, and, if the symptoms do not increase in severity during the first five or six days, a favorable result is highly probable. The prognosis in chronic bronchitis is ordinarily favorable, so far as life is concerned, provided that no emaciation occur. If there be emaciation, the bronchitis may be due to tubercles in the bronchial glands or lungs, and, of course, the prognosis is unfavorable.

Treatment.—Bronchitis may be rendered much milder, and perhaps even prevented, by an emetic employed in the first twelve or twenty-four hours, in conjunction with a warm bath. The physician is not, however, ordinarily called sufficiently early to render this treatment effectual. The remedial measures proper for this disease vary greatly, according to the stage and intensity or extent of the inflammation and the age of the patient. Bronchitis, *limited to the larger tubes*, requires simple measures. A laxative may be employed, with a mild expectorant, and moderate counter-irritation should be produced by camphorated oil, or the occasional employment of a sinapism. I have sometimes ordered for these cases a mixture recommended by Dr. James Jackson, of Boston, in his letters to a young physician. "For young children," . . . says he, "I employ the following: Take of either almond or olive oil, of syrup of squills, of any agreeable syrup, and of mucilage of gum acacia, equal parts, and mix them. Of this mixture, a teaspoonful may be given to

a child at two years of age ; a little less if younger, and increased if older, so as to double the dose to one in the sixth year. This may be given from three to six times in the twenty-four hours. Sometimes a little opiate must be added at night to appease an urgent cough." These cases also do well with simple mucilaginous drinks in conjunction with gentle aperients.

Bronchitis, *extending* beyond the primary or secondary bronchial divisions, requires more careful watching and more decided measures. The abstraction of blood by leeches, or otherwise, is seldom required in the treatment of bronchitis. Occasionally, if the inflammation be intense and the symptoms urgent, moderate abstraction of blood at an early period might perhaps be useful, but the employment of cardiac sedatives, as aconite or digitalis, under such circumstances is generally preferable.

As a rule, actively depressing agents should be avoided in the treatment of bronchitis in patients under the age of two years ; and, on the other hand, sustaining remedies are in a large proportion of cases required after the first two or three days. Many infants with bronchitis are sacrificed in consequence of the old theory, which still influences medical practice, that an inflammation, with its increased force of circulation, is necessarily best controlled by depletory and sedative measures. Remedies too depressing are prescribed, and with a less favorable result than would follow the use of sustaining measures or even a strictly expectant course of treatment.

What is, therefore, the proper mode of treating bronchitis, severe or of ordinary gravity, occurring in infancy and childhood ? It is supposed that the physician is called when the inflammation is fully established, or that, if he have seen the patient at the commencement, and have prescribed an emetic, it has failed to throw off the disease. A large emollient poultice not thicker than the cover of a book, so wet as to produce constant moisture of the surface, and sufficiently irritating to produce constant redness without necessitating its removal, should be applied to the front, sides, and back of the chest, and over it an oil-silk jacket placed. I prefer a poultice of the following :

℞. Pulv. sinapis, ʒ ss ;
Pulv. semin. lini, ʒ viij. Misce.

Local treatment in bronchitis is very important. The exact mode of applying it, or the substances used, matters little, provided that it meets the indication, which is twofold—namely, derivation to the surface, and the application to it of warmth and moisture. Such applications are found, by experience, to give most relief. Warmth and moisture are furnished by cataplasms most conveniently, or by warm-water applications under oil-silk. Instead of the sinapised poultice, it is better for infants under the age of six months to apply a light flaxseed poultice with camphorated oil smeared over its under surface.

Derivation to the surface, early made and repeated, tends to check the downward extension of bronchitis ; but it is not advisable to vesicate, or to produce anything more than moderate and continued redness. Often improvement in symptoms is observed, especially less dyspnœa and restlessness, immediately on the employment of the local measures recommended above. If the bronchitis have that severity that there is a decided febrile movement, accelerated respiration or pain on coughing, this external treatment should in my opinion always be employed, but if the disease be so mild that these symptoms are absent the case will probably do well without it. The internal treatment appropriate for bronchitis varies according to the age of the patient and the character of the inflammation, whether it be primary or secondary. The following formulæ will be found useful :

℞. Ammon. carbonat., gr. viij ;
Syr. bal. tolut., ʒ ss ;
Aquæ, ʒ iss. Misce.

Dose, one teaspoonful every two or three hours for an infant of three months.

Instead of the carbonate, twice its quantity of muriate of ammonia may be prescribed.

Infants of this age usually require also alcoholic stimulants, as six or eight drops of brandy every hour or two.

℞. Spts. æther. nitr., ʒ j ;
Syr. ipecacuanhæ,
Ol. ricini., āā ʒ ij ;
Syr. bal. tolut., ʒ j. Misce.

Dose, one teaspoonful every two to four hours to an infant one year old with acute primary bronchitis.

℞. Syr. ipecacuanhæ, ʒ ij ;
Potas. acetat., gr. xvj–ʒ ss ;
Syr. simplicis, ʒ xiv. Misce.

Dose, one teaspoonful to an infant of six months with acute primary bronchitis.

Medicines which exert a greater controlling effect upon the action of the heart than those which we have mentioned, are often required during the progress of severe bronchitis, namely, in those cases in which the patient is weakly, while the pulse is unusually rapid and temperature elevated. One or two drops of tincture of digitalis may be added as a heart tonic to each dose of the prescription for a patient of six months to two years. For children over the age of two years, whose previous health has been good, aconite is preferable as a cardiac sedative. The following will be found a useful recipe for a robust child of five years :

℞. Tinct. rad. aconit., gtt. xvj ;
Syr. scillæ composit., ʒ ij ;
Syr. bal. tolut., ʒ xiv. Misce.

Dose, one teaspoonful from two to four hours.

The medicine should be omitted or given at a longer interval if the frequency of the pulse be reduced. I have nearly abandoned the use of

veratrum viride for the bronchitis of children on account of its very depressing effect. If there be restlessness, Dover's powder, paregoric, or syrup of poppy should be administered with the expectorant mixture or separately. Squibb's liquid Dover's powder, the tinct. ipecac. comp. is a useful and convenient remedy to procure sleep in these cases. It may be given to an infant of one year in one-drop doses. Agents more depressing than ipecacuanha should not be administered to infants under the age of six months, even in the commencement of acute bronchitis.

The effect of the stronger cardiac sedatives, as aconite and veratrum viride, in the bronchitis of children, should be carefully watched. In general they should be administered only during the first three to five days ; but if the child be robust, with full and strong pulse, they may be continued longer. In many cases of primary and secondary bronchitis during its active period, quinine administered with or without digitalis, is an invaluable remedy, as a substitute for aconite or veratrum viride. Like those agents, it diminishes the temperature and the frequency of pulse, while it acts as a general tonic and preserves the strength of the heart's contractions. This effect of quinine, which has only in recent years been brought prominently to the notice of the profession, and is now accepted as a valuable fact in therapeutics, indicates an important use for this agent in several of the most common and severe diseases of children, as bronchitis, pneumonitis, scarlatina, and diphtheria. While it may not reduce the frequency of the pulse as quickly as aconite, or to the same extent, it has in my practice been equally effectual in reducing the temperature. As many as six or eight grains may be administered daily in divided doses to a child of two or three years. If this agent be properly administered, and the dose reduced as the fever abates, cinchonism, at least so as to be injurious, seldom occurs. As the active inflammation begins to abate, simple expectorant mixtures may be given, as syrup of squills or ipecacuanha in spiritus Mindereri. At this stage of bronchitis, it is usually best to commence the use of stimulating expectorants, and they are required in nearly all cases of advanced bronchitis. In secondary forms of the disease, as when it occurs in connection with hooping-cough or measles, such expectorants should be employed from the first ; and also if there be a state of feebleness or cachexia, although the bronchitis be primary. The following will be found useful prescriptions, the digitalis being employed, as it is the best heart tonic with which we are acquainted, reducing the frequency of the heart-beats while it gives them more force :

℞. Tinct. digital., gtt. xij ;
Ammon. muriat., ʒ ss ;
Syr. bal. tolut.,
Aquæ, āā ʒ j.

Dose, one teaspoonful every two hours to a child of one year.

℞. Ammon. carbonat., gr. xvj–xxiv ;
Tinct. digital., gtt. xxiv ;
Syr. senegæ, ʒ ij ;
Ext. glycyr., ʒ ss ;
Aquæ, ʒ xiv. Misce.
Dose, one teaspoonful every two or three hours to a child of two years.

During convalescence the medicine should be administered less and less frequently, or in smaller doses. Emetics in ordinary cases of bronchitis are not required, except in the commencement. In severe bronchitis, however, especially when the smaller tubes are inflamed, they sometimes appear to be useful. The cases which justify their administration are those in which mucus and pus collect in the tubes more rapidly than they are expectorated, so as to give rise to urgent dyspnœa. An emetic administered under such circumstances may give prompt and decided relief. The object to be gained is obviously very different from that in the commencement of bronchitis, and such agents should be employed as act promptly, with the least possible depression. Turpeth mineral or sulphate of copper is, then, the proper emetic. The former may be given in a dose of three grains ; the latter, of one or two grains to a child five years old. If there be considerable strength of pulse and heat and dryness of surface, ipecacuanha may be administered. If there be evidences of exhaustion stimulants may be prescribed immediately before and after emesis. Infants oppressed by the accumulation of mucus and pus may sometimes be relieved by tickling the fauces with the finger. This provokes vomiting, and the viscid mucus which collects at the entrance of the glottis is removed by the finger.

In secondary bronchitis, whatever the age, in primary or secondary, occurring in infants or feeble children, the diet should, as a rule, be nutritious through the entire disease. Robust patients, or those who have had ordinary health, if over the age of two years, and affected with primary bronchitis, should have light diet, chiefly farinaceous, in the first days of the attack, after which animal broths are proper. Whatever food is given in severe bronchitis must be in the form of drinks, since the appetite is lost, while the thirst is such that liquids are less likely to be refused.

In primary bronchitis, if mild or of ordinary severity, alcoholic stimulants are not required. In secondary bronchitis they are often needed, and also in severe primary bronchitis, if there be dyspnœa with evidences of prostration. The occasional loose cough which is often present during the period of convalescence requires but little treatment ; either no medicine or a gently stimulating expectorant may be given.

CHAPTER V.

ATELECTASIS.

In certain new-born infants the lungs do not undergo inflation, or only a portion of the lobules are inflated, to wit, those in the upper lobes, while the remainder of the organ continues unchanged from the fœtal state. This non-inflation of the lung is designated congenital atelectasis. It is not due, unless in rare instances, to any defect or vice in the respiratory apparatus, for at the autopsies of cases which have ended fatally, as most cases do, at an early period, insufflation is easy, there being no occlusion of the air-passages, nor unusual adhesion of the walls of the alveoli to prevent the admission of air. Physicians have believed that in some instances they discovered the cause in an enlarged thymus gland, which compressed the lower part of the trachea, but this cause, in my opinion, does not exist or is exceptional, for although the thymus at birth is large, having nearly the size of an unexpanded lung, it has not seemed to me to be unduly enlarged in most atelectatic cases which I have examined after death.

The ordinary proximate cause of atelectasis neonatorum is feebleness of inspiration, whether due to general debility, as in infants born prematurely, or weakened by placental hæmorrhage in the last months of fœtal life, or, as is frequently the case, to injury of the brain and consequent impairment of the function of the pneumogastrics during birth. I have more fully treated of this form of atelectasis in the chapters which relate to the maladies incidental to the birth of the child, and to these the reader is referred.

Acquired Atelectasis, or collapse of lung, is less extensive than congenital atelectasis, being confined to a portion of a lobe, and often to only a few lobules. It occurs chiefly during the period of infancy and in feeble children. It is a common malady, in foundling asylums, in wasted infants who perish before the close of the first year. I have frequently at the autopsies of such infants observed it along the thin inferior margins of the lower lobes, and in the tongue-like prolongation of the left upper lobe. In this class of cases, catarrh of the bronchial tubes appears to have little or no agency in causing the collapse. The cause is found in the impaired functional activity of the lungs. In the state of debility the heart beats feebly and the stream of blood from it to the lungs is small and slow, so that the inspiration of a small amount of air suffices for its decarbonization. The inspirations also are seen to be feeble, causing little ex-

pansion of the walls of the thorax. Consequently the entire lung is imperfectly inflated, as is seen in fatal cases, but the distant thin portions of the organ are least expanded. These receiving little or no air, soon begin to contract from the presence of the elastic tissue, and collapse or atelectasis ensues.

This has been the most common form of atelectasis in cases of this malady, which I have observed in foundling asylums, and it probably occurred in the manner which I have described.

Another cause of acquired atelectasis to which all writers allude is bronchial catarrh, which commencing in the larger tubes extends downward into those of smallest size. By the swelling of the mucous membrane, and the accumulation of viscid muco-pus which cannot be expectorated, certain of these tubules become occluded, so that the inspired air is shut off from the alveoli situated beyond them. Occlusions are obviously most apt to occur in the bronchitis of feeble infants, whose cough has little expulsive force, so that debility is also a factor in the production of this form of atelectasis. The portion of lung withdrawn from the respiratory function soon collapses, the air which it contained being probably in part expired, but chiefly absorbed.

Atelectasis is not, however, so important or frequent a complication of bronchitis as was formerly supposed, for catarrhal pneumonitis due to extension of the inflammation from the bronchioles into the lung has been mistaken for it. Solid non-crepitant nodules or portions of lung are frequently observed at the autopsies of infants who have perished of severe bronchitis, and these may be atelectatic or pneumonic, but they have in my observations been more frequently the latter than the former.

The possibility of insufflating these solid portions when removed from the body after death, was till within a few years regarded as the decisive proof of atelectasis. But this is now known to be no test, since a lung solidified by recent catarrhal pneumonitis can be almost as readily inflated as that which is collapsed. Nevertheless, the inflated pneumonic lung is more solid and resisting when pressed between the thumb and fingers than is the collapsed lung. The decisive proof is afforded by the microscope, by which cell-proliferation is discovered within the alveoli in catarrhal pneumonitis, while it is lacking in simple collapse. An increase of the dyspnœa not infrequently occurs in severe infantile bronchitis, without either pneumonia or collapse from the accumulation in the bronchioles of the secretion which is with difficulty expectorated, but if dulness on percussion and other physical signs indicate solidification of the lung at some point, of course pneumonia or collapse has occurred. If a sufficient amount of lung be involved to produce well-marked physical signs the disease is in most instances pneumonia and not collapse, though it may be the latter. Both these pathological states may, however, occur in the same lung as complications of severe bronchitis. The severe paroxysmal cough of per-

tussis, especially when accompanied by considerable secretion, is apt to produce collapse of portions of the lower lobes, while it causes emphysema in the upper lobes.

Symptoms.—Atelectasis resulting from bronchitis gives rise to no new symptoms. So far as it has any appreciable effect it aggravates certain symptoms of the primary disease, but as it is ordinarily limited to a small area this effect is not very marked. When a bronchial tube is so occluded by muco-pus that the alveoli with which it communicates collapse, there is ordinarily, at the same time, more or less accumulation of this secretion in other tubes throughout the lungs. Therefore, the entrance of air into the alveoli with which these tubes communicate is slow and difficult, but usually without complete obstruction, and without true atelectasis, but with a semi-collapse such as we observe in fatal croup. This explains the dyspnœa which is present in these cases. If the secretion be expectorated from these tubes the dyspnœa abates, even if the plug which has completely occluded a tube and the consequent atelectasis remain.

Atelectasis occurring in wasted and feeble infants, in consequence of the diminished force of the inspirations, does not in most instances give rise to any prominent symptom, since it occurs chiefly in distant thin portions of the lungs. I have observed an occasional short, nearly painless cough in such infants, when the autopsy revealed no pulmonary lesion except the atelectasis.

Anatomical Characters.—The portion of lung which is affected with recent atelectasis has a dark-brown or dark-bluish color. It is depressed below the general level of the lung, is firm and non-crepitant on pressure, and its incised surface is smooth. Hyperæmia supervenes, for a portion of lung in which the circulation continues, but from which air is excluded, becomes congested. In acquired atelectasis the congestion is especially marked, since the vessels which have been adapted by growth for a larger area are compressed into one of smaller extent, so that they become tortuous and bulging within the lumina of the alveoli, while the free flow of blood through them is retarded by the constriction of the elastic fibres of the lung. An obvious and certain result of the hyperæmia is the transudation of serum into the alveoli, producing œdema. This union of pulmonary hyperæmia with œdema by which air is excluded from the alveoli constitutes the state known to pathologists as splenization, and in proportion as it occurs the lung depressed by the atelectasis rises toward the general level. It may even rise above it, and it now has a doughy elastic feel. The pathology of these œdematous atelectatic spots, heretofore obscure, has been clearly explained by Rindfleisch.

If the patient live, and the atelectatic lobules do not soon return to a state of health, they undergo further changes. Rindfleisch says: "From the series" (of changes, provided inflammation do not occur) "we especially render prominent two conditions, *inveterate œdema* and

slaty induration. But inflammation does commonly occur after a time in a collapsed lung." Those who are familiar with the post-mortem examinations of infants will fully agree with Rindfleisch when he says: "Splenization, quite generally taken, appears to present extraordinarily favorable preliminary conditions for the occurrence of inflammatory changes. It may directly represent the initial hyperæmia of acute inflammation, and be followed by lobular and lobar, but constantly catarrhal infiltrates." It is well known by pathologists that protracted congestion, active or passive, of whatever organ or tissue, is very apt to pass from a state of simple stasis of blood to one of cell-proliferation, and the atelectatic lung, as I have myself observed at autopsies, affords a common example of this. I have several times made or have procured microscopic examinations of the atelectatic portions of lungs of infants who had died, for the most part, in a wasted and enfeebled state, and have found in them clear evidence of the presence of a catarrhal pneumonia. The interesting fact, therefore, must be recognized, that atelectasis frequently passes to a state of inflammation, so as to present the characters of ordinary hypostatic pneumonia, and no doubt undergo the same subsequent changes.

Atelectasis, when recent and simple or uncomplicated, may soon disappear by the expectoration of the obstructing secretion, if such be present, or if there be no obstruction, by increased force of inspiration. If it do not soon disappear it undergoes one of the ulterior changes alluded to above, and henceforth the symptoms and history are those of the new malady which has supervened.

Treatment.—The treatment of acquired atelectasis is simple. If it be recent and there be evidence that it is due to the accumulation of the secretion in the bronchial tubes, an emetic, which acts promptly and with the least possible depression, may be very useful. It is especially indicated if there be little or no pneumonia, the strength not greatly reduced, and there be dyspnœa with insufficient decarbonization of blood in consequence of the abundance of the secretion in the smaller tubes. An emetic which acts promptly and with little prostration may aid greatly in establishing the respiratory function in collapsed lobules, by expelling the obstruction, and producing a freer and deeper inspiration. One of the best if not the best emetic for this purpose is sulphate of copper, given in a dose of one to two grains to a child of one year. With or without the use of the emetic our main reliance must be on sustaining and stimulating measures, by which the cough, the cry, and the inspirations acquire more volume and force. Most cases require alcoholic stimulants and the ammonium carbonate. Rubefacient applications to the chest are also commonly employed, and are probably useful.

CHAPTER VI.

PNEUMONITIS.

In children over the age of three years, pneumonitis differs but little in form or phenomena from that of the adult, being ordinarily primary except as it depends on an irritant, as tubercles, and extending rapidly over one or more entire lobes. In those under the age of three years it is, on the other hand, as a rule, a secondary affection, and limited to a part of a lobe. Most writers, until recently, have classified cases according to their origin as primary and secondary, or their extent as lobar and lobular, or their duration as acute or chronic. A better classification, having an anatomical basis, is that into catarrhal, croupous, and interstitial.

Catarrhal pneumonitis consists in an inflammation of the air-cells, with an abundant proliferation of epithelial cells within them, and the exudation of serum, but not of fibrin. The secondary and lobular pneumonitis of young children, alluded to above, is usually of this character. *Croupous* pneumonitis consists also in an inflammation of the alveoli, but with an abundant formation of pus-cells within them, and the exudation of fibrin and serum. The lobar and primary pneumonitis of advanced children and adults is commonly of this character. In both catarrhal and croupous pneumonitis, therefore, the solidification of the lung and exclusion of air are due mainly to the newly formed cellular elements with which the alveoli are filled, though the source and nature of these cells differ in the two diseases. *Interstitial* pneumonitis consists in an inflammation and hyperplasia of the connective tissue of the lungs. It is the chronic pneumonia of authors, resembling in many respects, in its anatomical and clinical characters, cirrhosis of the liver. The inflammation which produces this result is subacute, and in nearly all cases is dependent on some persistent local disease in the minute bronchial tubes or lungs, as softened or cheesy tubercles, cancer, abscesses, protracted inflammation of the alveoli or bronchioles, whether produced by the inhalation of dust of an irritating nature or other cause. Interstitial pneumonia is much more rare in children than adults, and, as it presents no peculiar features in them, it need only be alluded to in this connection.

Causes.—*Croupous* pneumonitis in most cases results from that common cause of inflammations—namely, taking cold. It commences as a primary disease within a few hours after exposure. *Catarrhal* pneumonitis, in exceptional instances, also commences abruptly as a primary disease from the same cause, but being, probably in nine cases out of ten,

secondary, it commonly results from antecedent pathological states, which we will enumerate.

First. Many cases result from bronchitis. The inflammation extending downward engages the minute bronchial tubes, and from them traverses the alveoli of one or more lobules. This is the broncho-pneumonia of children described by authors; it occurs most frequently between the ages of six and eighteen months.

Secondly. Hypostasis, or passive congestion, is an important factor in the causation of many cases, and in feeble infants it is not infrequently the sole cause. Infants with feeble health and languid circulation, lying in their cribs day after day with little movement of the body, are very liable to passive congestion of the depending portions of their lungs, and this by and by eventuates in a cell-proliferation within the alveoli—in other words, a pneumonia presenting some peculiarities, but of the catarrhal form. In foundling hospitals, where feeble infants are received and treated, this is one of the most frequent pathological states, and is the prevailing form of pulmonary inflammation. It is sometimes described as hypostatic pneumonia. Hence physicians, whose observations have been largely in such institutions, have almost ignored any other form of pneumonia in infants. Billard, a close and accurate observer, wrote nearly half a century ago: "Pneumonia of infancy presents peculiar characters, in which it differs from the same affection in adults. Instead of being an idiopathic affection arising from irritation developed in the pulmonary tissue under the influence of atmospheric causes, which often excite the disease, the pneumonia of young infants is evidently the result of a stagnation of blood in their lungs. Under these circumstances this blood may be regarded as a kind of foreign body. . . . . It would, therefore, appear that inflammation of the lungs, which produces hepatization, arises in infants, in general, from some mechanical or physical cause." Valleix also states that he found the lesions of pneumonia in a majority of the infants who died in the Hôpital des Enfants Trouvés. The statements of Valleix are applicable also to the Infants' Hospital, and Nursery and Child's Hospital, of this city, as regards those cases in which death results from chronic disease. We shall see hereafter that hypostatic pneumonia is one of the most common complications of chronic infantile entero-colitis, the summer complaint of the cities.

Thirdly. Catarrhal pneumonia of infants sometimes results from collapse. It is not unusual to find, at the autopsies of infants who have died in a state of emaciation and feebleness, portions of the lungs remote from the bronchi collapsed, as, for example, the thin edges of the inferior lobes, and the tongue-like process of the upper lobe, the process which lies over the heart. The immediate cause of the collapse has been a bronchitis, or it has resulted directly from the general weakness of the infant, and its feeble respirations. Now, a collapsed lung soon becomes

affected by passive congestion. The functional activity of an organ favors circulation through it, and if the function be abolished the flow of blood in the part is retarded, and stasis more or less complete results. The hyperæmic state of collapsed pulmonary lobules presents the same anatomical condition, for the supervention of pneumonia, as occurs in cases of hypostatic congestion. Consequently, cell-proliferation soon begins in the collapsed alveoli, the volume of the affected lung increases, and it becomes firmer and more resisting to the touch, and the microscope reveals the characters of a subacute but genuine catarrhal pneumonitis. I have made or have procured microscopic examinations of a considerable number of such specimens, and have found the alveoli more or less filled with cells of the epithelial character. (See article Atelectasis.)

In rare instances in infancy and childhood pneumonitis results, as it more frequently does in the adult, from an embolus detached from a clot, which had formed in some remote vein, in consequence of arrest of circulation in it, by inflammation of the contiguous tissues. This is described by writers as a distinct form of pneumonitis, designated embolic or embolismal. A specimen showing this mode of causation was exhibited by me at the New York Pathological Society, in February, 1868. An infant, born January 22, 1868, of strumous parents, had been fretful, but without appreciable ailment till February 3d, when inflammation of the connective tissue occurred on the anterior aspect of the left leg, a little below the knee. This extended downward, suppurated, and the pus was evacuated February 5th. In the mean time three other similar inflammations occurred, two on the right foot and leg, and the other over the parietes of the chest in the right infra-mammary region. Suppuration occurred in all of these.

Fig. 24.



On February 8th this infant was suddenly seized with extreme dyspnœa, and died in a few hours. Numerous minute puriform collections (formerly called metastatic abscesses) were discovered in each lung, most of them scarcely larger than a pin's head. One of them on the right side in the middle lobe connecting with a bronchial tube had ruptured into the pleural cavity, causing pneumothorax, collapse, and incipient pleuritis.

The annexed figure exhibits the microscopic appearance of this softened fibrin, which, to the naked eye, so closely resembled pus.

On account of the speedy death, the emboli had produced in the lobules where they had lodged little more than congestion or the first stage of pneumonitis around them. Had the infant lived longer, doubtless the ferments or the vibriones, which some consider the irritating element of emboli, would have caused a greater amount of pneumonia.

Anatomical Characters.—Nothing need be added in this connection to what has already been said, in reference to interstitial and embolismal pneumonias. Being comparatively rare in children, they present the same anatomical characters as in the adult. That unimportant form of pneumonia called pleurogenous, and which consists in a croupous inflammation of the superficial infundibula of the lung underneath an inflamed pleura, occurs in children as well as adults. Being secondary to the pleuritis, and produced by extension of the inflammation of the pleura, it gives rise to no appreciable symptoms, on account of its slight extent, and as it presents no peculiar features in the child, it need only be alluded to.

Croupous pneumonitis, which we have stated is the ordinary form of pulmonary inflammation in children over the age of five years, has the same anatomical characters as in the adult. It ordinarily involves an entire lobe. It is more frequent in the right than left lung, and in whichever lung it occurs its most frequent seat is the lower lobe. The inflammation may, however, be limited to an upper lobe, especially on the right side. It ordinarily commences near the root of the lung, and extends forward.

Croupous pneumonitis presents three stages, that of congestion, red hepatization, and gray hepatization. In the stage of congestion the capillaries in the walls of the alveoli are greatly distended, bulging forward in loops within the alveolar spaces so as to diminish them, and a viscid albuminous fluid begins to exude, in which points of extravasated blood appear. The affected lung in this stage has a deep-red color, its elasticity is greatly diminished, and its density and weight increased. On account of the reduced size of the alveoli from the bulging of the alveolar walls, and the viscid fluid within the alveoli and terminal bronchial tubes, the function of the affected lobe is nearly lost, and hence the dyspnœa which patients experience in the first stage of the inflammation.

The second stage is characterized by the continued and increased escape of the liquor sanguinis and red and white corpuscles through the stigmata or little apertures which exist normally in the walls of the capillaries. The inflamed alveoli and the minute bronchial tubes which terminate in them are filled with this pneumonic exudation. The relative proportion of the elements of the blood in the exudate varies in different cases. Fibrin is always present, immediately coagulating in delicate filaments within the interstices of which the corpuscles are lodged. The white corpuscles in some cases are much in excess of the red, while in others the red predominate. The lung in the second stage contains no air, has a greater specific gravity than water, is friable so as to be readily torn and penetrated by the finger. The torn surface in the adult presents a granular appearance, each granule being the contents of an air-cell. In

the child the granules are not distinct on account of the small size of the air-cells, but the volume of the inflamed lobe is somewhat increased as in the adult.

The stage of gray hepatization succeeds, in which the volume of the lung is still greater. The change of color is due partly to the compression of the capillaries by the inflammatory material, partly to the destruction of the red corpuscles, and disappearance to a greater or less extent of their coloring matter, while the white corpuscles (pus-cells) remain, but more to commencing fatty degeneration in the exudate prior to its liquefaction. In favorable cases the lung soon returns to its normal state, the liquefied substance which filled the alveoli being in part absorbed, in part expectorated.

Croupous pneumonitis often causes inflammation of the portion of the pleura which covers it. Pleuritis developed in this way is circumscribed, but it frequently extends beyond the inflamed parenchyma to the distance of one or two inches. Bronchitis is also a common accompaniment. It may be general, in which case it occurs independently, or be limited to the tubes lying within the inflamed lung, in which case it results like the pleuritis from the pneumonitis. It is seen from this description that the pus-cells which are produced so abundantly in the alveoli are believed to be chiefly exuded white corpuscles of the blood. Possibly some of them may be produced by proliferation of the epithelial cells, which line the alveoli, in the same manner as they are believed to be produced in the bronchial tubes.

Catarrhal pneumonitis, which is, as we have stated, for the most part the lobular pneumonitis of writers, and which, with an occasional exception, is the form of inflammation in children under the age of five years, presents not only clinical but anatomical features, which distinguish it from the croupous form of the disease. Those who have witnessed few post-mortem examinations of young children, and whose views of the lesion are influenced by the expression lobular, are apt to suppose that there is an alternation of inflamed and healthy lobules, so that the surface of the lung presents an appearance not unlike mosaic work. This is a mistake. Although an entire lobe is seldom inflamed, as in croupous pneumonitis, the inflammation commonly extends over more or fewer contiguous lobules, but we find certain lobules in the midst of the inflamed area which are but slightly affected or have escaped entirely. The extent of the inflammation is ordinarily from one to three inches, but I have seen a nodule of true catarrhal pneumonia not larger than a pea, while every other portion of the lung was healthy. On the other hand, almost an entire lobe may appear hepatized to the naked eye as in the croupous inflammation, but by a careful examination certain lobules will be found unaffected. Thus, in a case in the Nursery and Child's Hospital, in which death occurred at the age of one year from pneumonitis superven-

ing upon pertussis, an entire lower lobe, with the exception of a little of its anterior border, presented the appearance and feel of red hepatization, but a careful microscopic examination revealed not only the absence of fibrin in the exudate, showing the catarrhal nature of the inflammation, but also certain lobules in the midst of the inflamed lung which were not involved.

The first change occurring in a lung invaded by catarrhal pneumonitis is congestion, whether active, as in the common form of the disease, in which the inflammation has extended into the lung from the bronchioles, or passive, as when the inflammation results from hypostasis or collapse. An exudation of serum, but not of fibrin, follows, and soon the epithelial layer which lines the alveoli begins to swell. The nuclei of the epithelial cells divide, the cells themselves forming large round cells with vesicular nuclei. These cells, to which the solidification of the lung is mainly due, are, therefore, on account of their origin and appearance, regarded as epithelial. The alveoli in catarrhal pneumonitis, it is seen, are filled with an inflammatory product quite different from that in the croupous inflammation.

Inflammation of the pleura over the inflamed lung, so common in croupous pneumonia, and which gives it the name pleuro-pneumonia, by which it is sometimes designated, occurs less frequently in this disease. The seat of this inflammation is ordinarily the posterior part of the lungs, even when it results from extension of the inflammation from the bronchial tubes. When resulting from collapse, it affects chiefly those lobules which are remote from the bronchi, and which the air enters only by a long circuit.

Catarrhal pneumonitis, when it arises from extension of acute inflammation of the bronchioles, is acute, but in those forms of the disease which supervene upon passive congestion it is subacute. The alveoli are less distended by inflammatory products than in croupous pneumonia, not only from the absence of fibrin, but from a less amount of cells. Hence the volume of the inflamed lung is not so great as in that disease, and the torn surface, even in the adult, does not present a granular appearance. Hence, also, the stage of gray hepatization does not supervene so uniformly and regularly, since there is less compression of the capillaries in the alveolar walls, and the mutual pressure of the inflammatory product is less. In infants who have died with this form of pneumonitis, of six or eight weeks' duration, it is not unusual to find the affected lobules still in the stage of red hepatization. Cell-proliferation occurs in the bronchioles of the inflamed lung as in the alveoli, producing within them numerous plugs, which, though they obstruct the entrance of air, are not so firm as in croupous pneumonitis, since they are destitute of fibrin.

In favorable cases the lung affected by catarrhal inflammation returns to its normal state, probably by the same process as in croupous pneu-

monitis. In other cases, especially in scrofulous and feeble children, the inflammation, instead of resolving, passes into what is now designated cheesy, or by certain writers scrofulous, pneumonitis.

Cheesy Pneumonitis.—Cheesy degeneration of the inflammatory product occasionally occurs in the croupous form of inflammation, but it is more common in the catarrhal. I have most frequently observed it in New York during epidemics of measles, when this form of pneumonitis supervened upon the catarrhal bronchitis of that disease. Cheesy pneumonitis is in its nature chronic, and attended with great reduction of the vital powers.

Cheesy degeneration of the exudate or infiltrate consists essentially in the absorption of the liquid portion, and fatty degeneration of the solid. The obstruction of the circulation in the capillaries and the accumulation of cells in the alveoli and bronchioles which cannot be expectorated, are conditions which favor the cheesy metamorphosis. The appearance and consistence of the lung when it has undergone this change are well expressed by the term which is employed to designate it. The cheesy mass consists of fatty, shrivelled, and fragmentary cells, and amorphous matter, in which can be traced the elastic fibres and larger vessels of the parenchyma, the other histological elements having disappeared.

The caseous mass after a time softens, attracting moisture from the surrounding tissues. The molecular detritus and the shrivelled cells are now suspended in a liquid, and, like any dead matter, they are irritant to the surrounding lung-substance. The bronchial tube which supplies the affected lobule, and which in many instances was the starting-point of the disease, again becomes pervious, either by softening of the plug or by ulceration at a higher point upon its walls, and air is admitted, which promotes the putrefactive process and chemical changes of the caseous substance.

The lesion now described is that of pulmonary consumption, a disease not infrequent in children of two or three years. There are as yet no tubercles, but the presence of softening caseous material in the lungs very frequently leads to their development (see Art. Tuberculosis), and accordingly, before the case ends, clusters of tubercles may appear in the connective tissue and walls of the vessels of the lungs and in other organs.

In the subsequent progress of cheesy pneumonitis, if the patient live sufficiently long, there occurs more or less expectoration of the offending substance, producing a cavity. Around the cavity a vascular pyogenic membrane forms, upon which granulations arise. These granulations, which produce pus abundantly, and from which small extravasations of blood are frequent, are gradually transformed into connective tissue. If the dead portion be expectorated, and there be a single small cavity, the child may recover, the empty space being finally filled up by the extension of the granulations, and the production of a cicatrix, which contracts,

producing a puckered appearance. Ordinarily, however, there are several centres of caseous degenerations, and several cavities resulting, which continue to enlarge by the progressive softening of the cheesy matter. Often, also, certain of the cavities intercommunicate. The bronchial glands undergo hyperplasia, and certain of them are apt, also, to become cheesy. As the disease advances, the suppuration and expectoration increase. The fatal result occurs sooner in children than in adults, and, therefore, the lesions, destructive and inflammatory, observed at autopsies, are ordinarily not so far advanced in the former as in the latter. Other unfavorable changes may occur in the hepatized lung, but cheesy degeneration is the most common and noteworthy.

Whether it is possible to inflate a lung which presents to the naked eye the appearance of pneumonitis, has long been regarded as a reliable sign of the presence or absence of inflammatory consolidation. The facts as regards the possibility of insufflation are these : In croupous pneumonitis, when it has passed beyond the first stage, insufflation is impossible in the lung of the child as well as adult, with the utmost force of the breath. We produce emphysema in healthy portions of the lungs, while the inflamed area is not encroached upon.

On the other hand, in catarrhal pneumonitis, which we have seen is the common form of pulmonary inflammation in children under the age of three years, and in which there is less distension of the air-cells by inflammatory products, the lung can be inflated, except in protracted cases, but when fully inflated the solidified lobules can still be felt between the thumb and fingers. In protracted catarrhal pneumonitis, as well as in protracted collapse, which, indeed, may and often does become a pneumonitis, full inflation is impossible. Central portions still remain impervious to air. While, therefore, the possibility or impossibility of inflating a lung removed from an adult, and which presents to the naked eye the appearance of pneumonic solidification, is a valuable sign as indicating whether or not the disease be pneumonitis, this test is uncertain and unreliable when applied to the pulmonary lesions of children under the age of three years.

Symptoms.—Croupous pneumonitis commonly begins abruptly, or it is preceded for a brief period by symptoms of a cold. In the adult, the abrupt commencement is ordinarily with a chill. In the child, there is often a sensation of chilliness, but a distinct chill is not common. Convulsions sometimes occur in place of a chill. Catarrhal pneumonitis, being ordinarily a secondary disease, begins in a more gradual way, its symptoms being preceded by and associated with those of the primary affection.

The symptoms of acute pneumonitis, whether catarrhal or croupous, are the following : Anorexia, thirst, restlessness, elevation of temperature, acceleration of pulse according to the intensity of the inflammation and

the feebleness of the patient, flushed face, a countenance expressive of suffering, accelerated respiration, with an expiratory moan. These symptoms are constant in the acute inflammation unless of the mildest form. Those which are important I shall explain more fully.

The expiratory moan is described by writers as a pathognomonic symptom of this disease, or of pleurisy. It is evidently due to the pain experienced from the movement of the inflamed part. As a rule, the expiratory moan does indicate either pneumonitis or simple pleuritis ; but there are exceptions. It may occur, for example, from indigestible substances in the stomach and intestines, giving rise to acute dyspepsia ; or from certain forms of abdominal inflammation, which render movements of the diaphragm painful, as diaphragmatic peritonitis.

The cough in the first days of pneumonitis is often dry or hacking and painful. It afterward, if the case be favorable, becomes looser, and is painless. We very seldom observe in the child the bloody sputum which characterizes pneumonitis in the adult, since in catarrhal inflammation there is much less exudation of blood-corpuscles. The sputum, which in this form of the disease is the product of secretion and cell-proliferation, is at first thin and frothy, but afterward thicker and less tenacious from the increased number of cells. There is often, in the first period of the inflammation, pretty severe and constant headache, the patient complaining of the head, if old enough to speak, before he does of the chest. In a severe attack the child at this period lies with the eyes shut, apparently in a half-conscious state, fretful if spoken to or aroused, so that the physician might be led to suspect the presence of cerebral disease. If there be vomiting, accompanied with sudden twitching of the muscles, and convulsions—symptoms which sometimes occur—the liability to error in diagnosis is greatly increased. Cerebral symptoms are more prominent in the commencement of pneumonitis than subsequently. As the disease advances they subside, and symptoms referable to the chest become more conspicuous.

The breathing is, as I have said, accelerated. Thirty or forty respirations per minute are common, and, in severe cases, the number reaches sixty or even eighty. In infants there is greater frequency of respiration than in children. In those at the breast, if the dyspnœa be urgent, nutrition is sometimes seriously interfered with, since in these severe cases respiration is performed more through the mouth than nostrils, so that if the infant seize the nipple, it is forced to relinquish it in order to breathe. Dilatation of the alæ nasi, and depression of the infra-mammary region, accompany inspiration. The dyspnœa in catarrhal pneumonitis is often due in great part to accompanying bronchitis.

The temperature in mild cases of pneumonitis is elevated to about 101° to 103° ; in severe cases it may reach 105° or even 107°, the former being the highest observed by Mr. Squire. In ninety-seven observations

made by M. Roger, the average temperature was 104° during the active period of the inflammation. The face is therefore flushed, and the heat of surface pungent, except in weakly children, in whom, even in severe and active inflammation, the face is sometimes pallid, and the extremities of natural or less than natural temperature.

The tongue is moist, and covered with a light fur ; the thirst is such that nutriment may be given in the form of drinks, when the loss of appetite prevents the use of solid food. The bowels are usually constipated. The secretions, in the first and second stages, are diminished. The urine is more deeply colored than in health, and in vigorous patients it deposits urates on cooling. The chlorides are also deficient or absent from the urine, so long as the inflammation is extending.

In favorable cases, in from seven to ten days the heat and thirst decline ; the pulse and respiration gradually become less frequent ; the cough looser ; the features have a more placid or contented expression ; the appetite returns, and the patient is again amused by playthings. The improvement is progressive, but gradual. A slight cough is occasionally observed for two or three weeks after convalescence is fully established.

Death in the acute stage of the inflammation commonly occurs from asthenia. The pulse gradually becomes more frequent and feeble, the respiration more oppressed, and finally, near the close of life, the face and extremities become cool. Occasionally death results from apnœa, due in great part to coexisting bronchitis. In exceptional instances it occurs from convulsions, followed by coma, especially in the first week. In those protracted cases in which the inflammatory products have undergone cheesy degeneration death occurs from asthenia.

Such are the symptoms and progress of ordinary acute pneumonitis in children. When the inflammation is subacute, as in those forms of the disease which result from collapse or hypostasis, the symptoms are less pronounced. The respiration in such cases is but moderately accelerated, is attended by little pain, and therefore the expiratory moan is often absent. An occasional short, dry cough occurs, with so little increase of temperature and quickening of the pulse that the pneumonitis is apt to be overlooked by the physician, the symptoms being referred to bronchitis. Pleuritis seldom occurs in connection with this form of pneumonitis, except when a small abscess or gangrene results in an affected lobule directly under the pleura. A few such cases I have observed.

Tubercular pneumonitis extends over much or little of the lung according to the amount of tubercles. The symptoms are like those of severe primary pneumonitis, superadded to such as pertain to tuberculosis. This inflammation, when once established in the consumptive child, commonly continues till the close of life. I have sometimes had these cases under observation for several consecutive weeks, even months, and during

the whole time there was not only acceleration of pulse and respiration, but the expiratory moan. As regards pneumonitis occurring in hooping-cough, it is an interesting fact that its symptoms modify those of the primary disease, so that, during the active period of the inflammation, the paroxysmal cough diminishes, and a short, hacking cough and expiratory moan occur in place. As the inflammation abates, the spasmodic cough returns. Pneumonitis, occurring in measles, is more obstinate, protracted, and dangerous than the primary form. It usually commences about the period of the decline of the eruption, and, in favorable cases, continues two or three weeks. It is then a sequel, rather than complication.

Physical Signs.—The physical signs of pneumonitis in infancy and childhood are the same as in the adult, but in a large proportion of cases they are less distinct. In a majority of patients under the age of three years the crepitant râle is not observed. This is due to the small size of the alveoli at this age. I have now and then detected it in quite young children, in whom it is a finer râle than in the adult. If observed, it is, of course, positive proof of the existence of pneumonitis. The physical signs, therefore, in the first stage of the inflammation, are often obscure in consequence of the absence of the pathognomonic râle. The vesicular murmur is somewhat intensified through the chest, and there is in this stage slight dulness on percussion over the seat of the inflammation due to engorgement of the vessels, but it is difficult to appreciate this.

In the second stage, which supervenes more or less rapidly, the physical signs are more distinct. Bronchial respiration is in most cases detected, higher in pitch than the vesicular murmur, with the sound of expiration higher than that of inspiration. The voice of the patient is transmitted to the ear applied over the seat of the disease, and often a peculiar vibratory sensation is communicated to the hand applied over the part, so that it is possible to locate the disease by palpation alone. There are frequently, in the second stage, and sometimes in the first, coarse mucous râles in various parts of the chest from coexisting bronchitis.

Percussion, in the second stage, elicits a dull sound as compared with that produced on the opposite side of the chest. The dulness corresponds in extent with the solidification, and with the bronchial respiration.

As the inflammation abates, the dulness on percussion gradually diminishes, and the bronchial respiration is succeeded by the subcrepitant râle. Often, for a considerable period after convalescence is established, moist râles are observed in the chest, and sometimes the dulness on percussion does not entirely disappear till after the health is fully restored.

In catarrhal pneumonitis these signs are commonly less distinct than in the croupous form of inflammation. This is due in part to the limited extent of the inflammation, in part, in many cases, to its subacute character, and in part to the fact that it is apt to be double. When it results from hypostatic congestion it is nearly always bilateral.

Diagnosis.—It will aid in diagnosis to recollect that under the age of three years, pneumonitis is ordinarily catarrhal, and that it is preceded by and associated with bronchitis. Coincident with, and often preceding its development for a few days, are the usual symptoms of nasal and bronchial catarrh. Defluxion from the nostrils, and other symptoms due to "taking cold," help us to diagnosticate catarrhal pneumonitis from the essential fevers, with the exception of measles. Croupous pneumonitis begins more abruptly, but in this form of inflammation the greater extent of pulmonary solidification soon gives us clear and unmistakable physical signs. The various forms of so-called remittent fever bear considerable resemblance as regards symptoms to certain cases of pneumonic inflammation, but in the latter there is more acceleration of respiration, and greater suffering, especially when the child is disturbed, than in the former. The physical signs, however, afford the decisive proof of the nature of the malady, as dulness on percussion, bronchial respiration of a higher pitch and harsher than the normal vesicular respiratory sound, bronchophony, vocal fremitus, etc.

Difficulty sometimes attends the diagnosis of broncho-pneumonitis from simple bronchitis. The presence of the expiratory moan, if it be pretty constant and marked, affords evidence that the inflammation has extended to the lungs, but the physical signs constitute the reliable means of exact diagnosis. They should be carefully noted, in order to determine if there be some point of solidification.

Solidification gives rise to dulness on percussion, bronchial respiration, and bronchophony. These three signs coexisting afford sufficient proof of pneumonitis, unless there be tubercular consolidation or possibly collapse supervening on suffocative bronchitis. The history of the case aids in determining whether there be either of these diseases. Moreover, collapse occurs later after the attack commences than hepatization, and does not produce so distinct bronchophony or bronchial respiration as is observed in ordinary cases of pneumonitis.

Pleuritis with effusion may present physical signs which bear considerable resemblance to those in pneumonia ; but in pneumonia, except when associated with tubercular disease, the dulness on percussion is not so great as that from pleuritic effusion. In pleuritic effusion in a young child the respiratory murmur can often be heard with the ear applied over the liquid, but it is indistinct and transmitted through the liquid from a distance. The practised ear is able to discover the difference between it and the bronchial respiration of pneumonitis. Vocal fremitus, which is absent in pleuritic effusions, is another reliable sign of pneumonitis in children over the age of three or four years. In younger children it is indistinct. Occasionally the physical signs indicate the coexistence of the pulmonary and pleural inflammations.

In catarrhal pneumonitis it is often difficult to determine certainly the

nature of the disease, since the physical signs, if there be but little extent of inflammation, are absent or indistinct. I have often, in post-mortem examinations, found so small a part of the lung hepatized that it could not possibly have produced any appreciable dulness on percussion, bronchial respiration, or bronchophony. Such cases are apt to pass for simple bronchitis, and, practically, this matters little, since the treatment required by the two is not dissimilar.

Prognosis.—Primary pneumonitis, affecting only one lung, if properly treated, in most instances terminates favorably in children, and even in infants. If double, it is, as in the adult, much more serious, and in a large proportion of cases, fatal. Secondary pneumonitis, pneumonitis occurring in measles, hooping-cough, tuberculosis, or resulting from hypostatic congestion in the course of some exhausting disease, is, on the other hand, more frequently fatal. As death usually occurs from asthenia, the younger the child and more feeble the constitution, the greater the danger.

Unfavorable symptoms are a pulse becoming more and more frequent and feeble, pallor of countenance, inability of the patient to support the head, total loss of appetite, refusal to notice or be amused by playthings, absence of tears when crying—a symptom which the French writers have pointed out—and the appearance of pemphigus on the face or elsewhere.

Indications on which a favorable prognosis may be based are moderate acceleration of pulse, pneumonitis primary and limited to one side, ability to support the head or sit erect, being amused by playthings, etc.

Treatment.—The treatment of the two forms of pneumonitis, namely, catarrhal and croupous, the former occurring chiefly under the age of three years, and being secondary, the latter occurring in most patients over that age, require to be considered separately as much as do their symptoms and anatomical characters.

Catarrhal pneumonitis when developed from and upon a bronchitis, as it so often is, requires for the most part the continuance of the remedies which are appropriate for the primary disease. (See Art. Bronchitis.) But from the fact that it is secondary, and in children of a tender age, and since the danger as regards the pneumonitis is due to asthenia, more actively sustaining measures are demanded than might be required for the uncomplicated bronchitis. When the pneumonitis has continued a few days, and often in its commencement, carbonate of ammonium and alcoholic stimulants are needed, and the diet from the first should be nutritious. An opiate, as the compound tincture of ipecacuanha, should be added to the cough-mixture, if there be restlessness or insufficient sleep, and the external treatment recommended for bronchitis should be continued. In that form of catarrhal pneumonitis which is due to passive congestion or hypostasis, in the causation of which debility is an important factor, tonic and stimulating measures are still more imperatively required. Frequent change of position is useful in such cases.

In *croupous* pneumonitis, if seen at the commencement or within a few hours of the commencement, an emetic of ipecacuanha may be given, as recommended by Trousseau. This acts promptly as a cardiac sedative, diminishing somewhat the afflux of blood to the lungs, and moderating the inflammation. It should not be employed except at the period mentioned.

The abstraction of blood by leeches or otherwise has justly fallen into disrepute in the treatment of the inflammations of children, as it is too depressing. But while the application of leeches in catarrhal pneumonitis is very rarely admissible, on account of the tender age of the patient and the secondary character of the inflammation, they may be useful in robust children with croupous pneumonitis, if applied sufficiently early, namely, within the first twelve hours. Two leeches are sufficient for a child of five years. When solidification of the lung has occurred, the time for the abstraction of blood is past. But we have in aconite and veratrum viride efficient substitutes for bloodletting, which, by their sedative effect on the heart, diminish the exaggerated afflux of blood to the inflamed lung, and thus enable us to meet the indication of treatment in the first stage of the inflammation. It is important in all severe cases to preserve the blood and the strength, for the danger in the end is chiefly from asthenia. Aconite as a cardiac sedative in the treatment of children is safer than veratrum viride ; it is not necessary to watch its effects so carefully.

The following will be found a useful formula for a child of five years :

℞. Tinct. ipecac. comp. (Squibb's), gtt. xxxij ;
Tinct. rad. aconit., gtt. xvj ;
Syr bal. tolut ;
Aquæ, āā ℥ j.

Dose, one teaspoonful every three hours ; or the aconite may be given alone, dropped in sweetened water or syrup of tolu.

If bronchial respiration, bronchophony, and dulness on percussion are present, indicating the second stage ; in other words, if it appear from the signs that the inflamed lobe or lobes are hepatized, little benefit accrues from the further use of aconite or veratrum viride, and harm may result. In this stage the above prescription, with the aconite omitted, may be continued, or the following may be employed :

℞. Morph. sulphat., gr. j ;
Syr. ipecacuanhæ, ℥ ss ;
Syr. bal. tolut., ℥ iijss. Misce.

Dose, one teaspoonful every three hours to a child of five years.

The remarks made in reference to the use of quinia and digitalis for bronchitis apply with still more force to their use in both the catarrhal and croupous forms of pneumonitis. In secondary pneumonitis and primary occurring in feeble children these agents are in many instances preferable to any other medicine for the purpose of reducing the temperature

and pulse, since they produce this result without depression. They may be administered in these cases from the first day, and their use may obviously be continued longer than would be safe for aconite or veratrum viride.

From some observations recently made (1880–1881) in the New York Foundling Asylum, it seemed to us probable that quinine, given in one or two large doses at the commencement of acute primary pneumonitis, as five grains to a child of three years, exerted some controlling effect on the inflammation, perhaps even rendering it abortive, and that its subsequent use in smaller doses may yet supersede in great part that of aconite and veratrum viride.

When the inflammation begins to abate there is usually progressive improvement. Many now recover with simple mucilaginous drinks or mild expectorants for the accompanying bronchitis, as syrup of ipecacuanha or squills in small doses. Others require more sustaining measures, and for such carbonate of ammonium is pr ferable with, perhaps, quinia. In severe pneumonitis it is of the utmost importance to sustain the vital powers, even from the commencement of the inflammation. There can be no doubt that the great error in the therapeutic management of children with this malady has been the employment of medicines which reduce the strength when gentler measures or those of a sustaining nature were needed. Alcoholic stimulants are required sooner or later in most cases, at an early period in feeble children and in secondary forms of the inflammation. Infants may take three or four drops of Bourbon whiskey or brandy for each month of their age every two or three hours. The diet should be nutritious, consisting of milk, animal broths, and the like, unless during the first three or four days in robust children.

The bowels should be kept open, as an important part of the treatment of croupous pneumonitis in its first stages. A small dose of castor oil, Rochelle salts, or citrate of magnesium should be given if there be any tendency to constipation, and repeated from time to time if required. A saline aperient by its derivative and refrigerant effect in some cases obviates the necessity of employing cardiac sedatives. A laxative enema is preferable for a feeble child, and in most cases of secondary pneumonitis.

Local treatment is required in all cases ; counter irritation should be produced as soon as possible over the inflamed lobe, by mustard, iodine, or some stimulating liniment, and, except at the time of this application, the chest should be constantly covered with an emollient poultice, or with a cloth wrung out of warm water and covered with oil-silk. I prefer, however, the constant application, under the oil-silk, of the following poultice, made large but as thin as the cover of a book, and therefore light :

℞. Pulv. sinapis., ℥ ss ;
Pulv. semin. lini, ℥ viij Misce.

Vesication, in my opinion, very rarely expedites the cure or benefits the patient. The ordinary fly-blister should never be employed; and if it be thought best to vesicate, cantharidal collodion should be prescribed for this purpose. A safe, almost painless, and at the same time efficient, mode of applying this, is in spots as large as a ten-cent piece, half a dozen, more or fewer according to the extent of the inflammation, the skin of course remaining sound between them. This mode of application obviates the danger of producing a troublesome sore, which sometimes occurs in children from the ordinary mode of vesication.

In *cheesy* pneumonitis, which is always accompanied by anæmia, and great reduction of the vital powers, carbonate of ammonium with citrate of iron and ammonium equal parts, or cod-liver oil administered three times daily with two drops or more of syrup of iodide of iron, will be found useful, as is also quinine with iron. The patients require the most nutritious diet and alcoholic stimulants. In the local treatment of this form of inflammation vesication, even so mild as that by cantharidal collodion, should be avoided.

CHAPTER VII.

PLEURITIS.*

The term pleuritis or pleurisy is employed, in the following paper, to designate inflammation of the pleura, when not produced by extension of the inflammatory process from the lung, or by the irritation of tubercles upon or under the pleura. Catarrhal pneumonia, common in infancy; croupous pneumonia, common in childhood; and pulmonary tuberculosis, not rare in both periods in wasted and cachectic children, are ordinarily accompanied by pleurisy, arising consecutively to the lung disease, and limited nearly to the portion of the pleura which covers the affected lobes or lobules. But since in these cases the pleuritis is subordinate to and dependent on the graver diseases, and is comparatively unimportant, it does not require separate consideration. It is properly treated of in our books in connection with and as a part of those diseases. All other cases of pleuritic inflammation, although presenting wide differences in form and clinical history, are embraced under the general term *pleuritis*.

Pleuritis: its frequency.—Pleuritis was formerly supposed to be rare in young children. Even M. Barrier, of Lyons, the author of a creditable treatise on diseases of children, wrote as late as 1860: "Ainsi donc, en généralisant les faits de Vallieux et les nôtres, nous pouvons dire: que la pleurisie, depuis la naissance jusqu'à l'âge de six ans environs, ne constitue presque jamais une affection simple, unique et independante de la

* From the *New York Obstetric Journal*, 1880–1881.

pneumonie." But greater precision in the examination of cases, more accurate means of diagnosis, more knowledge of the nature of diseases, and more frequent autopsies have enabled the profession to correct this, as well as many other errors ; and it is now known that primary pleurisy is not infrequent in young children, even in infants. In asylums and hospitals for children, in which institutions the nature of diseases is more accurately ascertained than in private practice—for autopsies are made in the fatal cases—the frequency of pleurisy in its various forms : latent, sero-fibrinous, and purulent, is surprising to those whose knowledge of the disease has been acquired only through private practice. Thus, in the New York Foundling Asylum, in the seven months from April 1st to November 1st, 1879, while there were 35 cases of bronchitis, 21 of pneumonia, and 3 of tuberculosis, there were 11 clearly ascertained cases of pleurisy. There can be no doubt that many cases of this malady in young children are mistaken by good practitioners for other diseases, especially for pneumonia, or if the pleurisy be to a certain extent latent, for remittent or malarial fever, or fever due to intestinal irritation. I have records of several cases occurring in family and hospital or asylum practice, in which children perished with a wrong diagnosis, or without diagnosis, when the post-mortem examination revealed pleurisy, sometimes of long standing. Thus in one case of fatal empyema, commencing at the age of six months, and continuing several months, chronic pneumonia had been diagnosticated by physicians known to be thorough in their examinations, and usually accurate. In another case, which proved fatal at about the age of one year, the child, who lived in a malarial locality, had been for weeks under treatment for supposed malarial disease ; but in this case diagnosis was easy, for at my first visit, which was when the child was dying, there was decided dulness on percussion over the right side of the chest. In this case, the right lung was adherent to the ribs anteriorly and laterally, while posteriorly it was separated by pus, which crowded forward the organ, so that its posterior surface was concave.

In the wards of the institutions and in the crowded quarters of the poor, pleurisy appears to be more frequent than in families in comfortable circumstances. Its frequency varies, also, in different years, according to the presence and prevalence of its causes. Thus, during epidemics of scarlet fever, it is more common than at other times.

During several weeks immediately preceding May, 1874, when there was no unusual prevalence of the causes or conditions which give rise to pleurisy, I noted carefully the character of the sickness in 404 consecutive cases, under the age of twelve years, in private practice, and of these, two had primary pleurisy, or one half per cent. This is probably about the usual proportion of pleurisies in children in family practice, except when scarlet fever is prevalent.

I have preserved the records of 56 cases of pleurisy in children under the age of twelve years, most of them occurring in the institutions which I am attending, or have attended as physician, and the remainder in private practice. The statistics of these cases, embraced in the following table, are interesting, as showing the frequency of pleurisy, and pleurisy of the suppurative form, in young children. The large number of empyemas seen in the table does not, however, indicate the true proportion of suppurative to sero-fibrinous pleurisies, since protracted and stubborn cases, which are largely empyemas, are more apt to be brought to the institutions for treatment than are those of a milder and more manageable type. Thus, in the class of children's diseases in the Bureau for the Relief of the Out-Door Poor, a large percentage of the cases are empyemas which have resisted treatment elsewhere. Besides, pleurisy with little exudation is sometimes latent or so mild that it is overlooked or not diagnosticated, even by physicians who are thorough and careful in their examinations, and I do not doubt that such cases have occurred in the institutions and in my private practice during the time in which my statistics were collected.

AGE. 49 CASES.

UNDER 2 MOS.	FROM 2 TO 6 MOS.	FROM 6 TO 12 MOS.	FROM 1 YR. TO 3 YRS.	FROM 3 YRS. TO 6 YRS.	OVER 6 YRS.
3; all empyemas; one double.	15; nine at least empyemas; seven on right side, four on left side, four double.	2; both empyemas; one right, the other left.	13; eight right, five left. Exudation in some sero-fibrinous; in others purulent.	10; seven right, three left. Exudation in some sero-fibrinous; in others purulent.	6; five right, one left, one empyema.

CAUSES.—The common cause of primary pleuritis is the same as that of other idiopathic inflammations, namely, "taking cold." It is, therefore, most common in times of changeable temperature. Cachexia is an acknowledged predisposing cause, so that children whose blood is impoverished, whether from previous disease or from anti-hygienic influences, are more liable to this inflammation than those who possess a sound and vigorous constitution. From the operation of these two causes a larger proportion of cases occur among the children of the city poor than among those who are well nourished and who live in comfortable circumstances, since the cachectic and ill-cared for are not only more exposed, but are less able to resist noxious agencies.

Pleurisy is not rare in new-born infants, and its cause, when thus occurring, is not always apparent. It may sometimes be heedless exposure to cold or to currents of air by the nurse, and sometimes cachexia, espe-

cially when the inflammation is bilateral. The cause may perhaps sometimes be derived from the mother, since septicæmia and puerperal fever are admitted causes.

Billard, whose observations were made among foundlings in the Hospice des Enfants Trouvés, says : " Pleurisy is more common among young infants than is generally supposed ; it often appears without the lungs participating in the inflammation. I have seen several infants die immediately after birth from this affection." He relates two cases of double idiopathic pleuritis ending fatally at the ages of two and ten days (Diseases of Infants, page 419). Mignot, whose observations were made in the same institution, also records ten pleurisies, five of which were idiopathic, in 119 dissections of new-born infants (Maladies pendant le Premier Age).

Cases like the following are not infrequent :

In 1867, I made the post-mortem examination of a foundling who died in the New York Infant Asylum, at the age of about one month. On each side of the thorax, the pleura, costal and pulmonary, was uniformly injected, and a small amount of pus, not more than one drachm, was found in one pleural cavity, and a still less quantity of pus in the other, with little or no sero-fibrinous exudation. There was also pus at the root of each lung, lying not entirely upon the free surface of the pleura, but partly underneath it.

The fact of a double pleurisy without disease of the lungs, which might produce it, indicated a constitutional cause, but the nature of this cause was obscure.

One of the eruptive fevers, scarlatina, not infrequently produces pleuritis, occurring as complication or sequel. This result seems to be sometimes due to the altered state of the blood, resulting from the presence of the scarlatinous virus. In other instances, it is probably the result of the retained urea, consequent on scarlatinous nephritis, for pleuritis is a common complication of Bright's disease, due, it is supposed, to the irritating property of urea, which is excreted upon the pleural surface. Pleuritis, in young children, is sometimes also caused by the discharge into the pleural cavity of some morbid product, as pus, softened tubercle, or decomposed lung-tissue, which, from its highly irritating effect, causes intense and general inflammation of the pleura. I have observed several such cases.

Thus, in November, 1866, an infant of three and a half months died of pleurisy, occurring upon the left side. The left lung was firmly bound down by adhesions, so as to be reduced to about one sixth its normal size. On attempting inflation of this organ, when it was removed from the body, air escaped from a small opening in the middle of the upper lobe, and around this opening the lung-substance was of a dark-reddish color, softened and disintegrated. It seemed probable from the ap-

pearance that there had been hypostatic congestion, or perhaps pneumonia, in the posterior part of the lung, and that the loss of vitality and softening had occurred from the sluggish or suspended circulation in the part, and that the fatal pleurisy had resulted from a little of this decomposed tissue entering the pleural cavity.

A case having apparently a similar origin occurred in the New York Foundling Asylum in October, 1879.

An infant, aged five months and a half, became suddenly and severely sick with pleurisy on the right side, and died in five days. On opening the pleural cavity, air escaped. The record of the examination states: "In about the middle of the posterior surface of the lower lobe was an opening which admitted the tip of the little finger to the depth of one fourth to one third inch. The lung-tissue seemed to be disorganized, and of pultaceous consistence around the cavity. Through this cavity, which communicated with a bronchial tube, the air had escaped, which was noticed on opening the chest.

Occasionally we meet cases, especially in foundling asylums, in which the cause is different from the foregoing, but in some respects similar. An indolent pneumonitis occurs over a circumscribed area in the posterior part of the lung, whether from hypostasis or exposure to cold. Minute abscesses occur in the inflamed parenchyma, not larger than pins' heads or small shot. Perhaps they are located in bronchioles, and are produced by the accumulation of muco-pus which collects in these tubes, and is not expectorated on account of the low vitality and feeble functional activity of the tissues concerned. These abscesses approaching the pleural surface produce a circumscribed pleuritis of small extent; and finally one, probably in some sudden movement of the lungs, as in crying or coughing, breaks into the pleural cavity, causing general purulent inflammation. The following was such a case:

In May, 1859, a male infant, aged two months, was admitted into the Nursery and Child's Hospital. He was delicate, and had what was diagnosticated a mild bronchial catarrh; but by wet-nursing his general condition gradually improved. In July, however, he had repeated attacks of diarrhœa, and progressively lost flesh and strength. On August 3d his respiration became suddenly accelerated and painful, and death occurred from dyspnœa and exhaustion. No cough or other symptoms referable to the respiratory apparatus had been observed previously to the day of death.

At the autopsy the intestines were found to present the usual lesions of intestinal catarrh of the summer season. The right lung was compressed by a sero-fibrinous exudation, though, from the small size of the pleural cavity, the quantity of exuded liquid was not more than two ounces. Nearly the entire right pleura, visceral and parietal, was covered with fibrin of a creamy appearance, and there were loose flocculi in depending portions of the cavity. This lung could be inflated, except a little of the lower lobe which was hepatized. The left lung also occupied a very small space, being partially collapsed. It could be readily inflated, when it ap-

peared normal, except a small portion in the posterior aspect of the lower lobe, which was partially covered with lymph, and was found to contain two abscesses, one closed and the other opening externally on the surface of the lung, and connecting internally with the bronchial tube. On attempting inflation, air passed directly through this opening. The closed abscess contained from one third to half a drachm of pus and disintegrated lung-tissue, as shown by the microscope.

Another case showing a similar cause of pleurisy occurred in a female infant of about four months, in the same institution, in November, 1869.

She was admitted in October, somewhat reduced from diarrhœa, but her health improved partially, though she remained feeble, and the records state that she was much troubled with meteorism and occasional pain. On November 2d, she was suddenly seized with great dyspnœa, and died in about fifteen minutes. No cough had been noticed or other symptom referable to the chest, but there can be little doubt that the occasional symptoms of pain, referred to in the notes, were due to the pleurisy. The body was much emaciated, and depending portions showed hypostatic congestion ; right lung adherent to diaphragm and to a considerable part of the costal pleura by fibrinous exudation ; this lung was somewhat compressed and non-crepitant ; its upper lobe floated in water, while its middle and lower lobes sank, and could be only partially inflated ; this portion of the lung contained a few small superficial abscesses, each holding scarcely more than one drop of pus ; two of these were empty, and air passed through them on attempting inflation. They probably one or both opened into the pleural cavity during life, but possibly they were opened in separating the adhesions which united the two pleural surfaces at this point ; the pleural cavity contained from two to three ounces of liquid, consisting mainly of pus and fibrinous shreds.

A similar case occurred in the New York Foundling Asylum, in October, 1879.

The patient, aged four months, began to be sick October 11th, having the characteristic symptoms, and died October 15th. The right pleural cavity contained about ʒiii of sero-purulent liquid, pressing the lung forward and toward the median line. In the posterior surface of the right lower lobe, near its base and immediately under the pleura, were three or four small abscesses, each not larger than a small drop of pus, and two or perhaps three of these had ruptured so that air escaped from them on attempting inflation, while one was closed, the pus in it being visible under the pleura.

This cause of pleurisy, namely, the bursting of a minute abscess in the lung, and that in which a portion of the lung loses its vitality, disintegrates, and enters the pleural cavity, are probably rare, except in the first months of infancy in wasted and ill-conditioned infants, in families of the city poor and in the asylums.

A peri-pharyngeal abscess, descending along the œsophagus, has been known to cause fatal pleuritis by bursting into the pleural cavity, and pus

from carious vertebræ has produced the same result. In January, 1864, I presented to the New York Pathological Society the lungs of an infant whose history was as follows :

R., aged nine months, of strumous parentage, and whose only sister had suffered severely from strumous ophthalmia and periostitis, was taken sick about December 19, 1863, with febrile movement, attended by restlessness, but apparently without any serious indisposition. On the 22d, the mother called my attention to a prominence just below the right clavicle, which proved to be an abscess, and a poultice was applied over it. On the 24th, the prominence suddenly subsided, and immediately the symptoms were greatly aggravated. The pulse rose to 160 per minute, the respiration to from 60 to 80, and expiration was accompanied by a moan, indicating acute pleuritic or pulmonary inflammation. Within forty-eight hours after the disappearance of the swelling, and the exacerbation of symptoms, dulness on percussing over the right side of the chest was observed, and this increased till it was complete from the clavicle to the base of the thorax. The acceleration of pulse and respiration continued, the patient grew more and more feeble, and death occurred December 31st.

On dissecting away the integument from the right side of the chest, an abscess was opened, containing nearly one ounce of pus, located at the point where the tumor had been observed. At the base of this abscess, between two of the ribs, was a small, round opening, not much larger than a knitting-needle, leading directly into the cavity of the chest, so that on depressing the ribs liquid flowed back from the pleural cavity. On removing the sternum the liquid was found to be sero-fibrinous, with considerable pus in depending portions of the cavity.

I have met one other, apparently almost identical case, occurring in an infant of seven months.

Pleurisy in the adult is sometimes the result of violence. The most notable and unequivocal cases, having this origin, are those in which the ribs are fractured. It rarely happens that we can attribute the pleurisy of children to this cause. I can recollect only one case in which the inflammation seemed to be due to violence.

In September, 1867, an infant of twenty-two months, in the Almshouse on Blackwell's Island, having had a cough for half a year, and being somewhat reduced, fell from bed, striking against the left side of the thorax. Severe pleuritic symptoms supervened, and the child died of empyæma in three and a half weeks. More than a pint of pus was found in the left pleural cavity, pressing the heart beyond the median line, and the diaphragm downward, so that it was convex toward the abdomen. The bronchial glands were hyperplastic and slightly cheesy, and a caseous nodule lay in the anterior surface of the right lung, which seemed otherwise healthy. The left lung bound down by adhesions could be partially inflated. Whether or not it contained small tubercles is not stated in the records.

The occurrence of the injury just before the commencement of the pleurisy may indeed have been a coincidence, but the mother constantly

believed that the fall caused the inflammation, and there was no other assignable cause.

It is probable, from the history of this case and the lesions, that the cheesy degenerations antedated the fall, and that the pleura was in an abnormal state and prone to inflammation when the injury was received.

The etiology of pleurisy in children differs, therefore, from that in adults. Certain causes are the same ; but others, as scarlet fever, and irritating products generated in the system and bursting into the pleural cavity, are not rare in infancy and childhood, while they seldom occur in adults.

Anatomical Characters.—In the commencement of pleuritis, the sub-pleural blood-vessels, lying in the connective tissue, and the capillaries of the pleura are engorged with blood, producing vascular points and arborescence, well seen through a magnifying-glass of low power. Frequently, in children as in adults, minute extravasations of blood, resulting from extreme congestion, occur under the endothelial layer, perhaps scarcely perceived by the naked eye, but readily seen under the glass. Immediately exudation of liquid, holding numerous cells, begins in the connective tissue which surrounds the capillaries, the pleura becomes dry and lustreless, while the production and exfoliation of its endothelial cells are greatly increased. These no longer present their normal appearance, but are swollen and granular, in consequence of the inflammation.

Immediately after these parenchymatous changes occur, serum, fibrinogenic substance, and leucocytes begin to exude upon the free surface of the pleura. The term fibrinogenic substance, instead of fibrin, is employed, because it is now believed that fibrin itself is not exuded, but a substance which becomes fibrin, through the presence and action of certain agents with which it comes in contact, among which may be mentioned air, red blood-corpuscles, and even serum, from which fibrin has been precipitated (Virchow, Cornil, Ranvier, and others).

In the exuded liquid, even if it have the appearance to the naked eye of ordinary serum, the microscope always reveals the presence of pus-cells or leucocytes, and red blood-cells, however small their quantity may be. The minute rootlets of the lymphatic system, which are interspaces or lacunæ in the sub-pleural connective tissue, and which, here and there, open by stomata upon the pleural surface, are clogged by inflammatory products, and their walls swollen at an early stage (E. Wagner and others). In these lymphatic channels, both pus-cells and coagulated fibrin are seen by the microscope. That pneumonitis, whether catarrhal or croupus, seldom occurs in superficial parts of the lungs without causing inflammation of that portion of the pleura which covers the affected lobules is universally known ; but the reverse is also true, that pleurisy seldom occurs without causing inflammation of the alveoli which are adjacent to the inflamed membrane. The pneumonitis thus caused is so super-

ficial that it is very liable to be overlooked at the post-mortem examination, in the presence of the graver lesions of the pleura ; but a knowledge of its occurrence is important in diagnosis, for, though it may have no greater depth than a line, it is sufficient to produce crepitant râles, like those in ordinary pneumonitis. Therefore, if we hear these râles, we might mistake the disease for pulmonary inflammation and overlook the pleuritis—an error not unusual in the treatment of children. Trousseau, who surpassed most of his contemporaries as a clinical observer, wrote : "This sound, which is met with in the great majority of cases of pleurisy, is in fact a crepitant râle, and I have called it the crepitant râle of pleurisy. My interpretation is very simple. Just as we never have erysipelas without engorgement of the cellular tissue, there cannot be erysipelas of the pleura or pleurisy without an irritative engorgement of the subpleural cellular tissue or of the peripheric pulmonary parenchyma. This fluxion naturally carries with it into the pulmonary vesicles a serous exudation. . . . We also meet with a fine sub-crepitant râle, which is very often heard quite at the beginning of pleurisy, and which likewise nearly always continues for some weeks." More recent observers and writers fully agree with the statement of Trousseau, except that what he designates irritative engorgement the microscope shows to be a true inflammation of the pulmonary alveoli.

There are four constituents of every pleuritic exudation, namely, serum, fibrin, red blood-corpuscles, and leucocytes or pus-cells, which last are identical, in appearance, with the white blood-corpuscles and the lymph-corpuscles, and the origin of which has been investigated by many microscopists. It is convenient to classify cases of pleuritis according to the quantity and relative proportion of these constituents as follows : 1st. The plastic, sometimes designated dry or adhesive. 2d. The sero-fibrinous. 3d. The purulent. 4th. The hæmorrhagic. In cases which pertain to the first group, the inflammation is chiefly parenchymatous, either no exudation occurring upon the free surface of the pleura, or if any, whether fibrin, pus, or serum, it is so slight that it possesses no clinical importance. The essential anatomical changes in this form of pleuritis, as regards the pleural surface, are rapid proliferation, retrogressive change, or decay and exfoliation of the endothelial cells, and the sprouting out of granulations which develop into connective tissue. In plastic pleuritis, there is no compression of the lungs, and the pleural surfaces are separated from each other only by the granulations which soon unite with those of the opposite surface. This form of pleuritis is not infrequently latent in children, for at the autopsies of those who have died of various diseases we often observe bands of connective tissue, uniting the opposite pleural surfaces, when the parents or nurses cannot recall to mind any sickness or symptoms, such as pleuritis commonly causes. It is certain, also, that plastic pleuritis is often overlooked, when not latent ; the fever and other symp-

toms being attributed to causes quite distinct from the true one. The symptoms and physical signs are obviously less pronounced in this than in other forms of pleuritis.

2d. Sero-fibrinous Pleuritis.—This is the most frequent of all. It is the pleuritis which commonly results from catching cold. The serum exudes from the capillaries of the inflamed pleura in very variable quantity in different cases, and the pleural surface is soon covered with a fibrinous layer. This may be a mere film, or it may attain the thickness of half an inch or more. It is usually at first slightly attached, but afterward, from being blended with the granulations, it may be firmly adherent. In some cases it is quite compact, while in others it has a loose areolar texture, containing in its interstices serum and pus-cells. The fibrin is for the most part deposited on the pleura, but shreds and flakes of it also float in the serum. In the serum, as well as entangled in the fibrin, we find not only red blood-cells and leucocytes, but endothelial cells thrown off from the pleura which, as well as those still adherent, are almost always in the process of degeneration and decay.

If a perpendicular section be made through the pleura, in this as well as in the other forms of pleuritis, many newly-formed cells, the lymph-corpuscles, are observed in the meshes of the sub-pleural connective tissue, and, as we examine the section nearer to the surface of the pleura, these cells are seen to be aggregated in masses, and held together by a structureless, homogeneous matrix. The lymph-corpuscles appear to be the active agents in the formation of granulations. They are observed in various stages of transformation, from the round to the spindle-shaped. The prolongations of the spindle-shaped cells unite with each other, so as to form the connective tissue, capillaries, and other elements of the granulating surface. That the endothelial cells take no part in the production of the new tissue is inferred from the fact that most of them present the appearance of retrogressive change and decay. The granulations, as they sprout out from the pleura, become intimately blended with the fibrinous exudation, and when the effused liquid is absorbed, they unite with those of the opposite pleural surface, forming an organic union, by blood-vessels and nerves, between the lung and parietes, the lung and pericardium, or different lobes of the same lung, as the case may be. They pass, in two or three weeks, from embryonic to perfect tissue, vessels and nerves grow in them, and they possess, henceforth, all the properties of living tissues ; they are able to absorb ; they are liable to inflammation and hæmorrhage, and may, in fine, participate in all the alterations of the organism of which they are a part (Jaccoud).

3d. Purulent Pleuritis.—Although, as stated above, pus-cells are always present in the pleuritic exudation, we designate the disease purulent or empyæma when the cells are so numerous as to render the liquid turbid. If there be a cloudiness, appreciable to the naked eye, and due

to the pus-cells, the case is regarded as one of this form of pleuritis. Purulent pleuritis is, at first, in a large proportion of cases, sero-fibrinous, becoming purulent after some days or weeks—a fact readily ascertained by the use of the hypodermic syringe at different periods. In other instances, the pleuritis is purulent from the first. Pleuritis is, according to my observations, more apt to be purulent in children than in adults, and in ill-conditioned children than in those who are robust. It is, therefore, apt to be purulent in one who has had an exhausting disease, as scarlet fever, and in the cachectic children, who reside in or are brought to the institutions for treatment. Thus, in the New York Foundling Asylum, in 1879, an infant, aged two months and three days, became feverish, and had the expiratory moan and hurried respiration characteristic of pleuritis. On the fourth day, Dr. Reynolds, who was in attendance, inserted the hypodermic syringe and filled it with thin pus. This was, apparently, a case of primary idiopathic empyæma. Pleuritis is purulent when it is produced by the entrance of some irritating substance into the pleural cavity, as pus or decomposed lung-tissue.

The production of pus in the pleural cavity is often surprisingly rapid, for, when many ounces have been removed by the aspirator, nearly the original quantity is sometimes restored within two or three days. As Fraentzel says, it does not seem possible that so many pus-cells, which must surpass in number the aggregate of the white blood-corpuscles, could wander from the blood-vessels in so short a time, so that we must look for some other source of the immense production of leucocytes, in addition to that discovered by Cohnheim. A large part of the pus-cells is, in all probability, produced by rapid segmentation of the lymph-corpuscles. In two cases of purulent pleuritis, both infants, I found pus underlying the pleura near the hilus, without apparently any loss of integrity in the pleura, in such quantity that it was immediately recognized by the naked eye. Pus under the pleura, as well as within the pleural cavity, was apparently due to unusual violence in the inflammation, and rapid production of leucocytes.

Hæmorrhagic Pleuritis.—This is not common. I recall but one case in a child, in whom the pleuritis occurred as a sequel of scarlet fever. The fluid several times removed by the aspirator had a deep reddish-brown color. I was apprehensive that the point of the aspirator, by wounding the granulations, had caused the hæmorrhage which stained the pus removed at each subsequent operation. But, with the care exercised, and the great amount of blood-stained exudation, it seems almost certain that this was not the true explanation, and that it was a genuine case of hæmorrhagic pleuritis.

Hæmorrhagic exudation in the pleuritis of children is sometimes due to purpura hæmorrhagica, being, like the other hæmorrhages, a symptom of the general disease. In other cases it signalizes the commencement of a

new inflammation in the vascular granulations of a previous pleuritis. Occurring under such circumstances, it is due to the increased fluxion in the numerous delicate capillaries of the granulations. Pleuritis due to cancerous or tubercular formations in or upon the pleura is sometimes also hæmorrhagic. Jaccoud says : " A sero-fibrinous or purulent exudation may be red by the transudation of hematin, without true hæmorrhage . . . ; the red exudations, which have been observed in scorbutus and marsh cachexia are really due to these pseudo-hæmorrhages." In those cases in which there is true hæmorrhage, it is still uncertain whether rupture of the capillaries or a transudation ordinarily occurs, or whether the blood-cells may not escape in both modes.

A liquid pleuritic exudation, whether sero-fibrinous or purulent, obviously produces an important mechanical effect from its location. In young children, especially those enfeebled by sickness, the expansive power of the lung is slight, so that it readily yields to pressure applied to its surface, and becomes more and more compressed as the liquid accumulates. Except when retained by adhesions, the lung is pressed toward the mediastinum, and at the same time carried forward and upward. Patients with pleuritis usually lie on the back and affected side, so that gravitation determines to a considerable extent in what part of the pleural cavity the liquid will collect. In the considerable number of post-mortem examinations which I have witnessed of children who perished from pleuritis, chiefly empyæma, the lung was usually attached anteriorly to the thorax from the mediastinum outward, as far as the costo-chondral articulations, or farther, except in the lower part of the cavity, where there were no adhesions, or adhesions only near the mediastinum. There were also attachments along the mediastinum, and attachments more or less firm on all sides, anteriorly, laterally, and posteriorly in the upper part of the pleural cavity, toward which the lung was compressed. Many variations occur, depending on the amount of liquid and the extent of the adhesions, but judging from autopsies which I have seen, I would say that, in the average, in cases so severe that the question of operative interference arises, if we draw a line from the axilla downward and forward to the epigastrium, the lung is adherent to the thorax over the space anterior and internal to this line, while external and posterior to it the liquid separates the lung from the ribs. This fact is important, as indicating the proper point for puncturing the chest, namely, below the lower angle of the scapula, and between the eighth and ninth ribs. One reason why the earlier performers of thoracentesis were so unsuccessful was that they selected the anterior wall of the chest as the point of operation. Nowadays, however, no one would be justified in performing thoracentesis unless he first employed the hypodermic syringe and removed fluid at the point which he selects for the puncture. The statistics of Mohr, relating to lung displacement in empyæma, chiefly statistics of adult cases, are

somewhat different from my general recollection of cases occurring in infancy and childhood as stated above. In 23 cases he found the lung free from adhesions, and compressed against the vertebral column and the mediastinum ; in 13 cases the organ was compressed from below upward ; in 1 from above downward ; in 4 from within outward ; in 4 from behind forward, and in 4 from before backward. These variations depend on the adhesions which the lung happens to contract. Perhaps a point a little external to the perpendicular, passing through the angle of the scapula, is preferable for puncture, as I have known the lung to be adherent to the posterior wall of the chest near the mediastinum, when the portion farther removed, say two inches from the median line, was separated by interposed liquid.

Sometimes the liquid is collected in multilocular cavities formed by the connective tissue, and these frequently intercommunicate. Exceptionally in children, as in the adult cases observed by Mohr, when there has been a large and rapid liquid exudation, or when the disease has been violent and of short duration, there are no adhesions.

On account of the great difference in the size of the pleural cavity at different ages during infancy and childhood, the amount of liquid, which produces that degree of compression of the lung which materially impairs its function, varies greatly. At the age of four months, three ounces produce complete collapse of lung, so that it resembles a fleshy mass (carnification). The largest amount of liquid relatively to the size of the chest, in any of the cases which I have observed, was about one and one half pints, in the left pleural cavity in an infant that died at the age of twenty-two months, in September, 1867. The heart lay chiefly to the right of the median line, and the diaphragm was convex toward the abdominal cavity. The case occurred in the Almshouse on Blackwell's Island, and might in all probability have been relieved, had attention been directed to it sufficiently early.

Liquid in the left pleural cavity, when considerable, presses the heart toward the mediastinum, so that the apex beat, instead of being a little internal to the linea mammalis, approaches the sternum. As the heart is carried to the right, the beat is felt under the lower end of the sternum, and with still greater increase in the effusion, the pulsation is detected by the finger, to the right of the sternum. If the exudation be on the right side, the displacement of the heart toward the left is, for obvious reasons, less than the displacement toward the right, in pleuritis of the left side. Much external pressure upon the heart embarrasses its movements, and prevents proper filling of its cavities, while the action of the organ is accelerated so as to compensate. Therefore, the pulse is quick and feeble.

In one instance in my practice, the lower extremities, and the portion of the trunk below the thorax, became œdematous, from compression of

the ascending vena cava, and writers allude to cases in which other vessels and ducts, as the thoracic, are compressed, so as to seriously embarrass their functions. The patient with the œdema was a boy of about four years, with empyæma of the left side.

In large effusion, the mediastinum is pressed against the healthy lung so as to diminish its transverse diameter, and Traube has shown that the effect of this is to increase the length of the lung, or its vertical measurement. Consequently as the lung on the healthy side extends lower than in the normal state, the convexity of the diaphragm on this side is diminished, as well as on the affected side, where it is depressed by the effusion.

The pleura in protracted cases of empyæma becomes much infiltrated, and from the growth of connective tissue which blends with it, is thickened, sometimes to the extent of one or two lines. A few months since, in removing the lungs from the body of a young infant that perished of empyæma in the N. Y. Foundling Asylum, a portion of the costal pleura, two or three inches in diameter, being adherent to the lungs, was detached from the ribs. It had a thickness of fully two lines, and its free surface was rough.

Occasionally the inflammation extends from the pleura to the pericardium, producing general pericarditis. I recall to mind four cases with this complication, in which the diagnosis was verified by post-mortem examinations. All had empyæma, three on the left, and one on the right side. Pericarditis, always a grave disease, is almost necessarily fatal, when thus occurring as a complication of empyæma. More rarely the inflammation extends from the pleura to the peritoneum. One such case occurred in my practice, the child dying of empyæma of the right side, and at the autopsy we found the lesions of a localized diaphragmatic peritonitis of the right side, with a fibrinous exudation of small extent on the convex surface of the liver, directly opposite to that on the diaphragm. We are indebted to Von Recklinghausen for knowledge of the mode in which inflammation is propagated from the pleura to the peritoneum, and the same explanation probably applies to its propagation to the pericardium. In the serous covering of the diaphragm, pleural and peritoneal, minute stomata have been discovered, which pertain to the lymphatic system. They open upon the surface of the diaphragm, and underneath in the substance of the diaphragm connect with lacunæ or interspaces, from which the minute lymphatic vessels originate. These stomata and lymphatic spaces, pervious in their normal state, are usually clogged, as has been stated above, by inflammatory products, when the serous membrane is inflamed. Occasionally the inflammation traverses these lymphatic channels from one surface to the other, from the pleura to the peritoneum, thus causing by extension a circumscribed peritonitis.

The changes which the inflammatory products undergo are the follow-

ing : With the abatement of the inflammation, the liquid portion begins to be absorbed, though absorption is much more tardy than in non-inflammatory effusions, since the absorbents are to a great extent covered, and clogged by fibrin and pus. The serum is first absorbed, and the flocculi of fibrin sink into depending portions of the cavity, or become attached to the fibrinous layers or the granulations upon the pleural surface. The pus-cells and the fibrin, whether in flocculi or layers, begin to undergo retrogressive change. They become granular from fatty degeneration, liquefy, and are absorbed. Sometimes portions of these degenerated products, which are not absorbed, form inert caseous masses, in recesses of the cavity, or between the bands of connective tissue, where they remain unchanged for years. With few exceptions, those who recover from an attack of pleuritis experience no subsequent ill-effect, though the bands and patches of connective tissue are permanent.

Pus always possesses irritating properties. Decomposed and putrid pus (ichor) is very irritating. Empyæmic pus, therefore, like pus in other situations, now and then produces ulceration or necrosis of the pleural surface, by which it is confined, and in consequence of its destructive action, it sometimes establishes an outlet by which it escapes, with relief of the patient and cure of the disease. The chest wall is thinnest anteriorly, in the infra-mammary region, and at this point the pus, when it makes its way through the thoracic wall, usually points and discharges. The fistulous opening thus produced continues many months, until the pleural cavity is gradually obliterated by the adhesions, and the patient recovers.

By a similar destructive process in the pulmonary pleura, pus occasionally escapes into the bronchioles, and is expectorated. This mode of cure appears to be common in children, for my attention has not infrequently been called to the fact that children, during the progressive but slow convalescence from empyæma, expectorated large quantities of muco-pus, although in some of the cases pus had been removed by the aspirator or trocar. Fraentzel makes the remark, which is fully sustained by clinical experience in this country, that although an opening is made in the lung by the necrotic or ulcerative process, so that pus escapes into the bronchioles, air does not pass from them into the pleural cavity. Pyopneumothorax is very rare in the empyæma of children, except as air is admitted in the operation of thoracentesis.

As the liquid is absorbed, the compressed lung ordinarily expands in proportion to the absorption, so that more and more air enters its alveoli. But frequently, in cases of long duration, the absorption proceeds faster than the expansion, so that the ribs on the affected side sink below their normal level. As a consequence, the inter-costal spaces are narrowed, the shoulder is depressed, and the dorsal portion of the spinal column bends to accommodate the ribs so as to be concave toward the

affected side. It is very rarely that the deformity thus produced is permanent. Though the newly formed bands and patches of connective tissue may so bind the lung that its return to the normal state is tardy, yet, with few exceptions, the alveoli one after another open to admit air, and when full inflation is attained, the symmetry of the chest is restored. But there are rare cases in which the newly formed connective tissue is firm and unyielding, almost as cartilage, and lime salts are sometimes deposited in it, forming a calcareous *plaque*, which invests the lung like a cuirass. An unexpanded lung, with such a covering, obviously can never afterward be fully inflated. I can recall to mind, however, only one case of permanent complete collapse or carnification of lung, resulting from pleurisy. The inflammation, which was treated by the late Dr. Cammann, occurred in childhood, and several years afterward, when the patient reached womanhood, although the general health was good, there were physical signs of an unaërated lung, and the consequent deformity (depressed shoulder and ribs, and bent spinal column). Pleurisy with its granulations and retrogressive products affords one of the conditions in which tubercles are developed, so that we sometimes find at the post-mortem examination of cases which have been protracted, "miliary tubercles in the pleura, while chronic phthisis and general tuberculosis are absent" (Delafield).

From the intimate relation of the heart to the lungs, this organ obviously suffers severely in every large pleuritic exudation. Total compression of a lung arrests one half of the circulation through the pulmonary artery, except as the increased flow in the opposite lung serves for compensation. Hence, in cases of large effusion, which end fatally, we commonly find the pulmonary artery and the right cavities of the heart distended with blood and clots, while the left cavities, having received a diminished quantity of blood, are probably empty.

Symptoms.—As has been stated above, pleuritis in children is sometimes latent, or attended by symptoms so mild as to attract little attention, even when there has been general inflammation of the pleural surface with much effusion. Both primary and secondary pleuritis may present this form, latency being more frequent the younger the patient. In feeble, cachectic children, with blood thin and impoverished, pleuritic symptoms, as pain, dyspnœa, and fever, are less pronounced than in the robust, and, hence, latency is more common in the tenement-house population of the cities and in the institutions than in the better walks of life. The following is a not infrequent example of latency. A feeble infant, aged five months and twenty-eight days, died suddenly in the Nursery and Child's Hospital, in December, 1870. The attention of the resident physician had not been called to it, as it was not supposed to be sick, except that it was ill-nourished and its general condition bad. The nurse who had charge of the ward stated that it presented no symptom of acute

disease, unless a slight cough during the three or four days preceding its death. Percussion over the right side of the chest of the corpse gave a flat resonance, and at the autopsy the right lung was found compressed, nearly or quite destitute of air, and covered by a loose fibrinous layer, three fourths of an inch thick in places, and a moderate serous exudation.

Ordinarily acute idiopathic pleuritis in children begins quite abruptly, and with symptoms which attract attention from the first. Probably in most instances it is preceded by rigors, or a chilly sensation, but this usually escapes notice, if it be present, in patients under the age of five or six years. Fever, fretfulness, and a physiognomy indicative of pain are the common initial symptoms. If the patient be an infant, the fretfulness closely resembles that produced by colic, for which I have on several occasions known it to be mistaken by the attending physicians.

The symptoms of pleuritis are twofold, namely, the constitutional, or such as are common to all inflammations, and the local, or those referable to the chest. Various observers have noted the position in which patients lie in bed, as indicating the seat of the inflammation. It has been stated that adults, in the commencement of pleuritis, ordinarily obtain most relief with a decubitus on the sound side, but, when effusion has occurred, they lie on the affected side, unless there be marked dyspnœa, which is most relieved by a semi-erect position, which allows greater descent of the diaphragm. I have not noticed that children with pleuritis prefer any fixed or uniform position, except there be marked dyspnœa, which may prompt them to elevate the shoulders. The patient in the acute stage is commonly quiet when he lies in the position which he selects, and if disturbed from it becomes more fretful, his cough more frequent, and his suffering apparently increased.

In ordinary cases, the temperature rises on the first day to 102° or 103° If it be more elevated than this, there is apt to be a complication. The fever begins to abate when the exudation has occurred. In suppurative pleuritis, the febrile movement is more protracted, often continuing for weeks or months, presenting, after the acute stage has passed, the characters of hectic fever with morning abatement and evening recrudescence. In weakly and anæmic children, even when the pleuritis is pretty severe, and most of the usual symptoms are present, the temperature may be but slightly elevated. Thus, in one of the institutions with which I am connected, a young infant, whose fretfulness was during the first twenty-four hours ascribed to colic, the axillary temperature during the first three days never rose above 100°.

The pulse, in a quiet state, is usually between 105° and 120°, but in young children who are restless it is often more frequent than this, during the first three or four days. It is accelerated as long as the temperature is elevated, but in sero-fibrinous pleuritis, after exudation has

occurred, its frequency diminishes unless the heart be compressed. Compression and imperfect or partial filling of the cavities of the heart produce a feeble and rapid pulse. In empyæma the pulse is accelerated as long as pus is confined in the pleural cavity, unless its quantity be small.

Headache, usually frontal, is frequent during the febrile stage. Convulsions, which occasionally occur in the beginning of pneumonitis, are rare. Pain in the chest, on the affected side, is common, and is, therefore, a valuable diagnostic symptom, but it is often slight, and apt to be overlooked in infants and feeble children. It is increased by movements of the chest-walls, as in full inspiration, by coughing, or when pressure is made by the fingers in the examination. Its common seat is between the fifth and eighth ribs, external to the linea mammalis, but there are many cases in which the pain is referred to some other part, as the infra-clavicular, mammary, infra-mammary, or even the scapular or infra-scapular region. Rarely, it is referred to the epigastric or umbilical region, or even, it is said, to some point upon the sound side of the thorax. This location of the pain at a point distant from the seat of the inflammation is attributable to the anastomosis of the intercostal nerves with those of the opposite side of the chest, or with those which ramify in the abdominal walls.

The pain of pleuritis, as it ordinarily occurs, has received different explanations. It has been attributed to tension of the pleura, to friction of the pleural surfaces on each other, and to extension of the inflammation to the neurilemma of the minute nervous branches of the pleura. All these causes apparently act in producing it, but the persistent pain in the first days of pleuritis, though increased by motion, is probably due in great part to that last mentioned. Pleuritic pain is sharp or stitch-like. It begins to abate in a few days, and in a large proportion of cases ceases by the fifth or sixth day; it is no longer noticed, except in coughing or during sudden movement of the chest.

The respiration is accelerated, as in all febrile diseases, but it is more rapid than in inflammatory ailments, which do not involve the thoracic organs, on account of the pain experienced on full inspiration. The patient instinctively avoids full inflation of the lungs, and the breathing is consequently rapid, to compensate for incompleteness of the inspiratory act.

In ordinary attacks of pleuritis, painful and hurried respiration is of short duration. It becomes easier and more natural toward the close of the first week. In subacute and chronic cases, the rhythm and frequency of respiration differ but little from the normal.

A cough, whatever the form of pleuritis, is one of the earliest symptoms. It is short, frequent, and dry, and in the most favorable cases begins to diminish in the second week. A loose cough is due to accompanying bronchitis, or broncho-pneumonitis, or, at a late stage of the disease, to escape of pus from the pleural cavity into the bronchial tubes.

Little need be said in regard to symptoms referable to the digestive apparatus. Vomiting is common on the first and second days. Thirst, loss of appetite, and consequent loss of flesh and strength, are uniformly present. In empyæma, which, from its nature, is protracted, nutrition is always greatly impaired. The surface presents an anæmic appearance, the flesh is soft and flabby, and the emaciation is progressive till the pus is evacuated.

Physical Signs.—In children above the age of three or four years, the physical signs differ but little from those in adult cases, but under this age there are certain differences which the practitioner should know. We may, in the commencement of the attack, notice diminution in the movement of the chest-walls on the affected side, since the patient instinctively endeavors to repress respiration on that side, in order to lessen the pain. In severe cases, the epigastrium and hypochondria are sometimes depressed during inspiration (the so-called abdominal respiration), but this sign is less common and less marked than in severe bronchitis, and when present it may be largely due to accompanying bronchitis. After effusion has occurred, and the pain has abated or is slight, the signs due to irregular respiration are less pronounced than at first. The breathing is now nearly or quite normal ; but it is well known that the effusion, if considerable, is apt to cause fulness or bulging of the thorax on the affected side, which is appreciable to the sight, so that its circumference on measurement is found to be greater than in health. But inequality of the two sides produced by the liquid is more common in children of an advanced age than in those under the age of three or four years. In infants, even when there is a large liquid exudation, the bulging is often so slight that it is scarcely appreciable, either by sight or measurement, and in not a few there is no apparent difference in the circumference of the two sides. I have repeatedly made careful measurements in infantile pleuritis during the stage of effusion, and been unable to convince myself that there was any difference, although other signs indicated the presence of an effusion which filled at least one half the pleural cavity. I explain this fact in this way. The lungs of an infant, especially of one reduced by sickness, are very liable to a state of semi-collapse or partial inflation in their whole extent, and of complete collapse of their thin borders, as of the tongue-like process of the left upper lobe, which lies over the pericardium and of the margins of the lower lobes, which lie in the angle made by the thorax and diaphragm. This occurs in the weakly infant, even when there is no obstruction to the entrance of air, and the liability to it is greatly increased by external pressure applied to the lung, as from a pleuritic effusion, so that the lung recedes, becomes compressed, and unaërated, before the ribs yield to the pressure. If the exudation cease as soon as the lung is collapsed, there is little or no outward displacement of the ribs, and the intercostal spaces are not elevated. It is obviously very

important to know this difference between infantile and adult cases, as it has a bearing upon the diagnosis between pleuritis with effusion and pneumonitis.

Palpation.—In adults, and in children with strong voices, if the lung, deprived of air either by compression or an exudation within its alveoli, lie against the chest-wall, speaking or moaning produces a vibratory sensation which is communicated to the hand placed upon the chest. The fremitus is feeble or not appreciable when the voice is feeble. Therefore, in infants whose vocal cords are small, and particularly in infants reduced by sickness, this sign is ordinarily absent, or so slight that it is detected with difficulty, while in older and robust children it is distinctly perceived. If the conditions be otherwise favorable for the production of fremitus, but the lung be pressed away from the ribs by an intervening liquid, no vibration is felt when the patient speaks or cries. But if, in the same case, the fingers be removed to the supra-scapular, axillary, infra-clavicular, or mammary region, where the compressed lung comes in contact with the walls of the chest, fremitus may be perceived. Palpation also enables us to ascertain the point of apex-beat of the heart, variation of which from the normal site being one of the most conclusive proofs of a pleuritic effusion.

Percussion.—In the first hours of pleuritis, there is either no perceptible change in the percussion sound, or the resonance is slightly diminished, from the fact that inspiration on the affected side is resisted by the patient, and the lung is only partially inflated. When exudation occurs, if there be a thin layer of liquid over the lung, the percussion sound is tympanitic. It has, therefore, this quality at an early stage in the infra-mammary, mammary, and perhaps infra-scapular regions, when the amount of liquid is small, and at a later stage, when the quantity of liquid is greater, the percussion sound over the lower part of the chest is dull, while that over the central or upper part is tympanitic. Entire filling of the pleural cavity with liquid, and total exclusion of air from the lung, give rise to a dull or flat percussion sound over every part, from the apex to the base. It may be stated as a rule in the pleuritis of children that, at a certain stage of the effusion, percussion produces a sound which is either decidedly tympanitic or which partakes of the tympanitic character. Skoda attributed the occurrence of tympanism to the fact that a lung still aërated vibrates better if surrounded by a thin layer of liquid, and consequently gives better resonance than when it lies against the chest-walls.

When the exudation is so great that the lung is totally compressed, and removed to a distance from the chest-walls, the finger in percussing experiences a sensation of solidity or resistance, and there is no longer any vibration of the ribs. Consequently the percussion sound is dull or flat, as over any solid body, differing from that in pneumonitis, in which

there is still some vibration of the chest-walls, and the dulness is not absolute. In pleuritis, therefore, there is, according to the amount of exudation, either nearly the normal percussion sound, as at the beginning of the attack and in any stage of plastic pleurisy (pleurésie séche), or a zone of dull sound below, and another of tympanitic sound above, or a zone of normal resonance above, and one of dull resonance at the base, with an intervening one of tympanism, or, finally, there is absolute dulness from the clavicle to the base of the chest.

It very rarely happens in the child that the level of the fluid changes by changing the position, on account of the adhesions, so that this sign, described in the books as one of great importance in diagnosis, affords very little assistance in case of children.

Auscultation.—In the beginning of pleuritis, auscultation affords but slight information, except that the practised ear may detect a little diminution in the fulness of the respiratory act in the lung, whose pleura is inflamed, and perhaps a slightly exaggerated respiration in the other lung. But after twelve or fifteen hours, when exudation begins to occur upon the pleural surface, we may hear the dry friction sound, which can be imitated by pushing the finger strongly across the dry palm of the hand. It is only heard in occasional cases, since the physician may not make his visit at the proper time for hearing it, or he does not apply the ear over the proper place. Fraentzel says: "We shall scarcely ever fail to find the friction sound, in recent pleuritis, if we look for it early and diligently in some circumscribed spot." I do not think that this remark, however true it may be of adult cases, is entirely correct as regards children, for it is only in exceptional instances that it can be heard in them. It occurs both during inspiration and expiration, and it does not disappear after coughing. Being produced upon the surface of the lung, it seems near the ear of the auscultator. Perhaps it is not observed during several consecutive respirations, and then a deeper inspiration causes the pleural surfaces to glide upon each other, and it is detected. The friction sound as sometimes heard is well expressed by the term scraping, and in other cases by the term creaking, as was noticed by Hippocrates, who compared it to the creaking of leather.

In some patients it is heard for a brief period and does not recur, and it may be detected only during strong and deep respiration or in coughing. It disappears entirely when the accumulation of liquid prevents contact of the surfaces. After absorption of the liquid, the friction sound may reappear, and in certain patients it is heard only at this time, namely, in the third stage.

An interesting and common sound heard on inspiration is the so-called *crepitant râle of pleurisy*, produced in the superficial alveoli. The remarks made by Trousseau upon it have been already given. As stated above, the inflammation extends from the pleura to the pulmonary vesicles

which lie directly underneath, and as soon as exudation occurs within them, the anatomical conditions are present in which the crepitant râle is produced, as in the ordinary form of pneumonitis. This râle may obviously be heard before any effusion takes place upon the free surface of the pleura, and it continues until the alveoli are so compressed by the pleuritic exudation that they no longer admit air.

The exudation in the pleural cavity changes the character of the respiratory sound. A thin layer of liquid over the lung causes diminution in the force of the vesicular murmur, and soon an expiratory as well as an inspiratory sound begins to be heard. This modified vesicular murmur is weak, and more distant from the ear than the respiratory sound of health. When the exudation is sufficient to close the alveoli, while the air still traverses the medium-sized bronchial tubes, we notice a tubular or bronchial *bruit*. If the small and medium-sized tubes are compressed, while the air enters the large tubes, the respiratory bruit may be amphoric. Total absence of respiratory sound results from complete collapse of the alveoli, and consequent exclusion of air from them, and arrest of the movements of the air in the tubes of the affected side. Jaccoud says: "Regarded as a sign of the quantity of the effusion, the modifications of the respiratory *bruit*, and of the respiration, may then be arranged, in an increasing series as follows: diminution of the vesicular murmur; feeble respiration (*souffle doux*); no sound, and feeble respiration; bronchial respiration; no sound, and bronchial respiration; no sound, and cavernous respiration; general absence of sound (*silence général*). The replacement of an inferior term of the series by a superior term implies an augmentation in the quantity of liquid, and in general the passage of a superior term to an inferior term denotes a diminution of the effusion." But this statement relating to the effect upon the auscultatory sounds of the increase and decrease of the liquid must be modified as regards patients under the age of five years. In such patients it is rare, however great the effusion, that respiration is not heard when the ear is placed over the liquid. This is due to the small size of the pleural cavity, and the consequent ready transmission of sound from the centre of the thorax to its periphery. According to the amount of exudation and the degree of compression, the respiratory sound is a faint and distant vesicular, or broncho-vesicular, or bronchial murmur, and its character is found to vary from one to the other of these sounds, as we apply the ear over different parts of the chest.

When the inflammation is active, and the exudation occurs rapidly, bronchial respiration may be heard as early as the second or third day, or even by the close of the first day, in the infra-scapular region. If, on the other hand, the inflammation be chiefly plastic, or the exudation of liquid be slow, and its quantity be small, the respiratory murmur may be vesicular, though faint and distant, during the whole course of the

attack. Sometimes when the murmur is vesicular in the greater part of the lung, broncho-vesicular or bronchial respiration is heard over a limited area, where the effusion happens to be sufficient to produce requisite compression of the lung.

The voice of the patient, when auscultated over the affected side, has a character which corresponds with and varies according to the respiratory murmur. Vocal resonance is feeble or absent if the respiratory murmur be vesicular. If it be bronchial, the auscultated voice is more distinct, having the character known as bronchophony, or when there is a moderate quantity of liquid over the lung, so that this organ vibrates, it may have that modification of bronchophony known as egophony. Occasionally we can hear the voice as a confused and distant sound, when the quantity of liquid is so great that respiration is inaudible. The signs derived from the auscultated voice are not, as is well known, pathognomonic of liquid effusion. Bronchophony is more common and distinct in pneumonic or tubercular solidification of lung than in pleuritis, and even egophony may be produced without the presence of a liquid, by "pleural membranes realizing certain physical conditions" (Jaccoud). But since the auscultated voice is weaker in children than in adults, we often do not hear it in infants and ill-conditioned children, even when the anatomical conditions, as regards the lungs and pleural cavity, are favorable for its transmission.

In children as in adults, bronchial râles are common in pleuritis, dry or moist; coarse when produced in the larger tubes, or fine when occurring in the finer tubes.

Diagnosis.—Ordinarily, a careful observance of the history, symptoms, and physical signs enable the physician to make a positive diagnosis. Obscure or doubtful cases occur chiefly in infancy. Circumscribed pleuritis, or pleuritis attended with little or no liquid exudation, is obviously most apt to be overlooked, and its symptoms mistaken for those of another disease.

Pleuritis, before the stage of exudation, may be mistaken for pneumonitis, since the prominent symptoms in the commencement of the two diseases are similar. But in pleuritis there are commonly greater acceleration of pulse and respiration, greater suffering, as evinced by the features, greater tenderness on percussing or pressing the chest-wall, and a more decided expiratory moan, while the patient probably endeavors to repress respiration on the affected side, so that inflation of the lung is partial and shallow. It will aid in the diagnosis to recollect that, in children under the age of five years, acute pneumonitis is, in most instances, catarrhal, and not croupous, and is preceded and accompanied by severe bronchitis, being due to downward extension of the inflammation from the bronchial tubes. It therefore does not begin with the abruptness of pleuritis.

Pleuritis with effusion may be mistaken for pneumonitis in the stage of solidification, for hydrothorax, or, on the left side, for pericardial effu-

sion, or *vice versa*. But the percussion sound over a pleuritic exudation is either tympanitic or flat, while over a lung solidified by inflammation it has some resonance, though dull. There is also a sensation of greater resistance and solidity in percussing over a pleuritic exudation than over an inflamed lung. Moreover, the respiratory murmur, whether vesicular, broncho-vesicular, or bronchial, is more distant and less distinct to the ear of the auscultator when applied over a liquid than over a solidified lung.

A pleuritic exudation, unless slight, also changes the apex-beat of the heart, pressing it toward the median line in left pleuritis, and away from the median line in right pleuritis, as has been stated above—a change not observed in pneumonitis. Bulging of the intercostal spaces, expansion of the chest-walls, change in the height of the fluid by change in the position of the child, important signs in the diagnosis of adult pleuritis, are, as we have seen, commonly absent in young children, even when there is abundant liquid effusion, but they are sometimes observed in children of a more advanced age. Bronchophony and vocal fremitus, signs of pneumonic solidification, are absent, or so feeble in the pneumonitis of young children that their absence cannot be regarded as indicative of the presence of pleuritic effusion, except in children over the age of four or five years. Moreover, these signs, when present, do not necessarily indicate pneumonitis, for if, in pleuritic effusion, the ear or hand be placed over a part of the chest where adhesions have united the lung to the ribs, and the child be of such an age that the vocal cords have sufficient vibration, both bronchophony and the fremitus may be perceived. The absence or presence, therefore, of vocal fremitus and bronchophony affords only limited assistance in the differential diagnosis of pleuritis and pneumonitis in young children. In those of an advanced age whose vocal cords have greater vibration it aids in the discrimination of doubtful cases, especially if the examination be made in the infra scapular region, which corresponds with the location of the liquid, if any be present.

A pleuritic effusion is distinguished from hydrothorax by the fact that the latter is usually bilateral and of slow increase, without symptoms referable to the chest, except when there is considerable effusion, which causes more or less dyspnœa. Pleuritis, unlike hydrothorax, causes fever and other constitutional symptoms, and also a cough, pain in the chest, and early embarrassment of respiration. Moreover, hydrothorax seldom occurs, except from cardiac or renal disease, or scarlet fever.

A greatly distended pericardial sac simulates, in some degree, a pleuritic effusion on the left side, but the absence of symptoms which pertain to pleuritis, as the cough, stitch-like pain in the chest, the localization or greater distinctness of the dull sound on percussion, in the cardiac region, absence or feebleness of the apex-beat, and indistinctness or distance of the heart-sounds, will preserve the observant physician from error of diagnosis.

Prognosis.—In mild cases attended with liftle exudation, the inflammation soon begins to abate, and, by the close of the second week, the

symptoms have nearly disappeared. In plastic, and sero-fibrinous pleurisies, recovery may be confidently expected, unless there be some grave complication, or perchance syncope should occur from large and rapid effusion. A large effusion, whatever its character, especially if located on the left side, often causes such a twist in the great vessels within the thorax as to seriously retard the circulation of blood and endanger life. In effusions of the left side, the heart is often carried so far toward the right that the ascending vena cava, where it emerges from the central tendon of the diaphragm, is bent at an angle so as seriously to obstruct the return of blood from the lower half of the body, and consequently a reduced quantity of blood reaches the right cavities and the pulmonary artery. The result is a diminished flow of blood in the systemic circulation, with anæmia of important organs, as the brain. The great arteries connected with the heart are also more or less bent in cases attended by displacement of this organ. In effusions on the right side, the right auricle and ventricle sometimes do not expand to the normal extent during the diastole, on account of the pressure of the liquid, and the result is similar to that in effusions on the left side, as regards obstructed circulation and anæmia of important organs. Therefore, patients with large pleuritic effusions, whether left or right, are liable to sudden fainting and even to fatal syncope. Fortunately, with our present improved methods of thoracentesis, children need not perish in this way if the operation be resorted to at the proper moment. There is another danger. When, in consequence of the exudation, the lung is so compressed that its function is nearly or quite lost, the sound lung obviously receives an augmented supply of blood. It is, therefore, very liable to sudden congestions and transudation of serum (œdema). If this occur, the dyspnœa is augmented and the condition is one of the utmost peril. Death is apt to result.

The prognosis obviously varies according to the cause of the inflammation and the quantity and nature of the exudation. Idiopathic pleurisies do better as a rule than those which occur as a complication or sequel of some other disease. Absorption is more rapid in the beginning of convalescence, when the fluid is thin, than at a later period, when it has greater consistence. Fibrin, whether flocculent or laminated, is necessarily slowly absorbed, first undergoing fatty degeneration and liquefaction. Empyæma, if not relieved by operative measures, continues many months, and even after pus is let out convalescence is slow. In the very considerable number of empyæmic cases which have from time to time been brought to the class of children's diseases in the Bureau for the Relief of the Out-Door Poor, the histories commonly showed that the disease had continued from three to six months, with progressive loss of flesh and strength. Nevertheless, after proper evacuation of the pus and establishment of a fistulous opening, the majority have gradually recovered, death in the unfavorable cases being commonly due to extreme prostration with perhaps fatal organic changes, as amyloid degeneration and tuberculosis.

Secondary pleuritis occurring in a reduced state of the system, as after scarlet fever, and pleuritis complicated by a grave disease, as pericarditis or pneumonia, are always dangerous to life.

It is the common belief that pleuritic effusions involve greater danger on the left than on the right side, from the fact that the former produces more immediate and direct pressure on the heart and cause a greater twist in the vessels, but Leichtenstern (*Deutsches Archiv für Klin. Med.*, Band iv.) states that, in 52 cases of sudden death from pleuritic effusions, 31 were right and 20 left pleurisies. The walls of the right cavities of the heart, upon which the liquid in the right pleural cavity directly presses, are thinner and therefore more yielding than the walls of the left cavities. The records of the cases collected by Leichtenstern show that sudden death sometimes results from extensive and far-reaching thrombi in the right cavities of the heart and in the superior vena cava, or to emboli detached from the thrombi and intercepted in the pulmonary artery. In grave cases attended by large effusion, sudden death sometimes occurs after some exertion on the part of the patient, as after vomiting, severe coughing, or hurried rising to the erect position, or lifting a heavy weight. It is believed that, under such circumstances, there is a retarded flow of blood through the lungs and into the left cavities of the heart and the aorta, so that sudden and fatal anæmia of the brain is produced.

As already stated, death may occur in protracted cases from amyloid degeneration of important organs, as the kidneys and liver. This can sometimes be detected by enlargement of liver and spleen, and the occurrence of albuminuria.

It is evident that the prognosis varies greatly according to the degree of dyscrasia. In profound blood-poisoning, whether scarlatinous, uræmic, or septicæmic, pleuritis is always grave. Septic pleuritis, which occurs for the most part in new-born infants, during epidemics of puerperal fever, is especially so. When it has continued a few hours, the pinched features and rapid sinking show that we have to deal with something more than an ordinary attack.*

---

* The following case which occurred in my practice during the recent epidemic of puerperal fever (1881) may be adduced as an example: Mrs. D., a primipara, was delivered by the forceps after a tedious labor, at 9 P.M., April 6th. On the following morning her temperature, without the occurrence of a chill, had risen to 105½°, and her pulse varied between 125 and 134. She was in a critical state for several days, with a temperature varying between 103° and 105½°, and without any local symptoms either of metritis or cellulitis, but finally recovered. The baby, healthy and vigorous at birth, had been allowed to obtain what nutriment it could from the breast, but the nurse remarked that she "never saw a child sleep so much," and I gave very little attention to it, as my time was devoted wholly to the mother. On the 10th, when four days old, its sleepiness ceased, and it became constantly fretful, as from colic, and it refused to draw upon the nipple. Early in the morning of the 11th I was summoned to it, and was astonished at its altered appearance, its shrunken features, and its evidently

Pleuritis is also very severe, and ordinarily fatal, when it is caused by the entrance of some pathological product into the pleural cavity, as pus or decaying lung substance.

Treatment.—It will be convenient, in considering the treatment, to describe that which is appropriate for each of the three stages into which systematic writers have divided pleuritis. First, the stage preceding effusion, secondly, that of effusion, and thirdly, that of absorption and convalescence. In the beginning of the inflammation, appropriate measures should be promptly employed for the purpose of reducing the inflammation, and preventing or diminishing, so far as possible, the exudation which soon follows. The abstraction of blood is now properly discarded in the treatment of most inflammations of infancy and childhood, but in certain cases of pleuritis occurring in robust children over the age of four or five, or even three years, the early and judicious employment of one or two leeches diminishes the pain and apparently also for a time the febrile movement and the inflammation. But it may be stated as a rule that the loss of blood is not only not required, but is injurious in all secondary

---

dying state. Percussion upon the right side gave a flat resonance from the clavicle to the diaphragm, and there was some meteorism in the abdomen. The thermometer introduced into the rectum showed no elevation of temperature, and no unusual heat of surface or cough had been noticed by the nurse. By active stimulation the infant lived till the middle of the afternoon. The autopsy revealed a sero-fibrinous exudation filling the right pleural cavity, producing complete carnification of the lung, so that it resembled that of the fœtal state, and soft patches or flakes of fibrin upon the lungs. By an oversight, the peritoneum was not examined. Cases like this, of pleuritis in the new-born having a septic cause, I believe to be rare, and met only or chiefly during epidemics of childbed-fever. Some years ago I saw a new-born infant in one of the institutions, whose mother had puerperal fever, die in a similar manner, and the autopsy showed that the cause was peritonitis. The following extracts from Trousseau's clinical lecture on erysipelas of new-born infants will aid in understanding such cases. Speaking of Dr. P. Lorain, he says: "During the epidemic at the maternity, where this able and laborious observer was a resident pupil, he collected the information of which the following is a summary: Of 106 still-born infants, 10 were found to have died from peritonitis, and 3 of the mothers of these 10 infants were carried off by puerperal fever after delivery. Of 193 infants born alive, 50 died of the very same affections which proved fatal to the lying-in women. The most frequent causes of death were peritonitis, numerous abscesses, purulent infection, phlegmonous swellings, erysipelas, gangrene of the limbs, putrid infection, or some other remarkable septic condition." . . "Mother and child then are subject to the same morbific influence." Farther on Trousseau says of the infant affected by this puerperal poison: "He will cry incessantly from pain. A state of restlessness will be succeeded by collapse, which will close the scene on the fifth, sixth, or seventh day. On examining the body after death, pus will be found in the cellular tissue, sometimes *suppurative pleurisy*, more frequently phlebitis of the umbilical vein, or of the vena porta, or peritonitis." An interesting incidental fact shown by these statistics is that the cause of this puerperal disease of the new-born is sometimes operative in the fœtal state.

pleurisies, and in the primary form after exudation has occurred. It is injurious in all forms of pleuritis in pallid and cachectic children, and, therefore, in a large proportion of the cases occurring in the tenement-houses and institutions of the cities. The flow of blood from the bites should ordinarily be arrested after two or three hours, but if slight, it may continue longer in vigorous children of eight or ten years.

At the first visit of the physician, an emollient and slightly irritating poultice should be ordered, enveloping the entire chest, to be constantly worn, except as it is temporarily removed during the application of the leech, and the subsequent flow of blood. The poultice should be so mildly irritating that it causes constant redness of the skin without pain, and it should not be removed except when a fresh poultice is prepared to replace it. Thus employed it produces constant dilatation of the capillaries of the skin, and, by the fluxion caused, diminishes, in my opinion, the engorgement of the capillaries of the costal pleura. A poultice of the common white mustard, with flaxseed in powder, one part to sixteen, between two pieces of muslin, and so wet that it moistens the hand in holding it, produces this effect. Applied morning and evening, it can be constantly worn without complaint of pain due to it. For infants under the age of eight months, I prefer the use of the plain flaxseed, with camphorated oil smeared upon its under surface. The oil may be applied several times daily, while the morning and evening application of the poultice is sufficient. Spongiopilin or compresses of flannel wrung out of hot water and covered with oil-silk meet the indication, and possess the advantage of being lighter and cleaner, and more readily applied than the poultice. Redness may be produced, by applying under the spongiopilin a single thickness of muslin soaked with camphorated oil, or for children of a more advanced age, with camphorated oil and one fourth or one third part of turpentine.

Vesication, formerly much employed, has properly nearly fallen into disuse in the treatment of the pleuritis of children. While it is apt to increase the suffering, it has apparently no tendency to diminish the inflammation, in whichever stage employed, and there is no certainty that it stimulates the absorbents and expedites the removal of the liquid, according to the old theory. A case is reported, in the practice of one of the New York physicians, in which a blister had been applied when the inflammation was still active, and at the autopsy, the portion of the costal pleura which lay directly underneath the surface that had been vesicated was covered by a thicker fibrinous exudation than that upon the contiguous surface. The increased afflux of blood caused by the blister had, to appearance, extended to the costal pleura, and increased the pleuritis. The application of cold bandages around the chest, which is recommended by some, seems to aggravate the cough in certain patients, and does not ordinarily give the relief of moist and warm applications.

Internal Remedies.—The indications are to employ such medicines as diminish the frequent action of the heart, and thus retard, in a measure, the flow of blood to the pleura, and such as diminish the pain and frequency of the cough, which, by increasing the friction of the pleural surfaces, tends to increase the inflammation. For robust children over the age of three years in the first stage of primary pleuritis, the tincture of aconite may be prescribed, half a drop for a patient of three years, and one drop for one of six years, every third hour for two or three days, or until the required effect be produced upon the pulse, when it should be discontinued. It is, as a rule, too depressing for other patients. Digitalis is a better and safer remedy for children under the age of three years for all secondary pleurisies, and for all cachectic cases. Benefit results from continuing the use of digitalis in the stage of exudation when aconite would be inadmissible. A child of two years can take one drop of the officinal tincture, and one of five years two drops every three hours.

The use of quinia is suggested, since it is an antipyretic and tonic, but in my practice it has been much less useful in pleuritis than in pneumonitis. This agent, in whatever form given, does not appear to exert any notable controlling effect either on the fever or gravity of pleuritis. Nevertheless, I have often employed it, especially in secondary pleurisies, with or without digitalis, and it probably does some good as a tonic. The salts of quinia, as ordinarily given in solution to young children, are very apt to be vomited. When vomited, a soluble salt, as the bisulphate, may be given as a suppository, or Squibb's oleate of quinia may be employed by inunction. I should, however, add that, though I have used inunctions of the oleate in pleuritis during the last year, ten grains of the alkaloid, at a time, I have not seen any marked beneficial effect. To meet the second indication in the treatment of the first stage, namely, to relieve the pain and restlessness, and to diminish the cough, so that there is less friction of the pleural surfaces, our chief reliance must be on hyoscyamus or one of the opiate preparations. The following formulæ will be found useful :

℞. Tinct. opii deodorat, gtt. xx ;
Tinct. digitalis, gtt. xvi ;
Syr. pruni Virginian, ʒ j :
Aquæ, ʒ iss. Misce.

Dose, one teaspoonful (one drachm) every three hours for an infant of eighteen months. The tincture of hyoscyamus may be employed in place of the opiate in double the dose.

For a child of three years :

℞. Tinct. ipecac. comp. (Squibb's liquid Dover's powder), Tinct. digitalis, āā gtt. xxxij.
Syr. pruni Virginian, ʒ ij. Misce.

Dose, one teaspoonful every two or three hours.

For a robust child of eight years with primary pleuritis :

℞. Morph. sulphat., gr. i.
Tinc. rad. aconit., gtt. xx.
Syr. pruni Virginian, ʒ iiss. Misce.
Dose, one teaspoonful every three hours.

The diet in the first stage should consist of milk and farinaceous food, given liberally. The meat-teas or the expressed juice of meat may be added, and in secondary pleurisies, as after scarlet fever, it is often proper to give a moderate amount of alcoholic stimulants from the first.

Second Stage.—Measures employed in the first stage have been designed to diminish the inflammation and relieve suffering. The duty of the physician, in the treatment of the second stage, is chiefly to aid in the removal of the inflammatory product, and prevent, so far as possible, its further formation. If this be sero-fibrinous, and its quantity be small, so as to fill only the lower portion of the cavity, little aid may be needed from therapeutics ; but a larger effusion, compressing the lung and displacing the heart, requires medicinal and often surgical measures. The recommendation of Niemeyer, that the patient's food contain little liquid, and that his drinks be restricted, as a means of increasing the absorption from the pleural surface, is not applicable to young children, whose diet must of necessity be largely liquid, and that of infants chiefly milk.

Attempts to stimulate the absorbents by external treatment of the chest are of doubtful efficacy, whether by the application of the so-called small flying-blisters, the iodine ointment or tincture, or a stimulating liniment. The common practice of treating glandular swellings by iodine applications suggests their use for pleuritic effusions, and of the agents employed locally to hasten absorption they are probably the best, but they should not be used so often or in such quantity as to cause pain or restlessness from their irritating effect.

It is an established principle in therapeutics that the removal of a serous liquid in either of the larger cavities of the body is hastened by such remedies as produce an abundant liquid secretion or transudation from any of the organs or surfaces. Hence in the treatment of pleuritic effusions, those medicines which act on the skin causing diaphoresis, upon the intestines causing watery stools, and upon the kidneys causing diuresis, are at once suggested as most likely to be efficacious. But sudorifics, though useful for dropsies having a renal origin, have not been much used of late years for the removal of exudations in the pleural cavity, experience having shown that they are inadequate for this purpose. Recently, however, the discovery of a very active agent of this class, jaborandi, has revived, in a measure, the sudorific treatment of the second stage, so that in the National Dispensatory of Stillé and Maisch this diaphoretic is one of the

recommended remedies. Having witnessed the effect of jaborandi in various diseases, I am persuaded that the risk attending its use for pleuritic effusions more than counterbalances any good result which might accrue. The heart, crippled in its action by the pressure of the liquid, badly tolerates agents of a depressing nature, and there is little doubt that jaborandi, or its active principle pilocarpin, exerts a weakening effect on this organ.

Again, the fact that sero-fibrinous exudations have been known to diminish rapidly during attacks of diarrhœa suggests the use of purgatives ; but, although an open state of the bowels, as two or three daily stools, aids absorption, free purgation is badly borne by young or feeble children, as it reduces the strength, and, therefore, like the use of jaborandi, is not to be recommended as a therapeutic measure. Moreover, there is not the need of employing severe or exhausting medicines for the removal of the liquid, which may have existed in former times, since we are able to accomplish this quickly, easily, and safely by the excellent aspirating instruments now in common use.

Diuretics, on the other hand, are apparently more useful, while they are less exhausting, than sudorifics or cathartics. Digitalis, combined with the citrate or acetate of potassium, has stood the test of experience, and is now more widely used than any other agent of this class. Being both a diuretic and heart tonic, it possesses properties which render it especially serviceable in the treatment of pleuritic effusions. The following is a useful prescription for a child of five years :

℞. Potassii acetatis, ʒ ij ;
Infus. digitalis, ℥ iij Misce.
Give one teaspoonful every three hours.

It is a matter of observation that absorption occurs more rapidly, and a sero-fibrinous is less likely to become a purulent effusion, if the bodily condition be good. Hence tonics, especially the bitter vegetables, are sometimes useful, and a diuretic in combination with a tonic, as the acetate of potassium in decoction of cinchona, may often be prescribed with advantage.

Still, however judicious the treatment, hygienic and medicinal, many cases require surgical interference, and the number of such is certainly larger in the city than in the country, and in the tenement-houses than in the better walks of life, since the cachexia so common in city children increases the liability to purulent exudations.

Thoracentesis.—The indications for the operation are the following :

1st. Dyspnœa due to the presence of the liquid, whether it be sero-fibrinous, purulent, or hæmorrhagic. Usually when dyspnœa occurs, the pleural cavity is full, but if there be parenchymatous disease of either lung, a moderate quantity of liquid may cause such embarrassment of respiration that thoracentesis is indicated.

2d. A flat percussion sound over the entire affected side, with displacement of the heart, even if there be no present dyspnœa, is also an indication for the operation, for dyspnœa might occur suddenly with other alarming symptoms between the visits of the physician. Moreover, experience has shown that absorption from a distended pleural cavity is very tardy, in consequence of compression of the absorbents, whereas, if a portion of the liquid be removed, absorption of the remainder is more rapid. The patient with full pleural cavity and lung totally compressed lies on the affected side, and is apt to feel uncomfortable in any other position, and the withdrawal of a portion of the liquid, as, for example, one half, the operation being discontinued when the patient begins to cough or evince distress, produces no ill-effect, and increases the comfort.

3d. A moderate effusion, without material decrease in quantity after some weeks of observation, also indicates the need of surgical interference, since long compression of a lung involves risks. There is danger that catarrhal ending in cheesy pneumonia and tubercles may occur in a lung whose function is long suspended ; besides, the longer compression has existed, the more tardy, difficult, and incomplete will be the inflation when the liquid is removed, on account of the altered state of the alveoli, and the presence of fibrinous bands over the lung. Thus, in a case recently under observation, only partial inflation of the lung occurred, after letting out the liquid, so that the ribs and shoulder on the affected side are permanently depressed, and unequivocal symptoms of tuberculosis are now present.

4th. If the inflammation extend to the pericardium, so as to cripple the heart's action, or if there be any serious pre-existing heart-disease, the liquid, even in moderate quantity, may, by pressure, so embarrass and retard the heart's action that its cavities are not properly filled, so that passive congestion of certain organs, and dangerous anæmia of others, especially of the brain, may result. Under such circumstances, an early performance of thoracentesis is indicated.

5th. *Empyema.*—The presence of pus in the pleural cavity affords in itself, in a large proportion of cases, sufficient indication of the need of thoracentesis. In recent cases, with only moderate constitutional disturbance and embarrassment of respiration, if we ascertain by the hypodermic syringe that the liquid is only slightly clouded by leucocytes, surgical interference may be postponed, while the acute inflammation is treated. Thus, in case of an infant of two months, thin pus was withdrawn on the fourth day of acute pleuritis, and, although thoracentesis was early performed, it appeared probable, from the subsequent course of the case, that it would have been as well had the operation been deferred. If spontaneous evacuations of pus have occurred through one of the intercostal spaces, producing a fistula, from which there is a daily oozing, or if it be probable, from the symptoms and signs, that pus is escaping from the

pleural cavity into a bronchial tube, and is being gradually expectorated —a mode of cure which, as I have elsewhere stated, is not infrequent in children—thoracentesis may be deferred. In the case of an infant, aged six months, recently under treatment for empyema of the left side, we removed four ounces of pus, and washed out the pleural cavity. The opening having closed, and the physical signs indicating the re-accumulation of a considerable quantity of liquid, we were preparing for a second operation, when the parents and nurse called our attention to the fact that there were occasional severe attacks of coughing, during which the breath presented a very decidedly purulent odor. Although there was no external expectoration, as the sputum was swallowed, thoracentesis was postponed, and the result justified the decision, for the patient gradually convalesced. Except under circumstances like the above, empyema, when clearly diagnosticated, by the employment of the hypodermic syringe, should be promptly treated by evacuation of the pus.

Instrument to be Used, and Mode of Operating.—Ingenious instruments for tapping the chest have been invented by Dr. Chadbourne, of the New York Foundling Asylum, Dr. A. M. Phelps, of Chateaugay, Franklin Co., N. Y., and others, which, by india-rubber packing, totally exclude air, while the operation is performed with facility and little pain. That devised by Dr. Chadbourne has a canula with two arms, one for attachment, by means of tubing, to the exhausting receiver, and the other is designed to facilitate irrigation of the pleural cavity.

Phelps' apparatus has a third tube, entering the bottle through the stopple, and a glass tube passes from the stopple to nearly the bottom of the bottle. With this apparatus, by reversing the movement of the syringe, the liquid can be withdrawn from the chest, the bottle emptied of it, the water used for irrigation be conveyed into the bottle, from the bottle to the chest, and back into the bottle, without changing the position of the bottle or removing the stopple. I would suggest the use of the trocar and canula instead of the sliding aspirator point which plays outside the canula, as an improvement in this instrument.

The instrument which I have been in the habit of employing is of simpler construction. The canula has about the size of the smallest needle of Dieulafoy's aspirator ; the proper size, in my opinion, for thoracentesis, for both sero-fibrinous and purulent exudations. I greatly prefer the use of the exhausting-bottle rather than the exhausting-pump without the bottle, as it is more convenient and produces greater suction, from its greater size. The canula is provided with an arm, which connects it by tubing with the exhausting-bottle. Beyond this arm, the body of the canula, sufficiently expanded to contain india-rubber packing, extends about one and one half inches, and is provided with a stop-cock. Through this packing the trocar is introduced, and, after the puncture, it is withdrawn to the stop-cock, which is then turned to prevent the admission of

air. Then the obturator is introduced in place of the trocar, so as to remove any obstruction which may enter the canula.

The tubing which extends from the arm of the canula to the bottle should be firm, with a somewhat larger bore than that of the canula, and its point of attachment to the bottle should also be provided with a stop-cock. A short glass tube introduced into this tubing near the canula is convenient for noticing the character of the fluid, which, if it be thick pus, may flow with difficulty, and not reach the bottle. A bottle of sufficient capacity to hold two quarts obviously produces more suction power than one of less size, and is, therefore, preferable for certain cases, and its sides should be marked to indicate ounces and drachms. The tube which connects the canula with the bottle enters through the stopple, and proceeding from the stopple is another tube similar to the first, to which the syringe is attached. The syringe has two points for attachment to the tube, and a double action in its interior, so that attached by one point, it exhausts the air from the bottle, and attached by the other point, it condenses air in the bottle. The stop-cock between the canula and the bottle should always be closed when the syringe is used, whether for exhaustion or condensing. It is very important that this should be constantly borne in mind when working the syringe, or air may be thrown into the pleural cavity and much harm done.

Mode of Operating for Sero-fibrinous Exudations.—In the following remarks I shall state what I consider the best method of performing thoracentesis, having formed my opinion from the cases which I have witnessed and been able to follow, in the institutions and in family practice. A mode of treatment which may be safe and proper for the adult is not always the best for the child, and, as there are different opinions and different modes of procedure, and as many who are familiar with adult cases recommend similar treatment for the child to that which they have employed with success for the older and more robust cases, I shall advise the abandonment of certain measures which are in common use, and the substitution of others. The hypodermic syringe should be first introduced at the point where it is proposed to perform the operation, the needle being inserted about one inch, for I hold it unjustifiable to tap the chest without first ascertaining that there are no adhesions at the site selected for puncture, and at the same time ascertaining the character of the liquid. Incision of the skin with the knife and spraying the surface with ether are not required as preliminary treatment, since the puncture is quickly and easily performed with a small trocar, and with very little pain. The rule is established by many observations that the operation should be performed in or near the vertical line passing through the angle of the scapula, and between the eighth or ninth ribs, or one of the adjacent intercostal spaces. I have elsewhere stated that a point a little external to this line is preferable, as the lung is less likely to be injured. The

instrument should obviously be inserted no farther than will be sufficient to reach the liquid, and, as from measurements which I have made, the thickness of the thoracic wall in rather fleshy children is about half an inch, penetration to the depth of one inch will ordinarily be sufficient to pass the fibrinous layer. We are apt to puncture more deeply than is necessary without some safeguard, and incur the risk of wounding the lung. India-rubber tubing may cover the instrument to within one inch of the end, or a cord may be tied snugly around the instrument at one inch from the tip. The sensation communicated to the fingers will, however, be the best guide to the careful operator as regards the exact depth to which the instrument should be carried. The trocar should now be withdrawn, the obturator introduced in its place, the air exhausted from the bottle, and then the stop-cock turned, to allow the liquid to escape.

It should flow slowly, as it probably will, through so small a canula, but the flow can be regulated by the stop-cock. The quantity to be removed depends upon the age and condition of the child, the size of the cavity, and the quantity of the liquid, but if the patient begin to cough or feel uncomfortable after the removal of one half, or even one third of the liquid, the canula should be withdrawn. The sensation of insufficient breath is no longer experienced, and the remaining liquid is progressively absorbed. This operation is one of the easiest in surgery, while, with the precautions mentioned above, no ill effect need be apprehended. One operation is, in most instances, all that is required, though, if need be, it can be repeated after some days, and it is very seldom that the lung does not fully expand to fill the chest if the operation be performed at the proper time.

Mode of Operating for Empyema.—It will aid in understanding this part of our subject to remember that all pleuritic exudations contain pus-cells, and that the only anatomical difference between sero-fibrinous exudations and empyema is in the proportion of these cells. There is, therefore, no fixed and definite boundary line between the two kinds of exudation. The term of empyema is, as all know, applied by common usage to the liquid when it contains so many leucocytes or pus-cells that a turbid appearance is imparted to it. Absorption is slow and difficult, or impossible, if the liquid contain a large amount of solid ingredients, namely, fibrin and pus-cells, while liquid containing only a small proportion of these constituents more readily enters the absorbents. In other words, thin pus may be absorbed and removed from the system by natural methods, or by the same instrument and operation which we have recommended for sero-fibrinous exudations, while a thick liquid adherent to the pleura, or sinking heavily in dependent portions of the cavity, disappears very slowly, losing by absorption only a little of the liquor puris, while the bulk of it cannot be absorbed, so that the only relief is by evacuation through an opening. Often in practice, after the acute symptoms of an

empyema have in a measure abated, the physical signs indicate some diminution of the liquid in successive weeks, but further removal soon comes to a standstill, and the resources of surgery must be tried.

In my opinion, the same small trocar and canula should be used for tapping the chest of an empyemic child which we have recommended for sero-fibrinous exudation, and with the same precautions. If the liquid be thin and but slightly turbid, if it be but little removed from sero-fibrin in its character, it will flow through the canula, even if it be necessary to use the obturator often to remove obstructions. Having withdrawn all the liquid which will flow through the opening, unless severe coughing or some unpleasant symptom occur, which is an indication to discontinue the withdrawal, the instrument is removed, and the aperture may be closed with adhesive plaster. One operation may be sufficient to effect a cure, though convalescence in empyema is tardy under the most favorable circumstances. If we observe from week to week some return of appetite, more cheerfulness and sleep, easier breathing, and less frequent cough, the case can be left to hygienic management and restorative medicines. But if the improvement be only temporary, and after some days examination shows that the liquid has re-accumulated to nearly or quite its former quantity, and symptoms occur which indicate the need of surgical interference, the operation should be repeated. The use of so small an instrument produces no shock or prostration, and very little more pain than occurs from the hypodermic injection of a medicine.

And now I come to a subject in regard to which my observations have led me to differ from some whose opinions I respect. If the liquid be so thick, so heavily loaded with leucocytes that it do not pass through the canula, what shall be done? Shall a larger instrument be used, as one corresponding in size with the medium or even large needle of Dieulafoy's aspirator, or shall a free incision be made with a knife? The latter, I am convinced, is the proper alternative. The canula may serve as a director, and an incision should be made with the sharp-pointed bistoury along the upper border of the rib, sufficiently large to admit the blunt-pointed bistoury, and with this the incision should be extended to the distance of one third to one half inch, which will allow the pus to flow out freely. The opening should then be covered by oakum confined by long strips of adhesive plaster. Pus may or may not continue to flow into the oakum. If it do not, the opening will close, if left to itself, within two or three days. No tent or drainage-tube is employed, for reasons to be mentioned hereafter. The physician should return after twelve or twenty-four hours, not later, and should introduce through the opening the ordinary gum-elastic male catheter, warmed so as to be flexible, and strongly bent at its middle. The point should be directed to the bottom of the cavity. Perhaps the soft rubber catheter might be preferable, but I have never used it, being satisfied with the other. The

catheter should be attached by tubing to the exhausting-syringe or bottle, and any pus in the depending portions of the cavity will be readily removed. I have generally, at this visit, removed from the bottom of the cavity two or three ounces, sometimes very thick, and such as would not readily flow from the opening. Every day or twice daily the operation should be repeated, which will, I think, more effectually remove the pus than washing out the cavity, and the opening cannot close. This operation detains the physician only a few moments. The catheter should be a No. X., and it is the best possible probe. By the close of the first week the opening becomes fistulous.

After each removal of the pus, long strips of adhesive plaster firmly applied over the ribs, from the sternal region downward and backward, facilitate approximation of the pleural surfaces and obliteration of the cavity. During convalescence, the patient, if old enough, should be directed to make full inspirations, which serve to expand the lungs.

That thoracentesis, so simple and important an operation, should have been known and practised by the ancients, even, it is said, by Hippocrates, and have fallen into disuse, till it was revived, in our own times, by Bowditch and Trousseau, seems remarkable. This was probably in part due to the bad instruments employed, and in part to the fact that in olden times the operation was performed in the anterior walls of the chest, where adhesions are very apt to be present. But there are certain accidents and unfavorable results of the operation which may be profitably considered, since, in my opinion, they can nearly always be avoided.

1st. *The Admission of Air into the Pleural Cavity.*—This is unnecessary, and can be avoided ; but those who have often witnessed the operation, as ordinarily performed, have remarked the fact that the admission of more or less air is common.

The entrance of a certain amount of air into a serous cavity, when the serous membrane is in its normal state, does not appear to be productive of harm with ordinary precautions, as regards temperature, etc., as in ovariotomy, in which air is admitted into the largest serous cavity in the body ; and the moderate admission of air into the pleural cavity, when the pleura is healthy, does not, as a rule, produce any ill effect. Thus in the *London Lancet*, January 15, 1831, the case is related of a man who suffered from heart disease, and was led to think that the pressure of a small amount of air internally might be substituted for external pressure, which always gave relief. He was his own instrument-maker and operator. He constructed a small tube about as slender as a common pin, to which a bladder was attached filled with air. The point of this was thrust through an intercostal space till it penetrated the pleural cavity, and air was made to enter by compressing the bladder. Relief always followed, and the patient's health improved. This treatment was continued two or three years. Dr. Lizars, who was present at the meeting of

the Medical Society before which this case was related, stated that he had performed a similar operation on four or five patients affected with aneurisms, with some apparent benefit, and in no case with injury.

But the condition is very different if there be inflammatory products in the cavity. It is a fact known to all observers that animal liquids withdrawn from the circulation, and escaped from the vessels through injury or disease, remain in a closed cavity for a lengthened period without putrefactive change, as for example a clot of blood under the scalp or pericranium of a new-born infant; but if air be admitted, it becomes offensive within a few hours. The admission of air into the pleural cavity which contains exuded products undoubtedly promotes putrefactive changes in the latter, and the admission of even a small amount of air, containing, as it does, micro-organisms, which multiply rapidly in the animal fluids, and which appear to be the active agents in putrefaction, suffices to convert sero-fibrin, or laudable pus, into an offensive, irritating, and poisonous liquid, which increases the constitutional disturbance and the gravity of the disease.

Air in the pleural cavity, in proportion to its quantity, also tends to prevent the approximation to each other of the pleural surfaces and the obliteration of the cavity, which is required in all empyemic cases, since it is the mode of cure. Obviously the entrance of air does less harm if there be a fistulous opening and pus escape as soon as it forms, than in a closed cavity, but it should, in all instances, be avoided, as never beneficial, and likely to do harm in the manner indicated. It is never a necessary accident of thoracentesis, since it can be avoided by the use of proper instruments provided with India-rubber packing and stop-cocks. There can be no doubt, also, that the point of the aspirator has often so pricked and torn the lung, that air has entered the cavity from this organ —a result avoided by judiciously using the trocar and canula.

2d. The lung is sometimes injured by the point of the hypodermic needle, employed for diagnosis. Cases are recorded in the hospitals of New York, of the breaking off and loss of the needle in the lung, from sudden and strong movement of this organ, as in coughing. The most severe injury is, however, commonly produced by the aspirator needle, and some very serious cases of this accident have occurred, in which the needle so pierced and tore the lung that not only air escaped from it, but also a considerable quantity of blood. It is obvious that the danger of injuring the lung is greater in recent than in chronic cases, and greater in sero-fibrinous than in purulent pleuritis, for a thickened, infiltrated, and firm pleura affords protection to the lung. It is very difficult to avoid injuring this organ if suction be made and the liquid be withdrawn with the unguarded point of the aspirator needle projecting into the chest. The removal of the liquid necessitates the impinging of the lung upon the point of the instrument even if it be held very obliquely, and in recent

cases, when there is little thickening and infiltration of the pleura, the surface of this organ may be pricked or torn sufficiently to allow air to escape, and hæmorrhage occur, when the operator who holds the needle can scarcely believe that such an accident were possible, so slight has been the sensation communicated to the fingers. Thus thoracentesis was performed on an infant of two months who had severe empyema of short duration. The instrument was held by myself obliquely, and it entered the pleural cavity only a short distance, and yet the lung was injured in three places, from which it was probable, from the signs and symptoms, that air had escaped. The specimen showing the injury was exhibited to the Pathological Society in 1879. Obviously, to prevent this injury, aspiration should be performed through the covered needle, as that of Phelps, or Potain's, or, which I have recommended above and prefer, the trocar. I must here repeat what has been stated above, not to plunge the trocar to a greater depth than is needed, which is about one inch. The end of the canula may also injure the lung if it be pressed too deeply in, since it is necessarily rather sharp from its small size.

3d. *Washing out the Pleural Cavity.*—Since the aspirator has come into general use, it is the common practice to wash out the pleural cavity with carbolized water in the treatment of empyema. The proportion of carbolic acid to water commonly employed is about one part to eighty, and at a temperature of 100°. From a discussion at the meeting of the New York Surgical Society, Oct. 12, 1880, it appears that the use of carbolized water involves risk of carbolic-acid poisoning in case the liquid be only partially removed after it is thrown into the pleural cavity, and Prof. Erskine Mason has for some time been in the habit of employing salicylic acid, one part to one hundred of water, in place of carbolic acid, as it possesses all the advantages with none of the possible risks of the latter. He states that it promptly deodorizes fetid pus even in the proportion of one part to two hundred. The use of carbolic acid would probably be entirely safe if the liquid were removed immediately after washing the cavity, but for some reason this is not always possible. In case of an infant with empyema under treatment by Drs. Lockrow, Billington, and myself, after removing the pus by trocar and canula attached to the exhausting-bottle, and once washing out the pleural cavity, the liquid was thrown in a second time, ℥iij into the left pleural cavity of an infant of five months, but not a drop of it could be removed. There was, however, no symptom which we could refer to the carbolic acid. In view of these facts, and the possible danger of carbolic-acid poisoning, the use of salicylic acid appears to be preferable, at least for children, who are less able to resist the action of poisonous agents than adults.

In this connection I must state my conviction that washing out the pleural cavity is unnecessary if empyema be treated as recommended above, and is apt to be injurious except in those cases in which the pus

has undergone decomposition, is offensive to the smell, and therefore poisonous. If it be putrid, its immediate disinfection as well as removal from the pleural cavity appear to be clearly indicated, but in the common form of empyema, as the pus escapes through the opening which has been made, and the suppurative cavity becomes smaller, adhesions of the pulmonary and costal surfaces occur, which the injection of water is apt to tear up and destroy, and thus the obliteration of the cavity is retarded. Letting out the pus and approximation to each other of the pleural surfaces are the indications as regards surgical measures. Besides washing out the pleural cavity is not devoid of danger. Alarming symptoms may be developed unexpectedly and rapidly, even when the operation is slowly and cautiously performed. The infant of five months, with empyema, whose case I have alluded to, furnished a striking example of this. Four ounces of pus had been removed through a small canula from the left pleural cavity, and without removing the canula the cavity had been once washed out. It was proposed to repeat the washing, as the infant had thus far tolerated the operation, and was in an unusually favorable state for a case of empyema. The patient was in a semi-erect position, and three ounces of water at a temperature of 100° had entered the cavity from the inverted bottle, when he began to cough, fretted, and became very restless. Immediately Dr. Lockrow applied the suction-point of the syringe to the tubing, and attempted to withdraw the liquid, but with no result. The patient's face assumed a deadly pallor, he frothed at the mouth, his lips were compressed, and breathing ceased. He was to all appearance dead. He was immediately placed upon the back by Dr. Billington, and by prompt resort to artificial respiration, the terrible suspense was soon ended by the gasps of the child, and the return in a few moments of consciousness and normal respiration. It seemed to me that this untoward accident was due to the flow of water against the heart, so that it prevented full dilatation of its cavities, and, consequently, diminished the flow of blood into the aorta and produced anæmia of the brain. Lichtenstern says : " Various causes, which sometimes quite interrupt or impede the flow of blood to the left heart, such as severe paroxysms of coughing, vomiting, lifting heavy burdens, may give rise to a suddenly fatal anæmia of the left heart, and secondarily of the brain. The anæmia of the lungs or brain found in many cases is only of secondary importance. It frequently happens after thoracentesis with aspiration that an anæmia is produced in the partially distended lung, and this may lead to death by asphyxia. In sudden death during, or immediately, or a short time after thoracentesis by aspiration, the cause is anæmia either of the heart or brain. In cases in which severe syncope and sudden death are observed during the irrigation of the pleural cavity, the cause is either direct mechanical concussion of the easily exhausted heart, by the stream of water thrown in, or shock." (*Deutsches Archiv*

für Klin. Med., Band IV., 4 Heft. *Lond. Med. Record*, Dec. 15, 1880.)

4th. *The Use of Tent and Drainage Tube in Empyema.*—With due regard for the opinions of the experienced surgeons who employ and recommend the tent and drainage tube, but whose observations have been largely upon adult cases of empyema, I cannot recommend their employment for children, unless perhaps the tent for a day or two after the incision ; but the tent is not necessary if the catheter be daily introduced in the manner which I have advised. The drainage tube almost necessarily admits air during inspiration, but this is not the most serious objection to it. Cachectic children with poorly nourished tissues badly tolerate pressure upon an open wound by a hard substance. It is apt to cause ulceration and enlarge the opening, and continued pressure of the tube is apt to cause periostitis upon the edge of the rib and necrosis. Scrofulous and feeble children are very prone to both caries and necrosis from even slight pressure or bruises upon the surface of the bone—a result to which adults are much less liable. In a paper published by Mr. W. Thomas, in the *Birmingham Med. Rec.*, 1880, N. S., vol. iii., on the treatment of empyema by resection of one or more ribs, nine cases are detailed, in three of which necrosis had occurred from pressure, it is stated, of drainage tubes, thus necessitating the removal of the diseased portion. During the last six months, a wasted empyemic infant was brought to one of the institutions of this city for treatment. After letting out the pus, a drainage tube was introduced and secured. At the next visit ulceration had so enlarged the opening that a large amount of air entered the chest with a whistling noise at each inspiration, and was expelled during expiration, and necrosis of the portion of the rib against which the tube pressed had also occurred. Air was finally excluded by covering the opening with a cloth smeared on each side with a concentrated solution of gutta-percha in chloroform, but the case after some days ended fatally. The escape of the drainage tube into the pleural cavity, which has occurred by breaking of the threads which secured it, is so rare an accident that it does not constitute an objection to the introduction of the tube ; but aspiration daily or twice daily through the catheter so completely removes the pus that drainage is not required, and the risk of injury by the pressure of the tube is therefore avoided.

5th. I have witnessed, in a few instances, the burrowing of pus under the skin at the point where an incision had been made to let out the pus. This complication may lead to more or less ulceration or sloughing, and it greatly increases the danger of poisoning. But infiltration of pus will almost never occur if the incision be direct through the tissues and not with the skin pushed one side, so that it forms a covering or valve when it returns, as was once recommended in the books as a means of excluding air. But air does not enter the cavity through a direct opening if it

be properly covered after the pus has escaped. Burrowing of pus and pyæmic poisoning therefrom cannot then be regarded as an accident of the mode of operation which I have recommended.

Exsection of a Portion of one or more Ribs.—This operation has now been performed a considerable number of times in Europe and in this country, and, from the published accounts, certain cases have apparently recovered more rapidly in consequence. Thus in one case a fistulous opening, spontaneously established, had continued several months, with little diminution in the discharge, and very slow progress toward recovery, when by this operation, which produced a larger opening and a freer escape of pus and falling of the chest-wall, so as to obliterate the cavity, the patient rapidly convalesced.

The alleged benefit from the exsection, which consists in the removal of an inch or a little more of one or more ribs, in or near the site for the usual performance of thoracentesis, is, that there is a readier escape of pus and the facility for washing out the pleural cavity is increased, and the thoracic wall and lung more readily approximated so as to produce obliteration of the pleural cavity. The greatest benefit is claimed for it in those cases in which the intercostal spaces are small and the ribs lie close to each other.

Without denying that certain cases have apparently been benefited by the operation, I must say that I have not yet met a case either in family or hospital practice, in which I could conscientiously recommend the operation, except where necrosis had occurred from a periostitis produced by the irritating property of the pus, or the pressure of a drainage tube. The gum-elastic catheter, introduced as recommended above, will pass through any intercostal space which I have yet observed, so as to allow free evacuation of the pus by suction, if it be not incapsulated by fibrinous bands, and allow also the free washing out of the pleural cavity if this be desired.

There are also serious objections to the exsection in case of a child. The system, exhausted by a suppurative inflammation, is in poor condition to tolerate an operation of any severity, and although we are directed to preserve as far as possible the periosteum from injury by the knife, and be careful not to wound the intercostal vessels, there are necessarily more or less shock and hæmorrhage and consequent danger of hastening the death of the patient. In one of the cases, that of an infant, reported by an advocate of the operation, it seems to me that death was largely attributable to the exsection.

In order that exsection aid materially in the approximation of the lung and ribs, it is necessary to remove portions of two or more ribs, and the greater the operation the greater the risk. But what is needed is not depression of the ribs, which may produce permanent deformity, but expansion of the lung, and this is promoted by the integrity and resiliency

of the ribs. Therefore, in my opinion, a reaction will take place in the professional mind against this operation.

Nervous Cough.

A nervous cough sometimes occurs in children, especially between the ages of two or three and ten years. It may result from disease of the brain, from the second as well as first dentition, from some irritant in the intestines, as worms, and also from spinal irritation. Occasionally there appears to be no local cause, but a state of anæmia, or a highly developed nervous temperament, to which it seems proper to ascribe the cough. Occurring under these last circumstances it corresponds with, and is some times accompanied by, functional disturbance in the action of the heart, as palpitation.

A nervous cough is short, painless, and without expectoration. It usually attracts little attention at first, but from its long duration the friends finally become anxious lest it betoken some serious disease. At times it may nearly subside if the patient lead a quiet life and the general health improve, and there are periods of recrudescence if the opposite conditions obtain. It may have a spasmodic character, especially in times of mental excitement, but in a less degree than the cough of pertussis. If not properly treated, it usually continues several weeks or months, disappearing as the general health and the tone of the nervous system improve. It is not in itself a serious disease, nor does it lead to any ailment or produce any injury of the respiratory organs, but it is an unpleasant malady, and is liable to be mistaken for incipient tuberculosis if it occur in one decidedly cachectic, and belonging to a family predisposed to phthisis.

Treatment.—If there be a local cause of the cough, measures calculated to remove this, or at least to palliate its effects, are obviously required. Especially should constipation, or any abnormality in the digestive function be corrected. But in many cases there is no apparent local ailment which produces the cough by its irritative effect, and the remedial measures must then be twofold, namely, measures designed to improve the general state, and, secondly, measures designed to relieve the cough. Such measures are also required in most cases in which there is a local cause, provided that the cough do not cease when treatment calculated to remove this cause has been employed.

For constitutional treatment no remedy is so useful in ordinary cases as iron. The following example shows the benefit which may result from the use of this agent, since in this case it effected a cure without the aid of other measures. B—, aged 11 years, pallid and of spare habit, but active, and with good appetite, had been treated for this malady by different physicians but without improvement. His mother had died of

tuberculosis, and some at least of the physicians believed that he was in the commencement of the same disease. Finally he was placed under the care of the late Dr. Cammann, who, detecting the nature of the malady, wrote the following prescription :

℞. Ferri. subsulphat., ʒ ss ;
Acid. nitric., ♏ ʒ ss.
Aq. destillat., ℥ ss. Misce.
Dose, three drops four times daily in sweetened water.

The cough disappeared in a surprisingly short time. If the appetite be poor the vegetable tonics are required in combination with iron.

If the cough be frequent and troublesome, medicines which exert a direct controlling effect upon it are required in addition to the medicines and measures employed to improve the general state. For this purpose no remedy is so useful as the bromides, employed alone or in combination with belladonna. If there be no decided anæmia, and no local cause of the cough, the bromides and belladonna usually effect a cure without the employment of constitutional measures, or if the case seem to require iron it may be given in the interval. The following is the prescription for a child of three years :

℞. Tinct. belladonnæ, gtt. xxxij ;
Potas. bromid.,
Ammon. bromid., āā ʒ j ;
Syr. simplic., ℥ ij. Misce.
Dose, one teaspoonful twice daily.

In 1871 I was asked to prescribe for a German boy, aged 8½ years, who had a cough of this kind of two months' duration, which latterly had been frequent and annoying. Within a week he was entirely relieved without other remedy, by the employment of tincture of belladonna, drops v, and bromide of ammonium, gr. v, twice daily. Outdoor exercise, or country residence, and other regimenal measures which improve the general health, are useful in ordinary cases.

SECTION III.

DISEASES OF THE DIGESTIVE APPARATUS.

CHAPTER I.

SIMPLE STOMATITIS, ULCEROUS STOMATITIS, FOLLICULAR STOMATITIS.

Diseases of the digestive system are very frequent in infancy and childhood. They are for the most part readily recognized, and are more easily and quickly controlled by therapeutic agents, if rightly applied, than are the diseases of any other system. If misunderstood and improperly treated, they may, even when mild and very manageable in their commencement, become chronic and obstinate, or even fatal, or they may lead to other and more dangerous diseases. It is necessary, then, that the physician should understand thoroughly the pathology as well as therapeutics of the digestive system, that he may make timely and correct use of the required remedies.

The diseases of the buccal cavity in early life are for the most part inflammatory. The mildest is that known as

Simple or Catarrhal Stomatitis.

This form of catarrh occurs usually before the completion of first dentition, and it is most frequent under the age of one year. Giving rise in itself to no severe symptoms, and often being connected with other grave and dangerous maladies, it is, doubtless, in many cases overlooked. It is sometimes confined to a portion of the buccal surface, or is more intense in one part than in another. In other cases the catarrh is uniform, or nearly so, affecting the entire cavity of the mouth.

Causes.—The common cause of simple stomatitis in infants is the same as that of most cases of gastro-intestinal inflammation at that age. This is the use of indigestible and therefore irritating food, uncleanliness, personal and domiciliary ; in fine, all those agencies which impair the general health, and enfeeble the digestive organs. Therefore, stomatitis, like entero-colitis, is more common in the city than in the country, and among the city poor than those in the better walks of life. Infants de-

prived of the mother's milk, and given a diet which, with all care of preparation, is a poor substitute for the natural aliment, are very liable to this disease. Beaumont ascertained from his experiments on St. Martin that irritative changes produced in the stomach by indigestible substances were soon followed by similar changes in the buccal mucous membrane. Since in young infants any kind of artificial food is less digestible than the breast milk, it is evident why those who are prematurely weaned or are carelessly fed are so liable to stomatitis. This inflammation is also sometimes due to irritating substances taken in the mouth, as drinks habitually too hot or too cold. Stomatitis is also present in measles and scarlet fever. It then corresponds with the cutaneous eruption, and disappears when that subsides.

Another cause is dentition. The gum over the advancing tooth first becomes inflamed, and, other causes perhaps conspiring, the inflammation extends over more or less of the buccal surface. When due to dentition the stomatitis is more apt to be partial than when it arises from a constitutional cause. Mercury, in whatever form introduced into the system, excreted from the salivary glands, and flowing over the buccal surface, is an occasional though nowadays rare cause.

Symptoms—Appearances.—Stomatitis, like other mucous inflammations, is characterized by increased redness and more or less thickening of the inflamed buccal membrane, by rapid proliferation and exfoliation of epithelial cells, and by an increased functional activity of the muciparous follicles. The heat of the mouth is sometimes augmented in an appreciable degree. The gums in severe cases are swollen and spongy, and bleed easily if rubbed or pressed. The tongue is usually covered with a light fur, and the salivary secretion is augmented to such an extent sometimes as to dribble from the corners of the mouth. Often there is little suffering, but in other instances the patients are fretful, experience pain from the contact of solid food, and, if nursing, may even wean themselves from dread of pressure of the nipple.

Simple stomatitis is not difficult of detection, provided that attention be directed to the mouth. Inspection informs us of its presence and extent. A favorable termination may be confidently predicted, unless there be a state of marked cachexia, or a grave coexisting disease. If circumstances are unfavorable, simple stomatitis may terminate in a more severe form, as the ulcerous or diphtheritic.

Treatment.—The physician should endeavor to ascertain the cause, and, if possible, should remove it by appropriate medicinal or hygienic measures. Sometimes no special treatment is required, as in measles or scarlet fever. When the primary affection terminates, the stomatitis disappears of itself. If dentition be the cause, and there be much fever and fretfulness, it has been the common practice to scarify the gums, but this operation is in my opinion seldom advisable. A few doses of the bro-

mide of potassium relieves the fretfulness, and mucilaginous and mild astringent lotions suffice for the catarrh. Borax is a good local remedy used either with honey or with glycerine and water; one part of borax to three of honey, or a drachm of borax to an ounce of glycerine and water. A weak solution of alum is also a useful topical remedy. With either of these agents in a favorable condition of system, and without any serious coexisting disease, the stomatitis is relieved.

Ulcerous Stomatitis.

In ulcerous stomatitis, the anatomical characters are those of severe simple stomatitis, with the additional element which gives it the name by which it is designated.

The inflammation usually begins upon the gums and extends along the buccal surface. Little white points soon appear upon the under surface of the mucous membrane, producing slight prominence of it. These points, which are inflammatory exudations, mainly fibrinous, gradually enlarge. Some unite and give rise to large irregular ulcerations; others remain isolated, producing ulcers which are smaller and of more regular shape. There is, indeed, no uniformity as regards the size and form of the ulcers. In the folds of the buccal membrane they are apt to be elongated, while inside the lips, or where the surface is smooth, the circular or oval form predominates. It is a noteworthy fact that the exudation underlies the mucous membrane, obstructing its nutrient vessels, so that the ulcer which results causes destruction of the mucous layer, and cure is effected by cicatrization.

Ulcerous stomatitis is usually confined to that part of the buccal surface which covers the gums, or is in their immediate vicinity, but in some instances it affects nearly every part of the cavity of the mouth.

If the disease be severe, considerable swelling occurs around the ulcers, but the swollen part is soft and cushiony, and not very tender on pressure. The soft and yielding nature of the swelling serves as a means of diagnosis between this disease and the premonitory stage of gangrene, since in the latter affection the swollen part is more indurated.

If the disease grow worse, more ulcers appear, and those already present grow deeper and wider, and their edges more vascular.

If, on the other hand, there be improvement, the swelling subsides, the ulcers become more clean, their bases approach the level of the mucous membrane, and present a granulating appearance. Finally the mucous layer is reproduced. A considerable time after the ulcers are healed, the new membrane which occupies their site has a redder hue than the adjacent surface.

Causes.—Ulcerous, like simple stomatitis, is most frequent in the families of the poor. Personal uncleanliness, poor food, a residence in

apartments dirty, humid, or in other respects insalubrious, favor its development. In fine, a cachectic condition, however produced, is a common predisposing cause. It frequently occurs when the system is reduced or enfeebled by acute diseases, as after the essential fevers and thoracic and intestinal inflammations. In protracted entero-colitis of infants, it is sometimes severe and obstinate, and a case in which this complication arises usually ends unfavorably. The abuse of mercury is an occasional cause of this form of stomatitis, as well as of simple catarrh. Jaccoud states that Bergeron established the fact that ulcerous stomatitis is propagated among soldiers by contagion, and he adds "it is very probable that it is the same in infants."

Symptoms.—The symptoms in ulcerous stomatitis are more severe than in the simple form. There are more pain, more salivation, and more fretfulness. The ulcerated surface is sometimes very tender, so that there is but little sleep. Drinks, unless bland and lukewarm, are painful, and, if the ulcers be on the lips or the front of the mouth, the infant nurses less eagerly than usual, and even with reluctance, sometimes weaning itself. Occasionally the submaxillary glands are tumefied, hard, and tender. The breath has an offensive odor. In mild cases, in which the stomatitis is of limited extent, this odor may scarcely be noticed, but in severe cases it is almost like that exhaled from putrid substances. The febrile movement is usually slight.

Prognosis.—A favorable prognosis may be given unless the patient be in a decidedly cachectic condition, or there be a serious coexisting disease, under which circumstances the case may be protracted. If death occur, it is due to the cachexia, or to some pathological state quite distinct from the stomatitis, most frequently entero-colitis. Ulcerous stomatitis, when the ulcers are small and the inflammation of limited extent, is of course more easily cured than when it is extensive and the ulcers are large.

This disease is very liable to return, unless the general health be good.

Treatment.—The physician should endeavor to ascertain the cause of the stomatitis, and as far as possible should remove the patient from its influence. It is often necessary, in order to insure a speedy recovery, to recommend a change in regimen, especially as regards diet and cleanliness. If the patient live in damp, dark, and dirty apartments, the family should seek a better residence, and he should be taken daily in the open air.

Tonic remedies are generally required. The ferruginous preparations may be advantageously given, or the vegetable tonics, or the two in combination. In selecting the internal remedies we must regard the antecedent disease, if there be any, which the buccal inflammation complicates, and on which it depends. For that large proportion of cases in which there is chronic intestinal inflammation, the liquor ferri nitratis with tincture of colombo administered in simple syrup will be found useful. For

local treatment Trousseau recommends occasional applications of nitrate of silver or muriatic acid as a caustic, and in the intervals a wash of equal parts of borax and honey.

The chloride of lime is also considerably used in Paris. It is recommended by Rilliet and Barthez. It is applied dry to the ulcerated surface twice daily, and in the interval the mouth is washed with simple water. This treatment is continued till the ulcers present a healthy appearance and begin to cicatrize. Then a weak solution of chloride of lime is employed, one grain to forty-five of the vehicle. By this treatment a cure is usually effected. Bouchut prefers using chloride of lime with honey, one drachm to the ounce.

But painful applications are not required. The remedy which is most employed in this country and in Great Britain is chlorate of potassium. It often acts like a specific for this as well as other forms of stomatitis. It may be given dissolved in water with sugar, or with one of the syrups, to render it more palatable. The dose is about two or three grains every two hours. It should be allowed to run over the affected part, as it is believed to have a local action.

℞. Potass. chlorat., ʒ ss–j ;
Mellis, ℥ ss ;
Aquæ, ℥ ij.
One teaspoonful every two hours.

Of all topical remedies in common use, chlorate of potassium is probably the most efficacious. Some physicians prefer the chlorate of sodium, on account of its greater solubility. If this wash be too painful in consequence of the irritable state of the ulcers, it may be mixed with mucilage or less frequently used, and borax applied in the interval.

Aphthous Stomatitis.

Aphthous stomatitis may occur at any age, but it is most frequent in childhood. It is sometimes designated follicular stomatitis, but the disease affects the contiguous mucous surface, as well as the seat of the follicles. At first a vascular injection is observed, and within a few hours a whitish exudation occurs immediately under the epithelium, and upon the corium, in small round or oval isolated spots. The smallest of these patches are not larger than a pin's head, but most of them have a diameter of one to two lines, and they cause slight prominence of the surface. In two or three days the exudation softens ; and the epithelium, which covers it is thrown off, producing an ulcer, superficial, without induration of its edges, but sensitive to the touch. It heals in one to two weeks, leaving only a reddish spot or stain, which soon fades. Sometimes two or more aphthæ unite, forming a patch, and an ulcer of corre-

spondingly large size. The seat of aphthous stomatitis is usually the internal surface of the lips and cheeks, the gums, tongue, and occasionally the roof of the mouth.

Causes.—Probably in most instances the exciting cause is some derangement of the digestive organs, which may not be appreciable. We sometimes observe it in cases of diarrhœa. Occasionally, especially in spring and autumn, two children in a family are affected at the same time, or two or more in a school, so that it presents an epidemic character. Children surrounded by bad hygienic conditions, as in the tenement houses of the cities, are more liable to this as well as other forms of stomatitis, than are children who live in clean and airy localities, and have nutritious and wholesome diet.

Symptoms.—The constitutional symptoms in a large proportion of cases of aphthæ are slight. In twelve children affected with this disease Billard found the pulse from sixty to eighty beats per minute.

The ulcers are painful, as is indicated by the cries of the child when they are pressed, and its fretfulness. Solid food and even drinks, unless bland and unirritating, are badly tolerated. The salivary secretion is also augmented.

In those rare cases in which the ulcer becomes confluent or gangrenous, the state of the patient is really serious. There is then often gastro-intestinal disease. The symptoms indicate prostration. The pulse is feeble, the countenance pallid, and the body and limbs become wasted.

Diagnosis.—This is easy. The only disease with which it is liable to be confounded is ulcerous stomatitis. In the ulcerous form there is antecedent and accompanying stomatitis affecting a considerable part, if not the entire buccal cavity, while in the follicular form the inflammation is ordinarily confined to the immediate vicinity of the ulcers. The character of the ulcers serves also as a means of distinction. In ulcerous stomatitis there is great variety as to size and form, while in aphthous stomatitis there is great uniformity in both these respects. The small, circular ulcers are characteristic of the follicular inflammation. Before the ulcerative stage the circumscribed character of the eruption serves to distinguish this form of stomatitis from other local diseases affecting the cavity of the mouth.

Prognosis.—Aphthous stomatitis usually ends favorably; but, if the ulcers become concrete or gangrenous, the health is seriously affected, and a more cautious prognosis should be expressed. The unhealthy appearance of the mouth and the real danger are often more due to the depressing effect of some concomitant disease than to the stomatitis.

Treatment.—In ordinary aphthous stomatitis, which is discrete and attended by little or no constitutional disturbance, local remedies suffice to cure the disease. Demulcent drinks or applications to the mouth should be used, as the mucilage from gum acacia, marsh-mallow, or flaxseed.

Mild astringent lotions with the demulcent are also beneficial. The mel boracis is one of the best and most agreeable applications. It may be placed in the mouth with a spoon, or applied with a camel-hair pencil. If there be much tenderness of the ulcers, with restlessness, a small quantity of some opiate should be added to the lotion, or it may be administered separately.

With this simple treatment the ulcers generally soon heal, and the health of the patient is restored. If, however, the ulcers be quite painful, and not disposed to heal, or be healing tardily, they may be touched lightly with a pencil of nitrate of silver, or, as Barrier recommends, hydrochloric acid in honey of roses. This diminishes the tenderness and expedites the healing process.

If, as may in rare cases occur, the ulcerations be numerous, and accompanied by considerable fever, there may be symptoms indicative of cerebral congestion, or even premonitory of convulsions. In such cases laxatives and the soothing effect of one of the bromides and sometimes of the warm foot-bath are required.

If there be an unhealthy appearance of the ulcers, if they gradually enlarge or become concrete, or gangrenous, indicating a cachectic state, tonics should be employed with nutritious and easily digested diet, and anti-hygienic influences should so far as possible be removed.

CHAPTER II.

THRUSH.

The terms thrush, sprue, and muguet, the last from the French, are synonymous. They are used to designate a particular form of inflammation of mucous surfaces, the peculiar feature of which is the presence of points or patches of a curdlike appearance on the inflamed surface.

The usual seat of thrush is the buccal membrane, but occasionally it affects the faucial, pharyngeal, or œsophageal surface. It is rare in the subdiaphragmatic portion of the digestive tube, but a few such cases have been reported by Billard and others. It never affects the membrane of the nostrils, larynx, or bronchial tubes, and it very seldom occurs in any other part of the alimentary canal without also being present in the mouth. Thrush, then, is a stomatitis, pharyngitis, or œsophagitis, or a gastro-enteritis, with the additional element which I have described.

Anatomical Characters.—The first stage of thrush is that of simple inflammation of the mucous surface. There next appear minute semi-transparent points or granules, which, increasing, soon become white

and opaque. Some of them remain as points, while others, extending, and perhaps coalescing with those adjoining, form patches of greater or less extent. The white points or patches are unequally elevated. Their central part, which was first formed, is most raised, while their circumference projects but little above the epithelium. Their highest elevation is not ordinarily more than a line above the surface. They are smaller in the pharynx and œsophagus than when occurring upon the buccal surface. They resemble closely, in color and consistence, portions of curdled milk, and the nurse often mistakes them for such, and neglects to call attention to the state of the mouth. They are readily detached by a little force, but are speedily reproduced. Their color in the first days of the sprue is white, and sometimes this color continues. In other cases they assume, if the disease be protracted, a yellow hue.

Their true nature, long unknown, was finally revealed by microscopy. They consist in part of epithelial cells, and in part of a vegetable growth. This parasitic plant is in most cases the oïdium albicans. Like other confervæ, it consists of roots, branches, and sporules. The roots are transparent, and they penetrate the epithelial layer, sometimes even to the basement membrane. The branches divide and subdivide at an acute angle, and under the microscope they are seen to consist of elongated cells, with one or two nuclei. Around these branches are numerous sporules. In two or three instances I have examined the product of thrush removed from the œsophagus, and in both the parasitic plant was the penicillium glaucum, or a conferva closely resembling it.

In the mildest form of thrush, this morbid product is in points or small patches. If the patches be of large extent, especially if, as rarely happens, a considerable part of the buccal surface be covered by them, there is generally a state of great prostration and danger, from some antecedent or concomitant disease. Thrush is, indeed, often the sequel of some grave affection, as pneumonitis or gastro-intestinal inflammation. Its complication with the last-named disease is common in young, ill-fed infants, especially those deprived of the breast-milk, and such cases are very apt to be fatal.

Hence, some writers, who have observed infantile diseases in foundling hospitals, regard thrush as one of the most serious maladies of early life. Valleix, in a book of seven hundred pages relating to diseases of children, devotes more than one third to the consideration of muguet. Of twenty-four cases, the records of which he publishes, twenty-two died, but their death was due to gastro-intestinal inflammation, which the author considered a part of the more general disease, muguet. Doubtless the same cause which produced the stomatitis, with the confervoid growth, in these infants, also produced the fatal gastritis or gastro-enteritis, occurring without this growth. Nevertheless it seems better to restrict the term sprue, thrush, or muguet to those inflammations of mucous surfaces which

are accompanied by the parasitic growth. I reject, then, from my description of the anatomical characters of thrush, those subdiaphragmatic phlegmasias which some writers consider an important part of severe muguet, and regarded them as complications, unless indeed the case be one of those exceptional ones in which the parasite has lodged and grown upon the gastric or intestinal surface. This explanation seems necessary in order to understand the different statements of writers in relation, not only to the anatomical characters of thrush, but also in reference to its mortality.

The frequent coexistence of thrush with gastro-intestinal inflammation, has been remarked in the hospitals of Europe, and in the Infant Asylum and the Child's Hospital, in this city. In the post-mortem examinations of those who have died in these last institutions, having thrush at the time of death or immediately prior to it, and who for the most part have been infants under the age of three months, I have frequently found evidences of inflammation in every division of the alimentary canal. The confervoid growth was, however, seldom seen below the fauces, and never below the œsophagus.

Symptoms.—The symptoms in thrush are not different in most patients from those of simple inflammation. In the mildest cases they are chiefly of a local nature, such as have already been described in our remarks on simple stomatitis. If the inflammation be more extensive, especially if it affect the fauces and œsophagus, the infant becomes feverish and fretful, and the inflamed surface is hot, red, and tender. In the worst forms of thrush this surface not only presents the ordinary features of severe inflammation, namely heat, redness, and tenderness, but it is sometimes deficient in the natural secretion, so as to present a dry or parched appearance. It is in these cases that there is often a more extensive inflammation than that of the buccal or œsophageal membrane. The sub-diaphragmatic portion of the digestive tube is inflamed. In this severe form of sprue, thirst, loss of appetite, restlessness, vomiting, and frequently diarrhœa occur. The countenance is anxious and pallid ; there is rapid emaciation, and, if the disease be not arrested, a state of extreme prostration soon arrives. The twenty-four severe cases related by Valleix, already alluded to, twenty-two of which were fatal, were examples of this severe form.

Causes.—Thrush is most apt to occur in those who are constitutionally feeble, or who are enfeebled by disease, or by unfavorable hygienic conditions. Cachexia is a cause common to thrush and most other subacute inflammations of the alimentary canal. The most obvious and common of the unfavorable hygienic conditions alluded to is the continued use of indigestible and improper food. It is, therefore, a common disease among foundlings, in institutions where these unfortunates are received, since they not only breathe an atmosphere which is often impure, but are

deprived of the mother's milk, and are so frequently given a diet which is a poor substitute for it. Among the destitute of the cities thrush is common, since with them, from necessity or choice, there is the greatest neglect of sanitary requirements. Exposure to humidity, to variations in temperature, increases the liability to the disease, though in less degree than defective alimentation. Billard and Valleix agree that thrush is more frequent in the warm months than in the cold, that its maximum frequency is in the months of July, August, and September. Cases in the Infant Asylum and Child's Hospital of this city, have appeared to me to correspond in this respect with those related by Billard and Valleix. Various writers have mentioned the age at which thrush is most apt to occur, as one of the predisposing causes. Uncomplicated thrush is not common above the age of six months. Most cases occur under the age of three months. Infants of the age of one or two weeks, if in addition to lactation they are spoon-fed by nurses over-anxious that they should thrive, are apt to take the disease. Thrush is not uncommon in children under the age of eighteen months who are suffering from exhausting diseases. It is then an unfavorable prognostic sign.

Diagnosis.—This is easy so far as thrush in the mouth is concerned, for simple inspection by one familiar with the disease is all that is required in order to discover it. The presence of thrush in portions of the alimentary canal hidden from view cannot be positively ascertained.

The vomiting, diarrhœa, pain or fretfulness, emaciation, and rapid sinking, which sometimes accompany severe forms of thrush, indicate gastro-intestinal inflammation, to which the attention of the practitioner should be chiefly directed.

Prognosis.—The duration of thrush varies according to its intensity, and the favorable or unfavorable condition of the child. If it be slight and the health of the infant otherwise good, it may often be cured in two or three days. Under other circumstances it may continue as many weeks or even longer, before it is entirely removed.

When thrush occurs in connection with gastro-enteritis, the mortality is very great. It has been already stated that in Valleix's twenty-four cases twenty-two were fatal. M. Auvity estimates the mortality of such cases at nine in ten, and M. Godinat at two in three.

Treatment.—As one of the most common causes of thrush is the use of indigestible or improper food, the physician should ascertain the nature of the infant's diet, and if it be faulty, should direct a better. In many cases the infant is bottle-fed. It should be given only the mother's milk if practicable, or that of a healthy wet-nurse. This change of alimentation often removes the sole cause of thrush in the young infant, so that it rapidly recovers.

If artificial feeding be necessary, such diet should be advised as is directed in our remarks on the treatment of the diarrhœal maladies.

There is often in thrush an excess of acidity in the digestive tube, and an alkali is required. Trousseau recommends the addition of saccharate of lime to the milk. Children with this disease should also be taken from filthy and damp apartments, to those in which the air is pure and dry, and their mouths and persons should be kept clean.

The remedy in common use in the treatment of thrush, and which is usually effectual, is borax. This, if applied sufficiently often to the affected membrane, not only destroys the parasitic growth, but prevents its reproduction. It is commonly employed with honey, or in a powder with sugar or dissolved in water. The officinal mel boracis, consisting of one part of borax to eight of honey, is so much used in families that it may be considered almost a domestic remedy. There is, however, an objection to using any application for the removal of thrush which contains either sugar or honey, since either substance remaining in the mouth would rather promote the growth of the parasite. Still, it is desirable to employ a wash of such consistence that it will remain a longer time in contact with the buccal surface than will a simple solution in water. I know no better vehicle for the borax than glycerine, which has the advantage of consistence, does not undergo any chemical change, and has no unpleasant flavor. The borax may be used dissolved in glycerine, with or without some flavoring ingredient :

℞. Sodii borat., ʒj ;
Glycerinæ, ʒij ;
Aquæ. ʒvj. Misce.

Borax should be used four or five times daily, and continued for a time after the disease has disappeared from sight, since the roots of the plant must be destroyed or the branches are rapidly reproduced. It should be applied by a camel-hair pencil, or with a soft cloth upon the finger, or a stick. It should be so freely used, in extensive and severe forms of the disease, that the infant will swallow some, since the entire œsophagus is apt to be affected in such cases. In the intervals between the applications of borax, if the buccal surface be hot, dry, and tender, so as to increase the fretfulness of the infant, it is well to use mucilaginous washes, as the mucilage of acacia or mallows. If the disease continue notwithstanding the use of these measures, the mouth should be occasionally washed with a weak solution of nitrate of silver or sulphate of zinc :

℞. Zinci sulph., gr. ii–iv ;
Aq. rosæ, ℥ij. Misce.

In many cases, however, the treatment of thrush is of less importance than that of the disease which the thrush complicates. The remedial measures which I have mentioned then become subordinate to those employed for the graver disease. When this disease is relieved and the general health improves, thrush is more easily and permanently cured than during the state of feebleness and ill-health.

CHAPTER III.

GANGRENE OF THE MOUTH.

The diseases of the mouth which we have been considering are attended by little danger, but the one which we are next to consider is among the most fatal of early life. It is gangrene of a portion of the cheek or gums, or of both. It is described by writers under various names, as cancrum oris, noma, necrosis infantilis, aqueous cancer of infants.

Anatomical Characters.—Gangrene of the mouth is sometimes preceded by ulceration of the mucous membrane, at the point where it is about to commence, but in other cases this membrane is entire. The tissues at the point of attack, which is most frequently the inside of the cheek, become inflamed, thickened, and indurated. The induration extends, and soon the purple hue of gangrene appears and increases. The next stage in the progress of gangrene is sloughing of the portion the vitality of which is lost.

The slough does not present the appearance of uniform decay. While the color is generally dark, there are in the mass fibres of connective tissue, or even bloodvessels which remain unchanged or are but partially decomposed. After separation or sloughing of the part where the vitality is first lost, the surface of the excavation, if the disease be not checked, has a dark, jagged, and unhealthy appearance. Commencing with the mucous membrane and the tissue immediately underlying it, the disease extends on the one side toward the skin, and on the other toward the deeper seated structures of the jaw. According to Billard, the swelling which precedes and surrounds the gangrene is in great part œdematous.

This disease is occasionally primary, but in a large proportion of cases it is secondary. Occurring secondarily, its symptoms are often masked by those of the antecedent and coexisting affection. Under such circumstances attention is sometimes first directed to the mouth, by the loosening of one or more of the teeth, or the appearance on the skin of a livid circular spot, which indicates the approach of the disease to the cutaneous surface. The mucous membrane presents a dark-red appearance to the distance of a few lines beyond the point of gangrene. It covers tissues which are inflamed and indurated and about to become gangrenous.

The tongue is usually more or less swollen, unless the disease be mild ; an offensive odor arises from the gangrene, due to the evolution of sulphuretted hydrogen and other gases. There is great difference in the extent of the destruction, and the gravity of the disease, in different cases.

It may sometimes be arrested by proper applications and a favorable change in the general health of the child at an early period, when there is little loss of substance. In other cases it extends till it perforates the cheek, or even destroys a considerable part of the side of the face, and, extending inward, attacks the periosteum of the maxillary bone, destroying the gum and teeth, and denuding the alveoli. Recovery, if it take place at all under such circumstances, is with the loss of a portion of the bone, and with deformity.

The duct of Steno is sometimes included in the gangrenous portion, but it commonly resists the destructive process, and remains pervious.

Age.—The age at which gangrene of the mouth occurs is usually between two and six years. In twenty-nine cases collated by Rilliet and Barthez, twenty-one were between the ages of two and six years, and the remaining eight were from six to twelve years old. Of the cases which have fallen under my observation, most were between the ages of two and six years. It is seen that the period of greatest frequency of gangrene of the mouth is different from that at which the ordinary forms of stomatitis occur.

Gangrene of the mouth may, however, occur under the age of one year. Billard reported three cases under the age of one month, but in two of these the disease does not appear to have been sufficiently marked to render it certain that they were genuine cases.

Causes.—Gangrene of the mouth usually occurs in those whose systems are reduced or cachectic. It is, therefore, more frequent among the poor than those in comfortable circumstances; in the city than in the country. It is more frequently observed in asylums for children than in private practice. Most of the cases which I have seen have been in these institutions. If the constitution be naturally good, it can only occur in those long deprived of pure air and wholesome nutriment, or those enfeebled by disease.

Among the diseases which have been known to terminate in or be followed by gangrene of the mouth, are the pulmonary and intestinal inflammations, hooping cough, and the fevers, both eruptive and the non-eruptive. Rilliet and Barthez have published a table of ninety-eight cases in which gangrene resulted from other diseases. In forty-one of these the antecedent disease was measles, in five scarlet fever, six hooping cough, nine intermittent fever, nine typhoid fever, seven mercurial salivation, and five enteritis. It is seen that the essential fevers were the most frequent cause of the gangrene. Of forty-six cases collected by MM. Bouley and Caillault, the antecedent disease was measles in all but five. In this city, also, a larger number result from measles than from any other disease.

One reason why so many cases of gangrene occur as a sequel of measles

is probably because this disease is accompanied by stomatitis. Simple or ulcerous stomatitis often precedes gangrene.

Diseases sometimes terminate in gangrene of the mouth chiefly in consequence of injudicious treatment, which has lowered the vitality of the system. Rilliet and Barthez mention the case of a child four years old, in whom gangrene commenced at the twenty-ninth day of primitive pneumonia. This child had been reduced by the application of twelve leeches, three scarifications, a large blister, and by the use of absolute diet.

The misuse of mercury was once a much more frequent cause of gangrene than at present, at least in this country, since this agent was formerly much more employed than now. In fact most of the affections of infancy and childhood in which mercurials were formerly employed are now treated without it.

Symptoms.—Gangrene of the mouth so often occurs in connection with other diseases, that its symptoms are in a large proportion of cases blended with those which arise from a distinct pathological state.

Fig. 25.



There is usually prostration more and more pronounced as the gangrene extends. The features are ordinarily pallid, but occasionally their normal color is preserved for a time ; the expression of the face is melancholy, but composed. Sometimes the child is fretful, if disturbed ; at other times it will quietly consent to an examination. The suffering is not proportionate to the gravity of the disease. There is less pain often than in some of the forms of stomatitis which are unattended with danger.

As the disease advances, the body and limbs gradually waste, the eyes are hollow, or, if the gangrene be near the orbit, the eyelids become œdematous, the lips are infiltrated, and both the lips and nostrils are often incrusted. If the cheek be perforated, alimentation is rendered more difficult, and the appearance of the child is melancholy in the extreme.

The tongue is usually moist; it is occasionally swollen. The saliva flows from the mouth, either pure or mixed with offensive sanguinolent matter. Unless the disease be slight, there is the peculiar gangrenous odor. The appetite is sometimes poor, at other times it is preserved through the whole sickness. There is no vomiting or looseness of the bowels, unless from a complication. The thirst is usually great, and the pulse is accelerated and feeble, except in mild cases.

The skin in the commencement of gangrene is hot. When the vital force is much reduced, and especially as the disease approaches a fatal termination, the face and limbs become cool, and the surface generally presents a waxen or ashy appearance. No derangement occurs of the respiratory system. Those cases which are attended by a cough or accelerated respiration are really cases of bronchitis or pneumonitis, coexisting with the gangrene.

Diagnosis.—Gangrene of the mouth is easily diagnosticated. In those cases in which ulceration precedes the gangrene, it might be mistaken in its first stages for that form of ulcerous stomatitis in which the ulcers assume an unhealthy appearance. The following are the distinguishing features of the two affections: Around the ulcer where gangrene is about to commence the tissues are greatly thickened and indurated, or œdematous, while ulcerous stomatitis begins with a submucous deposit of fibrin, and is attended by little thickening of the surrounding parts, and little or no induration or œdema. In ulcerous stomatitis the skin over the seat of the disease presents its normal appearances, whereas in gangrene it presents a distended and shining appearance. The destructive process in ulcerous stomatitis is also more limited than in gangrene. Deep ulcerations do not occur, or are rare. Ulcerous stomatitis is more readily healed, and it leaves no eschar, contraction, or deformity.

The differential diagnosis of gangrene of the mouth from those cases of follicular stomatitis in which the ulcers occupying the seat of the follicles assume a gangrenous appearance, must be made by a consideration of the same facts or particulars which serve to distinguish it from ulcerous stomatitis.

Malignant pustule, of rare occurrence in the child, resembles this disease in some of its features. But the pustule always begins on the skin, while gangrene is a disease of the mucous surface primarily. In gangrene, therefore, the chief destruction is of the mucous membrane and of the submucous tissue, while in malignant pustule the chief destruction is of the skin and the subcutaneous tissue.

Prognosis.—This depends not only on the extent of the gangrene, but the nature of the disease, if there be one, which gave rise to it, and the degree of cachexia. If it occur in connection with or as a sequel of one of the least debilitating diseases, and there be considerable vigor of system, it may often be arrested when it has destroyed only the mucous and subcutaneous tissues, so that no deformity results. The friends may congratulate themselves if the case terminate so favorably. In the graver cases, when the gangrene extends till it destroys the periosteum of the maxillary bone on the affected side, and perhaps perforates the cheek, if the child recover it is with the permanent loss of teeth, tedious separation of the necrosed bone, and a cicatrix, which is apt to interfere with the free use of the jaw. Death is, however, the more common termination of severe cases. Occasionally the gangrene destroys the continuity of a bloodvessel, causing abundant hæmorrhage, and accelerating the fatal result. In most cases, however, there is little or no hæmorrhage, in consequence of coagulation in the vessels.

Another serious complication sometimes arises, namely, gangrene of other parts, as of the external genital organs. The English editor of Bouchut's treatise on diseases of children relates the following interesting case, from the *Transactions of the Edin. Medico-Chir. Society:*

An infant eight months old became affected with gangrene of the face, head, and hands. "The right ear and the entire hairy scalp were of an intensely black color, and on both cheeks patches existed about the size of a half-crown piece. The right thumb and the backs of both hands were similarly affected. The child was noted to have been restless and feverish on May 22d, and on the 23d a slightly darkened ring was found to have formed round the thumb, about the middle of the first phalanx; in a few hours the whole thumb was gangrenous, and the dorsum of the hand became involved. On the ear the gangrene commenced with the appearance of a fleabite, and subsequently extended rapidly to the scalp, assuming a remarkable regular form, and giving to the child the appearance of wearing a black skull-cap. The pulse was observed to be very feeble. . . . Death took place in twelve hours from the first appearance of gangrene on the thumb, the child being sensible and continuing to suck well, up to a few minutes before death."

Rilliet and Barthez state that pneumonitis is apt to arise in the course of gangrene of the mouth. Such a complication evidently diminishes materially the chance of recovery.

Whether the result be favorable or unfavorable, it is evident, from the nature of the disease, that the duration is very different in different cases. The physician's attendance may be required for a week or two or for several weeks.

Treatment.—As gangrene of the mouth is eminently a disease of debility, all anti-hygienic influences should be removed, and the most nour-

ishing diet, together with tonics, be recommended. The ferruginous preparations or the bitter vegetables are required.

As soon as the physician is called, he should endeavor to arrest the gangrene, accelerate the detachment of the slough, and produce a healthy and granulating state of the surrounding tissues. This is best effected by applying a highly stimulating or even escharotic agent to the inflamed surface underneath and around the gangrene. For this purpose a great variety of substances have been used by different physicians, such as acetic, sulphuric, nitric, and hydrochloric acids, nitrate of silver, the acid nitrate of mercury, chloride of antimony, and even the actual cautery.

M. Taupin recommends, after removing a considerable part of the gangrenous substances with scissors or some instrument, the application of strong muriatic acid, and, when the slough is detached, of dry chloride of lime.

Rilliet and Barthez advised the use twice daily of muriatic acid or the acid nitrate of mercury, applied by a brush upon and around the slough, followed immediately by the application of dry chloride of lime, when the mouth is to be thoroughly washed with water from a syringe. They direct in the interval frequent ablution with water. After the slough has separated, the escharotic is to be discontinued, and the chloride of lime used alone. If gangrene extend to the skin, a crucial incision is to be made and the escharotic applied, after which powdered cinchona is introduced and retained by a plaster. This treatment is to be continued till the gangrene is arrested and the decayed portion removed. Barrier, Valleix, and most French writers, recommend essentially the same treatment, namely, the application of undiluted escharotic agents.

A safer, less painful, and in many cases successful treatment, is that employed by many British and American physicians, namely, the use of escharotic agents diluted, or, if applied in their full strength, such as are least active and penetrating. Some employ from the first topical treatment which is astringent and stimulating rather than escharotic, and they report satisfactory results.

Dr. Gerhard believes "the best local applications are the nitrate of silver, if the slough be small in extent; if much larger, the best escharotic is the muriated tincture of iron, applied in the undiluted state. After the progress of the disease is arrested, the ulcer will improve rapidly under an astringent stimulant, such as the tincture of myrrh, or the aromatic wine of the French Pharmacopœia."

The local treatment recommended by Evanson and Maunsell differs from that advised by any of the writers from whom I have quoted. A knowledge of this treatment from which I have myself seen good results will be best imparted by quoting from the authors (*Diseases of Children*, 2d Amer. edit., page 188): "The lotion which we have found by far the

most successful is a solution of sulphate of copper as employed by Coates in the Children's Asylum. His formula is as follows :

"℞. Cupri sulph., ʒ ij ;
Pulv. cinchonæ, ℥ ss ;
Aquæ, ℥ iv M.

" This is to be applied twice a day very carefully to the full extent of the ulcerations and excoriations. The addition of the cinchona is only useful by retaining the sulphate of copper longer in contact with the edges of the gums. A solution of the sulphate of zinc, ʒ j to an ounce of water, by itself or combined with tincture of myrrh, Dr. Coates found to be also useful in some cases."

A moment's reflection will show us that the above treatment is preferable, provided that it is equally effectual in arresting the gangrene, to the treatment by the strong acids which are in common use, and the efficiency of which cannot be questioned.

The purpose in applying the acid is to establish a healthier state of the tissues. It cauterizes and destroys whatever soft tissue it comes in contact with, besides it produces a strong corrosive action on the teeth and bone. Therefore in gangrene affecting the jaw, there is great danger that it will destroy the periosteum, and consequently increase the necrosis.

Dr. West, who advocates the use of the acid (*Diseases of Children*, 4th Amer. edit.), says: "In one of the cases that I saw recover, the arrest of the disease appeared to be entirely owing to this agent, though the alveolar processes of the left side of the lower jaw, from the first molar tooth backward, died and exfoliated, apparently from having been destroyed by the acid." No such result follows the use of the solution of sulphate of copper.

In one of those severe cases in which the disease resulted from scarlet fever, and in which there was so much debility that an unfavorable prognosis was made, I succeeded in arresting the disease by the use of Dr. Coates's prescription. The child recovered with the loss of two teeth and the corresponding portion of the maxillary bone. From the good effects which I have observed from iodoform, as an application for gangrenous vulvitis following measles, it has occurred to me that it may also be useful in gangrene of the mouth.

If after employing the milder treatment for two or three days, the gangrene continue to spread, the strong muriatic acid should be cautiously applied by a camel-hair pencil or small swab, in such a way that it comes in contact only with the diseased surface. Its use should be immediately followed by an alkaline wash, as lime-water made turbid by lime. If the gangrene be of small extent, and do not involve the periosteum, I would not hesitate to use the acid at my first visit, since it acts promptly in arresting gangrene, and with little pain. In May and June, 1881,

an epidemic of measles occurred in the New York Foundling Asylum during the attendance of Drs. O'Dwyer and Lee. The number of children affected with it was 165, and since many of them were cachectic, we were not surprised that gangrene appeared as a complication or sequel in seven cases. In a girl of 3½ years, it appeared upon the upper jaw at the base of the teeth ; in two girls of four years it appeared upon the inside of the cheek and upon the vulva, and not upon the gums ; in a boy of three years it attacked the lower jaw, destroying four teeth with their sockets, and the upper jaw, destroying five teeth, with the corresponding portion of the maxillary bone, so that all the incisors and one canine were lost, as well as the cartilaginous portion of the nasal septum. Gangrene also occurred in the groin in this case. Another boy of 3½ years lost two incisors from gangrene of the jaw. The treatment by muriatic acid was employed, and according to the house physician, Dr. Kortright, there was no farther extension of the gangrene after the first application in any of the cases. All lived except the first, who had broncho-pneumonia. The remaining two patients, aged respectively four years, died of diphtheria and pneumonia before treatment could be tested. One of them had commencing gangrene of the lower jaw, the other of the soft palate.

The gases arising from the gangrenous mass are not only highly offensive to others, but they are doubtless injurious to the patient, who is constantly inhaling them. To remove the fetor, chlorine or carbolic acid, properly diluted, should be occasionally used between the applications of the sulphate of copper. Labarraque's solution, one part to eight or ten parts of water, is an eligible form for its use. When the gangrene is removed, and the granulations present a healthy appearance, all danger is usually past and convalescence is fully established. Then no energetic topical treatment is required. A mild stimulating lotion, like the tincture of myrrh, as recommended by Dr. Gerhard, suffices, with the aid of tonics and nutritious diet.

CHAPTER IV.

DENTITION.

The opinion formerly entertained in the profession, and now prevalent in the community, that many infantile maladies arise directly or indirectly from dentition, is erroneous. Still there are physicians of experience who believe that teething is a common cause of certain maladies, especially of functional derangements, even of organs remote from the mouth. On the other hand, equally good observers, and the number is increasing,

almost wholly ignore the pathological results of dentition. They say that, as it is strictly a physiological process, it should, like other such processes, be excluded from the domain of pathology.

A moment's reflection will show how important it is to understand the exact relation of dentition to infantile diseases. Every physician is called now and then to cases of serious disease, inflammatory and others, which have been allowed to run on without treatment, in the belief that the symptoms were the result of dentition. I have known acute meningitis, pneumonitis, and entero-colitis, even with medical attendance, to be overlooked, and the symptoms attributed to teething during the very time when appropriate treatment was most urgently demanded. Many lives are annually lost from neglected entero-colitis, the friends believing the diarrhœa to be symptomatic of dentition, a relief to it, and therefore not to be treated. Such mistakes are traceable to the erroneous doctrine, once inculcated in the schools, and still held by many of the laity, that dentition is directly or indirectly a common cause of infantile diseases and derangements.

I shall endeavor to point out what is really ascertained in regard to the pathological relations of dentition.

The first dentition commences at the age of about six months and terminates at the age of two and a half years. The corresponding teeth of the two sides pierce the gum at about the same time. The two inferior central incisors first appear at about the age of six or seven months, followed, in the order in which they are mentioned, by the upper central incisors, upper lateral incisors, lower lateral incisors, the four anterior molars, the four canines, and, lastly, the four posterior molars.

The incisors usually appear in rapid succession, so that all are in sight by the age of one year. From the age of one year to sixteen months the anterior molars appear, from the age of sixteen to twenty-four months, the canines, and from twenty-four to thirty months the posterior molars. This order is not always preserved. Sometimes the upper central incisors appear before the lower, and sometimes the lower lateral before the upper lateral. In rare cases there have been teeth at birth. I have seen but one or two infants with such premature dentition. Retarded dentition is much more common. Those who have rickets, or are feeble either constitutionally or by disease, often have no teeth till considerably after the usual period. In such the first incisors may not appear till the age of twelve months, or even later.

Pathological Results of Dentition.—The evolution of the teeth is commonly attended by more or less turgescence around the dental bulbs. This is greater with some of the teeth than with others. Thus, the superior incisors cause more swelling than do their congeners of the inferior jaw. The turgescence, although attended by more or less congestion, is physiological within certain limits, and not a disease.

But sometimes there is an unusual amount of swelling around the dental follicles ; the afflux of blood to them is greatly augmented ; they are the seat of such a degree of tenderness and pain that the infant is fretful. It carries the finger often to the mouth, indicating the seat of its suffering. The surface over the follicles presents greater redness than in ordinary dentition, and the salivary secretion is considerably increased. There is now actual gingivitis.

Occasionally the inflammation affects a greater extent of the buccal surface than that lying directly over the follicles, so that most writers speak of stomatitis as one of the results of dentition. In a few cases I have known such a degree of inflammation over the advancing tooth, that a small abscess formed, producing much pain and restlessness, till it was opened by the lancet.

The pathological results of dentition which I have mentioned, though they may interfere more or less with the nursing or feeding, are not dangerous. They are easily detected. They result directly from the rapid growth and augmented sensibility of the dental follicles.

There are other supposed accidents of dentition occurring in distant parts of the system in consequence of the relation and interdependence of organs which exist through the system of nerves.

Some children, previously to the eruption of the teeth, are affected with diarrhœa, occasionally accompanied by irritability of stomach. Certain writers have supposed that gastro-intestinal catarrh is present in these cases ; others that there is simply a hypersecretion, an increased activity of the intestinal follicular apparatus, that it is, in other words, one of the forms of non-inflammatory diarrhœa. Barrier believes that the diarrhœa of dentition depends usually on what he calls a " subinflammatory turgescence limited to the gastro-intestinal follicular apparatus." He believes that, in occasional cases, it is due to defective or altered innervation. It would then be analogous or similar to that form of diarrhœa which occurs in the adult from the emotions. Bouchut calls the diarrhœa of dentition nervous diarrhœa. It is certain, however, that in most cases of diarrhœa which are attributed to dentition there are other causes, such as unsuitable food, or residence in an insalubrious locality. It is certain, as regards city infants, that the chief causes of diarrhœa during the period of dentition are strictly anti-hygienic, dentition being quite subordinate as a cause, and probably ordinarily not operating at all as such. But when, as sometimes happens, at each period of dental evolution, the infant is affected with diarrhœa, the influence of teething is apparent. Such cases enable us to see that teething may really sustain a causative relation to certain diseases not located in the buccal cavity.

Among the most common pathological results of difficult dentition, are certain affections referable to the cerebro-spinal system. Eclampsia is one of the admitted results. Barrier attributes convulsions in the teeth-

ing infant to excitement of the nervous system arising from the pain which is felt in the gums, and to a determination of blood to the dental apparatus, in which afflux the whole vascular system of the head participates.

In most cases of convulsions occurring during the period of dental evolution, a careful examination discloses other causes in addition to the state of the gums. Difficult dentition must then be considered, not so frequently a direct as a co-operating or predisposing cause, producing a sensitive state of the nervous system, or possibly an afflux of blood to the head, of which Barrier speaks, and which, by an additional stimulus, perhaps trivial in itself, ends in convulsions. In exceptional instances eclampsia occurs mainly from dentition, or, if there are other causes, they are quite subordinate. This may happen when several teeth penetrate the gum at or about the same time. Infants who are burned or scalded are very liable to clonic convulsions. This is, in fact, the chief danger as regards life from such accidents. So, the swollen and tender gum, if several teeth are about emerging, may affect the cerebro-spinal system like the burn or scald, and produce the same nervous phenomena. Thus, in a case already alluded to in the chapter on convulsions, five incisors pierced the gum within about two weeks, and in this period there were two attacks of eclampsia with an interval of a few days. The attacks were not severe, and the most careful examination could discover no other cause than the simultaneous development of so many dental follicles. Previously, and since, the infant has been well.

Dentition, sometimes, though rarely, occasions also tonic convulsions. The following case occurred in the practice of Dr. A. S. Church, of this city, the history of which he has communicated, as follows :

" H., seven months old, was first visited April 3, 1863. The patient had been fretful for several days, but about daylight on the morning of my first visit it commenced crying, and had not ceased for a moment at the time of my visit, 9 A.M. The bowels were somewhat constipated and tympanitic ; abdominal muscles very tense. The pain was supposed to be in the abdomen, and a brisk cathartic, to be followed by an anodyne, was ordered. Some relief followed, but, on the ensuing and for several consecutive mornings, the pain returned, each day lasting longer, until the child only ceased crying while under the influence of a full anodyne. The gum over the upper incisors was considerably swollen, hot, and dry, but the parents would not consent to have it scarified. For the first week there was no fever, no vomiting, and not the least indication that the nervous system was suffering. About the 10th the thumbs were noticed to be flexed during the attack of pain, and about the 15th the flexors of the toes were contracted and the hands were turned backward and outward, but only while the child was awake. About the 20th there was constant contraction of the flexors of both extremities, with opisthotonos, and constant rolling of the head, loss of appetite, progressive emaciation, coated tongue, and highly inflamed gums. Consent was,

finally, obtained to relieve the inflamed gum, and free incisions were made, and the following night the child slept comfortably for three hours without opiates. In three days the gums were freely cut again, and the teeth soon made their appearance. All symptoms of disease had now ceased, the child became playful, and on 30th the patient was discharged."

The opinion has been prevalent in the profession, that painful and difficult dentition is one of the chief causes of infantile paralysis, but it is now commonly admitted that it is only a subordinate or remote cause, if indeed it is proper to consider it as a cause at all. (See Art. Paralysis.)

Some writers express the opinion that acute meningitis occasionally results from teething. The facts, however, that are relied upon to prove this are uncertain. The occurrence of meningitis during dentition is probably in most instances a coincidence.

Teething less frequently disturbs the respiratory system than either the digestive or cerebro-spinal. A cough occurs in some infants at each period of dental evolution. It is attended by little expectoration, but appears to be associated with, in at least certain cases, an inflammatory turgescence of the bronchial mucous membrane.

Acceleration of pulse is often observed at the time of greatest swelling and tenderness of the gum. It subsides with the protrusion of the tooth. The febrile movement of dentition is irregular, sometimes presenting a remittent form, like remittent fever or the fever premonitory of meningitis. Eczema and certain other cutaneous diseases are common during dentition, but their dependence on it as a cause has not been demonstrated.

Diagnosis.—The accidents of dentition which are located in the mouth are easily diagnosticated, except the odontalgia which writers describe, and which is not necessarily attended by any perceptible anatomical alteration of the gums. Those accidents which pertain to remote and concealed organs are usually detected with ease, though it is often difficult to determine with certainty their relation to dentition.

When similar symptoms arise at each epoch of teething, and subside with the subsidence of the gingival turgescence, teething must be regarded as the cause. Or, if the disease be such as is known to be produced occasionally by difficult teething, and if, after a careful examination, we can discover no other cause, while the gums are swollen, especially over two or more advancing teeth, it is proper to refer the malady to dentition.

It is evident that we must often be in doubt whether the disease which we are treating be due at all to the state of the gums, or, if so, whether directly or indirectly, or to what extent ; but, as a rule, if any other cause be apparent, we may properly regard the influence of dentition as quite subordinate.

Treatment.—It is obvious that remedial measures in cases of difficult

dentition must be twofold, namely, those directed to the state of the gums, and those designed to relieve the derangements or diseases to which dentition has given rise. If there be diarrhœa, this should be controlled by proper remedies, so as to reduce the number of evacuations to two or three daily. It is well to state to the friends of the child, who believe that diarrhœa is salutary during the period of teething, that this number is quite sufficient, and that more frequent evacuations will endanger the safety of the child.

The nervous affections, as convulsions, require such soothing and derivative measures as are recommended in our remarks on diseases of the nervous system. The bromide of potassium I have found especially useful and safe in cases of fretfulness and nervous excitement due to dentition. The rational employment of therapeutic measures requires strict attention to be given to the causes of disease. Therefore, the physician called to treat an ailment, believed to be due to dentition, should not fail to examine the state of the gums, and adopt such measures as will mitigate the intensity of the cause—in other words, diminish the tenderness if not the swelling of the gum. Demulcent and soothing lotions are sometimes useful. The infant should be allowed to hold in the mouth an india-rubber or ivory ring, which, by pressure on the gum, gives considerable relief.

Mothers will often attempt to "rub through a tooth," as they term it, by means of a ring or thimble. This should be discouraged. So great friction cannot fail to have an injurious effect, by increasing the swelling and inflammation, unless the tooth have already reached the mucous membrane.

We come now to a subject which has engaged the attention of many physicians of ample experience, and in reference to which there is still a difference of opinion among the highest authorities in medicine. I refer to scarification of the gums.

The gum-lancet is now much less frequently employed than formerly. It is used more by the ignorant practitioner, who is deficient in the ability to diagnosticate obscure diseases, than by one of intelligence, who can discern more clearly the true pathological state. Its use is more frequent in some countries, as England, under the teaching of great names, than in others, as France, where the highest authorities, as Rilliet and Barthez, discountenance it.

It is well to bear in mind, as aiding in the elucidation of this subject, the remark made by Trousseau, that the tooth is not released by lancing the gum over the advancing crown. The gum is not rendered tense by pressure of the tooth, as many seem to think, for, if so, the incision would not remain linear, and the edges of the wound would not unite, as they ordinarily do, by first intention within a day or two. This speedy healing of the incision, unless the tooth be on the point of protruding, is an important fact, for it shows that the effect of the scarification can only

last one or two days. The early repair of the dental follicle is probably conservative, so far as the development of the tooth is concerned. It may help us to understand how active, how powerful, the process of absorption is, if we reflect that the roots of the deciduous teeth are more or less absorbed by the advancing second set, without much pain or suffering from the pressure. If the calcareous particles of the teeth are so readily absorbed, what is the foundation for the belief that the fleshy substance of the gum is absorbed with such difficulty? Too much importance has evidently been attached to the supposed tension and resistance of the gum in the process of dentition.

Follicles in the period of development are especially liable to inflammation. We see this in the follicular stomatitis and enteritis, so common when the buccal and intestinal follicles are in the state of most rapid growth. Does not this law in reference to the follicles hold true of those by which the teeth are formed, so that the period of their enlargement and greatest activity, which corresponds with the growth and protrusion of the teeth, is also the period when they are most liable to congestion and inflammation? This fact affords a better explanation of the frequency of the so-called laborious or difficult dentition than that it is due to the resistance which dental evolution encounters from the gums.

If there be no symptoms except such as occur directly from the swelling and congestion of the gum, the lancet should seldom be used. The pathological state of the gum which would, without doubt, require its use, is an abscess over the tooth. As to symptoms which are general or referable to other organs, as fever and diarrhœa, the lancet should not be used if the symptoms can be controlled by other safe measures. All co-operating causes should first be removed, when in a large proportion of cases the patient will experience such relief that scarification can be deferred.

If the state of the infant be one of immediate danger, as in eclampsia, and it be not quickly relieved by the ordinary remedies, scarification may not only be proper but required to insure safety. For in such cases all measures, provided that they are safe and simple, which can possibly give relief, should be employed without delay. But I can recall to mind only two accidents of dentition which would be likely to be benefited by scarification, namely, suppurative inflammation in the dental follicle and convulsions. But since the bromide of potassium and hydrate of chloral have come into use as nervous sedatives, and as efficient remedies for clonic convulsions, scarification of the gums is much less frequently required, for even severe eclampsia commonly yields to these medicines, if the condition of the bowels be attended to.

Second Dentition.

The fact is well established, though often overlooked in practice, that second dentition occasionally deranges the functions of organs, and gives rise to pathological symptoms. Rilliet and Barthez mention particularly neuralgic pains, rebellious cough, and diarrhœa, as effects which they have observed. Rilliet relates the case of a girl, eleven years old, who had a very obstinate and protracted cough, the paroxysms lasting often half an hour to one hour. This cough immediately and permanently disappeared when the molars pierced the gums.

Dr. James Jackson, in his *Letters to a Young Physician*, says: "I have seen persons between twenty and thirty years of age much affected by a *wisdom tooth* not yet protruded, and distinctly relieved by cutting the gum. But I think the most common period of suffering from the second dentition is from the tenth to the thirteenth year. The most characteristic affections are wasting of flesh and nervous diseases. The boy loses his comeliness, and his complexion is less clear, while emaciation takes place in every part, though mostly, perhaps, in the face. The nervous symptoms are various, but the most common are a change in the temper and a loss of spirits. With these there is some loss of strength. The patient is unwilling to engage in play, and soon becomes tired when he does do it. Among the distinct symptoms which are not uncommon, I may mention pain in the head and in the eyes. The headache is not commonly severe, but it is such as inclines the patient to keep still. The eyes are not only painful, but are often affected with the morbid sensibility to which these organs are subject. I have known boys truly anxious to pursue their studies obliged to give them up on this account; and these, not having the disposition to play, will of choice pass the day with their mothers, and increase their troubles by the want of air and exercise. Nervous affections of a more severe character are sometimes manifested."

Whether the symptoms which have been attributed to second dentition have always been due to this cause, is questionable. Practically, however, it matters little whether we recognize dentition as the cause, or assign something else. Hygienic and medicinal measures to improve the general health will usually suffice to relieve the patient. Elsewhere I have related the case of a boy, of nervous temperament, about seven years old, who recovered immediately from a cough which had lasted for several weeks, by taking a mixture of iron and nitric acid. Many do well without medicine, simply by hygienic measures. Dr. Jackson says: "The remedies which I have found most useful are as follows: First, a relief from study or from regular tasks, yet using books so far as they afford agreeable occupation or amusement. Second, exercise in the open air, preferring the mode most agreeable to the patient, and in more grave cases the removal from town to country."

CHAPTER V.

CATARRHAL PHARYNGITIS, PERI-PHARYNGEAL ABSCESS, ŒSOPHAGITIS.

Children of all ages are liable to inflammation of the pharynx. In its mildest form it often, doubtless, escapes detection in the young infant. In older patients it is revealed by pain in swallowing solid food, and more or less tumefaction below the ears, apparent to the sight. It is said to be less frequent in infancy than in childhood. In the adult, and in children over the age of four or five years, inflammation of the pharyngeal surface is often confined to the portion of membrane which covers or immediately surrounds the tonsils. It occurs in connection with inflammation of these glands. But in infancy and early childhood this limitation is comparatively rare. Catarrhal inflammation of the fauces at this age is ordinarily general, the tonsils participating in the morbid state.

Pharyngitis is primary or secondary. The secondary form occurs in measles, scarlet fever, bronchitis, croup, pneumonitis, and occasionally in other affections. As these diseases are common, physicians are oftener called to treat patients who have the secondary form than the primary. Rilliet and Barthez met eighty-three secondary to sixteen primary cases.

Anatomical Characters.—The pathological anatomy of pharyngitis is ascertained by depressing the tongue and inspecting the fauces. The faucial surface is seen to be redder than in health, with more or less swelling, according to the intensity of the inflammation. In the primary inflammation the color is commonly bright red, almost like that of arterial blood. If, on the other hand, the inflammation occur in connection with a constitutional malady, the hue is apt to be darker. In grave cases of scarlet fever or measles it is sometimes even livid, indicating a vitiated state of the blood, a condition of real danger. The tonsils are tumefied so as to project, though not to the extent which we often observe in the adult. They are then less firm than in the normal state. The follicles of the throat are enlarged and active, pouring out a muco-purulent secretion. This is sometimes seen in a layer over the tonsil or the posterior portion of the fauces. In a case of primary pharyngitis examined after death by Rilliet and Barthez, the tonsils were softened, infiltrated with pus, and slightly enlarged. A layer of bloody mucus lay on the pharyngeal surface, which was dark-red, thickened, and glandular. The submaxillary glands were also swollen and somewhat softened.

If the inflammation be intense, the deep-seated portions of the tonsils

become involved, and even sometimes the adjacent connective tissue. In such cases, by applying the fingers in the hollows below the ears, the tonsils can be felt.

Causes.—The usual cause of primary pharyngitis is exposure to cold. It also occasionally occurs from the use of drinks too hot or containing some irritating substance. I have met it in the most intense form caused by swallowing boiling water, and, in one case, from acetic acid taken through mistake. When it occurs in the eruptive fevers, it is usually part of a more extensive phlegmasia, in which the buccal and perhaps laryngeal and nasal surfaces participate.

Symptoms.—Fever, with thirst and loss of appetite, is common, and is usually proportionate, in intensity, to the extent and severity of the inflammation. At first there is dryness of the faucial surface, and this is succeeded by a more or less abundant viscid secretion. Swallowing is painful, except in mild cases. The muscles of the anterior half arches, which, by their contraction, close the opening from the pharyngeal to the buccal cavity, and those of the posterior arches, which close the opening to the nasal cavity, both which sets lie a little under the mucous membrane, are often so infiltrated with serum that their contractile power is diminished, and if the same happen with the constrictor muscles, which carry downward the food, swallowing becomes difficult, and in the attempt, more or less of the ingesta is apt to return into the mouth, or enter the nostril. During health the air passes through the nostrils in the pronunciation of two letters only, namely, N and M, but in severe pharyngitis, in consequence of the swelling, and the impairment of the action of the muscles concerned in speech, the air passes through the nostrils with the utterance of many words, producing the nasal tone of voice. Sometimes the inflammation traverses the Eustachian tube to the middle ear, causing earache, which may be relieved by the escape of pus down the tube, or by perforation of the drum into the external ear.

The breath is foul, but not fetid; the respiration normal, or but slightly accelerated; there is commonly no cough, but it is sometimes present, due to the extension of the inflammation to the upper part of the larynx, or to the collection of mucus around the aperture of the glottis. In most cases of pharyngitis a light fur covers the tongue, and stomatitis of a mild grade is present, as shown by the redness of the buccal surface, and an increased mucous secretion.

Chronic pharyngitis, which is so common in adults, and which is produced in some by gastric derangements, and in others by excessive smoking, or the prolonged use of intoxicating drinks, and in others, still, by the syphilitic or mercurial cachexia, is comparatively rare in children.

Prognosis.—In mild cases of pharyngitis convalescence commences within a week. If the inflammation be dependent on a constitutional malady it may continue considerably longer, especially if the glands of the

neck, and the connective tissue, be much involved. The prognosis in secondary pharyngitis is less favorable than in that of the primary form. In fatal cases there is usually a vitiated state of the blood, either from the coexisting constitutional disease, or from previous cachexia.

Pharyngitis may, however, become dangerous from complications to which it gives rise. The proximity of the inflammation to the brain, or its effect upon the cerebro-spinal axis through the medium of the nerves, sometimes gives rise to clonic convulsions. In a recent case of primary pharyngitis in my practice, repeated and violent convulsions occurred in an infant, about one year old, from this cause. They commenced at the inception of the inflammation, and constituted the only real danger. Pharyngitis may interfere materially with nutrition in consequence of the dysphagia, but in most cases of primary pharyngitis this symptom does not continue sufficiently long to endanger the life of the patient. In grave constitutional affections, as scarlet fever, the difficulty of swallowing, and the consequent innutrition, augment the danger. As regards, therefore, the prognosis in catarrhal pharyngitis, whether primary or secondary, it may be stated as a rule, that it is not, *per se*, a fatal disease, but is only so from complications, or from aggravating the primary malady with which it is associated.

Diagnosis.—This is not difficult provided that attention be directed to the throat ; but the physician often fails to discover it at his first visit, from neglecting to examine this part. In many cases the local symptoms are not well-marked, and in the absence of these the febrile reaction may at first be referred to some other cause than the true one. Inspection not only reveals the presence of inflammation, but enables us to determine whether it be simple pharyngitis, or diphtheritic, or ulcerative. In some instances, simple pharyngitis resembles the diphtheritic, from the presence of confervoid growths upon the inflamed surface, usually the leptothrix buccalis. The differential diagnosis is based on the easy removal and soft pultaceous character of the confervæ, and the appearance under the microscope.

Treatment.—*Mild* cases of simple pharyngitis require little treatment. With moderate counter-irritation over the throat, and the use of laxative medicines, the inflammation soon subsides. The oleum camphoratum may be occasionally rubbed over the throat, and retained upon it by flannel. The effect is increased by the application, once or twice daily, of mustard or tincture of iodine, or by adding to the liniment one fourth or one third of its quantity of turpentine.

Some children seem to be most relieved by a muslin compress frequently wrung out of cool water, or a light india-rubber bag containing ice. Frequently rubbing the neck with warm oil or camphorated oil, and binding upon it a rind of salt bacon, are popular modes of treatment, and no doubt are productive of benefit.

In the severe forms of this inflammation, occurring independently of any other disease, more acute measures are sometimes required.

If there be stupor or restlessness, with unusual heat of head, and starting or twitching of the limbs which threaten convulsions, two to five grains of the bromide of potassium given every two or three hours produce an excellent calmative effect.

Diaphoretics and sometimes cardiac sedatives are also indicated, such as liquor ammoniæ acetatis, spiritus ætheris nitrosi, ipecacuanha, and aconite. Medicines of this kind may be variously combined according to the age and condition of the patient, and the severity of the disease.

As the symptoms abate, the intervals between the doses may be increased.

In cases attended by much tenderness and dysphagia great relief is often obtained by hot poultices frequently applied over the neck.

Topical treatment of the pharynx is recommended by most authors. Rilliet and Barthez use for this purpose nitrate of silver or powdered alum. The former has been most employed by physicians. It may be applied in the proportion of ten grains to the ounce two or three times daily. I prefer the following mixture, used with the hand atomizer every two or four hours :

℞. Acid. carbolic., gtt. xxxij ;
Potas. chlorat., ʒ iij ;
Glycerinæ, ℥ iij ;
Aquæ, ℥ vj. Misce.

This can of course be used as a gargle by those old enough, or more continuously by the steam atomizer.

The treatment of secondary pharyngitis will be described in connection with the treatment of the diseases which it complicates. Suffice it here to say that this form of inflammation must not be treated by those depressing remedies which are useful in certain cases of idiopathic pharyngitis.

Peri-Pharyngeal Abscess.

Every practitioner should bear in mind the fact that an abscess occasionally forms between the pharynx and vertebral column (retro-pharyngeal), or upon the side of the pharynx in the submucous connective tissue. This constitutes a disease which is apt to be fatal, but which can ordinarily be promptly relieved by the surgeon.

Yet, if we look over the records of peri-pharyngeal abscess, we shall see that in a large proportion of fatal cases, the disease was supposed to be something else, and so treated until its nature was revealed by post-mortem examination. The most complete monograph on this malady

with which I am acquainted was published by Dr. Allin, of this city, in the *N. Y. Jour. of Med.* for November, 1851, under the title of retro-pharyngeal abscess. To this paper I am largely indebted for facts.

Age—Cause.—This abscess may occur at any age, but it is most common in infancy and childhood. It is more frequent in the first two years of life than at any other period. Of the cases collated by Dr. Allin, in which the age is stated, twenty were under ten years, and twenty-one over this age. The abscess occurs in some patients from caries of the vertebral column, and, in others, from inflammation developed in the connective tissue or small lymphatic glands lying immediately outside the pharynx, or from a catarrhal pharyngitis. Whichever the cause, there is usually a scrofulous or reduced state of system.

Writers describe two kinds of peri-pharyngeal abscess, the primary and secondary. This distinction is based on the fact, whether or not the inflammation which leads to the abscess be dependent on an antecedent pathological state.

In the primary form the cause is usually atmospheric, or it is some irritating substance which has been swallowed, and which, lodging in the pharynx, produces phelgmonous pharyngitis.

The cause is mentioned in twenty cases of the primary form, collated by Dr. Allin, as follows : exposure to cold, ten cases ; lodgment of bone in pharynx, eight cases ; blow with a fencing-foil, one case. In the last case the button of a fencing-foil passed through the right nostril into the pharynx.

The secondary form occasionally occurs after measles and scarlet fever. The inflammation of the pharynx, common in those diseases, extends to the subjacent connective tissue, and, aided by the dyscrasia of the patient, becomes suppurative. Such cases have been observed by Rilliet and Barthez. The most common cause of the secondary form is, however, caries, occurring in the cervical vertebræ.

When thus occurring it is similar, both as regards cause and nature, to lumbar abscess. It would follow the same chronic course, and would properly be described in connection with it, were it not for its proximity to the air-passages, which renders the symptoms so urgent and dangerous. In a few recorded cases the abscess was a sequel of erysipelas. In nineteen cases of secondary abscess, in Dr. Allin's collection, the cause is assigned as follows : erysipelas of face, two ; inflammation following a fall upon the inferior maxilla, one ; after cerebritis, one ; syphilis, four ; caries of the cervical vertebræ, six ; scrofula, five.

The plausible opinion is expressed by Mr. Fleming (*Dublin Journ. of Med. Sci.*, vol. xviii.), that the suppuration begins, in a large proportion of cases, in the small lymphatic glands which lie in the connective tissue external to the pharynx. The late Prof. Geo. T. Elliot has recorded the case of an infant of seven months (*Obstet. Clinic*, N. Y., Appleton & Co.,

1868), in whom peri-pharyngeal abscess immediately followed, and was apparently due to parotiditis.

In rare instances the abscess, or the local disease which leads to it, appears to exist from birth. Thus, Dr. E. O. Hocken relates, in the *Prov. Med. and Surg. Journ.*, 1842, the history of an infant who died at the age of nine weeks. It had always, when taking the breast, thrown back its head as if nearly suffocated. The walls of the abscess were thick and firm, described by the writer as cartilaginous. Occasionally there is no apparent cause of the abscess, except the strumous or cachectic state.

Anatomical Characters.—The seat of the abscess is not the same in all cases. The swelling can ordinarily be seen on examining the fauces, but occasionally it is so low as to be really peri-œsophageal, and, therefore, invisible. The size of the abscess varies ; sometimes it is large, pressing inward the wall of the pharynx even against the velum palati and into the posterior nares, if the abscess have a high location, or, if lower, against the larynx, so as to embarrass respiration. Sometimes the abscess is so large, or has such lateral extension, that there is external swelling along the side of the neck. In a few cases on record the pus, instead of being discharged into the pharynx, made its way down the neck between the muscles and the connective tissue to the pleural cavity, which it entered, producing fatal pleuritis.

The walls of the abscess have been found in a different state in different cases. Sometimes the sac, at the projecting point, is so thin that it seems as if there might have been a spontaneous cure, could life have been preserved a few hours longer. In other cases the sac is so thick and firm that its rupture, for many days, would be impossible.

Symptoms.—The precursory symptoms differ in different cases, according to the nature of the cause, whether it be phlegmonous pharyngitis or simply adenitis or vertebral caries. If the abscess proceed from caries, it is preceded by deep-seated pain, greatly increased by movements of the head, and probably by induration along the sides of the vertebræ.

The patient with this disease is restless, his mouth hot and dry ; tongue furred ; deglutition more or less difficult. Sometimes after suppuration has occurred there are alternations of rigors and fever. The symptoms indicate approximately the seat of the inflammation, but on examination we do not find that degree of redness of the mucous surface which we had been led to expect. The tissues which are chiefly involved in the inflammation, being submucous, are hidden from view. We observe redness of the pharynx, but it is disproportionate to the intensity of the symptoms. Sometimes there is a sensation of chilliness through the entire period of the abscess, though greater at one time than at another, and occasionally convulsions occur, especially in young infants. In ordinary cases embarrassment of respiration begins early, and is the cause of the chief danger. It becomes more and more marked as the abscess increases. It is noticed

both during inspiration and expiration. The dysphagia also increases, sometimes to such a degree that drinks are taken with difficulty, and solid food refused. The respiratory symptoms bear considerable resemblance to those in protracted laryngitis, for which this disease has been mistaken. While the respiration becomes impeded or whistling, the voice is also feeble or indistinct, from the pressure of the tumor.

But the symptoms described above are not all present in every case. They vary according to the size and location of the abscess, whether it be high or low, posterior or lateral. I have met the disease in a child old enough to express its subjective symptoms, in whom there was little or no dysphagia, and others report similar cases. When the tumor has attained such a size as to produce well-marked symptoms and jeopardize the life of the patient, it, or a part of it, can ordinarily be seen on depressing the tongue, but usually its location and condition can be better ascertained by exploration with the finger. The dyspnœa increases as the abscess enlarges, and, after a time, unless it burst spontaneously or be opened by the surgeon, imperfect oxygenation of the blood results. In some patients paroxysms of dyspnœa occur, so as to threaten immediate suffocation ; coughing or attempts to swallow induce these paroxysms, and the patient is forced to remain in an erect or semi-erect posture. The tongue is protruded, the head thrown back, the pulse is frequent and rapid, the limbs become livid and cool, and finally death results from dyspnœa. Occasionally, when death seems inevitable, the abscess breaks during the struggles of the child, and the patient is restored to health. In rare cases the result is different. The trachea and bronchial tubes are deluged by the purulent discharge, and immediate suffocation occurs. The following was an example : In May, 1871, a boy two years and five months old was brought to the class at Bellevue, who had had the symptoms of an abscess for three months. The head was carried on one side, its rotation caused pain, and a laryngeal râle accompanied respiration. The upper part of the tumor could be detected by the finger ; but, on account of its low location, it was impossible to open it with the bistoury. The temperature was 103°, pulse 156. The case was kept under observation, but in a few days the dyspnœa suddenly became so urgent that death was imminent, when the attending physician of the class, Dr. Swezey, broke the abscess with his finger, and pus was ejected on the floor ; death, however, occurred almost immediately.

A correct appreciation of the symptoms and the nature of peri-pharyngeal abscess will be best obtained by relating a case. I select the following from the *Trans. of the Lond. Pathol. Soc.*, Oct. 20, 1846 :

A female infant died at the age of seven months, having had difficult breathing three weeks, and extreme dyspnœa during the last days of life. The dyspnœa was constant, and was aggravated by mental excitement, by movements of the body, and by exposure to cold. During the parox-

ysms a peculiar, croupy sound accompanied inspiration. There was no dysphagia through the entire sickness, and death occurred from apnœa.

The sac of the abscess was of the size of a pigeon's egg, and was situated between the upper cervical vertebræ and the back of the pharynx. The abscess was flattened in front, so as not to cause any decided prominence of the wall of the pharynx. From the sac a second small cyst extended forward, forming a nipple-like swelling in the pharynx, which completely closed the orifice of the glottis. Its aperture of communication with the body of the abscess admitted the point of the little finger, and the whole swelling was freely movable and perfectly translucent at its extremities and sides. The abscess might have been easily punctured, with probably the preservation of life.

The *duration* of this malady is very different, according to the severity of the inflammation, the rapidity with which the abscess enlarges, and the direction which it points. A lateral or downward extension is not so immediately dangerous to life as the anterior.

The time when the abscess begins to form cannot be precisely ascertained, and most writers, in determining its duration, compute from the first appearance of symptoms which are referable to the pharynx. Dr. J. Bryne relates, in the *Amer. Journ. of Med. Sci.*, 1838, a fatal case in which the disease had apparently continued only about one week. The patient was an infant one year old, and its death was from apnœa. The abscess was large, extending from the base of the skull to the thorax, and pressing both on the larynx and trachea. M. Besserer (*Archiv Gén. de Méd.*, 1840) gives the history of an infant four months old, who died in the same way after thirteen days. An infant nine months old, whose case was published by Dr. W. C. Worthington, in the *Prov. Med. and Surg. Journ.*, 1842, lived nine days. The abscess occurred from exposure to cold ; the patient was treated for croup, and died from suffocation. The anterior wall of the abscess was very thin. Since the first edition of this book was published, I have met four patients with this disease in whom the pus was evacuated when the dyspnœa had become urgent. In two the symptoms indicated a continuance of the disease from two to four weeks, and in the third case four months. The fourth case is interesting on account of the short duration of the severe symptoms. The following is the record of it : M. E., aged 7 months, female, nursing, inmate of the New York Foundling Asylum, was observed to have difficult breathing for the first time, on March 28, 1875. Since about March 8, some swelling had been noticed along the side of the neck, but it gave rise to no marked symptoms and she had not seemed ill, till the obstruction in the respiration commenced. At my visit on the evening of the 28th, the infant was pointed out to me as in a dying condition. She was lying in a state of stupor, pallid, and gasping for breath, with a temperature of 103°, and very feeble pulse, numbering about 200 per minute. On carrying the finger

into the throat an abscess could be readily detected, situated in the walls of the pharynx on the left side posteriorly. This was easily opened by a curved bistoury, around which adhesive plaster was wound to within half an inch of the point. The breathing immediately began to improve. On the following day the infant was playing in the mother's lap, with a pulse of 140, but a normal temperature. With the use of cod-liver oil and the syrup of the iodide of iron, its health was soon fully restored.

When the abscess grows slowly, and presses lightly on the air-passages, the case may continue for months. Such a one was observed by Professor Willard Parker. (Allin.) This infant was one year old ; it suffered from pharyngeal symptoms nine months, was treated for tonsillitis, and death occurred as usual from apnœa. The abscess was two inches long, and there was no disease of the vertebræ. The same surgeon saved the life of another patient four years old, in whom the disease was protracted, by puncturing the abscess ; and Professor Post, of this city, also treated successfully a case which had continued three months. (Allin.)

Diagnosis.—The diagnosis of this disease is ordinarily easy, provided that the physician examine carefully and bear in mind the occasional occurrence of such an abscess. In a large proportion, however, of the recorded fatal cases, the true nature of the disease was not recognized during life. Especially is the diagnosis difficult when the cerebro-spinal system is early implicated, and symptoms arise which divert attention from the throat to the brain.

The maladies with which peri-pharyngeal abscess is most frequently confounded are laryngitis and simple but severe pharyngitis. From laryngitis, for which it has been most frequently mistaken, it may be distinguished by the dysphagia and by the character of the initial symptoms. In laryngitis there is usually the peculiar cough from the first or very early, while in abscess there is an initial period of several days or even weeks before respiration is materially affected. This is the period of inflammation which precedes suppuration.

In abscess pressure of the larynx backward is badly tolerated, greatly increasing the dyspnœa, while in pharyngitis and croup this effect is not so marked. In abscess the horizontal position aggravates the dyspnœa, but not in pharyngitis and croup. The character of the voice will also aid in diagnosticating abscess from laryngitis, since in the former it is apt to be nasal, and in the latter hoarse or whispering. The decisive test is afforded by inspection and digital exploration. The tumor is seen, or, if situated too low to be seen, is felt, upon the walls of the pharynx.

If the symptoms of abscess are masked by those arising from the cerebro-spinal system, as by convulsions, the priority of the pharyngeal symptoms will serve to aid in determining the true disease.

In a case of suspected abscess the physician should not only carefully inspect the fauces, but should employ digital examination. The finger

will often detect fluctuation when no evidence of an abscess or uncertain evidence is presented to the eye.

Prognosis.—With proper treatment the result is usually favorable, but, if the disease be not recognized, many die. In Dr. Allin's cases, of those under the age of twelve years nine died, while ten recovered by the opening of the abscess by the lancet, trocar, or finger, and one by its spontaneous rupture.

If the abscess be due to disease of the spinal column, death may occur immediately after the sac is opened, the caries of the intervertebral cartilages producing, according to Dr. Allin, dislocation of the vertebræ. Death may also occur, though rarely, from pleuritis, in consequence of the bursting of the abscess into the pleural cavity. Even in caries, if the sac be properly opened, and if need be reopened, and the head supported by suitable apparatus, recovery is possible, as in a case treated by Prof. Post.

Treatment.—The proper treatment of peri-pharyngeal abscess is simple, consisting in breaking or puncturing the sac by the finger, the lancet, bistoury, or pharyngotome. Each method has been successfully employed. In the majority of cases the proper way to open the abscess is by the ordinary curved scalpel or bistoury, which should be covered by a strip of adhesive plaster to within a half inch of the point. If the abscess be post-pharyngeal, it should be opened in the median line. A single incision suffices to evacuate the pus. If the abscess point or be elastic, there is little danger of wounding any important vessel or producing dangerous hæmorrhage if the operation be properly performed. It may be necessary to open the abscess more than once, as in a case reported by Dr. Post, and another which I saw with Dr. Livingston, of this city. In certain cases, when the knife cannot be readily employed, the abscess may be opened by pressure with the finger-nail or the edge of a teaspoon.

Patients with this disease ordinarily require constitutional treatment, especially the use of tonics, ferruginous and vegetable. The citrate of iron and quinine, the citrate of iron and ammonium, and in strumous cases the syrup of the iodide of iron with cod-liver oil, are eligible preparations. Nutritious diet and often alcoholic stimulants are required.

Œsophagitis.

Disease of the œsophagus in infancy and childhood is comparatively rare, inflammation being the most frequent affection of this portion of the digestive tube in these periods, and, indeed, the only one which claims attention. It is most common in infants under the age of three or four months, who are deprived of the breast-milk, and are given a diet which is with difficulty digested, and perhaps taken too hot or too cold. It is, therefore, most common in foundling hospitals. I have frequently ob-

served it in the Infants' Hospital, and the Nursery and Child's Hospital, of this city, chiefly at the autopsies of bottle-fed infants, under the age of six months, whose symptoms had indicated disease or derangement of the digestive function. Many of them had diarrhœa, and died in a state of emaciation. Œsophagitis in these cases was associated with simple or gangrenous stomatitis, thrush, or with gastritis or entero-colitis. Sometimes all these inflammations coexisted. In a few cases the confervoid growth of thrush had extended from the mouth to the œsophagus. It occurred in small hemispherical masses, scarcely as large as a pin's head. Swallowing corrosive or strongly irritating substances, as the acids or alkalies, is an occasional cause of œsophagitis, the irritant at the same time producing stomatitis and gastritis.

Anatomical Characters.—The inflamed surface sometimes presents a uniformly injected appearance. Usually, however, there is greater intensity of inflammation in streaks or patches than over the surface generally. I have frequently observed at autopsies a greater degree of inflammation in the lower than upper half of the œsophagus, even when the infant had stomatitis at the time of death.

Œsophagitis occurring from faulty regimen or anti-hygienic conditions is not accompanied by as much thickening of the walls of the tube as often occurs in some other portions of the digestive canal, as, for example, in the colon. Diphtheritic inflammation of the œsophagus is accompanied by so great infiltration of the mucous membrane and underlying connective tissue that I have seen the œsophageal walls three or four times the normal thickness.

Occasionally ulcerations of the œsophageal mucous membrane are observed in the lower part of the tube, and Billard describes the ulcerative form of œsophagitis. At the first autopsies at which I observed these ulcers, I supposed that they were pathological, and indicated a severe grade of inflammation ; but a more extended observation has convinced me that they are usually post-mortem, and are not at all dependent on inflammations of the œsophagus. The solvent power of the gastric juice not only causes ulceration in the stomach, but entering the œsophagus may and not infrequently does produce a solvent action on the mucous tissue there. At the meeting of the London Pathological Society, March 4, 1852, Dr. Graily Hewitt presented a specimen in which the gastric juice had not only eaten entirely through the coats of the œsophagus an inch above the stomach, but had even attacked the left lung. Over the age of six months inflammation of the œsophagus is rare.

The symptoms of œsophagitis, in those young and emaciated infants in whom it ordinarily occurs, are not well-pronounced. Pain in deglutition, or tenderness on pressure over the œsophagus, if present, is ordinarily not appreciable. Nor have they seemed to me to vomit oftener than other infants of this class who suffered from indigestion and gastro-enteritis,

without œsophagitis. It is, therefore, difficult to diagnosticate œsophagitis in them. It is, according to my observation, oftener present than absent in spoon-fed infants of three months or under who have persistent stomatitis and entero-colitis.

Treatment.—In the œsophagitis of foundlings and ill-nourished infants, which arises, as has been stated, from faulty regimen, no treatment is required apart from that designed to relieve the stomatitis or entero-colitis with which it occurs. Attention must be directed mainly to the diet and hygienic management. The remedial measures are more fully detailed in our remarks on entero-colitis. Œsophagitis produced by swallowing corrosive or highly irritating substances requires the same treatment as in the adult, namely, poultices, demulcent drinks, etc.

CHAPTER VI.

INDIGESTION, CONGESTION OF STOMACH, GASTRITIS, FOLLICULAR GASTRITIS, DIPHTHERITIC GASTRITIS, POST-MORTEM DIGESTION, SOFTENING.

Indigestion is more common during infancy than in any other period of life. While the digestive organs in the adult easily assimilate a great variety of food, it is necessary for the well-being of the infant that its diet be simple and carefully prepared. Departure from this rule leads to indigestion and ulterior diseases.

After the age of two years a mixed diet is readily assimilated, the digestive function less frequently disordered, and indigestion presents few peculiarities to distinguish it from that of the adult.

Indigestion in some children is habitual ; in others the digestive process is ordinarily well performed, but, from some temporary derangement of system or error of diet, an acute attack of indigestion occurs. Hence, two forms of this ailment may be described ; first, acute, referring to temporary attacks ; secondly, chronic, referring to the habitual state.

Causes.—The causes of indigestion are twofold : first, the condition of the digestive function independently of the aliment ; secondly, the unwholesome or improper character of the ingesta. Anything which lowers the vital powers may be a predisposing cause of indigestion, by impairing the function of the organs which assimilate the food. Impure air and personal uncleanliness, protracted hot weather, and previous disease, are among the common predisposing causes. The strong country child can thrive upon a diet which, given to the more feeble child of the city, would produce deleterious results. During the summer months it often happens that an infant in the city cannot digest properly any food given

to it except the mother's milk ; and from this results much of the infantile sickness and mortality which make this season of the year so much dreaded by parents. There is a natural difference in children, as regards liability to disordered digestion. Some do well upon a diet which given to others similarly situated occasions vomiting, gastralgia, and flatulence.

In the majority of cases of indigestion, however, the fault does not exist in the child. It is fed too often or irregularly, or upon a diet that is unwholesome or indigestible. It is well known that the milk of the mother or the wet-nurse is liable to changes which render it for the time unsuitable for the infant. Her food may be of such a quality, or her mind so excited, or some function of her system so disordered, as to effect a temporary change in the constitution of the milk. The occurrence of the catamenia, or of gestation, in mothers who are suckling, not infrequently produces this unfavorable result.

Indigestion is most common in those infants who, deprived of the mother's milk, are intrusted to wet-nurses, or fed from the bottle. The milk of the wet-nurse, from not agreeing with the age of the infant, from irregularity in her mode of life, from the acescent nature of her food, or from other causes which are not appreciable, may disagree with the infant, and be imperfectly digested.

The most common cause of indigestion in the infant is artificial feeding. This, in the cities, is productive of a great amount of gastric and intestinal derangement and disease. The younger the infant, the less frequently does it thrive if brought up by hand.

Whatever care may be bestowed in the preparation of its food, whether cow's or goat's milk, or farinaceous substances be used, there is seldom that healthy nutrition which is observed in infants who receive the breast-milk. The "swill milk" in common use among the poor families of this city is totally unfit for the feeding of infants, and is apt to cause flatulence, acidity, and indigestion. Acute indigestion occurs in children of any age from food unsuitable in quality or quantity, which produces gastralgia and other symptoms to be detailed hereafter. Those who suffer habitually from mal-assimilation are especially liable to such acute attacks.

In the period of childhood, chronic indigestion is much less frequent than in infancy, but children are, perhaps, more subject than infants to the acute form. This is induced by ingesta taken in too large quantity, or of a kind which is with difficulty digested. Cherries, currants, raisins, and the parenchyma of oranges and lemons, dried fruits and confectionery, which are so often heedlessly given to children, are common causes of acute attacks of indigestion. These substances, being but partially digested or not at all, and sometimes accumulating for days in the stomach or intestines, may lead to a very serious and dangerous condition.

Symptoms.—The *nursing* infant, if the milk continually disagree with it, is fretful. It has a discontented aspect. It seldom smiles, and is not

amused by playthings, or is only amused for a short time. Its features are pallid, and bear the appearance of faulty nutrition. Its body and limbs are more or less wasted, or are soft and flabby. Vomiting is frequently present, and sometimes a large mass or masses of casein are ejected, which have evidently lain a considerable time in the stomach. The bowels may be constipated or loose, and the evacuations are unhealthy. This state of the infant continuing prevents the necessary rest of the mother, and may affect unfavorably her health, so as to reduce the quantity of her milk, or render it still more unwholesome.

In addition to the habitual indigestion, these infants sometimes have acute attacks, similar to the acute dyspepsia of adults, and which have been described by writers as gastralgia or enteralgia. Their countenance indicates suffering ; they utter sharp cries, their thighs are often drawn over the abdomen, notwithstanding attempts made to amuse them. Flatulence is common. By vomiting or an evacuation from the bowels, the offending substance is removed, and the pain subsides.

Indigestion in the *spoon-fed* infant is similar to that in the infant who nurses, except that it is ordinarily accompanied by symptoms of greater gravity and persistence, and there is in such infant more liability to the acute attacks.

In those who have advanced beyond the age of infancy, chronic indigestion is less frequent than in infants, but as the diet of such children is prepared with less care, and is less restricted, they are very liable to attacks of temporary indigestion. These come on suddenly, and sometimes are so severe as to endanger life. The child, previously well, is suddenly seized with languor ; the pulse becomes accelerated, the face flushed, and surface hot. Drowsiness compels him to seek the bed, where he lies with his eyes shut. He sometimes has headache, and a sensation of oppression in the epigastrium. The nervous system is not infrequently affected, as shown by tenderness of a neuralgic character of the body and limbs, sudden twitching of the limbs premonitory of convulsions, and occasionally severe and repeated convulsions. These alarming and really dangerous symptoms speedily subside on the removal of the cause. One of the most severe attacks of eclampsia which I have seen occurred in a boy eight or ten years old, induced by swallowing the parenchymatous portions of oranges which he had been in the habit of eating, and which had accumulated in the stomach and intestines. The expulsion of the offending substance gave immediate relief.

Sometimes, but not often, the symptoms of acute indigestion closely resemble those of pneumonitis. For example, an infant, whom I once treated, was seized at night with fever, hurried respiration, and the expiratory moan, which writers consider almost pathognomonic of pneumonitis or pleuritis. These symptoms subsided when the bowels were freely opened, and currants, which had been eaten the previous day, were expelled.

As the child advances in years and its general health improves, the digestive function is less frequently disturbed. After the age of three or four years indigestion is much less frequent than in infancy and early childhood.

Indigestion leads to some of the most common and serious affections of early life. In the infant, if it continue a considerable time, inflammation of the buccal, œsophageal, or gastric mucous membrane, or of some part of the intestinal tract, ordinarily occurs. In the young infant thrush soon makes its appearance, and, whatever the age, the cachexia which results from continued indigestion increases the liability to organic maladies. Eclampsia is, as we have seen, a serious, and at the same time a not infrequent, result of temporary or acute indigestion.

Prognosis.—In simple indigestion this is good. It is doubtful or unfavorable when ulterior diseases occur, and in proportion to their gravity.

Treatment.—The first indication in treatment is obviously the removal of the cause. In *acute* indigestion, when there is reason to believe that there is some offending substance in the stomach or intestines, if the symptoms occur soon after the substance is taken, an emetic may be administered, and ipecacuanha, in syrup or powder, is safe and usually efficient. If several hours have elapsed a purgative should be given, as castor oil, either alone or in combination with syrup of rhubarb.

If the symptoms be urgent, especially if convulsions be threatened, we should not wait for the slow action of a purgative, but should resort to enemata to open the bowels. Sometimes the pain in acute indigestion is such as to require the use of opiates. In the infant there is often an excess of acid in the stomach and intestines, which is best treated by alkaline remedies, as lime-water in combination with the opiate. The following mixture will be found useful in such cases :

℞. Tinct. opii deodorat., or liq. opii composit. (Squibb's), gtt. xij ;
Magnes. calcinat., gr. xij—xxiv ;
Sacch. alb., ʒj ;
Aq. anisi, ℥iss. Misce.

Dose, the bottle being first shaken, one teaspoonful every two hours to a child a year old, until relief. If there be much pain, it is well to add a little chloroform or Hoffman's anodyne to the mixture.

Or the following mixture :

℞. Tinct. opii deodorat.. or liq. opii composit., gtt. xij ;
Bismuth. subcarbonat., ʒiss ;
Syr. simplic., ℥ss. Misce.
Aq. cinnamomi, ℥j.

Shake bottle thoroughly and give one teaspoonful.

If in the acute indigestion of infants diarrhœa occur, the campho-

rated tincture of opium, in combination with chalk mixture, may be given, fifteen drops of the one to a teaspoonful of the other, or the above mixture. Infants, whose diet consists largely of cow's or goat's milk, digest with most difficulty the casein, which is apt to pass the bowels in an imperfectly digested state, or to collect in a large and firm mass in the stomach, causing gastralgia and rendering the child fretful till it is vomited. I have elsewhere recommended, as important to prevent these attacks of acute dyspepsia, the use of the upper third of the milk, which contains less than the average casein, and the addition of an alkali to the milk, which retards the coagulation till it begins to be acted upon by the gastric juice, and tends to prevent the formation of large and firm caseous coagula in the stomach. The addition of a little farinaceous food, as barley water, to the nursing-bottle will sometimes produce the same effect by mechanically separating the particles of milk.

In *chronic* indigestion the means of relief are different. They are twofold : first, as regards change of diet ; secondly, measures to improve the digestive function. Spoon-fed infants, suffering from habitual indigestion, require the utmost care as regards the character of their food, its preparation, and the times of feeding. Often it is best, if practicable, to procure a wet-nurse, and sometimes removal to a more salubrious locality is followed at once by improvement in the digestive function. If the infant be already wet-nursed, the milk should be examined microscopically and otherwise, and inquiry should be instituted in reference to the health and diet of the wet-nurse. Sometimes a change of wet-nurse is advisable. For facts and considerations bearing on this point the reader is referred to the chapters relating to regimen.

Children with chronic indigestion are occasionally much benefited by the moderate and judicious use of alcoholic stimulants. They should be given sparingly with their food, and should be discontinued as soon as the digestive function is fully restored. M. Donné and some other French writers recommend the habitual use of wine for infants even in a state of health, but there are reasons, moral as well as physical, why alcoholic stimulants should only be used as medicines, and not in a state of health.

If the case be one of simple or uncomplicated indigestion, pepsin or lactopeptin of the shops and tonics may be employed. In many instances, however, especially in infancy, gastro-intestinal inflammation has supervened, and in such cases those tonics should be employed which exert a favorable, or, at least, not an unfavorable effect on the hyperæmic and irritable surface over which they pass.

When indigestion is simple, or accompanied by no serious complication, wine of iron, citrate of quinine and iron, and the elixir of calisaya bark, may be mentioned among the safe and efficient agents to improve the digestive function.

The ferruginous preparations are most efficacious in cases which are attended by signs of anæmia.

Among the useful vegetable stomachics and tonics may be mentioned the compound tincture of cinchona, compound tincture of gentian, infusion of columbo, fluid extract of columbo, and fluid extract of cinchona.

If chronic indigestion be complicated with gastro-intestinal inflammation, subacute or chronic, for this is the form which is usually present, there are still certain tonics which may be advantageously administered. Columbo and the compound tincture of cinchona are often useful in these cases, and of the chalybeates wine of iron or the citrate of iron and ammonium or the liquor ferri nitratis may be safely administered. In most cases, however, change in the diet properly made will be found more useful than tonic and corrective medicines.

I have only alluded to the use of pepsin as a remedial agent in indigestion. The theory of its employment in atonic states of the stomach is good, but physicians in this country have, in most instances, I think, not observed that benefit from its use which they have been led to expect, and which seems to have followed its employment in the practice of some of the European physicians. Perhaps the result would have been better had fresher and better preparations of pepsin been prescribed. Imported pepsin has been most used in this country, but the recent American preparations are, in my opinion, preferable on account of the care bestowed in their preparation, and their freshness. I have prescribed pepsin in doses of two or three grains, several times daily, to foundlings from one to three months old, and in proportionate doses to older infants, but I am not able to speak confidently of its effects, as I have commonly given it with bismuth.

The American pepsin, prepared under the intelligent supervision of experienced chemists, can be obtained in the shops in the form of a powder or liquid. That now prepared by Dr. Hawley, of Brooklyn, is among the best.

Infants affected with diarrhœa from indigestion often improve under the use of powders consisting of equal parts of subnitrate of bismuth and pepsin. An infant of three months can take three grains of each every three hours.

Dyspepsia often rapidly disappears by hygienic measures without the use of medicines, as by removal from the city to the country, outdoor exercise, or, if the patient be an infant, by being carried into the open air daily. In infants, also, marked improvement is often observed on the approach of the cool and bracing weather of autumn and winter.

Congestion of the Stomach.

Passive congestion of the stomach is described among the diseases of this organ by Billard ; but it is a pathological state of little importance in

itself. It occurs in new-born infants, asphyxiated at birth and with difficulty resuscitated. In these cases there is generally intense capillary congestion throughout the system. The mucous membrane of the stomach is injected, but not more than that of the mouth or intestines. If circulation and respiration be fully established, this injection of the capillaries subsides. No treatment is required, except measures to promote the circulatory and respiratory functions. In cyanosis and atelectasis there is often general congestion of the capillaries of the systemic circulatory system, on account of the obstruction to the flow of blood through the heart in the one disease and through the lungs in the other. There is in these cases passive congestion of the stomach, but not more than of the other organs.

Gastritis.

Inflammation of the stomach, except when produced by the direct contact of some irritant, is rare in infancy and childhood, independently of disease in some other portion of the intestinal tract. Cases have, however, been reported in which it was not known that any irritating ingesta had been taken, and in which a careful examination revealed a healthy or nearly healthy state of other portions of the digestive tube. The subjects were, for the most part, young infants. The following is an example related by Billard :

An infant, four days old, remarkable for the color of his face and firmness of flesh, refused the breast, and vomited yellow, acid matter. On the following day the vomiting had increased, the legs were œdematous, face pallid and pinched, respiration difficult, skin cold, pulse slow and irregular, and pressure on the epigastric region produced cries indicative of pain.

Third day : general sinking ; face thin and expressive of great pain ; stools natural.

Fourth and fifth days : condition the same. Death occurred on the sixth day, and the autopsy was made on the day following.

With the exception of slight pneumonitis, no disease was discovered in any part of the system besides the stomach. The mucous membrane of this organ was intensely vascular near the cardiac orifice and along the lesser curvature. This part was also tumefied, and could be easily raised with the finger-nail. The remainder of the gastric surface was hyperæmic, but to a less extent.

This case is interesting as showing what may happen, though rarely. A nursing infant is seized with gastritis without apparently having taken any irritating ingesta, and without other disease of the digestive apparatus. It is probable, however, that, in cases like the above, the cause, if ascertained, would be found in the ingesta ; perhaps drinks too hot, perhaps elements of colostrum, or pathological elements in the milk, which might

produce gastritis in young infants in whom the mucous membrane is delicate and sensitive.

Gastritis is not uncommon in infancy in connection with inflammation of the intestines. The latter inflammation is sometimes apparently subordinate to the former, and, if such patients die, the fatal result is due mainly to the gastric disease. The reverse is, however, the rule. The gastritis is ordinarily subordinate to the intestinal catarrh.

Cause.—Gastritis, as I have observed it in infants, has been in most cases due in great part to the continued use of improper food, of food not suitable to the age of the child, and which was, therefore, with difficulty digested. Milk, acid, or otherwise unwholesome, farinaceous substances, stale or of an inferior quality, and not properly prepared, drinks too hot or too cold, may be specified among the causes. Therefore, this disease is most common in bottle-fed infants, and is comparatively rare in those who receive abundant and wholesome breast-milk. Anti-hygienic agencies, apart from the diet, no doubt exert some influence in the production of gastritis, as they do of stomatitis. Uncleanliness, and residence in damp and dark apartments, or in an atmosphere loaded with noxious gases, produce a condition of system which strongly predisposes to these inflammations, if, indeed, they may not be enumerated among the direct causes.

Rilliet and Barthez have called attention to the fact that certain medicinal substances given to children occasionally cause gastritis. They have observed this effect from the use of tartar emetic, Kermes mineral, and croton oil. Gastritis occurring in this way may or may not be associated with inflammation in contiguous portions of the digestive tube. Elsewhere I have related a case in which gastro-enteritis occurred in a child nine years old, after having taken a considerable quantity of kerosene oil for spasmodic croup.

Inflammation of the stomach is thought by some to accompany measles and scarlet fever during the eruptive period, but this opinion is probably incorrect. If it occur, it corresponds with the stomatitis and dermatitis of those diseases, and disappears as they subside. It is mild, and accompanied by few symptoms. I have, as stated in the remarks on scarlet fever, examined in certain instances the stomachs of those who have died during the eruptive period of these diseases, and found them free from any appreciable inflammatory lesion.

Age.—From the records of about seventy cases of inflammatory disease of the digestive mucous membrane which I have preserved, it appears that gastritis is rare over the age of six months. On the other hand, it is not uncommon in infants under the age of three months who are deprived of the breast-milk. I have met it chiefly in foundlings fed with the bottle, and having at the same time entero-colitis and often also stomatitis and œsophagitis. In these cases there is sometimes continuous or almost

continuous injection and thickening of the mucous membrane, from the lips to near the pyloric orifice of the stomach, and even beyond this orifice in the intestines. The following is an example of gastritis as it frequently occurs in foundling institutions :

Case.—R. W., female, two weeks old, was admitted into the New York Infant Asylum, August 24, 1865, anæmic and somewhat emaciated. It was in part wet-nursed, and in part bottle-fed. The emaciation increased, and nearly the entire buccal cavity became covered with the confervoid growth of thrush. On September 4th, diarrhœa commenced. Borax was used for the mouth, and alkalies and astringents to check the diarrhœa, but without material improvement.

The following was the record for September 7th : "Cries almost constantly, with feeble or whining voice ; still has thrush ; nurses and does not vomit ; stools five or six daily, and green ; pulse 136, feeble." Death occurred September 8th.

Autopsy September 9th.—Mouth and fauces not examined ; mucous membrane of œsophagus vascular in its whole extent, with slight thickening, but without ulceration ; mucous membrane of stomach injected like that of the œsophagus, and somewhat thickened, except in its pyloric extremity, where the appearance was natural, or nearly so ; the color in the central part of the inflamed gastric membrane was deep red ; no thrush was noticed, except on the buccal surface during life ; along the great curvature of the stomach were white flakes, resembling those of thrush, but which were found by the microscope to consist mainly of oil-globules and epithelial cells, without the cryptogamic formation ; mucous membrane of small intestines healthy in their whole extent, except slightly increased vascularity in a few places in the ileum ; mucous membrane of colon much injected throughout, except near the ileo-cæcal valve, where the vascularity was slight ; in the transverse and descending colon the redness was pretty uniform ; and the membrane was thickened, but not ulcerated ; solitary glands and Peyer's patches somewhat elevated.

The observations of Valleix show how frequently gastritis is associated with severe attacks of thrush. In twenty-three of his cases of the latter disease, in which the condition of the stomach was noted after death, this organ presented inflammatory lesions in seventeen, and in three others appearances which may or may not have been due to inflammation.

Symptoms.—A difficulty exists in isolating and defining the symptoms of gastritis, from the fact that it commonly coexists with other inflammations of the digestive tube. Though we may never be able to diagnosticate this catarrh as certainly as we can croup or pneumonitis, still, there are symptoms which arise directly from the gastritis, and with care we may be able to distinguish them from those symptoms which are due to other pathological states.

If gastritis be acute, pain is present. In the above case from Billard, as well as in a case observed by myself and related under the head of gelatinous softening, there were frequent cries, and the countenance indicated much suffering, until the stage of collapse. If there be less intensity of

inflammation, and the disease be more protracted, as is ordinarily the case, the pain is not so severe, and it may be so slight as not to attract attention. Sometimes there is tenderness, so that pressure upon the epigastric region is badly tolerated. Vomiting is regarded as one of the most constant symptoms. The infant after nursing seems in distress till the milk is returned, but it nurses with avidity in consequence of the thirst, if it be not too exhausted or feeble. The dejections may be quite regular throughout the disease, as in the case from Billard. There is ordinarily, however, diarrhœa from the presence of entero-colitis. The pulse is sometimes accelerated, and sometimes nearly natural. The emaciation in gastritis is rapid, since not only the milk is in great measure vomited, but the digestive function, so far as the stomach is concerned, is seriously impaired. The features become wrinkled and senile, the eyes hollow, the limbs attenuated, and the cranial bones uneven. Death occurs from exhaustion.

Anatomical Characters.—Simple gastritis may affect the entire mucous surface of the stomach, or be limited to a certain part. The part which is most likely to escape is that toward the pyloric orifice. This portion of the organ is sometimes found in nearly or quite the normal state, while the cardiac half or two thirds is inflamed. The vascularity of the diseased surface is not uniform. In one place there is simple arborescence ; in another intense continuous redness, and between these two extremes are different grades of vascularity. The mucous membrane is somewhat thickened, softened, and the secretion of mucus increased. Extravasation of blood is not infrequent under the mucous membrane, usually in points, and mucus may be mixed with more or less blood. Small shreds or portions of coagulated milk are often found with the mucus attached to the gastric surface. I have observed, though rarely, small superficial ulcers at the point where the inflammation had been most intense.

Diagnosis.—In protracted cases, when entero-colitis is present, it is difficult to make a positive diagnosis. Our opinion must then be little more than a plausible conjecture. In the acute attacks we can diagnosticate the gastritis with more certainty. If a young infant affected with sprue be seized with pain, and it vomit often ; if emaciation be rapid, and there be no diarrhœa, or diarrhœa not sufficient to account for the prostration ; if the buccal mucous membrane, dotted with the points of thrush, present a dry appearance and the deep-red color of severe stomatitis, there can be little doubt of the presence of gastritis. The diagnosis is rendered more certain by signs of tenderness when pressure is made upon the epigastric region.

Prognosis.—Like other inflammations, gastritis is probably sometimes so mild that it does not materially increase the suffering or danger of the child. This mild form of the disease under favorable circumstances soon

subsides. In other cases, by the continuance or increase of the cause, the inflammatory process becomes more severe and extensive, resulting even in disintegration of the mucous membrane. Those cases are especially severe and likely to end fatally, which are protracted and accompanied by severe thrush, with a desiccated appearance of the buccal surface, or with entero-colitis. Pain, vomiting, and rapid emaciation in such children indicate the speedy approach of death. Improvement in the stomatitis or entero-colitis is a favorable indication, but these inflammations may improve without corresponding improvement in the gastritis.

Treatment.—All food or drinks, except those of a bland and unirritating nature, should be forbidden. If practicable, the young infant should take no nutriment except the mother's milk or that of a wet-nurse. As there is an excess of acid in inflammation of the mucous coat of the digestive tube, lime-water may be advantageously given in combination with the breast-milk. Opium is required to relieve the pain and quiet the action of the stomach. The camphorated tincture of opium, in doses of four or five drops to a child a month old, or the syrup of poppy, tincture of opium, or liquor opii compositus, in proportionate doses, may be administered. If there be thirst, a little gum-water should be given frequently. If there be much emaciation and the vital powers are failing, it will be necessary to resort to the use of stimulants. Stimulating enemata are preferable to stimulants given by the mouth. Much benefit may be anticipated from local measures. Irritation should be produced upon the epigastrium by mustard or other means, followed by fomentations. It is rarely, perhaps never, proper to use leeches, if the patient be a young infant. Death occurs from exhaustion, and it is, therefore, important that the vital powers should not be reduced. If the child be weaned, the diet at first should be restricted to arrowroot, rice-water, barley-water, or similar bland substances. In advanced stages of gastritis, animal broths and jellies may be required.

Follicular Gastritis—Diphtheritic Gastritis.

The pathological character of *follicular* gastritis is similar to that of follicular stomatitis. It is an inflammation affecting the gastric follicles and ending in their ulceration. It is not a frequent disease ; it occurs in young infants. Billard observed fifteen cases. The symptoms in these patients were similar to those in simple gastritis of a severe form. The emaciation and prostration were rapid, and death occurred early. We can only diagnosticate the gastritis without determining its follicular character. How many recover it is impossible to ascertain, but the disease is apt to be fatal on account of the intensity of the inflammation, not only of the follicles but of the intervening mucous membrane. The treatment is that of gastritis.

Diphtheritic gastritis is infrequent. It occasionally occurs during epidemics of diphtheria. Allusion is elsewhere made to a case treated in the Nursery and Child's Hospital of this city, in December, 1859. The patient, eighteen months old, previously had had protracted entero-colitis, and died exhausted after a brief attack of diphtheria. There were lesions referable to the entero-colitis, and the body was much emaciated. The diphtheritic exudation was found covering the fauces, epiglottis, glottis, to the rima glottidis, the entire œsophagus, and almost the entire stomach. The mucous surface underneath was injected; that of the œsophagus and stomach especially was very vascular, softened and thickened, and the submucous connective tissue was infiltrated.

The pseudo-membrane, taken from the epiglottis and examined under the microscope, presented an amorphous appearance; no cells were noticed in it, and fibrillation was not distinct; that from the stomach was found to consist almost entirely of cells, the plastic corpuscles of some writers, the pyoid of others. The digestive process, so far as the stomach was concerned, had evidently been almost if not entirely suspended, and hence in part the sudden prostration. Diphtheritic gastritis probably does not occur without general infection of the system with the diphtheritic virus. The proper treatment is the use of lime-water or one of the solvents of pseudo-membranes, which do not irritate the mucous membrane.

Post-mortem Digestion, Softening.

It is now many years since the attention of the profession was directed to disorganization of the coats of the stomach, which is sometimes observed at post-mortem examinations. John Hunter first ascretained that the gastric juice begins to have a solvent effect on the tissues of the stomach soon after death. Though Hunter erred, when he stated that the coats of the stomach are more or less digested in all or nearly all cases, it is certain that post-mortem digestion does take place in many cadavers, so that a few hours after death the gastric mucous membrane is destroyed to a greater or less extent, and occasionally the stomach is perforated or is even severed from its connection with the œsophagus. I have seen several examples of this post-mortem digestion in infants.

Some of the cases of supposed pathological softening of the stomach reported by the older observers, seem to have been such as I have described, namely, cadaveric. Yet there are two other kinds of softening occurring in children, which are strictly pathological, the one designated white, the other, by Cruveilhier, gelatinous.

White softening of the gastro-intestinal mucous membrane results from deficient alimentation. It has been observed only in anæmic and ill-nourished children. The mucous membrane in such loses its firmness, and is easily separated from the subjacent tissue. This disorganization has no

connection with any inflammatory process. It is simply a disintegration of the mucous membrane in consequence of the low vitality of the patient, whether or not there are co-operating causes. I believe that, in a large proportion of infants whose systems have been reduced and blood impoverished for a considerable time, the gastro-intestinal mucous membrane will be found after death less firm and resisting than in those who have been habitually robust. Probably acids which collect in the primæ viæ have much to do with this softening.

A vague opinion exists in the minds of most physicians as to the nature and even appearance of the so-called *gelatinous* softening of the stomach, and the following observations will be cited in order to give a clearer idea of it.

Billard has recorded two cases with his usual minuteness, and adds : "What inference shall be drawn from the preceding facts and considerations? None other than that the gelatinous softening of the stomach consists in a disorganization of the mucous membrane of this viscus, caused by an acute or chronic phlegmasia ; that this disorganization is characterized by an accumulation of serum in the walls of this organ ; the intumescence and gelatinous consistence of the mucous membrane in a part usually circumscribed, situated more frequently in the greater curvature, and about which the membrane exhibits more or less evident traces of an acute or chronic phlegmasia. . . . The softening now under consideration must not be confounded with another kind of softening" (white) "which does not usually succeed an acute phlegmasia."

Billard believes that, while gelatinous softening results from inflammation of the mucous membrane, its proximate cause is an afflux of serum to the part in which the disorganization occurs. In one of the two cases which he reports, he thinks that the inflammation was acute, but in the other chronic, and, therefore, presenting less vascularity.

West, in speaking of gelatinous softening, says : "Softening of the stomach varies in degree from a slight diminution in the consistence of the mucous membrane, to a state of complete diffluence of all the tissues of the organ. . . . When the change is not far advanced, the exterior of the stomach presents a perfectly natural appearance, but on laying it open a colorless or slightly brownish tenacious mucus, like the mucilage of quince-seeds, is found closely adhering to its interior, over a more or less considerable space at the great end of this organ."

Cruveilhier says : "This softening often proceeds from the interior toward the exterior. There is at the beginning simple separation of the fibres by a gelatinous mucus, and in consequence the parietes are thickened and semi-transparent. . . . If the transformation be complete, the disorganized portions are removed layer after layer, those which remain becoming gradually thinner. The peritoneum alone resists for some time, but at length it is attacked, worn, and gives way, and per-

foration of the stomach results. The parts thus transformed are colorless, transparent, apparently inorganic, completely deprived of vessels, and exhaling an odor resembling that of milk."

Bouchut remarks: "Softening of the mucous membrane of the stomach in children at the breast is not a special disease which it is necessary to describe by itself. This alteration is always connected with other diseases, and especially with disease of the large intestine, the knowledge of which fact has been too long neglected. It is the consequence of the acidity of the liquids contained in the digestive tube of young children, liquids which are very acid in the disease we have above referred to."

Dr. Carswell states that there is a pathological softening of the mucous membrane of the stomach, and that when it occurs the symptoms may be those of gastritis or enteritis.

Rokitansky says of this form of softening: "If we consider, in addition to the above remarks, the uniform localization of the disease, that in none of its stages it presents, either at the point of the softening, or in its vicinity, hyperæmic injection or reddening, and that we are still less able to demonstrate upon the inner surface of the stomach or in the tissue of its coats the products of inflammation, we are constrained to infer the non-inflammatory nature of the affection."

Without extending these extracts, it is seen that eminent authorities not only disagree in reference to the cause of gelatinous softening of the stomach, but that they also differ in their description of its appearance. This diversity of opinion is most likely attributable to the fact that the two kinds of softening have been confounded. Rokitansky and Bouchut probably refer to cases of white softening, which occurs in atonic states of the tissues in feeble infants, and, therefore, have concluded that softening of the stomach is not inflammatory. I believe, from my observations, that the opinion of Billard is correct, and that true gelatinous softening is the result of gastric inflammation, sometimes chronic, sometimes acute. But I have seen appearances which led me to think that the immediate causes of the softening continue to operate after death, so that its amount is less at the time of death than a few hours subsequently.

The following case, which was watched by myself with great interest, from beginning to end, is an example of inflammatory softening:

Case.—G. S., male, robust, was born July 10, 1865. The mother not being able to suckle the infant, and the danger of artificial feeding in the warm months being well understood, a wet-nurse was procured. About the 14th of July, this wet-nurse having insufficient milk, another was procured temporarily, who suckled the infant till July 20th, when a third wet-nurse was engaged, whose child, healthy and thriving, was six weeks old. Previously to this time the infant appeared well. It had uniformly nursed vigorously and seemed satisfied.

On the 22d of July, thrush, apparently mild, was observed in the mouth, and a powder, supposed to be borax, and labelled such, was ob-

tained at a drug-store, to be used as a wash for the mouth. This powder was afterward ascertained to be alum. Five grains were dissolved in as many teaspoonfuls of water, and the mouth of the child was swabbed occasionally with it. A piece of linen, folded so as to resemble the tip of a nursing-bottle, was occasionally dipped into the solution, and the infant was allowed to suck it. The use of the alum was commenced about 6 P.M. In the first part of the evening the infant slept considerably, and of course did not nurse often, but about 8 P.M. it began to be very fretful, and it then nursed more frequently. It vomited once between 8 and 10 o'clock P.M. In order to quiet the infant, the tip soaked in the solution was often applied to the mouth, but there was scarcely any intermission in its crying. Through the night it vomited again once or twice, and about the middle of the night had one free liquid stool, which was passed with much tenesmus. The countenance of the infant was indicative of suffering, and its thighs were repeatedly flexed over the abdomen, as if that were the seat of its distress. Paregoric in two-drop doses was several times given through the night, and flannel soaked with hot whisky was applied to the abdomen.

July 23d. In ignorance of the cause of the child's sickness, another wet-nurse was obtained early in the morning, and one sixth of a drop of liq. opii compos. was given every hour, with the effect of inducing a little sleep. The tongue was very red, desiccated, and studded with more numerous points of thrush than on the previous day. It now refused to nurse, apparently from soreness of the tongue. At each attempt of the nurse to induce it to take the nipple, it rubbed the mouth across the breast, crying either from pain or disappointment. The alum was not used in the latter part of the night of the 22d, but late in the morning of the 23d it was resumed, the mistake of the druggist not being discovered till midday, when it was estimated that about five grains had been used. Occasionally a little of the solution was placed in the mouth with a spoon so as to be swallowed, in the belief that the thrush affected the œsophagus. The infant continued to suffer much during the day, sleeping at times a few minutes. Its strength was evidently failing; respiration regular; pulse about 140; its alvine discharges yellow, of natural consistence and frequency.

Evening 23d. Surface hot; it is very restless; pulse 150 to 160; tongue dry, intensely red, and dotted with points of thrush. Is treated with opiates, a little lime-water, and fomentations.

24th. In the first part of the day nursed pretty well; in the latter part, could be induced to draw the breast only once or twice. The symptoms to-day were the same as yesterday, with the exception of greater emaciation and prostration; cranial bones uneven, and features pinched.

25th. Pulse 140 to 148; strength rapidly failing, but it cries at times loudly. The milk of the nurse, placed in the mouth with a spoon, is often held a considerable time before it is swallowed, and deglutition seems difficult. Respiration in the first part of the day and previously, natural; in the latter part of the day, accelerated; dejections natural; no vomiting; appearance of tongue more natural than yesterday.

26th. Died to-day in a state of collapse at 12½ P.M. The hands were cold several hours before death, and the milk given it was regurgitated.

Autopsy twenty-two hours after death.—Much emaciation; no rigor mortis; cranial bones uneven; the upper part of the pharynx injected to the extent of about half an inch; from this point to the stomach mem-

brane healthy ; mucous membrane covering the cardiac two thirds of the stomach disintegrated, almost diffluent, and in places detached from the subjacent tissue ; mucous coat of the pyloric third of the organ nearly healthy ; along the edge of the softened portion the mucous membrane was vascular to the extent of a few lines ; the muscular and serous coats of the stomach underneath the softened portion were easily torn ; the mucous membrane of the small intestine presented in places that degree of vascularity known as arborescence ; there was no destruction or softening of its mucous membrane ; the colon was healthy ; the stomach was nearly empty ; the contents of the small and large intestines were natural in color and consistence ; the other viscera were healthy ; in the left pleural cavity was about one ounce of transparent serum, and a less quantity in the right cavity.

It cannot be doubted that the softening in the above case was pathological. The weather at the time was warm, but the infant was placed on ice, and a pan containing ice was kept upon the abdomen. This infant died evidently of gastritis, the accompanying inflammation being subordinate, and in fact insignificant. At first it was a question with me whether the alum might not have caused the gastritis, so that the case should be properly placed in the category of deaths from swallowing corrosive substances. In order to determine this point, I administered alum daily to two kittens, commencing when they were seven days old. The quantity given to each was ten grains daily in two doses for three consecutive days, and on the two following days five grains. The only uniform result noticed was an increased flow of saliva, which washed some of the alum from their mouths, and occasionally slight vomiting. There was not even any apparent inflammation of the buccal membrane from the alum.

Post-mortem appearances as in the above case, and similar ones recorded by Valleix and others, in which gelatinous softening coexisted with evident lesions of gastritis, render it highly probable, if indeed they do not demonstrate, that the softening is a result of the inflammation at the point where it occurs.

In Valleix's twenty-four cases of what he terms fatal muguet, softening of the mucous membrane of the stomach was one of the most common lesions, and at the same time, which is the point of interest, there were signs which showed conclusively the presence of gastric inflammation. The common coexistence of the lesions of gastric inflammation, such as redness and thickening, with gelatinous softening of the stomach, is certainly most reasonably explained on the supposition that the one results from the other.

I am not prepared to accept nor reject the theory of Billard, that the immediate cause of the softening is the afflux of serum, nor that of Bouchut, that it is an excess of acid.

It has been said that M. Baron was able to diagnosticate gelatinous

softening. The symptoms are those of the severe forms of gastritis. The vomiting, great pain, restlessness, sudden and progressive emaciation, and, finally, collapse preceding the fatal result, without sufficient diarrhœa to cause the rapid sinking, are the symptoms on which the diagnosis is based. The treatment should be directed to the gastritis.

CHAPTER VII.

DIARRHŒA.

Diarrhœa is frequent during the whole period of infancy. The French writers describe several varieties, according to the character of the evacuations, as acescent, mucous, and serous. M. Rostan even describes fourteen distinct kinds. But the tendency of medical science in these modern times is to simplify the nomenclature of diseases—to describe under a single name those affections which are essentially the same though differing somewhat in their features. Now, all the forms of diarrhœa in the infant may be so grouped as to reduce the number to not more than three or four. In this way repetition and prolixity are avoided, as well as an unnecessary refinement.

Non-Inflammatory Diarrhœa.

The most common form of diarrhœa is that enunciated in our heading, which writers sometimes designate by the term simple or spasmodic. But often a diarrhœa which is non-inflammatory at first, becomes a catarrh. Thus the simple diarrhœa of infancy may become an entero-colitis from the continued use of improper diet.

Causes.—These are various. Conditions or agencies which have no appreciable effect in the adult often increase the number of evacuations in young children. Food which imperfectly digests, and some of which perhaps ferments, stimulates the intestinal follicles to excessive secretion, and increases the peristaltic movements by its vitiating property, thus causing diarrhœa. Too frequent and abundant feeding is another cause, especially in young infants, some of whom may vomit the surplus food and remain well, but others do not. Food which cannot be assimilated becomes an irritant in consequence of fermentative changes, and produces frequent and unhealthy evacuations. The late Dr. James Jackson, of Boston, directed attention to this cause of diarrhœa in his *Letters to a Young Physician.*

The mother's milk or the milk of the wet-nurse may disagree, either from some temporary derangement of her system, or continued ill-health,

or from causes which are not understood. Non-inflammatory diarrhœa in the nursling is the immediate result, with perhaps subsequent inflammation. The milk in these cases frequently contains the elements of colostrum.

Fright or strong mental impressions will also in some children increase the number of evacuations. This cause being transient, the diarrhœa soon subsides.

Another cause is exposure to cold. Children who are insufficiently clothed in the winter season, who are taken from a heated room into a cool one without sufficient precaution, or who lie uncovered at night, are very subject to diarrhœal attacks from the impression of cold on the system.

The cause of non-inflammatory diarrhœa may exist in the child itself. In some children the evolution of the teeth is attended by a relaxed state of the bowels, which ceases when the gum is pierced. Worms in the intestines may also operate as a cause. Diarrhœa is occasionally salutary within certain limits, and of course it is not strictly correct to call it a disease when it is a means of relief. If occurring from excessive or irritating ingesta, it is obviously conservative.

Symptoms.—Non-inflammatory diarrhœa may come on suddenly ; at other times there are precursory symptoms continuing for some days. Whether or not there be antecedent symptoms depends chiefly on the cause. If this be exposure to cold, or the use of improper aliment, it commonly occurs immediately.

Among the prodromic symptoms sometimes present are restlessness, disturbed sleep, transient abdominal pains, nausea or vomiting, and other symptoms of indigestion. The stools in simple diarrhœa differ much in color and consistence in different cases, and perhaps at different periods in the same case. In infants they are apt to be green. This color, which is a source of anxiety to the inexperienced, and especially to the parents, is often produced by trivial causes. Slight indigestion will produce it, and so will excess of food, even when bland and unirritating. The stools in infantile diarrhœa often contain particles of coagulated casein, but in children advanced beyond the period of first dentition, they do not differ materially in appearance from the evacuations of the adult. They are usually passed easily, but if they be acid or in any way irritating, there may be more or less tenesmus, especially in infants. Sometimes before the evacuations, there is a sensation of fulness in the abdomen. In that form of diarrhœa which has been designated acescent, not only are the stools acid, but matters vomited have an acid odor, and give an acid reaction.

During the quiet hours of sleep, when no food and drinks are taken, the diarrhœa diminishes. If the complaint be slight, there is little thirst ; but if the stools be frequent and thin, especially if they approach the

watery character, the patient is thirsty. The appetite varies, the tongue is moist, and covered with a light fur, and there is often more or less meteorism, but no abdominal tenderness.

The features in this disease are pallid. In a few days, if the evacuations continue, there is evident loss of weight and flesh. The rotundity of the limbs is gradually lost, and the tissues become soft and flabby. But in most cases, when the malady has reached this stage, its original character is lost, and it has become inflammatory.

There is no constant fever in true non-inflammatory diarrhœa. Sometimes the pulse is accelerated in the latter part of the day, but usually only for a short time.

Certain epiphenomena, as Barrier terms them, occur at times in non-inflammatory as well as in inflammatory diarrhœa, as for example a sympathetic cough, or, which is more serious, cerebral complications. Convulsions or stupor, indicating the supervention of spurious hydrocephalus, may occur in either form of diarrhœa. This disease is described elsewhere.

Anatomical Characters.—It is obvious from the nature of this malady that it is attended by little or no structural changes perceptible to the anatomist. In cases supposed to be non-inflammatory, which have ended fatally either from the diarrhœa or an intercurrent disease, the most marked lesions observed have been more or less tumefaction of the intestinal glands, with perhaps diminished firmness and resistance of the mucous membrane. Cases like the following, which have usually been regarded as non-inflammatory, are not infrequent, but it seems to me probable that in at least a certain proportion of such cases the intestinal follicular apparatus has passed beyond the physiological state of an exaggerated functional activity, and that the disease should be designated a catarrh or inflammation. Inasmuch as non-inflammatory diarrhœa, if protracted, is very apt to become inflammatory, it is often difficult to determine whether the malady has undergone this change, even when the case is fatal, and post-mortem inspection is allowed.

On the 7th of July, 1865, a foundling, one month old, died at the Infant Asylum. It was much emaciated, with eyes sunken and features pinched, at the time of its death. It was wet-nursed toward the close of its life, but the nurse's milk was insufficient. It did not vomit ; did not have any marked acceleration of pulse (128 per minute), and its evacuations were about four daily, and thin. The stomach and intestines were pale throughout. The solitary glands, particularly those in the colon, and the patches of Peyer, were tumefied so as to be visible, and somewhat raised above the surrounding surface. There was probably slight thickening of the mucous membrane, and tumefaction of the muciparous follicles, but these changes were not clearly ascertained.

Niemeyer, with others, describes even the mildest forms of diarrhœa

under the term catarrhal inflammation, and he appears to consider the transient effects of a purgative as an incipient catarrh. But it seems to me preferable, in the present state of pathological knowledge, to regard all those diarrhœas which immediately abate with the removal of the cause, and which are attended by no marked anatomical change, as non-inflammatory.

Prognosis.—In a large proportion of cases, non-inflammatory diarrhœa is not dangerous. With the adoption of suitable measures to remove the cause, and the use of medicines to control the discharges, the patient recovers. The remark already made may be repeated here, that occasionally diarrhœa is salutary within certain limits, as when there is a foreign substance in the intestines, either irritating mechanically or by its chemical properties, and which the diarrhœa serves to remove.

The danger arises from complications, as spurious hydrocephalus, or from the emaciation and exhaustion, or from its eventuating in inflammation.

If the rotundity of the figure and firmness of the tissues be preserved, showing that alimentation is still sufficient, and no complication arise, the diarrhœa is not as a rule dangerous. In infants that over-nurse and do not vomit the surplus milk, the evacuations are sometimes green and frequent, and yet fulness of figure is preserved, and the development of the body proceeds as usual. On the other hand, diarrhœa attended by emaciation or softness or flabbiness of the flesh, involves danger, and requires immediate treatment.

Treatment.—It is necessary, in order to treat diarrhœa in infancy and childhood successfully, to ascertain the cause, and, so far as possible, to remove it. It is not till the cause ceases to operate, that we can expect a satisfactory result from medication. The disease may be temporarily relieved by medicine, but it usually returns at once when treatment is omitted, unless the patient be removed from the influence of the agencies which produce it. These remarks are especially applicable to the diarrhœa of infants. With them very generally, when affected with this complaint, there is some fault as regards the quantity or quality of food. Attention to this matter will show the need of a change of wet-nurse, or, if the infant be spoon-fed, a change in the character of its food or the mode of preparation or even in the quantity given. Sometimes by change in the diet, and the adoption of hygienic measures, the complaint ceases, so as to require no medication. If medicines be needed, and the symptoms are not urgent, it is occasionally advantageous to commence treatment by the use of some of the milder purgatives in small doses. In the *infant*, in whom the dejections are so generally acid, an alkaline laxative, or a laxative conjoined with an alkali, often has a good effect as preliminary treatment. Half a teaspoonful to one teaspoonful of castor oil, or a proportionate dose of calcined magnesia, removes any acid or irritating sub-

stance from the intestines, and is followed by a diminution in the number of stools. The improvement, however, without subsequent treatment, is usually only for a day or two. In this city a purgative dose of castor oil is often given as a domestic remedy in infantile diarrhœa, the beneficial effect from it having popularized its use for this purpose. Trousseau usually gave Rochelle salts, but this medicine is too severe and dangerous for the treatment of infantile diarrhœa, especially in warm months.

If there have been previous constipation, and the diarrhœa have just commenced, a purgative is obviously indicated. West says : "Provided there be neither much pain nor much tenesmus, and the evacuations, though watery, are fœcal, and contain little mucus and no blood, very small doses of the sulphate of magnesia and tincture of rhubarb have seemed to me more useful than any other remedy :

℞. Magnesiæ sulphatis, ʒj ;
Tinct. rhei, ʒj ;
Syr. zingiberis, ʒj ;
Aquæ carui, ʒix. Misce.

ʒj ter die for children one year old ;

and I seldom fail to observe from it a speedy diminution in the frequency of the action of the bowels, and a return of the natural character of the evacuations."

In diarrhœa of infants, due to indigestion, and attended by acidity, the following prescription is sometimes useful. By improving digestion and correcting acidity, it has a beneficial effect on the diarrhœa. The cases are, however, in my experience exceptional in which this is the proper remedy :

℞. Pulv. ipecacuhanæ, gr. ss ;
Pulv. rhei, gr. ij ;
Sodæ bicarb., gr. xij. Misce.

Divide in chart. No. xij. One powder every four to six hours to an infant one year old.

The effect of laxative medicines, employed for the purpose of correcting the functions of the gastro-intestinal surface, is uncertain. If no improvement results from their use within two or three days, they should be omitted. We must rely on astringents, opiates, and, in infants, also on alkalies. If the symptoms be urgent, if the evacuations be frequent and exhausting, these agents should be employed from the first. Much harm is often done, and precious time lost, by prescribing laxative mixtures when opiates and astringents are required. I have known them to aggravate the complaint, when, by change of measures, immediate improvement followed. The majority of cases of non-inflammatory diarrhœa, at the period when the physician is called, are best treated by the use of astringents and opiates exclusively, proper directions at the same time being given in reference to the diet and hygienic management.

In the diarrhœa of infants the compound powder of chalk and opium is an excellent medicine, containing, as it does, an astringent with the opiate and alkali. It may be given in doses of three grains, to a child one year old, every three hours. I ordinarily employ it with double its quantity of subnitrate of bismuth, and know no better remedy for ordinary cases. The following is a convenient formula for administering substantially the same medicines in the liquid form :

℞. Tinct. opii deodorat., gtt. xvj ;
Bismuth. subnitrat., ʒij ;
Syr. simplic., ℥ss ;
Mistur. cretæ, ℥iss. Misce.
Shake well and give one teaspoonful from three to four hours.

In a large majority of cases I employ this prescription, or one similar to it, from my first visit. If the patient be not relieved by the opiate, alkali, and bismuth, and by proper regimen, in all probability inflammation of the intestinal mucous membrane is present. In patients over the age of two or three years simple diarrhœa approaches in character that of the adult, and the treatment appropriate for the adult is proper in these cases, allowance being made for the difference of age. In infants, in whom this disease, if protracted, is very liable to eventuate in spurious hydrocephalus, alcoholic stimulants are often required at an early period, on account of the prostration and feeble power of endurance.

CHAPTER VIII.

INTESTINAL CATARRH OF INFANCY.

It is customary with writers to treat of inflammation of the small and large intestines in infancy as a single disease, for the following reasons : First, the symptoms of colitis, at this period of life, do not ordinarily differ, in any marked degree, from those of enteritis. The tormina, tenesmus, and abdominal tenderness, which characterize colitis in childhood and adult life, are ordinarily lacking, or are not appreciable by the observer ; and the muco-sanguineous evacuations are oftener absent than present. On account of this absence of symptoms, Bouchut says : " Dysentery is a very rare disease among young children. Its existence might even be denied, if it had not been observed at the period of some severe epidemics of dysentery." If Bouchut refers, by the term dysentery, to the ordinary phenomena of that disease, his remark is correct ; but, as regards the lesions, it is erroneous, for colitis is a common infantile malady. Billard, after analyzing eighty cases of intestinal inflammation in infants, says : " From this calculation, it is evidently very diffi-

cult to make a correct diagnosis of inflammation of the intestinal tube in sucking infants, yet it would seem as if the proper signs of enteritis or ileitis were the rapid tympanitis of the abdomen, the diarrhœa, accompanied with vomiting; while in colitis, diarrhœa alone, without tympanitis, is the most frequent." And again: "In consequence of the impossibility we have found to exist of tracing with exactitude the series of symptoms proper to inflammation of the different portions of the digestive tube, we shall content ourselves with presenting an analytical sketch of the causes, symptoms, and ordinary course of inflammation of the mucous membrane of the intestines in general."

The frequent absence of any pathognomonic symptom or sign, by which to determine the exact seat of intestinal inflammation in the infant, is admitted by recent observers as well as Billard.

The second reason why intestinal inflammation in the infant is described as a single disease is, that enteritis and colitis, in the majority of cases, coexist. This will be seen when we come to speak of the anatomical characters.

Intestinal catarrh is one of the most common and fatal of infantile maladies. It is the great summer epidemic of the cities, in this country. Unfortunately for a correct understanding of its prevalence and mortality in this city, and perhaps elsewhere, it is very generally in the summer months when obstinate, and especially when fatal, called cholera infantum, although, in its symptoms and nature, it is very different from that disease. It usually has a mild beginning and is often protracted, while true cholera infantum begins abruptly, is characterized by violent symptoms, and rapid and extreme exhaustion.

The 1500 fatal cases of so-called cholera infantum, reported every summer in this city, are, with now and then an exception, cases of inflammation, generally protracted. Moreover, the excess of reported cases of infantile marasmus, in the second half of the year, over those reported in the first half, should be added to the statistics of intestinal catarrh, for this excess, which is noticed every year in the mortuary tables of this city, is due mainly to the death of those wasted infants who have lingered with entero-colitis from the summer months. Their marasmus is simply a result of the protracted inflammation.

Causes.—Catarrh of the intestines in infancy, I have said, is most frequently a summer malady—at least, in the cities. Occasionally it is observed in the winter, and it is then, when not due to error of diet, produced by exposure to cold. Infants who are taken from warm to cold rooms, or into the open air, by heedless nurses, or who sleep uncovered at night, are especially liable to it, whether residing in the city or country. In cases occurring from such exposure the inflammatory process may not commence suddenly. There is often a premonitory stage of simple diarrhœa, the first effect of the impression of cold.

The influence of the summer season in causing intestinal catarrh in young children is forcibly shown by the statistics of this city (New York), in which I found from the mortuary tables which I consulted a few years since, that during five years over 9000 young children, chiefly infants, perished from the diarrhœal maladies between the first of June and last of October. Indeed there is no disease except tuberculosis so prevalent and fatal as infantile entero-colitis, during the period of its epidemic occurrence in the summer months ; and so far as I have been able to ascertain, the same remark is applicable to most of the other large cities of the Union.

The epidemic commences about the middle of May. From this time there is a gradual increase in the number affected, till the months of July and August, when the disease attains its maximum prevalence and mortality. During the months of September and October, the number of seizures and of deaths gradually abates till the epidemic character is lost. It is thus seen that the prevalence of intestinal inflammation of infancy in the city bears a close relation to the degree of summer heat.

In looking for the causes of this disease of the summer season we must evidently consider those conditions which are peculiar to the hot months, or are more operative in them than at other times. The one peculiar to the summer which is most apparent is the increase of the atmospheric heat, but that this in itself does not cause the summer complaint is evident from the fact that in sparsely settled country towns there is often equal elevation of temperature, for many weeks, but with continued healthiness. The atmospheric conditions which render the summer months so detrimental to young children in the cities must be the noxious products which the heat generates, and which, diffused through the air, contaminate it. In the poor quarters of the cities more than anywhere else, those conditions occur which render the atmosphere impure and unsuitable for respiration. Hence those diseases which foul air produces occur most and present their severest type in those quarters of the city where the destitute, ignorant, and degraded congregate. One accustomed to the pure air of the country would hardly believe how stifling and poisonous it becomes during the hot summer days and close summer nights in and around the apartments of the city poor. Among the causes of this foulness of the air, and the consequent sickness which it entails, may be mentioned too dense a population and the occupancy of small rooms by large families, rigid economy, and ceaseless endeavor to make ends meet, so that in the absorbing interest sanitary requirements are sadly neglected. Adults of such families, and children of both sexes, as soon as they are old enough, engage in laborious and often dirty occupations. They seldom bathe, and often wear for days the same undergarments foul with perspiration and dirt. The intemperate, vicious, and indolent who always abound in the quarters of the city poor are notoriously filthy in

their habits. Children old enough to be in the streets and adults away at their oocupations escape to a great extent the evil effects of impure air produced by such mode of life, but the infantile population always suffer severely.

Families thus living, being habituated to foul air and odors, often do not appear to notice them, and neglect to obtain a purer air by open windows and doors. To add to the insalubrity, dirty and worn-out garments and utensils of various sorts collect under their beds and in their closets. Waste products of the table and excrementitious substances are allowed to stand for hours in the room occupied by the family, or in the attached bedroom, undergoing fermentative changes.

With such disregard of sanitary requirements as might be expected the halls, stairways, areas, and alleys within and around the domiciles ordinarily show a similar culpable neglect. They are seldom kept clean when families in their rooms are so slovenly and dirty, being the receptacle to a greater or less extent of rejected and waste animal matter. The fate of the infant compelled to breathe day after day an atmosphere which such uncleanliness produces is evident. It pines away, becomes pallid, perhaps exhibits strumous ailments, and in the hot weather is apt to have diarrhœa. At least this is a very common result. If it do not suffer in the way mentioned, it is because there are countervailing circumstances, an unusually robust constitution, or it is kept much of the time in the open air.

It is true that in our large cities health boards have done much to mitigate the evil alluded to, producing in families more regard for cleanliness. Still, even with vigilant health and police boards, it is impossible to obtain sufficient purity of air, so essential to infantile health, when families are totally indifferent to hygienic requirements through ignorance, vice, intemperance, or poverty. No city in the United States has probably experienced so great sacrifice of infantile life in times gone by from personal and domiciliary neglect as New York, of which I have been an eyewitness, but the evil, which we have experienced in the city in an aggravated form, exists in all our large cities.

The exact changes which the atmosphere undergoes, and the noxious principles diffused in it, which render it unwholesome to man, have been partially ascertained. We know that the air is the medium of communication of most of the infectious maladies, though the agents by which these maladies are propagated are so subtle that they have for the most part escaped detection. We know that when our senses can detect nothing wrong the air frequently contains principles which produce the most violent and fatal diseases ; and that impurities in the air arising from animal exhalations and excretions, and from decaying organic matter, are a common and potent cause of diarrhœal maladies is well established. The most violent and fatal disease to which the human race in modern times is

liable, namely, Asiatic cholera, belongs to the class of diarrhœas, and numbers its chief victims where the air is most tainted by effluvia from filthy streets and domiciles. The ravages of this disease chiefly occur where population is most dense and measures to insure personal and domiciliary cleanliness and purity of air are neglected. I might mention striking and pertinent examples which I witnessed in New York during the cholera of 1854, which ravaged chiefly the families living along the dirty streets and in tenement houses, and those whose occupations necessitated the respiration of a foul atmosphere. Moreover, an interesting fact often observed in the dirty sections of the city, and in the crowded tenements where the air was sensibly impure, during the epidemic of that year and in similar epidemics of cholera, deserves mention, namely, that persons exposed to the anti-hygienic conditions which predispose to cholera were apt to have diarrhœa very similar to the ordinary infantile summer complaint, whether or not they afterward had a true choleraic attack.

But each summer furnishes abundant direct observations showing that foul air sustains a causative relation to infantile diarrhœa. Several years ago, while serving as sanitary inspector for the Citizens' Association, my attention was particularly arrested by the state of one of the streets which was not sewered, though supplied with Croton water, and was densely populated on either side by families mainly of foreign birth. The ashes and garbage were placed in barrels and boxes along the sidewalks, or thrown at random in the street. The Croton water and the house-slops flowed into the gutters and mixed with the refuse and excrementitious matters from the tables and bed-chambers of the houses, while the interior of some of the houses and the spaces around them were in a similar filthy state. There was no Health Board at that time to enforce sanitary regulations, and any attempt to abate the nuisance of a filthy street in the absence of a sewer, and with the presence of a large and ignorant population, could be only partially successful. Consequently this street, with gutters constantly wet and containing decaying organic matter, was during the hot months one of the sickliest in the district which was assigned to me. The noxious gases emanating from such a source told fearfully on the general health, and a house-to-house visitation revealed the fact that diarrhœa was extensively prevailing among the infants thus exposed, and was the chief cause of the deaths during July and August. In another locality, occupied by tripe dealers and a low class of butchers, who carried on fat and bone boiling at night, the air was so foul after dark that the peculiar impurity which tainted it I could distinctly notice in the taste for a considerable time after a nightly visit. In the street where these nuisances existed, and in adjacent streets, a choleriform diarrhœa was most destructive to infantile life.

It is impossible to isolate and determine all the deleterious gases of

which the atmosphere of a city is composed ; but this we know, that in streets which are not properly cleaned of refuse matter and in and around dwellings occupied by the destitute and degraded who disregard sanitary laws, the air becomes so foul during the hot months, when chemical changes are most active, as to be quite perceptible and offensive to the visitor. The common practice of watering streets which are dirty only adds to their unwholesomeness, for organic matter, whether in masses or triturated to powder by passing vehicles, is comparatively harmless when dry, but yields poisonous gases in abundance when moist and undergoing decomposition.

The amount of carbonic acid present in the air is regarded as a pretty correct test of the degree of its impurity. This gas is always present in the atmosphere, but, when it exists in abnormal quantity, it is associated with other poisonous gases, generally in quantities proportionate to its own, but which cannot be so readily isolated. Its quantity is always greater in the city than in the country, and in badly ventilated dwellings and public halls it frequently accumulates so as to be decidedly hurtful to those who respire it. Pure air, it is estimated, contains three to four parts by measure of carbonic acid in 10,000 of air, but Pettenkoffer found 72 parts in a school-room two hours after the school was convened, and W. R. Nichols found 32 parts of the gas in 10,000 in a room which had been occupied by a Sunday-school for one and a half hours, while Baring discovered 120 parts in the rooms of a *Volks-schulen*. Now, it is admitted that carbonic acid may be largely increased in an atmosphere otherwise pure without causing serious consequences, but if this increase be from respiration, cutaneous exhalation, and from decomposition of organic matter, the carbonic acid is associated with other gases which are exceedingly poisonous. Pettenkoffer remarks, and those who have investigated the subject agree in the general statement, "Air is bad and improper for continuous use when it contains, in consequence of respiration and perspiration, more than one part of CO^2 in 1000, and a good air for chambers in which a person may remain for a long time in a state of health and comfort contains no more than . . . . 7 parts in 10,000." The gases which are found with carbonic acid in occupied rooms have been enumerated by Parks as follows : Carburetted hydrogen, sulphurous acid, sulphuric acid, sulphuretted hydrogen, phosphuretted hydrogen, and ammoniacal vapors.

In addition to these gases, which it will be perceived are very detrimental to animal life, the air contains motes of organic matter, often in considerable quantity, as every one has noticed by viewing a sunbeam in a darkened room. Among these motes in an occupied room, the microscope discovers vegetable débris and various animal substances, as fragments of epidermic cells.

Eulenberg discovered many animal and vegetable fragments and forms

in the air which he examined, some of them evidently having been wafted from long distances. The air of the city contains a vastly greater quantity of these organic particles than the air of the country, as is evident from the dust which is incessantly settling on furniture, and the dirt which gathers in neglected and unfrequented streets and lanes in the course of a few weeks.

These many impurities, solid and gaseous, in the air of the city, together with the countless monads, vibriones, and bacteria, just visible under high powers of the microscope, which spring into existence wherever decomposition is going on, afford sufficient explanation of the greater insalubrity of the city than of the country. Precisely in what way impurities in the air cause infantile diarrhœa is not known, though there are so many striking examples of the fact. Murchision states that twenty out of twenty-five boys in a school-room were affected with vomiting and purging from inhaling the effluvia from the contents of an old drain near the play-room. Perhaps the gases form certain combinations in the system which are purgative. Sulphuretted hydrogen, one of the most poisonous of these gases, is believed by those who have investigated the subject to be changed into sulphuric acid in the air, and we know that this acid, if it unite with a potassium or sodium base, forms a purgative salt. Medical students are familiar with a similar fact, that the foul air of a dissecting-room causes diarrhœa, gases from animal decomposition being sufficient to produce it in those otherwise healthy.

Another important cause of the summer diarrhœa is the diet. A large proportion of those who every year fall victims to this malady would doubtless escape if the feeding were exactly proper. The following facts relating to this subject are substantiated by the experiences of each summer : Infants weaned before the proper time are very liable to the summer diarrhœa, and the younger the infant thus artificially fed the greater the liability. In New York a large proportion of the infants, under the age of six months, when the warm weather begins, if deprived of the breast-milk, take diarrhœa, and unless removed to the pure air of the country, where also fresher and better cow's milk can be obtained, perish. Aware of these facts, the managers of the infant and foundling asylums employ, so far as possible, wet-nursing for the infants in these institutions, although it greatly increases the expense. Before the establishment of the Health Board in New York, when the air in and around the city was much more foul than at present, from the common disregard of sanitary laws, it was seldom that an artificially fed infant under the age of six or even ten months, residing within the city limits, escaped the summer diarrhœa. So fatal was this malady among bottle-fed infants in those days, when both atmospheric and dietetic causes were operative in a high degree, that when I was appointed physician to the foundlings, about fifteen years since, I found it the common belief among the nurses

and others, that all of them would sooner or later die. One was pointed out as a curiosity, since it had been several months in the institution, and was still alive. Such mortality was remarkable, for the foundlings of the city at that time exceeded one thousand annually. They were consigned to the care of the pauper women in the almshouse, who were mostly old, infirm, and filthy in their habits and apparel. Their beds, in which the foundlings were also placed, were seldom clean and properly aired, or washed, and under the beds were various garments and utensils which they had brought with them, as their possessions, from their miserable abodes in the city. With such surroundings the air which these infants breathed night and day was obviously totally unfit, while the diet was not less unsuitable, for it was prepared by these degraded women from such milk and farinaceous food as the Commissioners of Charities furnished the almshouse. The common disease of these foundlings was diarrhœa, and the cause of the frightful loss of life was obviously both dietetic and atmospheric.

Such waste of life was the legitimate result of the conditions, for it occurred under a law of general applicability that whenever the diet is improper and the air foul, infants pine away and die. What occurred with these foundlings is repeated every summer in the domiciles of the city poor, wherever infants are improperly fed, and the air which they breathe is loaded with poisonous gases, produced by overcrowding or the prolonged action of atmospheric heat on the decaying organic substances.

Dietetic errors by which diarrhœa is produced, and if they are repeated intestinal catarrh results, are numerous. The reader is referred to the chapter relating to diet, for a statement of the kind and variety of food which is suitable for different ages in infancy and childhood, departure from which is apt to cause indigestion and diarrhœa, and therefore to act as a potent cause of the malady which we are now considering.

But there is one dietetic cause of infantile diarrhœa operating not only in the hot months, but at other times also, to which I wish to call attention, and to which allusion has already been made in our remarks on non-inflammatory diarrhœa. The late Dr. James Jackson, of Boston, pointed out the fact that too frequent and too prolonged nursing, even when there is no fault in the milk, is a common cause of diarrhœa. Infants sometimes overnurse, and they may or may not vomit the surplus food. If they do not, the portion of the food which is not digested undergoes fermentative changes, becomes an irritant, and causes green and too frequent stools, which contain particles of undigested casein, and other ingredients of milk. If such infants fret, as they often do, from indigestion, they are applied still more frequently to the breast. Gases and acids form in the stomach and intestines, and in consequence of the irritation thus produced, intestinal catarrh may result. Too frequent feeding with artificial food often produces the same result.

In these various ways dietetic errors operate as the second factor in the causation of the summer diarrhœa, and they are not infrequently the immediate exciting cause.

It is a common belief that dentition is one of the chief causes of infantile diarrhœa, whether inflammatory or non-inflammatory. There is, indeed, great liability to this disease during the period of dental evolution. The following statistics, which were mostly collected during my term of service in one of the city dispensaries, and which comprise all the cases of diarrhœa under the age of about five years which were brought into that institution for treatment during the summer months of my attendance, show the preponderance of cases in the time of teething. The diarrhœa in most of these patients was evidently inflammatory.

Stage of Dentition.	Number of Cases.
No teeth,	47
Cutting incisors,	106
" anterior molars,	41
" canines,	40
" last molars,	20
Having all the teeth,	28
Total,	282

It is seen that although a large majority of the above cases occurred during dental evolution, yet in a certain proportion, about one in four, teething could not operate as a cause. My own opinion is that dentition does not sustain any causal relation to the intestinal catarrh of infancy, or if any it is indirect and unimportant.

An important predisposing cause of intestinal inflammation in infants is the rapid development of the intestinal crypts and follicles. This development, which increases the liability to organic diseases of the intestines, is coincident with dentition. Another important cause remains to be notified, namely, weaning. Weaning is a subject to which less attention is given than its importance demands. The summer succeeding the change of diet is always in the city a time of great danger to the infant from diarrhœal affections. Mothers uniformly speak with dread of the second summer. In this city, nearly every infant taken from the breast between the months of April and October very soon becomes affected with diarrhœa which, if not inflammatory in its commencement, soon becomes such. Weaning in the cool months involves less danger, but even then the succeeding summer is one of peril. I have memoranda of the time of weaning in forty six infants who were affected with diarrhœa apparently from its duration and obstinacy of an inflammatory character.

Weaned in spring or summer,	35
" " autumn or winter,	11
	46

The reader is referred, for other particulars in reference to weaning, to the chapter devoted to this subject.

The above facts and statistics, to which more might be added, suffice to show the causative relation of foul atmosphere and injudicious feeding to the intestinal inflammation of infancy.

This catarrh also occurs as a complication of certain diseases, especially the eruptive fevers. It is the opinion of some, that in measles and scarlatina there is often mild catarrh of the intestinal mucous membrane, coexisting with the eruption upon the skin, and disappearing with it. But in a proportion of cases, most frequently in measles, a more intense inflammation arises, constituting a serious complication. The peculiar intestinal catarrh in typhoid fever is well known.

AGE.—My observations in reference to the age at which this disease occurs were made in the summer months, and, therefore, relate to the summer epidemic. The cases embraced in the following table were nearly all observed between the months of May and October inclusive :

Age.	Number of Cases.
5 months or under,	58
From 5 months to 12,	212
" 12 " 18,	174
" 18 " 24,	93
" 24 " 36,	36
Total,	573

This table shows that the infant under the age of six months is less liable to entero-colitis than between the ages of six months and two years. The small comparative number, however, affected under the age of six months, I attribute to the fact that most of the infants under this age were wet-nursed. Observations made in the institutions of this city in which foundlings are received show that, the younger the infant is, the more liable it is to be affected with this disease, under unfavorable conditions of atmosphere and diet. Thus, in the New York Infant Hospital, prior to the adoption of wet-nursing, a large proportion of the foundlings received died of well-marked entero-colitis in the first and second months, and very few lived till the age of six months. A similar fact was observed in the New York Infant Asylum in Bloomingdale.* During my term of service in this institution I preserved notes of forty-nine fatal cases, which I diagnosticated entero-colitis, and in many of which post-mortem examinations were made. Of these cases eighteen were one month old or under, fifteen from one month to three, eight from three to six, and only eight over the age of six months.

* This institution was discontinued within a year after its establishment, all connected with it becoming discouraged from the great mortality of the foundlings, who were chiefly bottle-fed.

Symptoms.—Intestinal catarrh in the infant is announced by the occurrence of lassitude, febrile movement, and perhaps fretfulness, soon followed by diarrhœa. The stools are thinner than in health, and their color is yellow, brown, or green. Infants having a milk diet are apt to pass green and acid stools containing particles of undigested casein.

The tongue in the commencement of this malady is moist and covered with a light fur. At a more advanced stage it may be moist, but is often dry, and in dangerous forms of the malady accompanied by prostration, the buccal surface is red, the gums more or less swollen and sometimes ulcerated. Vomiting is a common symptom, commencing in some cases early, but in others not till the diarrhœa has continued a few days. Sometimes it appears to be a symptom of indigestion produced by the imperfectly digested or fermented and acid food in the stomach. Occurring at a late period it may have a cerebral origin from commencing *spurious hydrocephalus,* or it may be due to impaired function of the kidneys in consequence of which urea is retained in the system, and is excreted in the stomach. The matter vomited, when the vomiting is due to irritating substances in the stomach, has a sour odor, and produces a decidedly acid reaction with the appropriate tests. It contains coagulated casein, and undigested particles of whatever food has been given. I found from observations made in 1863 and 1864, in reference to the summer intestinal catarrh of infants, that vomiting commenced in less than one week after the diarrhœa, in a majority of the cases which I observed in those years.

The stools sometimes continue during the whole course of the malady of nearly the same character as at first. In other patients they vary in color and consistence at different periods, this change being due partly to the nature of the food. In the same case they may be brown and offensive at one time, green like mashed vegetables at another, and again they may contain masses of a putty-like appearance, the partly digested casein. They may consist largely of mucus, with or without blood, such stools indicating a predominance of inflammation in the colon. The malady, which Barrier designated mucous diarrhœa, is chiefly a colitis. The stools are sometimes yellow when passed, but become green by exposure to the air, or from chemical reaction due to admixture with the urine.

The *microscopic* character of the stools in entero-colitis is interesting. Aside from undigested casein, I have found unaltered fibres of meat, crystalline formations, epithelial cells, single or arranged regularly in clusters, as if detached from the villi, mucus, sometimes blood, and, in one case, an appearance resembling three or four crypts of Lieberkuhn united. If the stools are green, colored masses of various sizes, but mostly small, are also seen with the microscope. The microscopic elements, then, are the excrementitious substances, particles of undigested food, inflammatory

products, and epithelial cells or fragments of the mucous membrane, thrown off by the inflammatory process.

The *pulse* in entero-colitis is accelerated. There is, frequently, increased heat of surface in the commencement, but, as the disease continues, the vital powers soon become reduced, and the surface is either of the natural temperature or cool. As death approaches, the pulse gradually becomes more frequent and feeble, and the extremities, sometimes for hours before life is extinct, have a cadaverous pallor and coldness. The skin, in intestinal inflammation, is generally dry, and the urinary secretion diminished. In severer forms of the disease, attended by frequent evacuations from the bowels, the infant does not pass its urine oftener than once or twice daily. The imperfect action of the skin and kidneys is a noteworthy feature of the inflammation. The advanced stages of entero-colitis are apt to be complicated by two cutaneous affections, namely, erythema between the thighs, probably produced by the acid and irritating character of the stools, and boils upon the forehead and scalp. The latter sometimes extend down to the pericranium, and leave permanent depressed cicatrices. The external irritation caused by the furuncular affection has often seemed to me conservative, as it occurs at the time when there is danger from passive congestion of the brain and serous effusion. When entero-colitis is protracted, and the patient is much reduced, remaining constantly in the recumbent position, except when held in the arms of the mother or nurse, another symptom frequently arises, namely, a dry cough, which continues till the close of life, if the case be fatal, and subsides slowly if the disease terminate favorably. The complication which gives rise to this symptom will be considered hereafter. As death approaches, the infant sometimes becomes more fretful ; it turns peevishly from playthings, rolls its head, or the head has an unsteady movement ; and often the stomach becomes more irritable. The experienced physician rightly interprets these symptoms as the forerunner of cerebral accidents. In other cases there is too great prostration even for the exhibition of restlessness, and the patient lies quiet. As death approaches the infant becomes drowsy. The limbs are cool. It refuses to nurse, or, if spoon-fed, takes nutriment apparently without relish. The pupils are contracted, and insensible to light. The eyes are bleared, and a puriform secretion occasionally collects between the lids. The stools are less frequent, and the vomiting, if previously present, ceases. Death occurs quietly.

Sometimes, however, convulsive movements precede death, generally slight, as of one arm, or of the limbs on one side. Uræmia may be the immediate cause of death in certain cases.

In chronic entero-colitis there is extreme emaciation for a considerable time before death. The skin of the extremities lies in wrinkles ; the

joints, from contrast, appear enlarged, and the fingers and toes elongated; the angular projections of the bones are prominent. The hollowness of the cheeks and eyes causes the infant to appear much older than it really is. Death occurs in a state of extreme exhaustion.

The above description applies to infantile entero-colitis, as it so frequently occurs in the cities. It is sometimes much more violent, attended by much greater febrile reaction, and is more speedily fatal. Especially is this the case when it is due to the impression of cold; such cases are not infrequent in the winter months, in the country as well as city.

Instead of the mild and gradual commencement which I have described, infantile entero-colitis may be produced by violent symptoms—a true cholera morbus in which vomiting and purging, more or less severe, precede the inflammation. Among my records are cases which commenced in the summer season from eating gooseberries, currants, cherries, and cheese; the choleraic symptoms produced by these indigestible substances ending in protracted inflammation.

Anatomical Characters.—Billard says: "In eighty cases of inflammation of the intestines that I examined with great care, there were thirty of entero-colitis, thirty-six of enteritis, and fourteen of colitis." M. Legendre, in twenty-eight cases of diarrhœa, found colitis alone in nine, and in the cases in which enteritis occurred, colitis was also present. Rilliet and Barthez state that in certain rare instances almost the entire digestive tube is affected; that in exceptional cases the principal lesion is found in the small intestines, while, on the other hand, the large intestine is the part of the alimentary canal which is most frequently and intensely inflamed. Billard describes four kinds of intestinal phlegmasia: first, erythematic; second, with altered secretion; third, follicular; fourth, with disorganization of tissue. In some of the best works on diseases of children, published subsequently to that of Billard, different forms of inflammation are described, according to the presence or absence of certain anatomical changes, as ulceration or softening. Practically little is gained by such a division of the general disease, and the lesions which are made the basis of the division are often merely the result of severe and protracted, simple or catarrhal, inflammation. I have records of the post-mortem appearances in eighty-two cases of intestinal inflammation in the infant. Eleven of these occurred in private or dispensary practice; about fifty in the Nursery and Child's Hospital, and the remainder in the Infant Asylum. Since preserving these records, I have witnessed a larger number of post-mortem examinations of infants who died of this disease, chiefly in the institutions, and the lesions corresponded in general with those already observed. The question may properly be asked, Can inflammatory hyperæmia of the intestinal mucous membrane be distinguished from simple congestion if there be no ulceration and no appreciable thickening of the intestine? This is sometimes difficult, and it is possible that occa-

sionally I have recorded as inflammatory what was simply a congestive lesion, but I do not think that I have incorporated a sufficient number of such cases to vitiate the statistics. In a large proportion of the autopsies there was manifest thickening of the intestinal mucous membrane or other unequivocal evidence of inflammation. The following is an analysis of the eighty-two cases :

The upper part of the small intestine, embracing the duodenum and jejunum, was found inflamed in twelve cases. It was free from inflammation, and of a pale color, in fifty-one cases. The ileum was inflamed in forty-nine cases, and the cæcal portion, including the ileo-cæcal valve, was the part in which the inflammation was uniformly most intense, and to which it was often confined. In sixteen cases there was no ileitis, and in thirteen no enteritis whatever. Therefore, the ileum was inflamed in all but three of the cases of enteritis, in which the records give the exact location of the disease. In fourteen cases vascularity was observed in streaks or in patches, or simple arborescence in some part of the small intestines, the records not stating its exact location.

In most cases the inflamed mucous membrane was perceptibly thickened. Occasionally, especially if the vascularity were slight, the thickening was scarcely appreciable. In one case there was so much thickening of the ileum next to the ileo-cæcal valve that the mucous coat appeared as if closely studded with small warts. Ulcers of small size were found in the mucous membrane of the small intestines in five cases. These ulcers in one case were in the jejunum, in two in the ileum, and in two in both these divisions of the intestine. They were for the most part quite superficial, and circular or oval.

It is seen from the above records that the portion of the small intestine most frequently inflamed was the ileum. The inflammation usually affected the ileo-cæcal valve, and extended from it to a greater or less extent along the small intestine. In general, when inflammatory patches were found in different parts of the small intestine, those in the ileum nearest the ileo-cæcal valve presented the greatest vascularity and thickening. Billard noticed in his cases the frequency and intensity of the inflammation in the terminal portion of the ileum, and the consequent thickening of the ileo-cæcal valve, and conjectured that the vomiting so common and obstinate in enteritis might be due to obstruction at the ileo-cæcal orifice in consequence of this thickening. I have often seen the orifice reduced to a very small size from the hyperæmia and thickening of the valve, but have not seen any accumulation above it or other evidence of obstruction.

The inflamed mucous membrane was softened in greater or less degree according to the intensity of the inflammation. Sometimes the vessels of the submucous connective tissue were injected, and this tissue infiltrated. The softening of the mucous coat, and the firmness of its attachment to the parts underneath, varied considerably in different specimens. I was

able, in cases in which there was softening, to detach readily the mucous coat with the nail or back of the scalpel, within so short a period after death that it was evident that the change of consistence could not have been cadaveric.

The infants in whom the duodenum and jejunum presented the inflammatory lesions were, with few exceptions, under the age of three months, and in many of these cases there was hyperæmia of the gastric mucous membrane, and in some also stomatitis.

In all the cases except one, namely, in eighty-one, lesions were present, indicating inflammation of the mucous membrane of the colon. In thirty-nine, the catarrh extended over nearly or quite the whole extent of this portion of the intestine ; in fourteen, it was confined to the descending portion entirely, or almost entirely ; in twenty-eight cases, the records state that colitis was present, but its exact location was not mentioned. In eighteen of the examinations, the mucous membrane of the colon was found ulcerated. According to these statistics, therefore, colitis is present in nearly every case of intestinal inflammation in infancy, and in a large proportion of cases also ileitis. The portion of the colon which is most frequently inflamed is that in and immediately above the sigmoid flexure. If the colitis affect other portions also, it is nevertheless in this part that we find the most marked inflammatory lesions.

The solitary glands, both of the large and small intestines, and Peyer's patches, are involved in most cases of intestinal catarrh. Even in non-inflammatory diarrhœa they become tumefied, so as to be distinctly visible and somewhat elevated. In entero-colitis, as we have already seen, they present different appearances, according to the degree and duration of the inflammation. In recent cases, and in parts of the intestine where the inflammatory action has been mild, there is often no perceptible change of these glands except slight enlargement with vascularity. This enlargement is most apparent if the intestine be viewed by transmitted light, when not only the glands are seen to be swollen, but their central dark points are quite distinct. If a higher grade of inflammation, or inflammation more protracted have occurred, the volume of the solitary follicles is so increased that they rise above the common level and present a papillary appearance. Peyer's patches are in a corresponding degree thickened.

The enlargement of these glands is due to hyperplasia, namely, an augmentation in the number of the elementary cells. The ulceration in the cases which I have examined appeared to be primarily and chiefly follicular. While some of the solitary glands in a specimen were found simply tumefied, others were slightly ulcerated, and others still nearly or quite destroyed. The ulcers were usually from one to three lines in diameter, circular or oval, with edges a little raised, and red. They resembled in appearance the ulcers in follicular stomatitis. In one or two instances I have seen small coagula of blood in the ulcers, and I have also

seen ulcers which have evidently been larger, having partially healed. The principal seat of the ulcers was in the descending colon. They were either found in this portion of the intestine only, or, if occurring elsewhere, they were here most abundant.

Those in whom I have found ulcers have been ordinarily over the age of six months, which is the time when there is greatest development and activity of the glandular apparatus. In none of the cases observed by me were Peyer's patches ulcerated, though generally tumefied.

In cases in which the caput coli was inflamed, I have sometimes found the mucous membrane of the appendix vermiformis also injected and thickened. In one case only was there a pseudo-membrane upon the inflamed surface. This was in the descending colon, and it was thin like a film. The rectum presented no inflammatory or other lesions, or but slight lesions in comparison with those in the colon. Often, when there was almost general colitis, the rectum was found of a pale color, or but slightly vascular. This may explain the infrequent occurrence of tenesmus in infantile entero-colitis. The amount of mucus secreted from the intestinal surface in this disease is considerably in excess of the normal quantity. It often forms a layer upon the mucous membrane of the intestines, and appears in the stools, mixed with epithelial cells and sometimes with blood or pus. If the quantity of mucus appearing in the stools be considerable, this form of intestinal catarrh has sometimes been designated mucous diarrhœa, or mucous disease ; but there does not seem to me sufficient reason, either anatomical or clinical, for considering it a distinct malady.

The mesenteric glands are ordinarily enlarged, unless in very young infants. They are frequently found as large as a large pea, or even larger, and of a light color, from the anæmic state of the infant. In exceptional instances certain of them are found to have undergone cheesy degeneration. The enlargement of these glands, like that of the solitary follicles and Peyer's patches, occurs from hyperplasia. The condition of the stomach was recorded in sixty-nine cases. In forty-two it was healthy ; in seventeen red, apparently inflamed ; in seven of a pink color ; in three it contained ulcers which were probably cadaveric. The usual healthy condition of the stomach is a noteworthy fact, taken in connection with the frequent vomiting, in intestinal catarrh. I have stated elsewhere that stomatitis is also a common complication in protracted and grave cases, accompanied by sponginess of the gums, which bleed if pressed or rubbed. The buccal surface in these cases is more vascular than natural, and, if the vital powers are much reduced, superficial ulceration is not infrequent, especially of the gums. In infants under the age of three or four months, œsophagitis is also a common accompaniment of entero-colitis.

Thrush, though a frequent complication under the age of three or four

months, is rare in older infants. Thrush, in infants over the age of eight or ten months, occurring in connection with intestinal inflammation, is an unfavorable prognostic sign, indicating a gravity of the intestinal disease which commonly eventuates in death.

An opinion exists in the profession that the liver is in fault in this disease, especially in that form of it which I have described as a summer epidemic of the cities. This opinion is, probably, less prevalent than formerly, but is still held by many, and it influences the choice of therapeutic agents.

I have notes of the appearance and state of the liver in thirty-two fatal cases of the epidemic entero-colitis of the summer season. Nothing could be seen in these examinations that indicated any disturbance in the function of this organ. The size of the liver was in some cases very different in those of about the same age, but probably there was no greater difference than usually obtains among glandular organs within the limits of health. The following table gives the weight of the liver in twenty cases in which the weight of this organ and the age of the patient are recorded :

Age.		Age.	
4 weeks,	5 ounces.	10 months,	6¾ ounces.
2 months,	3½ "	13 "	6 "
2 "	3½ "	14 "	9 "
4 "	5 "	15 "	6 "
5 "	6½ "	15 "	7½ "
5 "	9 "	15 "	9½ "
7 "	4½ "	16 "	6 "
7 "	6 "	19 "	4½ "
7 "	6½ "	20 "	9¼ "
9 "	8 "	23 "	15 "

I do not have access to tables giving the weight of the healthy liver at different ages, but in none of the above examinations did the size or the weight seem to me to be above the healthy standard, except in one, in which this organ was quite fatty. But in this case the degeneration and enlargement of the liver were doubtless due to tuberculosis.

In most of the cases the liver was examined microscopically, and the only fact worthy of note observed was its variable amount of fatty matter. Sometimes this was in excess, sometimes in moderate quantity or rather deficient, and sometimes in greater amount in one portion of the organ than in another.

The prevalent belief, then, that the liver is greatly affected in the summer epidemic of entero-colitis, receives no corroboration from the inspection of this organ. The only pathological state (if it be such) observed in it relates to the amount of oily matter, and this obviously requires no special treatment.

The cutaneous affections complicating entero-colitis have already been alluded to.

Frequently at post-mortem examinations of infants who have died of intestinal catarrh, intussusceptions are found in the small intestines. These probably in general occur at the moment of, or not long before, death, as they are small and readily reduced, but I have in a few instances found intussusceptions which sustained the weight of two feet or more of intestine without being reduced, and which, from being in their interior more vascular than the contiguous membrane either above or below, probably occurred some hours, possibly days, before death, but, being sufficiently pervious to allow the food to pass, symptoms of obstruction were absent.

It has been said, in speaking of the symptoms, that a cough is common in protracted entero-colitis when the vital powers are greatly reduced, and the circulation is feeble. From the great emaciation and the character of the cough, the physician as well as friends is very apt to suspect the presence of tubercles. But tuberculosis is quite exceptional in these cases. I have, as stated above, records of eighty-two post-mortem examinations of infants who died of entero-colitis in the summer months, and tubercles were found in only one case. The cough was due to solidification of the posterior and dependent portion of one or both lungs. The mode in which this solidification of the lung (hypostatic pneumonia) occurs and its character are treated of in our remarks on disease of the respiratory organs.

In the cases of entero-colitis which were complicated with this state of the lungs, I have not usually found enough of the lung-tissue involved to make any perceptible difference in the sound on percussion. Its extent of solidification was sometimes not more than two or three lines, and frequently not more than a quarter to half an inch in an antero-posterior direction, although it embraced nearly or quite the entire posterior surface of the organ.

The state of the brain in the entero-colitis of infancy is interesting to the pathologist. When the disease is protracted, this organ wastes like the body and limbs. In the young infant, in whom the cranial bones are still ununited, the occipital and sometimes the frontal become depressed in proportion to the loss of brain-substance, so that the cranium is quite uneven. In older children with the cranial bones consolidated, serous effusion occurs according to the degree of waste, thus preserving the size of the encephalon. The effusion is chiefly external to the brain, extending on each side over the convolutions from the base to the vertex. The quantity of serum varies from one or two drachms to an ounce, or even more. The serous effusion is associated with passive congestion of the cerebral vessels and cranial sinuses, and this pathological state when sufficient to produce symptoms, occurs in the common form of spurious hydrocephalus.

The following is a common example :

In December, 1877, my attention was called to an infant, aged seven months, just admitted into the New York Foundling Asylum, with suspected brain disease. Its previous history had not been ascertained ; its pupils reacted feebly by light, and its head constantly rotated from side to side. The diagnosis was easy from the symptoms, for its wasted state, and sunken eyes, without any marked pulmonary symptoms, indicated protracted intestinal catarrh, and the depressed anterior fontanelle, showed that the brain disease could not be an inflammation either meningeal or cerebral. It was obvious that the anatomical state of the brain, which we are now considering, was present. At the autopsy on the following day, the lesions of severe protracted intestinal catarrh were found. The large intestine especially was thickened, and its mucous surface rough and uneven from proliferation of the mucous membrane, or sub-mucosa, which had evidently been going on for a considerable time. The portions of the surface which were roughened by this proliferation presented a dusky-red color. On opening the cranial cavity about one ounce of serum escaped, which had been effused between the superior surface of the brain and the meninges. The anterior portion of the brain, which was uppermost in the position in which the child had been in the crib, appeared normal, but the veins and capillaries in the posterior or depending portion were engorged with dark blood. The base of the brain did not present any inflammatory lesion. The cranial sinuses were also distended with dark blood and clots ; a long white clot was drawn out from the longitudinal sinus, being, from its color and firmness, in all probability, ante-mortem ; the presence of which, whatever the condition otherwise, obviously rendered recovery impossible.

Diagnosis.—Persistent diarrhœa, with elevation of temperature, indicates intestinal catarrh. Abdominal tenderness, which is so important a diagnostic symptom in the adult, is generally absent in the infant, or, if present, is not easily ascertained. It is more difficult to determine, from the symptoms, what part of the intestinal tract is chiefly involved in the catarrh, though it may be assumed that it is the colon, and the lower part of the ileum if the patient be under the age of eighteen months. The presence of mucus, or of mucus tinged with blood, in the stools, shows predominance of colitis.

Prognosis.—Though intestinal inflammation is one of the most fatal infantile maladies, still, by proper hygienic measures and a judicious selection and use of medicines, a large proportion of those affected may be saved. This inflammation and most of its complications are of such a nature that we may have reasonable hope that the infant will recover if suitable measures are employed sufficiently early. Many do recover from a state of emaciation and feebleness which, occurring in any other pathological state, would be almost necessarily fatal. The most unfavorable symptoms in this disease, except those due to extreme prostration or collapse, arise from the state of the brain. Rolling the head, squinting, feeble action of the pupils, spasmodic or irregular movements of the limbs, indicate the near approach of death. There are many facts which should be taken into consideration in making a prognosis. The age of the in-

fant, the time in the year, the surroundings, especially in reference to the impurity of the atmosphere, are to be considered, as well as the present state of the patient.

Intestinal inflammation of infancy might, in many instances, be prevented by judicious measures. Especially is it preventable in those cases in which the exciting cause is dietetic. The reader is referred to the chapters on weaning and artificial feeding, for facts in reference to this matter. Unfortunately, however, the physician in many instances is not consulted in regard to the alimentation of the infant, or the time and manner of weaning, or other important matters of regimen, until diarrhœa, inflammatory or non-inflammatory, is established; his purpose is then not to prevent, but to cure.

Treatment. *Regimenal Measures.*—The infant with intestinal catarrh is thirsty, and is, therefore, apt to take more nutriment, in the liquid form, than it requires. If nursing it craves the breast, or if weaned craves the bottle at short intervals, but no more nutriment should be allowed than is required for the sustenance of the patient, since an amount of food which cannot be fully digested undergoes fermentative changes and becomes an irritant to the intestines. The infant should, therefore, take its food in proper quantity and at proper intervals, and if it be thirsty, it should take a little gum water or light barley water, or a little cold water, in the intervals. But exhaustion should be guarded against, and while the diet should be bland and unirritating, it should be nutritious.

As one of the chief causes of intestinal catarrh, when not produced by exposure to cold, is the use of indigestible and therefore irritating food, it is obviously of the utmost importance that the food should be of suitable nature, properly prepared, and given in proper quantity. This remark is especially applicable to the catarrh of the summer months, the cause of which is largely dietetic. To infants under the age of one year, and even under that of fifteen months, no food is so suitable as the breast-milk, and one affected with the "summer complaint," and remaining in the city, will not in general do well unless it obtain the milk either of its mother or a wet-nurse. Many are the instances, every summer, in New York City, in which the diarrhœa continues in spite of all other measures, hygienic and medicinal, till a wet-nurse is employed, when in consequence of the changed diet there is rapid and complete restoration to health from a state of emaciation and weakness.

But if the mother's milk fail or become unsuitable on account of ill-health or pregnancy, and in consequence of family circumstances a wet-nurse cannot be employed, the important and difficult duty devolves upon the physician of deciding what shall be the diet. The shops contain several kinds of infants' food, most of which are proprietary, and the mode in which they are prepared and the materials employed are kept secret. A physician actuated by the proper spirit will not recommend a food

whose exact composition is unknown, or the materials employed in the making of which are not fully stated, especially if food can be conveniently prepared by the family which is equally good.

As the breast-milk is the best possible food in cases of infantile diarrhœa, in patients under the age of twelve or even eighteen months, the belief is reasonable that the best substitute for it is such food as most nearly resembles it, and cow's milk or goat's milk, when fresh and of good quality, more closely approximates to it in its ingredients and chemical character than any of the artificial preparations. Besides a close observation through many summers has convinced me that bottle-fed infants, as a rule, do better if a part at least of their food be the milk of one of these animals, prepared according to the directions in the chapter relating to artificial feeding. Great care is requisite that the food be of good quality, properly diluted, and without the least appreciable fermentative change. But to obtain and preserve milk, in a state suitable for use by night and day, is a real difficulty in a large city whose milk supply is received only once in twenty-four hours, and from remote dairies. Condensed milk has the advantage of more easy preservation, and accordingly it is largely employed.

Of the infants' food furnished by the shops, some are used with milk, as the imperial granum, and Ridge's and others with water only, as Nestle's, and the Anglo-Swiss food of Cham, Switzerland, recently introduced. But no one of these is, in my opinion, sufficiently nutritive for prolonged use, so that milk or some other nutriment is required in addition for the proper nutrition of the infant. Infants often do well for a time on Ridge's food and milk, the imperial granum and milk, Nestle's food alternating with milk, or the Anglo-Swiss food alternating with milk, but in most instances, sooner or later, before the hot weather is over, diarrhœa occurs, necessitating some change of diet.

The one food in the shops which, on account of its excellence, merits most the confidence of the profession is Liebig's. One of the last and the crowning work in the life of the distinguished chemist was the preparation of this food. Learning from the physiologist that young infants could digest only a small amount of starch, he prepared a food in which the starch is converted into glucose, and is thus made assimilable for infants only a few weeks old; and influenced solely by the desire to diminish sickness and save human life, he published to the world each step of the process. Liebig's food is now prepared by three competent parties, Hawley, Horlich, and Mellen. Consisting largely of glucose or grape sugar, if given in considerable quantity, without admixture with other food, I have found it too laxative for use in diarrhœal maladies, for all the sugars are more or less laxative, but if mixed with the proper proportion of milk so as to sweeten it slightly, it is probably the best food for infants under the age of three or four months. For those above this age,

who can digest starch, Liebig's food mixed with whatever farinaceous substance is employed, in the proportion of one to three, and used with milk, agrees with a large proportion of infants affected with diarrhœa. With this glucose food, which is a nutriment, it is not necessary to use cane-sugar, which is decidedly laxative, to sweeten the food in the diarrhœal maladies.

Of the farinaceous foods, barley flour has probably been the most used in New York in recent years. But in the treatment of the summer diarrhœa I am in the habit of employing wheat flour of the best quality, prepared by long boiling. Two pounds of this flour are pressed dry in a bag, and this is boiled twelve hours over a brisk fire and in water sufficient to cover it fully. When removed from the bag it has the appearance of chalk, and should be grated when needed for use. Witthaus, in his recent treatise on medical chemistry, says of starch : " When subjected to dry heat the granules of starch swell and burst ; at 200° it is converted into dextrin" (page 311), and processes which change starch into dextrine if continued are apt to produce more or less glucose. Whatever be the exact change effected, wheat flour thus prepared will be found very useful in all infantile diarrhœas. A gruel should be made of the flour, and milk afterward added. Milk should only be boiled for a few minutes. Boiling does not apparently render it more constipating, but it prevents early souring, which is a matter of importance, when milk is brought from a distance and only once each day. It is well to test the milk by litmus-paper, and if it show more than a trace of acid it should be rejected. In one of the New York institutions a little lime-water or other alkali is frequently added to the milk on hot days to insure against acidity. Cases, however, occur, and not infrequently, during the heated term, in which it is necessary to discontinue entirely the use of milk. In a recent case in my practice, cow's milk was so imperfectly digested and so quickly passed the bowels that the microscope showed the presence of even the oil globules in the stools. In such cases I have obtained the best results by preparing a gruel with the flour, and adding to the quantity used at each feeding, after it became cool, the white or albumen of half a fresh egg. With this change in the diet, the number of stools has frequently diminished at once. Beef, mutton, or chicken tea should not be given, as they are too laxative, but the expressed juice of beef and scraped raw beef, except as it involves danger of producing the tape-worm, are useful additions to the diet.

But one chief cause of the great summer epidemic of intestinal catarrh in the cities, we have seen to be atmospheric. This requires attention on the part of the practitioner, to a different matter in the hygienic management of these cases, namely, the state of the air which the infant breathes. in cool months the atmosphere is more pure than in the summer months, as it contains less of those noxious gases which arise from decaying animal and vegetable substances. In those months, then, in which the weather

is such that there is no decomposition of organic matter, the atmospheric cause of entero-colitis is less operative, and less is gained for the patient by change of locality. But in the summer season one of the most important conditions of successful treatment of this and the other diarrhœal maladies of infancy is the removal of patients from an impure to a pure atmosphere. Physicians of experience all agree in the choice of salubrious localities, containing a sparse population. Many are the instances every summer in this city of infants removed to the country with intestinal inflammation, with features haggard and shrunken, with limbs shrivelled, and skin lying in folds, too weak to raise or at least hold their heads from the pillow, vomiting nearly all the nutriment taken, with stools frequent and thin, resulting in great measure from molecular disintegration of the tissues, presenting indeed an appearance seldom seen in any other disease except in the last stages of phthisis, and returning in late autumn, with the cheerfulness, vigor, and rotundity of health. The localities usually preferred by the physicians of this city are the elevated portions of New Jersey and Eastern Pennsylvania, the Highlands of the Hudson, the central and northern parts of New York State, and Northern New England. Taken to a salubrious locality, the infant will soon begin to improve after it has recovered from the fatigue of travelling, unless the case be exceptionally obstinate.

Sometimes parents, not noticing the immediate improvement which they had been led to expect, return to the city without giving the country fair trial, and the life of the infant is almost necessarily sacrificed. Returned to the foul air of the city while the weather is still warm, it sinks rapidly from an aggravation of the malady. Some authors recommend, if the infant do not improve where it is taken, that it should be conveyed to another locality. This is good advice, provided that the selection be made of a place elevated, and having a sparse population. The infant, although it has recovered, should not be brought back while the weather is still warm. One attack of the disease does not diminish but increases the liability to a second seizure.

If the situation of the family be such that it is not practicable to take the infant to the country, and such cases are frequent among the poor, it should be kept much of the time in the open air ; it is a common practice in this city to take such patients in the daytime to the seashore, or upon ferry-boats. Dr. E. H. Parker says : " Many of my patients are sent to the ferries to cross them, so that the cool, fresh sea-breeze may fan them, and it acts sometimes like magic, to raise their drooping heads." I have not observed such marked benefit in these cases from the sea-breeze as from the air of elevated rural localities, which can generally be found in the vicinity of cities, and are easily accessible.

In New York great benefit has resulted from the floating hospital which every second day during the heated term carries a thousand sick children

from the stifling air of the tenement-houses down the bay and out to the fresh air of the ocean.

Medicinal Treatment.—Sometimes it is proper to commence treatment by the employment of a gentle purgative, particularly when the disease commences abruptly from a state of previous good health. It is then frequently caused by exposure to cold, or more rarely by some indigestible and highly irritating substance in the intestines. In such patients there is often a full habit. The pulse is strong and quick, the heat of surface great, the face perhaps flushed, the stools sometimes slimy and bloody, sometimes green or brown. It is proper and often serviceable, when there is this commencement of the affection, to give a single dose of castor oil or syrup of rhubarb. Any indigestible substance, if present, is removed from the intestine, and opiates or other remedies designed to control the disease may then be more successfully employed. Such cases occur in the winter not less than in the summer, and in all localities, rural as well as in the city. But the summer epidemics of intestinal inflammation in the cities do not in general require such preliminary treatment. Diarrhœa, moderate, perhaps, has already continued for a time when the physician is called, and no irritating substance remains except the acid, which is abundantly generated in the intestine in this disease, and which we have the means of removing without purgation. Preliminary treatment having been employed or not, according to the nature of the attack and condition of the patient, remedies calculated to arrest the inflammation should then be prescribed.

The same general plan of medicinal treatment holds good for the intestinal catarrh of infants which has been found efficacious for that of adults. But the causes of this catarrh are, as we have seen, in some respects different in infancy from those operative in other periods of life, so as to require some variation in the treatment. The acid fermentation occurring in the stomach, which is very common, especially in the catarrh of the summer season, requires the use of antacids. If by the appearance of the stools, or the substance ejected from the stomach, or by the usual test with litmus paper, the presence of acid in an irritating quantity be ascertained or suspected, lime-water or a little bicarbonate of sodium should be added to the food. The creta preparata of the pharmacopœia, or, which is more convenient, the mistura cretæ, administered every two hours, is an useful antacid for this condition. By the alkali alone, aided by the judicious use of stimulants, the disease is sometimes arrested ; but, unless circumstances are favorable, and the case be mild, other medicines are required. The physicians should see that the chalk is finely triturated.

Opium is used by most practitioners in the treatment of this malady. Either as a main remedy or adjuvant, it is employed, and properly, in nearly all severe cases. For a young infant paregoric is an eligible preparation of opium. For the age of one month, the dose is three to five

drops ; for the age of six months, ten to twelve drops, repeated in three hours or a longer time, according to the state of the patient. After the age of six months the stronger preparations of opium are more frequently used. At the age of one year the liq. opii compositus or tinctura opii deodorat. may be given in doses of one drop. Dover's powder is also a useful medicine in this disease, given in doses of three-fourths of a grain to an infant one year old.

Opium is, however, in general best given in mixtures which will be mentioned hereafter. It quiets the action of the bowels, and diminishes the number of evacuations. It is contraindicated or should be used with caution if cerebral symptoms be present. Sometimes in the commencement of the disease, if there be much febrile reaction, the patient may be drowsy and in danger of convulsions. Then opiates should be given cautiously. Also in the advanced stages of this disease, when, perhaps, there is more or less serous effusion in the cranial cavity, opium should be cautiously prescribed, as it might tend to produce that fatal stupor, in which unfavorable cases are apt to terminate.

Astringents have long been used as an adjuvant to the opiate, but the medicine, which, employed in combination with opium, is the most efficient in controlling infantile entero-colitis, is the subnitrate of bismuth. While it aids strongly in checking the diarrhœa, it is an efficient anticmetic and antiseptic. It should be prescribed in doses of ten or twelve grains for an infant of twelve months, and larger doses produce no ill effect, for its action seems to be almost entirely local, and soothing upon the intestinal surface. It undergoes a chemical change in the stomach, becoming black, being probably converted into the bismuth sulphide, and it produces dark stools. An observing physician has informed me that he has sometimes observed a peculiar faint odor, somewhat like that of garlic in the breath of those who are taking the bismuth in frequent large doses. I have since observed this in two instances. It is probably due to some impurity, and not the result of absorption of the bismuth. In those cases in which the symptoms are chiefly due to the colitis, and the stools contain blood with a large proportion of mucus, it has been customary to prescribe laudanum or other form of opium with castor oil. I now prefer, however, the bismuth and opium in the treatment of cases which are more decidedly dysenteric, as well as for cases of the usual form of intestinal catarrh.

The following formulæ are employed with the best results in the institutions of New York, with which I have an official connection, the dose being for an infant of one year :

℞ Tinc. opii deodorat., gtt. xvj ;
Bismuth. subnitrat., ʒ ij ;
Syr. simplic., ℥ ss ;
Mistur. cretæ, ℥ iss. Misce.
Shake bottle. Give one teaspoonful every two to four hours.

℞. Tinc. opii deodorat., gtt. xvj;
Bismuth. subnitrat., ʒij,
Syr. simplic., ℥ss;
Syr. cinnamomi, ℥iss.
Shake bottle. Give one teaspoonful from two to four hours.

℞. Bismuth. subnitrat, ʒij;
Pulv. cret. comp. c. opio, ʒss. Misce.
Divid. in chart. No. x. Dose, one powder every three hours.

℞. Bismuth. subnitrat., ʒij;
Pulv. ipecac. comp., gr. ix. Misce.
Divid. in chart. No. xii. Dose, one powder every three hours.

An infant of six months can take half the dose, and one of three or four months one fourth or one third the dose of either of the above mixtures.

Enemata.—These are of great service in many cases of intestinal inflammation. At any stage of the disease, when the stomach is irritable and medicines are not retained, they may be advantageously employed. Laudanum especially is often given in this way to the infant with great benefit. It may be prescribed mixed with a little starch-water, and the best instrument for administering it is a small glass or gutta-percha syringe, the nurse retaining the enema for a time by means of a compress. Beck, in his *Infant Therapeutics*, advises to give by injection twice as much of the opiate as would be administered by the mouth. A somewhat larger proportion may, however, be safely employed.

The following formula for a clyster has given more satisfaction in my practice than any other which I have employed:

℞. Argent. nitrat., gr. iv;
Bismuth. subnitrat., ℥ss;
Mucil. acaciæ,
Aquæ, āā ℥ij. Misce.

One-quarter to one-half of this should be used at a time, with the addition of as much laudanum as is thought proper, and it should be retained by a compress, held by the nurse.

In most of those cases of intestinal catarrh which occur under the depressing effect of warm weather, alcoholic stimulants are required almost from the commencement of the disease, and their use is beneficial in chronic or protracted cases, whatever the cause or season. Bourbon whiskey or brandy is the best of these stimulants, and it should be given in small doses, repeated at intervals of two hours. I have usually ordered three or four drops to an infant one month old, and an additional drop or two drops for each month. The stimulant is not only useful in sustaining the vital powers, but it also aids in relieving the irritability of stomach.

In certain cases vomiting is a prominent symptom. It is common and

often obstinate in cases occurring during the summer epidemic, and it increases greatly the prostration. Sometimes it is due to excess of acid in the stomach, sometimes it is the result of the general irritability and increased movement of the gastro-intestinal canal, and sometimes it has a cerebral origin. The following are formulæ which will be found useful for this symptom :

℞. Bismuth. subnitrat., ʒ ij ;
Spts. ammon. aromat., ʒ ss ;
Syr. simplic.,
Aquæ, āā ℥ j. Misce.

Shake bottle. Dose, one teaspoonful hourly, or every second hour if required, make cold by a piece of ice.

℞. Acid. carbolic., gtt. ij ;
Aq. calcis, ℥ ij. Misce.

Dose, one teaspoonful with a teaspoonful of milk (breast-milk if the baby nurse), to be repeated according to the nausea.

Lime-water alone often removes the nausea when there is an excess of acids in the stomach, but it is rendered more effectual in certain cases by the addition of carbolic acid, which tends to check any fermentative process.

Another remedy is the neutral mixture, prepared by the following formula, the bottle being tightly corked immediately on mixing the ingredients, so as to retain the carbonic acid :

℞. Potass. bicarbonate, gr. xxv ;
Acid. citric., gr. xvij ;
Aq. amygdal. amaræ, ℥ j ;
Aquæ, ℥ ij. Misce.

Dose, one teaspoonful to a child from eight to ten months, according to the nausea. The carbonic-acid water of the shops, given ice-cold, may be equally useful.

Dr. Sweezey, formerly one of the attending physicians in the class of children's diseases at the Out-Door Department at Bellevue, and who has called my attention to the good effects of minute doses of ipecacuanha to relieve nausea in this disease, employs the following formula :

℞. Tinct. ipecacuanhæ, gtt. iv ;
Aquæ, ℥ iv. Misce.

Dose, one teaspoonful, repeated according to the nausea.

I have employed all these prescriptions, and in certain cases with a satisfactory result, but my preference is for the bismuth in large doses, as it seems to afford relief in the largest proportion of cases. Nevertheless there are instances, especially during the summer epidemics, when this symptom is very obstinate, and all these remedies may fail. In these cases perfect quiet of the child, the administration of but little nutriment at a time, mustard over the epigastrium, and the use of an occasional small piece of ice may relieve the nausea.

When the catarrh is chronic, and the vital powers begin to fail, as indicated by pallor, more or less emaciation, and loss of strength, the following is the best tonic mixture with which I am acquainted. It aids in restraining the diarrhœa, while it increases the appetite and strength. It should not be prescribed until the inflammation has assumed a subacute or chronic character.

℞. Tinct. columbæ, ʒ iij ;
Liq. ferri nitratis, gtt. xxvij ;
Syr. simplic., ℥ iij. Misce.
Dose, one teaspoonful every three or four hours to an infant of one year.

In the Out-Door Department at Bellevue we commonly give this tonic alternately with the bismuth powders.

External Treatment.—Some writers recommend depletion by leeching in intestinal inflammation, advice likely to do harm, unless the particular cases are described in which it may possibly be of service. It can be useful only in those cases in which the infant is robust and of full habit, and the disease commences suddenly with decided febrile reaction. Such cases are oftenest seen with us in the winter season, and even these are ordinarily best treated without loss of blood. Sinapisms and poultices usually are sufficient as local measures. In these cases, also, the warm mustard foot-bath should be employed, and repeated if there be restlessness or cerebral symptoms.

In all forms of intestinal inflammation in infancy and in all its stages mild counter-irritation over the abdomen is often useful, but vesication, by increasing the restlessness of the infant and reducing its strength, without materially modifying the severity or duration of the disease, does more harm than good. It is not to be thought of as a remedial measure. I have known a troublesome sore continuing till death, and probably hastening this result, to occur from this treatment. Poultices or fomentations over the abdomen are sometimes beneficial, especially those of a mildly irritating nature. A poultice of powdered cloves, cinnamon, and ginger, or of linseed meal to which a little mustard is added, may be employed, or a linseed poultice spread thin, under which a single layer of muslin is placed, saturated with camphorated oil or tincture of camphor, and over both oil silk. In the entero-colitis of infants, occurring in the cool months, and due to exposure to cold, this treatment is especially useful. In the epidemic entero-colitis of the summer months, which may be aggravated by heat, treatment by poultices may be injudicious, but in such cases it is proper to produce moderate redness over the abdomen by temporary applications.

CHAPTER IX.

ENTERITIS AND COLITIS IN CHILDHOOD.

Intestinal inflammation in childhood differs materially from the form or type which it commonly presents in infancy. Its causes, symptoms and extent vary in important particulars in the two periods. In childhood there is not ordinarily such extensive inflammation of the mucous membrane of the intestines as we have seen is present in the majority of cases in infancy, and it may, therefore, be properly treated as two diseases, according to the seat of the morbid process, namely, enteritis and colitis. Both these affections in the child resemble so closely the form which they exhibit in adult life, that no extended description is needed in this connection.

Causes.—A main cause is sudden reduction of temperature by exposure to cold, or to currents of air, which checks perspiration, and causes determination of blood from the surface to the viscera. These inflammations are also caused sometimes by irritating substances in the intestines. I have know fæcal accumulations as well as worms to produce severe dysentery in the child, accompanied by the characteristic tenesmus and muco-sanguineous stools, and ceasing as soon as the offending substances were expelled. The use of unripe or stale vegetables, if there be a strong predisposition to mucous inflammation, may be a sufficient cause, and some of the most dangerous cases are due to the accumulation in the intestines of seeds and the parenchyma of fruits. But the most common cause is that mentioned, namely, sudden exposure to cold when the body is heated, a danger to which children are especially liable, on account of the easy disturbance of the circulatory system in them, and their heedless exposure of themselves, unless incessantly watched. Enteritis and colitis are also frequently secondary diseases occurring in children as complications or sequelæ of the eruptive fevers, especially measles.

Symptoms.—The alvine discharges in enteritis and colitis in childhood are such as occur in these diseases at a more advanced age. In enteritis they are thin and of the natural color, or occasionally green ; in colitis they are more consistent than in enteritis, and are largely muco-sanguineous. Sometimes in enteritis, if the inflammation be not intense, the diarrhœa is slow in appearing, or it may be slight, so as not to attract special attention. The disease may then resemble remittent fever, for which it is at times mistaken. The upper part of the small intestines is less frequently affected than the lower. If there be duodenitis, the flow

of bile is occasionally impeded from tumefaction at the mouth of the common bile-duct, and the icteric hue appears. In both enteritis and colitis there is abdominal tenderness, with more or less constant pain if the disease be severe, and in colitis, tormina and tenesmus. The pulse is accelerated, the heat of surface augmented, the face flushed, and, except in mild cases, expressive of pain. In many children at the commencement of the inflammation the nervous system is profoundly affected, as indicated by headache, stupor, twitching of the limbs, and sometimes by convulsions. The chief danger at the commencement of the disease is, indeed, from this source. Sometimes irritability of the stomach occurs, and the food is rejected, though much less frequently than in the intestinal inflammation of infancy. Anorexia and thirst are common symptoms. If the inflammation continue, there is soon perceptible emaciation, with loss of strength. The eyes become hollow, the face pallid, and the surface cool. Death may occur at an early period, the vital powers succumbing from the intensity of the inflammation. In other cases, the acute disease ends in a subacute or chronic inflammation ; the patient becomes gradually more reduced, till he dies in a state of extreme emaciation, such as we often observe in the entero-colitis of infancy ; or from this state he may recover by degrees, though perhaps with an irritable state of the bowels, which continues for months. In a majority of cases, however, enteritis and colitis in childhood, if properly treated, soon begin to yield, and they terminate favorably in one or two weeks.

Diagnosis.—It is not difficult to determine the existence of the inflammation. This is indicated by the fever, abdominal tenderness, and the relaxed state of the bowels. Whether the disease be enteritis or colitis is determined by the character of the stools, the seat of the tenderness and the presence or absence of tenesmus.

Prognosis.—It has been stated above that enteritis and colitis in children commonly terminate favorably. The result depends not only on the extent and severity of the inflammation, but the constitution and previous health. The inflammation is more serious when secondary than when primary. Extensive and great tenderness of the abdomen, features pallid, anxious, and expressive of suffering, pulse frequent and feeble, should excite the most serious apprehensions. Frequent vomiting also denotes a grave form of the disease. Stupor, and especially convulsive movements, show that the nervous centres are affected, and should make us guarded in the prognosis. Improvement in the disease, on which to base a favorable prediction, is apparent in the diminution of the tenderness, improvement in the pulse and character of the stools, a more cheerful countenance, and less disrelish of food.

Treatment.—This should be similar to that employed for the adult. In enteritis at the commencement of the disease, if there be reason to suspect the presence of any irritating substance in the intestines, and ordi-

narily in colitis, it is advisable to commence treatment by the use of some simple evacuant, like castor oil. After this our reliance, so far as internal treatment is concerned, must be mainly on opiate and antiphlogistic medicines. One of the best remedies of this class is the Dover's powder, which may be given to a child five years old in doses of three grains every three hours. A corresponding dose of any of the other opiates may be given, but with less sudorific effect. In colitis the occasional administration of a laxative should not be neglected, if the stools be entirely or mainly muco-sanguineous. It should be employed so as to prevent accumulation of fæcal matters in the colon, which would serve as an irritant and increase the inflammation. The dose should be small, merely sufficient to produce a fæcal evacuation, and repeated as required, daily or less frequently. The laxatives commonly preferred are magnesia, rhubarb, or castor oil. The physician may prescribe an opiate mixture containing sufficient of the laxative to have the effect desired, though ordinarily it is better to prescribe the two separately, so that the laxative can be given or withheld, according to circumstances, while the opiate is continued more regularly. Except that there be some irritating substance which requires removal, the effect of laxatives is injurious, instead of beneficial. Most of the formulæ given above in our remarks relating to the treatment of infantile intestinal catarrh, are likewise useful for the enteritis and colitis of childhood, the quantity of the opiate, which is the important ingredient, being increased according to the increase in the age. The following prescriptions may be employed for a child of five years :

℞. Pulv. opii, gr. v ;
Bismuth. subnitrat., ʒ ij. Misce.
Divid. in pulveres No. xx. Give one powder every two to four hours.

℞. Pulv. ipecac. comp., ʒ j ;
Bismuth. subnitrat., ʒ ij. Misce.
Divid. in pulveres No. xxiv. Give one powder as above.

℞. Tinc. opii deodorat., ʒ ss ;
Bismuth. subnitrat., ʒ ij ;
Aq. menth. piperit.,
Syr. zingiberis, āā ℥ j. Misce.
Shake bottle. Give one teaspoonful from two to four hours.

The local treatment which is found most useful consists in the use of emollient applications covered with oil-silk, and made sufficiently irritating by mustard or otherwise to cause constant redness.

The diet should be bland and unirritating. In the first stages of the inflammation, rice or barley-water, or arrowroot boiled in water, and similar drinks should constitute the main diet. When the active inflammation has abated, and at any period of the disease if there be a tendency to prostration, more nourishing food should be given. Milk and animal broths may then be allowed. In cases which are protracted, or attended with symptoms of exhaustion, alcoholic stimulants are required.

CHAPTER X.

CHOLERA INFANTUM.

Cholera infantum, or, as it is sometimes called, choleriform diarrhœa, is a disease of the summer months ; and, with exceptional cases, of the cities. It receives the name which designates it from the violence of its symptoms, which closely resemble those in Asiatic cholera. It is, however, quite distinct in its nature, occurring independently of the epidemics of that disease.

I have elsewhere stated that, as regards at least the city, the term cholera infantum has been so extended as to embrace a large part of the diarrhœal maladies affecting infants in the summer months. Some physicians apply it even to mild but protracted cases of ordinary non-inflammatory or inflammatory diarrhœa occurring in the season mentioned. I employ it, and it should, in my opinion, only be employed, to designate that form of infantile diarrhœa in which there are frequent watery stools, accompanied by vomiting, great elevation of temperature, and rapid and great emaciation.

The number of deaths from cholera infantum reported in our bills of mortality is so large, while the number from the same disease embraced in the death statistics of European cities is so small comparatively, that some have been led to believe that this malady is much more prevalent and fatal in this country than in Europe, whereas, were these terms employed in all places to designate precisely the same disease, probably no great difference would be found in the prevalence of cholera infantum on the two sides of the Atlantic.

Causes.—It has been stated that cholera infantum prevails mainly in the cities and in the summer months. Cases occur from the month of May to October. Its maximum frequency and severity correspond with the degree of heat, and it is therefore most prevalent in the months of July and August. One of the chief causes of this disease is, doubtless, residence in an atmosphere loaded with noxious vapors, especially gases arising from animal and vegetable decomposition, or an atmosphere rendered impure by overcrowding and by personal and domiciliary uncleanliness. It is, therefore, much more common in tenement houses and parts of the city occupied by the poor than in cleaner and less crowded streets and apartments.

Summer heat and the anti-hygienic conditions to which it gives rise in the cities, sometimes appear to be sufficient in themselves to develop cholera

infantum ; at least it occurs without other obvious cause. In other, and probably the majority of cases, another cause co-operates, namely, the use of improper food. Atmospheric heat and its depressing influences are then predisposing causes, while the use of indigestible or irritating food is the exciting cause. Infants upon whom both causes are operative are most liable to cholera infantum in its severe form. Hence bottle-fed infants of the city are especially liable to it, and infants whose food is carelessly and improperly prepared. Often in the hot months, acid and indigestible fruits, as currants, heedlessly given to an infant, occasion the attack.

Cholera infantum occurs commonly under the age of two years. It is so frequent during the period of first dentition that some writers consider dentition a cause. At this period, however, as has been stated elsewhere, there is great functional activity, and rapid development of the intestinal follicles, and the peculiar liability to cholera infantum at this age should be attributed to this cause rather than to dentition.

Symptoms.—Cholera infantum sometimes commences abruptly, the previous health having been good. In other cases it is preceded by a premonitory stage, that of diarrhœa. The stools are thinner than natural, and somewhat more frequent, but not such as to excite alarm. Suddenly the evacuations become more frequent and watery, and the parents are surprised and frightened by the rapid sinking and real danger of the infant. Occasionally this antecedent diarrhœa has continued several weeks, attended with emaciation and associated with intestinal inflammation.

This disease is characterized by the discharge of thin stools, designated by some watery, by others serous. The first evacuations, unless there have been previous diarrhœa, contain considerable fæcal matter. They are so thin as to soak into the diaper like the urine, and in some cases they scarcely produce more of a stain than does this secretion. The odor is peculiar, not fæcal, but musty and offensive ; occasionally the stools are almost odorless. Commencing simultaneously with the watery evacuations, or soon after, is another symptom, namely, irritability of the stomach, which increases greatly the prostration and danger. Whatever is swallowed by the infant is rejected immediately, or after a few minutes, or there may be retching without vomiting. The appetite is lost, and the thirst is intense. Cold water, especially, is taken with avidity, and if the infant nurse, it eagerly seizes the breast, in order to relieve the thirst. The tongue is moist at first, and clean or covered with a light fur. The pulse is accelerated, while the respiration is either natural or somewhat increased in frequency ; the surface is warm, but its temperature is speedily reduced. There is no disease of infancy in which the temperature of the blood is higher. In ordinary cases the thermometer introduced into the rectum rises above 105°, and I have seen it indicate 107°.

The infant apparently experiences no abdominal tenderness or pain. It is often restless at first, but its restlessness is due to thirst, or that unpleasant sensation which the sick feel when the vital powers are rapidly reduced. The urine is scanty in proportion to the gravity of the attack.

The loss of strength and the emaciation are more rapid than in any other diarrhœal malady, except Asiatic cholera, and the most severe form of cholera morbus. The parents scarcely recognize in the changed and melancholy aspect of the infant any resemblance to the features which it exhibited a day or two before. The eyes are sunken, the eyelids and lips are permanently open from the feeble contractile power of the muscles which close them, while the loss of the fluids from the tissues and the emaciation are such that the bony angles become more prominent, and the skin in places lies in folds.

As the disease approaches a fatal termination, which often occurs in two or three days, the infant remains quiet, not disturbed even by the flies which alight upon its face. The limbs and cheeks become cool ; the eyes bleared, pupils contracted, and the urine scanty or suppressed. As death draws near the respiration becomes accelerated from the pulmonary congestion consequent on the feeble contractile power of the heart, the pulse becomes more and more feeble, the surface has a clammy coldness, and stupor results, which becomes more and more profound, and from which it is impossible to arouse the infant.

In the most favorable cases cholera infantum is checked before the occurrence of these fatal symptoms, and often even in cases which are ultimately fatal, there is not such a speedy termination of the malady. The choleriform diarrhœa abates, and the case becomes one of ordinary entero-colitis as described in the foregoing pages.

Anatomical Characters.—Rilliet and Barthez, who of foreign writers treat of this disease at greatest length, describe it under the name of gastro-intestinal choleriform catarrh. "The perusal," they remark, "of the anatomico-pathological description, and especially the study of the facts, show that the gastro-intestinal tube in subjects who succumb to this disease may be in four different states : (*a*), either the stomach is softened without any lesion of the digestive tube ; (*b*), or the stomach is softened at the same time that the mucous membrane of the intestine, and especially its follicular apparatus, is diseased ; (*c*), or the stomach is healthy while the follicular apparatus, or the mucous membrane, is diseased ; (*d*), or, finally, the gastro-intestinal tube is not the seat of any lesion appreciable to our senses in the present state of our knowledge, or it presents lesions so insignificant that they are not sufficient to explain the gravity of the symptoms.

"So far the disease resembles all the catarrhs, but what is special is the abundance of the serous secretion, and the disturbance of the great sympathetic nerve.

"The serous secretion, which appears to be produced by a perspiration (analogous to that of the respiratory passages and of the skin) rather than by a follicular secretion, shows, perhaps, that the elimination of substances is effected by other organs than the follicles; perhaps, also, we ought to see a proof that the materials to eliminate are not the same as in simple catarrh. Upon all these points we are constrained to remain in doubt. We content ourselves with pointing out the fact."

American writers divide cholera infantum into three stages, the first characterized by turgescence of the intestinal follicles, with more or less softening of the mucous membrane. In the second stage the mucous membrane of the intestines is vascular in patches and streaks, and somewhat thickened and softened, while the solitary glands and patches of Peyer present an inflammatory hyperæmia, and occasionally certain of them are ulcerated. In the third stage the brain is involved. The cranial sinuses, veins, and capillaries of the brain are congested, and transudation of serum occurs upon the surface of the brain or in the ventricles. The following observations show the character of these lesions:

On the 1st of August, 1861, I made the autopsy of an infant sixteen months old, who died of cholera infantum, with a sickness of less than one day. The examination was made thirty hours after death. Nothing unusual was observed in the brain, unless, perhaps, a little more than the ordinary injection of vessels at the vertex; no disease of stomach and intestines except enlargement of the patches of Peyer as well as the solitary glands; mucous membrane pale. In this and the following cases there was apparently slight softening of the intestinal mucous membrane; but, whether it was pathological or cadaveric is uncertain, as the weather was very warm. The liver seemed healthy. Examined by the microscope, it was found to contain about the normal amount of oil-globules.

The second case was that of an infant seven months old, wet-nursed, who died July 26, 1862, after a sickness also of about one day. He was previously emaciated, but without any definite ailment. The post-mortem examination was made on the 28th. The brain was somewhat softer than natural, but was otherwise healthy. There was no abnormal vascularity of the membranes of the brain, and no serous effusion within the cranium. The mucous membrane of the intestines was of normal appearance throughout, unless somewhat thickened and softened; the solitary glands of the colon were prominent. The patches of Peyer were not distinct.

In the New York Protestant Episcopal Orphan Asylum, an infant twenty months old, previously healthy, was seized with cholera infantum on the 25th of June, 1864. The alvine evacuations, as is usual in this disease, were frequent and watery, and attended by obstinate vomiting. Death occurred in slight spasms, in thirty-six hours. The exciting cause was apparently the use of a few currants, which were eaten in a cake the

day before, some of which fruit was contained in the first evacuations. The brain was not examined. The only pathological changes which were observed in the stomach and intestines were slightly vascular patches in the small intestines, and an unusual prominence of the solitary glands in the colon. These glands resembled small beads embedded in the mucous membrane. The lungs in the above cases were healthy, excepting hypostatic congestion.

Since the dates of these autopsies, I have made others in cases which terminated fatally after a brief duration, and have uniformly found similar lesions, namely, the gastro-intestinal surface either without vascularity or scantily vascular in streaks or patches, sometimes presenting a whitish or soggy appearance, and somewhat softened, while the solitary glands were enlarged so as to be prominent upon the surface. In cases which continue longer, evident inflammatory lesions soon appear, which are identical with those already described in the article which relates to intestinal inflammation.

NATURE.—It was formerly my opinion that cholera infantum is essentially non-inflammatory, but that it soon became inflammatory if not checked. Careful observations of its symptoms and lesions have since convinced me that it is the most violent inflammation to which infants are liable in our climate. There is no other infantile malady in which there is uniformly so high a temperature, and under which patients sink more rapidly. The alvine discharges to which the rapid prostration is largely due, probably consist in part of intestinal secretions, and in part of serum which has transuded from the capillaries of the intestines. It is well known to pathologists, that in inflammation of mucous surfaces of short duration, the redness is apt to disappear in the cadaver.

The opinion has been expressed by certain observers that cholera infantum is identical with thermic fever or sunstroke. There is, indeed, a resemblance as regards certain important symptoms. In cholera infantum the temperature is from 105° to 108°; in sunstroke it is also very high, often rising above 108°. Great heat of head, contracted pupils, thin fæcal evacuations, embarrassed respiration, scanty urine, and cerebral symptoms are common toward the close of cholera infantum, and they are the prominent symptoms in sunstroke. Nevertheless, I cannot accept the theory which regards these maladies as identical, and which removes cholera infantum from the list of intestinal diseases. In cholera infantum the gastro-intestinal symptoms always take the precedence, and are, except in advanced cases, always more prominent than other symptoms. It does not commence as by a stroke like *coup de soleil*, but it comes on more gradually though rapidly, and it often supervenes upon a diarrhœa or some error of diet. In the commencement of cholera infantum the infant is not apt to be drowsy, and it is often wide awake and restless from the thirst. Contrast this with the alarming stupor of sunstroke. Sunstroke

only occurs during the hours of excessive heat, but cholera infantum may occur at any hour, or in any day during the hot weather, provided that there be sufficient dietetic cause. Again, intestinal inflammation is not common in sunstroke, while it is the common, or, as I believe, the essential, lesion of cholera infantum. These facts show, in my opinion, that the two maladies are essentially and entirely distinct. Nevertheless, cases of apparent sunstroke sometimes occur in the infant, and if the bowels are at the same time relaxed the disease is apt to be regarded as cholera infantum, and if fatal is usually reported as such to the health authorities. Such cases I have occasionally observed, or they have been reported to me, although they are not common.

With the exception of the organs of digestion, no uniform lesion is observed in any of the viscera, unless such as is due to change in the quantity and fluidity of the blood and its circulation. Writers describe an anæmic appearance of the thoracic and abdominal viscera, and occasional passive congestion of the cerebral vessels. The cerebral symptoms often present toward the close of life in unfavorable cases of cholera infantum may arise from that state of the brain known as spurious hydrocephalus, which is not attended by any uniform or certain lesion of this organ. As the urinary secretion is scanty or suppressed, cerebral symptoms may in certain cases be due to uræmia.

Diagnosis.—This disease is diagnosticated by the symptoms, and especially by the frequency and character of the stools. The stools have already been described as frequent, often passed with considerable force, deficient in fæcal matter, and thin, so as to soak into the diaper almost like urine. The vomiting, thirst, rapid sinking, and emaciation serve to distinguish cholera infantum from other diarrhœal maladies.

When Asiatic cholera is prevalent, the differential diagnosis of the two diseases is difficult if not impossible.

Prognosis.—This is one of those diseases in regard to which physicians often injure their reputation by not giving sufficient notice of the danger, or even by expressing a favorable opinion, when the case soon after ends fatally. A favorable prognosis should seldom be expressed without qualification. If the urgent symptoms be relieved, still the disease may continue as an ordinary intestinal inflammation, which, in hot weather, is formidable and often fatal. If the stools become more consistent and less frequent, without the occurrence of cerebral symptoms, while the limbs are warm and pulse good, we may confidently express the opinion that there is no present danger.

The duration of true cholera infantum is short. It either ends fatally, or it begins soon to abate and ceases, or it continues as an entero-colitis. Death may occur, in twenty-four or forty-eight hours, in a state of collapse, from the frequency of the stools, or not till after three or four

days. In general, if the case do not end within three or four days by recovery or death, it becomes one of severe ordinary entero-colitis.

Treatment.—Cholera infantum requires, beyond most other diseases, the employment of proper remedial measures, from the earliest possible moment, since the infant rapidly sinks, unless the evacuations from the bowels be arrested, or rendered less frequent and watery. Regarding the disease as a violent intestinal inflammation, we have no difficulty in determining the therapeutic indications. Those already recommended in our article relating to intestinal inflammation, are indicated, and to the full extent which the infant will bear, without causing too much stupor. An infant between the ages of eight and twelve months should take one teaspoonful of the following mixture every two or three hours, till the vomiting and diarrhœa are controlled :

℞. Tinct. opii deodorat., gtt. xvj ;
Spts. ammon. aromat., ʒ j ;
Bismuth. subnitrat., ʒ ij ;
Syr. simplic., ʒ ss.
Mistur. cretæ, ʒ iss. Misce.

An infant of six months can take one half the dose, and one of three or four months, one third or one fourth the dose. Instead of this, one of the equivalent mixtures which are recommended for the treatment of intestinal inflammation may be given. If cerebral symptoms appear, as rolling the head, drowsiness, etc., I usually write the prescription without the opiate, and it may then be given more frequently if the case require it, while the opiate prescribed alone is given more guardedly and at longer intervals.

There is danger in this disease of the sudden supervention of stupor, amounting even to coma and ending fatally. In these cases the stools are generally suddenly checked, and the opiate might aid in producing this result. In a few instances which I can recall to mind, where death occurred in this way, the friends believed that the melancholy result was hastened by the medicine. If the evacuations are partially checked and there are signs of stupor, the opiate should either be omitted or given less frequently. Explicit and positive directions to this effect should be given. Eligible preparations of opium for this disease are paregoric, tincture of opium, pulv. cretæ comp. c. opio, and, if there be no irritability of stomach, Dover's powder.

Certain writers recommend the employment of a purgative as preliminary treatment, in order to remove any irritating substance from the intestines. But delay in the use of remedies to check the evacuations involves too much risk. When the urgent symptoms are somewhat controlled, a moderate dose of castor oil may be prescribed if there be reason to suspect the presence of any irritating substance in the intestines.

By this mode of treatment the stools are generally in a few hours rendered less frequent and more consistent.

Certain physicians believe that calomel in small and repeated doses has a beneficial effect in choleriform diarrhœa, but those who use it employ it in combination with opium, and it is probable that the good effect observed is mainly due to the latter remedy. From the anatomical characters of cholera infantum there is apparently no indication for a medicine that affects the function of the liver, and there is no evidence that calomel exerts any good effect on the follicular apparatus of the intestines, which, so far as we can localize the disease, seems to be most in fault of any part of the digestive apparatus. On theoretical grounds, therefore, I should oppose the employment of this agent, and my observations of its effects have been such that I entirely discard its use while we have other safe and efficient remedies to meet every indication.

Ordinarily, as the diarrhœa is relieved, the vomiting ceases. The remedies employed for the former are also curative of the latter ; still the vomiting, if frequent and obstinate, sometimes does require special treatment, and we have no better anti-emetic mixtures than those recommended in our remarks on the treatment of intestinal inflammation. In robust infants, at the commencement of the attack, small pieces of ice taken in the mouth, aid in diminishing the irritability of stomach. Mustard should also be applied to the epigastrium.

In most cases alcoholic stimulants are required. The best of these is Bourbon whiskey or brandy, which should be used from an early period of the disease. Aside from its sustaining the vital powers, it aids also in relieving the irritability of stomach.

The diet in cholera infantum should be simple but nutritious. That recommended for intestinal inflammation is proper for infants with this malady.

Constipation.

The gastro-intestinal portion of the digestive apparatus has a double function. First, it receives and retains the food during the process of digestion ; it furnishes the most important of the liquids by which digestion is effected, and it absorbs those products of digestion which are required for the nutrition of the body, while it serves as a barrier against the admission of refuse matter. Secondly, it has an excretory function, so that a large part of the waste and noxious products of the system are eliminated from its surface. Having, therefore, a relation so close and fundamental to the general nutrition, it is necessary, for the normal activity of the organs and the maintenance of health, that its functions be regularly and fully performed. But retention of fæcal matter beyond the normal period is one of the most common ailments both in infancy and childhood, and occasionally it constitutes a grave disease.

Constipation is of two kinds, namely, *symptomatic* and *idiopathic*.

Symptomatic Constipation. Causes.—Many of these are obstructive. The more common of them are the following : (*a*) Congenital stenosis, or occlusion of the anus or rectum. The anus is not formed, or it terminates in a cul-de-sac, while the lower end of the large intestine forms another cul-de-sac. These two cul-de-sacs, lying opposite each other, one looking upward and the other downward, may be separated from each other by a small interspace, a fibrous septum, so that relief can be obtained by a puncture or incision, or they may be widely separated, so that there is no possible mode of relief, and death is inevitable, unless the fæcal matter escape through a congenital fistulous passage upon one of the adjacent mucous surfaces, which mode of relief was present in forty per cent of the cases of this obstruction collected by Leichtenstern. Exceptionally this malformation occurs in the sigmoid flexure, while the rectum is normal. The stenosis, if slight, may produce little delay in the evacuations, except when hardened masses or coarse, indigestible substances descend upon it, and it may, therefore, with careful selection of diet, cause little inconvenience for a lengthened period, while much stenosis causes early obstructive symptoms.

Rarely the stenosis is at the ileo-cæcal orifice. Thus, in the *Transactions of the Lond. Path. Soc.*, for 1870, is the history of a case in which there was such narrowing of the ileo-cæcal orifice, believed to be congenital, that a No. 9 catheter could barely be passed through it. The patient lived till his thirty-second year, having suffered from an early age with frequent attacks of colic and constipation. After his death, the ileum next to the ileo-cæcal valve was found to have a diameter of seven inches, while the large intestine was much atrophied, and its entire lumen contracted from the long disuse. Occasionally, the narrowing occurs a little above the ileo-cæcal orifice, and more rarely in the duodenum, at the point of union of the pancreatic or bile-duct with the intestine. In the last situation, the obstacle sometimes appears to be hypertrophied valvulæ conniventes, the edges of two opposite folds becoming more or less adherent. Such congenital intestinal obstructions, whether, as is probable, produced by inflammations in the fœtus or from simple perverted nutrition ; whether arising from syphilitic cachexia or other cause, of course retard the evacuations, according to their locations and the degree of closure. The same degree of stenosis in the colon or rectum obviously causes more constipating effect than in the small intestine, since the excrementitious substance is firmer in the former than in the latter, and the latter have more mobility by which to overcome obstacles.

(*b*) *Intestinal Displacements.*—These produce obstructions of a very painful and dangerous kind. Intussusception and external hernia are too well known to require description. Both are apt to produce complete obstruction if not soon relieved, but there are cases of intussusception in

children in which the displaced intestine remains pervious, and the evacuations occur with more or less regularity ; and the same is true of one form of hernia, namely, the congenital, which, although painful, seldom produces serious obstruction.

Painful and dangerous occlusion and consequent arrest of alvine evacuations occasionally results from the imprisonment of a loop of intestine in an opening, usually congenital, in the mesentery or diaphragm, or from the knotting of one portion of intestine with another, as described by Leichtenstern, or again from the twisting of the intestine. Thus, in the *Centralb. f. d. med. Wissensch.*, for April 24, 1879, Epstein and Soyka relate the case of a new-born infant that died in the second week after birth with symptoms of obstruction. At the autopsy, a portion of the small intestine with its mesentery was found twisted upon its axis, from right to left, without any marked evidence of inflammation.

(*c*) Substances which have been swallowed, or substances whose nuclei have been swallowed, and which consist of a deposit of carbonate and phosphate of lime, or substances which have been produced entirely in the system, and which, lodged in narrow parts of the intestine, cause obstruction. Such substances, some of which occur most frequently in children, and others in elderly people, produce acute constipation. Indigestible matter contained in the food, as seeds or the parenchymatous portions of fruits, occasionally collect in considerable quantity and obstruct the intestine. A large gall-stone, having escaped from the common bile-duct, sometimes lodges in the intestine, either at the ileo-cæcal valve or, more rarely, at some other point, and retards the passage of fæcal matter. But this seldom occurs in children.

In one instance, and in only one, have I known obstinate constipation to be produced by worms. The patient was a girl of about four years, in whom constipation came on suddenly, and was accompanied by distension of abdomen and great suffering. This continued nearly one week, when a mass of intertwined round worms was expelled, with immediate relief. The records of medicine also contain cases in which neoplasms, growing from the coats of the intestines internally, have attained such a size as to retard the evacuations.

(*d*) Abscesses and tumors, especially when occurring in the pelvis, also sometimes cause constipation by pressing upon the intestine, and obstructing or narrowing the passage through it. Thus, in 1868, Mr. Thomas Smith related to the London Pathological Society the case of an infant, aged fourteen months, in whom both alvine and urinary evacuations were retarded by a cancerous tumor growing between the rectum and bladder, and ending fatally in three months after the occurrence of the first symptoms.

(*e*) Peritonitis, during its continuance, is known to constipate the bowels. It is supposed that inflammatory œdema occurs around the

muscular fibres of the middle coat, by which their contractility is impaired. Hence the lax state, the meteorism, and inaction of the intestines in this disease. When the peritonitis abates, the normal action is restored, and the evacuations occur regularly, if the free surface of the peritoneum have undergone no unfavorable change. But unfortunately peritonitis often produces more lasting injury, so as to interfere seriously with the intestinal movements, and produce an habitually torpid state of the bowels. This occurs from adventitious bands of inflammatory origin, which lie across the intestines, compressing them at the points of contact, and restraining their movements, and from adhesion of the intestinal loops.

The most marked cases which I have observed of this were children who had had tubercular peritonitis. The following was an interesting example :

Charles, aged 4 years, was returned to the New York Foundling Asylum on April 16, 1877, to be treated for tumor albus of the left knee, and for general ill-health. His parentage and early history were unknown. The nurse in the city, to whom he had been intrusted when quite small, stated that he had no sickness when with her, except sore eyes, and that about April 1, 1877, the enlargement of the knee was first observed. The head of the boy was large, and the abdomen much distended, but without any decided tenderness on pressure ; its entire lower part had a purplish color. Percussion over it gave a dull sound, except upon and near the epigastrium, where there was some resonance ; umbilicus prominent ; circumference of body over abdomen, 23 inches ; pulse 128 ; axillary temperature 99°. It was stated that he had no stool without medicine, and that, usually, one tablespoonful of castor oil was required to produce it. The urine contained no albumen, and was apparently normal. As the appearance indicated struma, a mixture of cod-liver oil, syrup of the lacto-phosphate of lime, and iron was prescribed, to be given three times daily, and directions were given to rub cod-liver oil over the abdomen also three times each day, for five minutes each time. Some nodules were felt, on pressure upon the abdomen, which we suspected were enlarged mesenteric glands. From the day on which the friction and kneading of the abdomen was commenced, the stools began to occur, in the average, about twice daily. The kneading proved the safest, as well as most efficient, method of producing defecation.

On May 4th, the circumference of the trunk over the most prominent part of the abdomen was reduced to twenty-two inches. The records on May 11th state : "Same treatment is continued ; has tolerable appetite, but is pallid, and his flesh flabby and soft." On May 22d, the circumference of the trunk gave 22¾ inches. The tumor albus remained about the same.

I saw the patient again during attendance in the asylum, in August and November. The record in November states that he is feeble and failing ; is becoming weaker and thinner ; breath and exhalations from the surface offensive ; he is kept quiet on account of the knee. From this time he gradually failed, and died April 11, 1878. There was no cough to attract attention ; and instead of constipation, a diarrhœa of some weeks' continuance preceded death.

Autopsy.—Lungs healthy, except a little exudation over the summit of right lung ; bronchial glands cheesy ; numerous tubercles, some of them cheesy, upon the parietal and visceral surface of the peritoneum. Loops of the intestines were united to each other by old adhesions, and the small intestines were generally bound down by bands into a " uniform conglomeration ;" mesenteric glands enlarged and cheesy ; a large ulcer upon the surface of the rectum, and numerous small, round ulcers upon the surface of small and large intestines, apparently occupying the site of the solitary follicles.

Occasionally, a false band, the result of peritonitis, lies across the intestines, without restraining their movements, and producing no marked symptoms, and probably no symptoms at all, until a loop happens to pass underneath it, when, if not soon released, it is apt to become strangulated, with complete obstruction to the passage of fæcal matter. This displacement might properly be classified with the internal hernias described above. In my own person, at the age of twelve years, such an accident occurred about two months after the peritonitis. Upon the abatement of the inflammation, a sensation of traction had been noticed in the umbilical region, almost daily, during exercise, and the displacement was indicated by the extreme pain which characterizes such cases, and which ceased suddenly, when the parts were released after about eighteen hours.

(*f*) While it is important that the diet and glandular secretions should be such that the feculent matter may have proper consistence, for easy propulsion along the intestinal tube, the important agent by which alvine evacuations are effected is obviously muscular contraction. The muscular fibres of the intestines produce the vermicular and peristaltic movements, by which the excrement is carried forward, and the abdominal muscles, by their powerful contraction, are the chief agents of expulsion. Now any pathological state which impairs the innervation of these muscles, or renders it abnormal, destroying the proper balance between " exciting and inhibiting impulses," is apt to cause constipation. Hence meningitis, myelitis, and certain other diseases of the cerebro-spinal axis, rachitis, general weakness, etc., are commonly attended by a sluggish state of the intestines, either from tonic contraction of the muscular fibres of the middle coat, as in meningitis, or paralysis.

Idiopathic Constipation. Causes. —These are quite numerous. The more prominent of them are the following. First, too little liquid in the excrement, so that it is too firm for ready evacuation. There may be too little liquid taken in the ingesta, or too scanty secretion of the liquids which mix with the food, as those of the pancreas, liver, and mucous follicles, or there may be too great an absorption of liquid through the coats of the intestines and too active an excretion of water from the skin, kidneys, or lung. The firmer the fæcal matter, the greater the tendency to constipation. Those who lose a large amount of water, as in diabetes,

night sweats, or from occupations which expose to heat, or from residence in a hot climate, are especially liable to constipation, except as the loss of liquid is compensated by an increased amount of drink.

The character of the food, apart from the amount of liquid which it contains, obviously has a marked influence upon the consistence and frequency of the stools. Occasionally, the intestines act sluggishly from insufficiency of food. Thus, the infant sometimes hangs an unusually long time on the breast, and the mother or wet-nurse believes it to be a hearty nurser, when there is really deficiency of milk, and the stools are scanty and infrequent from lack of material. Again, constipation is not uncommon in infants who nurse heartily, and seem to obtain a sufficient quantity of milk, and the cause of it is not in the state of the digestive organs, but in the milk. We find that now and then breast-milk has a constipating effect, although we discover nothing to cause this result in the mother's diet or health. The comparison of ordinary milk with colostrum may furnish a clue to the explanation. Colostrum is known to be more laxative than ordinary milk, and it differs from it chemically in containing more butter, sugar, and salts. Hence the theory seems plausible that, when breast-milk is constipating, these elements occur in less than the normal quantity. And we shall see hereafter that treatment suggested by this theory obviates the constipation.

The use of a diet which consists chiefly of assimilable substances, as animal food, and from which, after the digestive process, little coarse and stimulating residuum remains, is obviously apt to produce a sluggish state of the bowels. On the other hand, coarse food, as fruits with their seeds, coarsely ground meal, etc., which stimulate the peristaltic action and the secretions, increase the number and frequency of the alvine discharges.

Habit also exerts a decided influence upon defecation. One who, for whatever reason, neglects or resists the desire for a stool, soon becomes less conscious of the daily recurring need, and establishes a constipated habit. Constipation is more apt to occur in those who lead a quiet life than in those who are active. A constipated habit is established in many school children, by neglecting or repressing the desire for a stool, during the school hours.

But there are cases in which there seems to be a constitutional tendency to constipation—a tendency quite independent of the usual conditions. Thus I have met children who were bright and active, free from obstruction or disease which might retard the evacuations, apparently far from having sluggish muscular contractility, and so far as I could see with proper diet, and yet with defecation, except as it was produced by measures employed, occurring no oftener than each second, third, or fourth day.

But it must be borne in mind that what is constipation in one child may

not be in another, for occasionally one does well with only one evacuation every second or third day, while a large majority require daily defecation, in order to the maintenance of perfect health.

In the adult, the sacculi or pouches which occur in the walls of the colon, produced by contraction of the longitudinal bands, acting at right angles to the direction of the circular fibres, and consisting of the internal and external tunics, without the muscular, become the receptacles for fæcal matter in those who are constipated, and obviously tend to increase the constipation. In children these sacculi are much less developed relatively, and in young infants, whose intestines lack the longitudinal bands, are absent, so that this anatomical condition by which the passage of fæcal matter is delayed, is unimportant as a cause of constipation in the young.

Gautier of Geneva, Switzerland, states that an anal fissure is a common cause of constipation in children. Pain in defecation when such a fissure is present might induce children to resist the desire, and postpone the act, and thereby establish a constipated habit, but if such fissures are common in this country, except in syphilitic infants, they have escaped our notice.

Constipation has a tendency to perpetuate itself, since retained feculent matter becomes more consistent and firmer, and the contractile power of the muscular tunic becomes weakened by long distension. Obviously, also, an abnormal length of the large intestine, so that it doubles on itself, whether congenital or the result of constipation, and a malposition, which diminishes the space occupied by the colon, and therefore increases its flexures, have a tendency to produce constipation.

Symptoms.—When there is a mechanical cause, which retards the passage of fæcal matter, the acuteness of symptoms and the suffering are generally proportionate to the degree of obstruction. Symptomatic constipation occurring in an obstructive disease, whether adhesions, peritoneal bands, intussusception, knots or twisting of the intestine, incarceration in a false passage, or from biliary or intestinal stones, or fæcal masses, is attended by severe symptoms, such as intense colicky pain, vomiting, loss of appetite, and rapid prostration. The ingesta accumulate above the point of obstruction, producing distension of the intestine with fæcal matter and gas, while below the point of obstruction the intestine is soon empty. The symptoms indeed have the severity, and the state involves the danger, present in ordinary strangulated hernia ; while, from being internal and therefore less accessible for treatment, the danger is even greater. If the intestinal tract be narrowed, whether by a false ligament, the result of an old peritonitis, or other cause, and there be still perviousness, so that excrementitious matter passes by the obstruction, though slowly, and with more or less difficulty, the patient may be comparatively comfortable, if the food be such that no hard masses remain ; but according to the degree of stenosis, and the amount and coarseness of the fæcal

matter, symptoms occur referable to the obstruction. If the excrement be propelled with difficulty through the narrowed part, the muscular coat above the obstruction gradually becomes more developed, from hypertrophy of the muscular fibres, just as the heart enlarges from obstructive disease of its valves, while below the obstruction the intestine atrophies, and its calibre diminishes from disuse. Colicky pains, accumulation of fæcal matter above the obstruction, distension of abdomen, eructation of gas, vomiting, impaired appetite, and consequent decline of the general health are common results. There is constant danger in these cases that the narrow passage may become obstructed by fæcal matter, if it happen to contain hard masses, or coarse indigestible substances. The gravest form of constipation is obviously that due to mechanical agencies which act as obstacles, but as the obstacles are numerous, differently located, and of different character, so there is great difference in the gravity of the cases.

Idiopathic constipation generally comes on gradually. It at first attracts little attention and is neglected. The symptoms, of course, vary greatly according to the degree and stage of constipation. In mild cases, the retention is only in the rectum, or rectum and sigmoid flexure, and there are no marked symptoms except a sensation of fulness or distension of these parts, which one or two evacuations relieve. Between these mild cases and the graver forms of constipation, there is every intermediate grade, attended by symptoms proportionately severe. It is surprising sometimes to observe how long patients live with extreme constipation, though with constant suffering and ill-health, and, which I wish especially to be noticed in this connection, a large proportion of the fatal cases of idiopathic constipation occurring in adults, and recorded in the literature of the profession, began early in life, even in infancy, at which time they probably might have been relieved by proper remedial measures, and a life of suffering prevented. This important practical fact shows the need of greater attention on the part of parents and nurses to the state of the bowels in children, that their sluggish action may be corrected before it becomes habitual, and those anatomical changes of distension and muscular paralysis occur, which are with difficulty corrected. Thus among the older authenticated cases is one related by Dr. Copland, in his Medical Dictionary, from Renauldin.

A medical officer in the French service was always costive from birth, he ate largely, but seldom passed a stool oftener than once in one or two months, and his abdomen assumed a large size. At the age of forty-two, his constipation was usually prolonged to three or four months. In 1806, after medicines had been taken to procure a stool, which had not been passed for upward of four months, abundant evacuations continued for nine days, and contained the stones of raisins taken a twelvemonth before ; but the constipation returned. In 1809 the enlarged abdomen became painful, vomiting supervened, and he died at the age of fifty-four, having seldom, through life, passed more than four, five, or six

stools in the year. On opening the abdomen, a fibrous partition obstructed the rectum, about an inch from the anus.

A case quite as remarkable, and of recent date, occurred in the practice of Dr. Strong, of Westfield, N. Y., and was reported by him in the *Amer. Journ. of Med. Sci.*, in 1874 and 1876.

This patient, at the age of two years, usually had one stool in two weeks, and several years later only one in six weeks. When an adult he was treated by Dr. Strong, who found great distension of the abdomen, so that the lower ribs were pressed outward in nearly a horizontal direction, and the thoracic organs upward so that the apex beat of the heart was about one inch above the nipple. At this time, months elapsed between the stools, the longest interval being eight months and sixteen days. Defecation when it did occur lasted from two to four days, and was attended by violent gastric and intestinal pain, vomiting, and prostration. At one of these prolonged stools, forty pounds of fæces, resembling, as it usually did, chewed brown paper, were evacuated, the quantity being accurately ascertained by weighing the patient before and afterward. He had appetite and was able to do certain kinds of farm work during the year preceding his death, which occurred at the age of twenty-eight years. At the autopsy the colon was found to have a length of six feet and three inches, and a circumference of thirteen inches, while the lungs were pressed upward and backward, as when compressed by a pleuritic exudation.

While such extreme cases are infrequent, all physicians of experience are consulted from time to time by adults who have had habitual constipation from their earliest recollection, and these cases, that aggregate so large a number, might, there is little reason to doubt, have been prevented for the most part during childhood, when the habit was being formed.

In long-continued constipation, in which there is a large fæcal accumulation, not only is the diameter of the colon increased, as stated above, but this part of the intestine becomes elongated. This may lead to change in its position, the curves of the sigmoid flexure extending farther to the right, and the central part of the transverse colon by its weight curving downward. This abnormal lengthening and the consequent curvatures have a tendency to increase the constipation, as has been stated above in our remarks relating to the etiology.

In these cases of extreme constipation, which, fortunately, are rare in children, as they are also in adults, the distension of the colon at the ileocæcal orifice has a tendency to widen this orifice, so that the valve which, in the ordinary state, prevents the return of any substance which has once passed by it, is apt to become insufficient. The adjacent folds which constitute the valve become separated, so that, if vomiting and antiperistaltic movements occur, fæcal matter may pass from the colon toward the stomach. In aggravated cases, in which there is retention of a large

amount of fæcal matter, distension, muscular paralysis, etc., similar to those which we have seen produced in the colon, are apt to occur, though to a less extent, in the small intestines, especially in the ileum.

Retained excrementitious matter accumulating in large masses evidently becomes an irritant, so that, by its pressure, it excites muscular contractions, which, if ineffectual in propelling the mass, cause colicky pains. The retained fæcal matter also undergoes more or less decomposition, producing gases which, by increasing the distension, also increase the pain.

Any irritating substance applied to a mucous surface is apt to excite increased secretion from the mucous follicles or from the glands whose orifices connect with the mucous membrane at the point of irritation. Many familiar examples will at once be recalled to mind, as the defluxion from the nostrils from the use of snuffs, and increased mucous secretion and salivation from objects held in the mouth. In the same way, retained excrement, forming hard masses which press upon the intestinal surface, excite a secretion, and not infrequently produce thereby a diarrhœa which is conservative, and which may for the time unload the bowels, or it may remove a part of the scybalæ, while the rest remain. Hence we sometimes hear patients speak of having irregular evacuations, constipation alternating with diarrhœa. In aggravated cases, the pressure of impacted fæces sometimes produces inflammation of the surface, when, in addition to abdominal pain, there are tenderness on pressure and some, usually quite moderate, febrile movement. In cases which have terminated fatally, after a longer or shorter time, destruction of the mucous surface has been found in places, in consequence of the pressure and inflammation. Thus, in the history of the French officer related above, it is stated that the inner surface of the distended intestine "presented gangrenous and ulcerated patches." We can readily believe that, as in cases of typhoid ulcerations, if the ulcers reach a certain depth, they may also give rise to localized peritonitis, and that occasionally perforation may result at the ulcerated or gangrenous point. The expulsion of hardened masses which have collected in the rectum is slow and painful, and accompanied by more or less tenesmus, which not infrequently causes a portion of the mucous membrane at the anal orifice to descend below the sphincter ani and protrude, by which hæmorrhoids are produced. Occasionally, as I have observed in certain cases, the entire circumference of the rectal mucous membrane, to the distance of half an inch or more above the anus, becomes so loosened from its attachment to the connective tissue that it descends below the sphincter ani, and protrudes during each defecation. But this displacement, known as prolapsus recti, more commonly results, in children, from protracted intestinal catarrh, attended by diarrhœa, loss of flesh, and by diminished tonicity of the tissues.

A beautiful and conservative provision in the system is that by which vicarious functions are established to relieve organs which imperfectly

perform their part. While the intestinal surface is to a great degree eliminative, so that noxious and effete products are largely expelled from the system in the stools, it possesses also, in high degree, an absorbent function, as all who employ rectal alimentation are aware. Now, if the intestine fail to perform its function of defecation, and feculent matter collect within it, and begin to exert pressure upon the intestinal surface, more or less of the liquid portion is taken up by the vessels, and, entering the general circulation, finds a mode of escape through other emunctories. The general ill-health or languor, the furred tongue, headache, and foul breath which characterize these cases are, no doubt, due to the absorption into the blood, or retention in it of noxious products contained in, and which in part constitute, the feculent matter. The fact that patients may live for years with tolerable appetite, and with only one dejection every second or third week, receives explanation in the fact that other organs, as the lungs, kidneys, skin, etc., act as depurants for such excrementitious matter as can be taken up in a liquid or gaseous form by the intestinal surface.

In infants, constipation, even when slight and temporary, often causes fretfulness, which is indicated by the character of their cries and the movement of the thighs over the abdomen. Continuing for a time, it causes more or less fever, and, in those young children who are liable to eclampsia, it predisposes to an attack, and it may be the chief cause.

Treatment.—If there be reason to suspect the presence of a mechanical obstacle which prevents normal defecation, a careful examination should be made, in order to discover, if possible, its nature and location. Often it is of such a nature that it cannot be removed, but its constipating effects may sometimes be in a measure obviated. In the case related above, in which constipation continued from early childhood to adult life, and finally proved fatal, its cause was ascertained to be a septum in the rectum, which probably might have been relieved by surgical measures. In all cases of constipation, which the history shows may be produced by mechanical causes, whether the obstruction be complete and the colicky pains and other symptoms severe, or there be occasional scanty evacuations, with but slight or moderate suffering, the history of the patient should be obtained, in order to ascertain if there had been at any previous time symptoms of peritonitis or other pathological state which might throw light on the etiology. The abdomen and the usual sites of hernia should be carefully explored by palpation, and the rectum by the finger, large-size catheter, or rectal tube. A thorough examination thus instituted, painless to the patient, will usually enable the practitioner to determine either the exact or probable obstacle, if any be present.

The proper treatment of symptomatic constipation obviously requires the removal, so far as possible, of the primary disease, or the cause, whether it be obstructive or otherwise, and we need not stop to consider

the special measures which are required, and will pass to the consideration of the treatment of idiopathic constipation.

Hygienic Measures.—We have already alluded to the fact that habit has a powerful control over the action of the intestines, so that it is important to obtain a daily alvine evacuation at a certain hour, and, by establishing the habit, the need will usually be experienced when that hour arrives each day. Many cases which become troublesome and obstinate might, no doubt, have been prevented, had this physiological law been heeded, and a daily evacuation obtained at a certain hour. The constipated habit, mild and not yet fully established, is more apt to be overlooked when it occurs in childhood than in infancy, for the infant is closely and constantly under observation, and it soon presents symptoms, as fever and fretfulness, if it do not have the regular evacuation, while children over the age of four to five years tolerate better a sluggish state of the bowels, and are likely to be constipated for a considerable time before it is ascertained. They therefore require more attention, in this regard, than is usually bestowed by parents.

The nature of the diet is obviously important, as certain kinds of food are more laxative than others. Chicken-tea, and, to a certain extent, beef and mutton tea, are laxative, and, made plainly, are, therefore, useful in connection with other articles. The various kinds of berries and fruits have also a decidedly stimulating effect on the intestinal surface, and aid in removing constipation. The apple scraped or baked, or apple-sauce, may be given to quite young children ; and for those that are older, currants, cherries, and, among dried fruits, prunes and figs are laxative. Unfermented cider, in its season, which has been found so useful for adults, may also be given to children in moderate quantity, at least to those who have reached the age of two or three years.

By the digestive process, starch, which is unassimilable, is changed into glucose, which can be absorbed and assimilated, and, from the small size of the salivary glands in the first months of infancy, it is believed that the salivary and pancreatic fluids are insufficient to convert starch into glucose except in very inadequate quantity. It appears, however, highly probable that there is an epithelial ferment, which converts starch into sugar (see Chemical Phenomena of Digestion, by Charles Richet, *Rev. des Sci. Méd.*, Oct., 1878), so that young infants can digest starchy food. Nevertheless, the theory that the infantile digestion, up to a certain age, is inadequate to effect the change, led to the preparation of food for infants, in which the change of starch into glucose was accomplished by a chemical process. Now glucose, given in considerable quantity, is laxative, and I have found it necessary to give the glucose preparation sparingly, and with other food in the hot months, when infants are so prone to diarrhœa. But this laxative effect renders the glucose preparations of the shops very useful in the treatment of habitual constipation of infants, whether we

employ the "maltose" or "granulated sugar of malt," or the preparations of Liebig's food. Of four constipated infants in the New York Infant Asylum, to whom Horlick's "sugar of malt" was given, three were relieved. Any of the glucose preparations can be given quite freely to a constipated infant, without impairing the digestive function, or producing other ill-effect, so long as no more than the normal evacuations are produced; and I consider them among the best and safest of the foods for the relief of constipation in infants, but glucose or grape sugar is only feebly laxative, probably not more than cane sugar.

Oatmeal is more laxative than most other kinds of amylaceous food. Made into a gruel and strained, it may be given to the nursing infant, and unstrained to those who are older. Bread or pudding from coarsely-ground or unbolted flour or meal, and vegetables which contain saline and fibrous substances, have a stimulating and laxative effect on the surface of the intestines, and, therefore, are useful for constipated children of the age of two or three years and upward.

There can be no doubt that the free use of water in the ingesta materially aids in relieving costiveness. In one of the numbers of the London *Lancet*, a physician asks the profession how to cure obstinate constipation in adults. Among the replies, one physician suggests drinking a tumblerful of cold water on retiring to bed, and another tumblerful in the morning, and there can, I think, be little doubt that the laxative effect of the broths, gruels, fruits, and mineral waters is partly due to the amount of water which they contain. One of the chief causes of constipation we have seen is too great firmness or consistence of the stools, due to absorption of the water, and if a larger quantity of water be swallowed during or after the meals than is removed by absorption, so that the stools have their normal or less than normal consistence, this cause of constipation is removed. An excess of water introduced into the system is to a great extent eliminated by the kidneys, and, in hot weather, by the skin, and, to a certain extent, exhaled from the lungs; but experience shows that, if the amount of liquid received be so great that the vessels in the coats of the intestines continue in a state of repletion, only a certain part of it is absorbed, while the rest descends and mixes with the excrementitious matter.

The simple expedient of allowing a liberal use of water, so useful in adult cases, doubtless also has a laxative effect in children, and its judicious use is proper for them. Another important aid in overcoming habitual constipation is frequent kneading of the abdomen. My attention was first particularly directed to this in the treatment of the case related above, in which obstinate constipation, occurring in a child of three years from peritoneal bands and adhesions, was to a great extent corrected by friction over the abdomen for three or four minutes at a time with cod-liver oil, three or four times daily. The manipulation probably

did the good, and not the oil, but the use of one of the oils for inunction renders the kneading less painful, and insures its more thorough performance by the nurse. All obstetricians in certain emergencies stimulate the uterine muscular fibres to contraction by kneading the abdomen, and it is probable that the muscular fibres of the intestines are stimulated in a similar manner, so that the intestinal movements are increased by which feculent matter is carried forward.

The external application of cold, so effectual in contracting the uterine muscular fibres, also stimulates the contractile power of the muscular fibres of the intestines. Cold-water bathing, the sudden application of a cloth wrung out of cold water to the abdomen, and in certain obstinate cases even the douche, may be used to stimulate the muscular coat of the intestines and the abdominal muscles, to greater activity. Trousseau says: "Before leaving the subject of the treatment of constipation, let me refer to the application of cold to the abdomen—a minor method, which I have seen recommended, and have myself prescribed with astonishing success. On rising in the morning, let there be placed on the abdomen a compress of several folds soaked in cold water, and let it be separated from the clothes by a sheet of gutta-percha or caoutchouc. This compress ought to remain on for three or four hours." This recommendation by Trousseau is for adults, who are much less susceptible to the influence of cold than children. So prolonged an application of cold and wet to a child, even the most robust, would involve danger, while its application during the brief period occupied in an ordinary bath, with proper exercise afterward, or with other measures to prevent chilling, could have no ill-effect.

Therapeutic Measures.—For temporary constipation and many cases that are habitual, enemata should be employed, since they promptly unload that part of the intestines in which feculent matter is ordinarily retained, while they do not impair the appetite or produce the prostration which so often results from purgatives. For temporary constipation, a warm clyster may be given, and it commonly is more agreeable to the patient than one of lower temperature than the body. Among the enemata which have been found useful are castile soap, with molasses and water, salt and water, the various oils, as sweet oil, with or without castor oil, linseed oil, alone or with molasses, and the gruels, as that of oat-meal or corn-meal made thin. The belief that the frequent use of warm clysters produces a relaxing effect is probably correct, so that, if it be necessary to employ clysters often, in consequence of the torpid state of the intestines, cool water, the effect of which is tonic and stimulating, should be used.

For infants, a clyster of one or two ounces usually suffices, administered by a gutta-percha or glass syringe, while for older patients a proportionately larger quantity is required, administered by preference through

a Davidson india-rubber or a fountain syringe. In certain long-continued, aggravated cases, the frequent injection of a large quantity of tepid water is indispensable, in order to wash away the accumulation of fæcal matter. Thus, in 1854, Mr. Gay exhibited to the London Pathological Society a boy of seven years, who at the age of three years had had typhus fever with dysenteric stools. After convalescence, he had habitual obstinate constipation, so that, when Mr. Gay began treatment, there had been no fæcal evacuation for nearly four months, and the girth of the body over the abdomen was forty-nine inches, and yet the appetite and general health were not seriously impaired. The shape of the abdomen and the examination showed great distension of the rectal ampulla and the descending colon. Mr. Gay first distended the sphincter ani, so that it admitted a speculum, and through a rectal tube, well introduced into the colon, the excrement was repeatedly washed away, so that at the time of the exhibition of the boy to the Society, the measurement in girth gave only twenty-four inches. Evidently in cases like the above, no other treatment except repeatedly washing out the intestines with warm water would have answered, and the dilatation of the sphincter ani and the introduction of the speculum to facilitate the escape of fæcal matter are noteworthy.

Suppositories may sometimes be usefully employed in place of enemata ; cocoanut butter, molasses candy, or soap cut in shape of a pencil may be used for this purpose. In the adult, long-continued constipation is not very rare, in which the rectal ampulla becomes so impacted that it is necessary to use the anal curette, the handle of a spoon, or the finger introduced, in order to break up the masses, and allow them to pass. In children, necessity for such treatment is much more rare, but there are occasionally cases like that above described by Mr. Gay, in which it may be needed. Dr. Nagel states that the evil may be removed by the introduction of a suppository of brown gelatine. This is steeped in water for twelve hours, and having been thus softened, is introduced into the rectum, and an evacuation obtained. The doctor attributes the laxative effect to the hygrometric action of the gelatine.

The known effect of the galvanic current in producing contraction of the uterine muscular fibres suggests its employment to relieve constipation, by stimulating the muscles of the abdomen and the muscular coats of the intestines, and those who have employed it speak favorably of its use. Habershon says : " A galvanic current, transmitted through the abdominal walls, induces a very speedy action, or rather emptying of the colon. . . . A case of partial paraplegia, in which injections did not act satisfactorily, and drastic purgatives were undesirable, was treated by a galvanic current passed through the abdomen every morning. In a few hours a free evacuation was produced without any discomfort." But the constipation of children very seldom requires the use of galvanism.

The ordinary purgatives should not be given habitually to relieve a constipated habit. They are apt to irritate the intestines, causing a catarrh, or else the intestines become accustomed to their action, and a large dose is needed to effect purgation. Given habitually, they cannot fail, also, to disturb the digestive and nutritive processes. One or two doses for present relief, both in habitual or temporary constipation, is sometimes required, provided that an injection is for any reason not preferred. For this purpose, castor oil or a few grains of calomel mixed with syrup of rhubarb, the syrup of senna, or the compound liquorice-powder of the German Pharmacopœia may be administered with advantage. But for habitual constipation I strongly advise to discard the ordinary purgative medicines, and if the measures of a dietetic or hygienic character, recommended above, are not sufficient, to employ such remedial agents as promote, or at least do not impair, nutrition.

Belladonna, so highly recommended by Trousseau and others, I have often administered to children, especially in pertussis, in large doses during several consecutive days, but it has not seemed to me to have any decided purgative effect. Though it may be useful in certain mixtures for adults, our experiences in this country, with reliable preparations, certainly have not been such as to justify its employment as the sole or main remedy for constipation. It diminishes reflex irritability, and may render the action of purgatives less painful, but from its known physiological effects we cannot believe that it increases the intestinal secretions or the action of the muscular fibres, one or the other of which results we expect from the use of an agent which is really laxative. Why the effects of belladonna, in this country, differ so widely from those observed abroad, needs explanation. On the other hand, nux vomica and its active principle, strychnia, are doubtless valuable adjuncts to purgative mixtures, from their effect in increasing the action of muscular fibres.

Physicians are not infrequently at a loss what to prescribe for the habitual constipation of nursing infants, which is by no means infrequent. But recollecting that the colostrum is more laxative than ordinary milk, and that it differs from it in containing more sugar, salts (largely phosphates), and butter, we have a hint, as stated above, as to what is probably lacking in the milk, and what, therefore, should be supplied. I am in the habit of giving the oil, sugar, and salts in the following formula, and usually with the desired laxative effect:

℞. Ol. morrhuæ, 2 parts,
Aq. calcis,
Syr. calcis lactophos, āā 1 part.

One quarter, one third, or one half teaspoonful may be given with each nursing, or a larger quantity, as a teaspoonful or more, three times daily. Breast-milk with this addition becomes more nearly like colostrum in its

laxative properties, while it does not possess those properties of colostrum which disturb the digestive process. I know no agent of a medicinal nature which meets the indication so well as this for infantile constipation. But in my practice I have found it necessary, in not a few instances, to rely mainly on simple enemata for the relief of the constipated habit, till the infants reached the age when a mixed diet was proper.

The habitual constipation of older children may ordinarily be relieved by the remedies recommended above, but occasionally a more active purgative effect may be needed. Since the portion of intestine which is chiefly implicated in ordinary forms of constipation is the colon, it is evident that, if it be necessary to employ frequently any of the active purgatives of the pharmacopœia, such should be selected as produce little or no irritation of the long tract of the small intestines, while they stimulate the function of the colon. The aloetic preparations are preferable for this purpose, as the tincture of aloes and myrrh, or the simple tincture of aloes, which may be given in dose of part of a teaspoonful in a convenient syrup, as the elixir adjuvans of Caswell & Hazard, or in coffee or milk.

CHAPTER XI.

INTESTINAL WORMS.

The belief has been prevalent in the profession in former times, and *is* now among the people, that worms in the intestines constitute a frequent disease, especially in children. As pathology and the means of diagnosticating diseases are better understood, this idea has been gradually abandoned by physicians and the intelligent portion of community. Still these parasites must be considered an occasional cause of serious derangements, and, in rare instances, a cause even of death. They indeed often exist in small number, without producing any appreciable deviation in the individual from the healthy state ; but the most common and best known species, when they have once effected a lodgment in the intestines of man, ordinarily grow and multiply so as to produce symptoms, and require medicines for their expulsion.

So far as is now ascertained by observations in different countries, about fifty animal parasites make their abode in man. It is not improbable that the number will yet be found greater by observations in distant uncivilized countries. Of these fifty, twenty-one reside in the alimentary canal (Heller), several of them being microscopic. Of those occupying the intestines only, the following species are specially interesting to the practising physician, on account of their relation—for the most part caus-

ative—to certain pathological states, to wit : the ascaris lumbricoides, or round-worm ; the oxyuris vermicularis, or thread-worm ; the bothriocephalus latus, and three species of tænia, or the tape-worms, and the trichocephalus dispar, or whip-worm.

Ascaris Lumbricoides.—The round-worm has a dingy reddish or yellowish-red color and a cylindrical form, tapering toward both extremities from the point of its greatest diameter, which is a little posterior to the middle. The dead worm is paler than the living. The anterior extremity is tipped with three lips, between which and the body is a circular groove. Between these three lips anteriorly is the aperture of the mouth, from which the œsophagus extends to the distance of one fourth to one third of an inch. The intestine, which has a light brownish color, extends from the œsophagus to near the posterior extremity of the animal, where it terminates in the anus. The females are in numerical excess of the males, and their size is also greater. The shape of the worm is like that of the common earth-worm, from which it derives the name lumbricus, but it is somewhat more pointed and its color paler red. The tail of the male worm is curved like a hook, while that of the female is straight.

The total number of eggs contained in a fully developed female has been estimated at sixty millions. The eggs when immature are conical, and are attached to a longitudinal band ; when mature they are oval, with dark granular contents and a strong double shell, and their diameter is about $\frac{1}{300}$ of an inch. They are expelled in countless numbers with the fæces, and at the time of expulsion are surrounded by an albuminous coating stained with bile. Their vitality is retained under apparently very unfavorable circumstances, even for years. They hatch even after they have been repeatedly frozen or desiccated.

The ascaris lumbricoides inhabits the small intestines, where it is rapidly developed from the embryonic state. The remark made by Heller, that when found in the colon it is always dead, cannot be true, for many live worms are expelled in the stools.

The round-worm, more than all other intestinal worms, is inclined to wander away from its usual abiding-place, namely, from the jejunum and ileum, producing symptoms of more or less gravity, referable to the part over which it crawls. It occasionally enters the stomach, from which it is vomited, or it ascends the œsophagus into the fauces, from which it is soon removed by the efforts of the individual. Cases are on record, one of which Andral witnessed, in which the worm entered the larynx, producing suffocation and speedy death. Mr. Tonnellé also witnessed such a case. A child, nine years old, was suddenly seized with great difficulty of respiration and pain in the upper part of the chest. A careful examination of the thorax gave a negative result. Death occurred in from twelve to fifteen hours, and at the post-mortem examination a lumbricus was found filling the cavity of the larynx. M. Blandin, also, witnessed a

case, when interne of the Hôpital des Enfants. An infant was suffocated by one of these worms, which had penetrated as far as the right bronchus. Very rarely they crawl from the fauces into the nasal passages. This worm is so strong and active that there is no recess or reflexion of the mucous membrane of the digestive apparatus which it could possibly penetrate, in which it has not been found. It has been discovered in the appendix vermiformis, in the pancreatic duct, in the common bile-duct, and even in the gall-bladder. The number of these worms found in the intestines is very various. There may be only one, or the number may be almost incredibly large.

Thus, Barrier relates the case of an infant thirty months old, who died in Hôpital Necker. It was believed to be tubercular. Numerous tumors, which could be felt in the abdomen, were supposed to be tubercular masses. On making the post-mortem examination, the mesenteric glands were found healthy, but the intestines throughout their entire extent were filled with lumbrici. The masses which, during life, were supposed to be tubercular glands, were found to consist of worms. The cæcum, especially, was greatly distended by them. The intertwining or collection in balls of these worms constitutes, indeed, one of the chief dangers, as it renders them so much the more difficult of expulsion.

The round-worm possesses no organs of penetration, still, if the intestine be weakened by disease, especially by ulceration, it may, by pressure with its head, force an opening, through which it escapes into the cavity of the abdomen, causing peritonitis and death. This worm is commonly found, whether single or in masses, surrounded by mucus, which serves as a partial protection to the intestines.

The portion of the mucous membrane in contact with lumbrici is often found inflamed, either from movements of the worm, or from pressure of a mass of worms, or even of a single worm in a confined position, as the appendix vermiformis. This inflammation, continuing and increasing, may end in ulceration, and thus a weakened spot be produced, which may be ruptured by simple pressure of the mouth of the worm. In this way are to be explained those apparent cases of perforation, which have led some observers to believe that lumbrici had actually the power of penetrating the healthy coats of the intestines. The perforation is obviously most apt to occur in those who have been enfeebled, and whose tissues have been rendered less firm and resisting by antecedent disease, as by typhoid fever.

M. Guersant describes a case in which the appendix vermiformis contained an ulcerated opening, through which two round-worms had partly passed into the abdominal cavity, producing fatal perityphlitis. The effect of their impaction in this narrow cul-de-sac was much like that of a bean or seed lodged in the same situation.

The ascaris lumbricoides has occasionally been found in the most

remarkable locations, namely, in abscesses lying without the intestines. They have been known to effect a lodgment in the liver, and produce an abscess there, no doubt by crawling up and distending a bile-duct. Their lodgment in other viscera, which have no pervious connections with the intestinal tract, is probably accomplished through fistulous openings produced by inflammation which they had no part in causing, as, for example, in the bladder and kidneys, of which there are well-authenticated cases. Worm cysts in the abdominal walls have been found to occur in most instances in the usual site of hernias, namely, at the umbilicus in children, and in the inguinal region in adults. It is presumed, therefore, that the worms had entered hernial protrusions, from which they had passed by ulceration into the abdominal walls, and had there become encapsulated.

The *oxyuris vermicularis*, or thread-worm, so called from its resemblance to pieces of ordinary white sewing thread, is also frequent in childhood, and is not infrequent in the adult. The length of the male oxyuris is from one sixth to one fifth of an inch ; that of the female from one third to one half of an inch. The posterior extremity of the male is blunt, and is curved, or rolled up, toward the abdomen ; that of the female is slender and pointed like an awl.

The head of this worm is relatively broad, from an unusual thickness or fulness of the cuticle, and the mouth, surrounded by "three nodular lips," is situated in the centre of the extremity. The œsophagus extends backward from the mouth, gradually growing larger, like the segment of a long and narrow cone, and ending in a globular enlargement, which has been designated the pharynx. From the pharynx the intestine runs in nearly a straight line through the worm.

The eggs are numerous, so completely filling the interior of the female as to conceal the organs from view. They are flattened on one side, but are rounded or convex on other parts of their circumference. One end is more pointed than the other, as in the eggs of birds. Certain of the eggs in the mature female are seen to be undergoing segmentation, preparatory to hatching, while others more advanced contain tadpole-shaped embryos, and others still contain worm-shaped embryos, either lying within the shells or protruding from them. The hatching and growth of this worm, which have been observed under the microscope, are very rapid under favorable circumstances. "I once," says Heller, "saw the metamorphosis from the tadpole-shaped embryo to the worm-shaped embryo completed in about one hour," but the usual time is longer. Leuckart saw oxyurides, one fourth of an inch in length, fourteen days after the eggs had been swallowed.

Oxyurides may be developed so rapidly from eggs swallowed in the ingesta, that they attain nearly or quite their full growth while still in the small intestines, so that, although their chosen residence is in the large

intestines, some of them are not infrequently found in the ileum, and even in the jejunum, of full size and active. The part of the intestinal tract which the oxyurides prefer, and in which the largest colony of them reside, is the cæcum and appendix vermiformis, and not the rectum, as stated in most of the books, and in this situation, where they have been little disturbed, their habits and the relative proportion of the sexes can be best observed. But they are ordinarily found both in the cæcum and rectum in the same individual, and, indeed, upon all parts of the intervening surface of the colon.

The number of oxyurides in the individual varies greatly. They are occasionally so numerous upon the intestinal surface that they resemble fur, and when they are so abundant they are commonly found above the ileo-cæcal valve as well as below it. The males are smaller and apparently more fragile and perishable than the female. Therefore in the rectum and other exposed situations, there is a numerical excess of the females; but in reflexions of the intestines, where they are securely lodged, as in the appendix vermiformis, no marked difference has been observed in the relative number of the two sexes. Since the males are more delicate, transparent, and smaller than the females, they are more apt to be overlooked in a hasty post-mortem examination.

The term *tape-worm* is applied to several species of the tænia, and to at least two species of the bothriocephalus, but all except four, namely, the tænia solium, tænia saginata or medio-canellata, tænia elliptica or cucumerina, and the bothriocephalus latus, are rare in Europe and North America, and are therefore of little interest to the practising physician.

The tape-worm is an hermaphrodite, each segment containing the two sexual organs. The head, or scolex, is small, about the size of a pin's head, and segment after segment is produced by a budding process from the head. The segments are attached to each other at their extremities, and each segment as it becomes further and further removed from the head, by the formation of new intervening segments at the upper end of the chain, becomes also larger and more matured. The oldest segments having attained their full growth, are detached, and have an independent existence. A separation of the chain of segments at any point does not compromise the life of the parasite. If only the head remain uninjured the segmentation continues from it, and in time the former number of segments and former length of the chain are restored. This worm resides in the small intestines, the larger species sometimes extending from the upper part of the jejunum to near the ileo-cæcal valve.

The *tænia solium* is developed from an embryo, known as the cysticercus cellulosæ, contained in the muscles of the hog. It has also been found in some other animals, as the dog, deer, and polar bear. It is a vesicle, about the size of a pea or small bean, having a delicate cell wall, and is nearly spherical, except as its shape is changed by compression be-

tween the muscular fibres. At one point of the cell wall is a depression, attached to the inner surface of which, and lying within the cyst, is a whitish, pear-shaped, solid body, which is the head of the cysticercus, and is identical in appearance and character with the head of the tænia solium turned inside out. Many experiments have shown the close relationship of the cysticercus and tænia solium, that they are two forms of existence of the same parasite. Segments of the tænia solium have been repeatedly fed to pigs, and the cysticercus produced in their muscles, though in what way the ovum or embryo passes from the stomach to the muscles is not known. On the other hand, swine flesh containing cysticerci has been fed to criminals who were soon to be executed, and after their death the tænia was found in their intestines. It is evident that this parasite occurs only in those who eat swine flesh, as sausages, either raw or but slightly cooked.

The head of this species of tænia, which is about the size of a small pin's head, has at the top a conical protuberance, upon which is a corona of hooklets, arranged in two circles, the hooklets of the outer circle being smaller than those of the inner. The projecting points, however, of the two rows fall together, forming one circle. The hooklets are inserted into depressions in the head, and many of them have fallen out in most specimens which we have an opportunity of examining. The depressions in which the hooklets are lodged are often dark from pigmentation. Back of the circle of hooks are four sucking disks, which the worm is able to protrude and move freely. When protruded they appear as small tubercles with slender pedicles. The neck, which is slender and about one inch in length, shows no markings from commencing segmentation, and it is succeeded by very small and delicate segments, which gradually increase in size as the distance from the head increases.

The mature segments (proglottides) vary in size accordingly as they are in a state of contraction or relaxation. When relaxed, their length is about half an inch and breadth one quarter of an inch. The genital organs are situated on the margin of each segment, a little posterior to the middle, and there is an alternation in their location between the right and left margins in the chain of segments. The uterus lies in the centre of the segment, forming a longitudinal straight line. From seven to twelve branches are given off from each side of the uterus, and these divide and subdivide like the branches of a tree. The male genital organs lie in the same aperture or pore in the margin of the segment, with which the uterus and ovaries connect.

The eggs of the tænia solium are globular, with a diameter of about $\frac{1}{150}$th of an inch, and with thick shells, which are striated like Mosaic work by lines which cross each other. It is estimated that not less than 50,000,000 eggs are contained in all the segments of a matured tænia.

This parasite is very liable to abnormal development. In some instances

two or more segments are fused together, and often they are stunted in their growth, or they contain holes, fissures, and flaws, either from their original development, or produced by rupture of the distended uterus. Again, rarely two tænia are blended, so that along the flat side of one chain another is united by the margin, so that a section of the double parasite resembles the Roman letter T or Y. The nutrition of the segments is maintained through a vessel running the whole length of the worm, near each margin, and having communicating branches.

The *tænia saginata*, designated also *medio-canellata*, is much larger, stronger, and thicker, both as regards the head and segments, than the tænia solium. When fully matured it measures eighteen feet. The diameter of the head is nearly one line ($\frac{8}{100}$ inch). It is furnished with four strong sucking disks, but it lacks the circlet of hooks which characterizes the tænia solium. Instead of the hooks the head is furnished with a small frontal sucking disk. The heads of some specimens of this worm are free from pigment, but other specimens present various shades of pigmentation—from a slight staining to a jet black color. The neck is short, and very near the head are markings which indicate commencing segmentation. The matured segments vary in measurement when relaxed —from a length of eight lines and breadth of two lines, to a length of nine lines and breadth of three lines. As in the tænia solium the genital pores are situated on the margins of the segments, varying irregularly from side to side, and the uterus has lateral branches, which divide dichotomously. There is but little difference in the sexual apparatus of the tænia solium and tænia saginata, but the eggs of the latter are somewhat larger than those of the former, and are oval.

The development of the tænia saginata is sometimes irregular, producing monstrosities, as in the tænia solium. The embryos of this parasite occur chiefly in the muscles of ruminating animals, as the ox, sheep, goat, etc., and therefore its presence in man is attributable to the use of the flesh of these animals, either slightly cooked or raw. The cysticercus of this species appears to be less tenacious of life than that of the tænia solium, and when it perishes it becomes changed into a greenish-yellow pulp, surrounded by the capsule, and imbedded in the muscular or other tissue where it had lodged.

It is easy to distinguish this worm from the tænia solium if the head be found, by its larger size, the larger size of its sucking disks, and the absence of the circle of hooks. The segments are distinguished by their greater size, and the greater number, and the dichotomous division of the branches of the uterus. This species occurs over a much greater area of the earth's surface than the tænia solium.

The *tænia elliptica* or *cucumerina* is a more delicate worm than the preceding species, measuring, when fully grown, from seven to ten or eleven inches in length. Upon its head is a rostellum or beak, which

the worm is able to thrust forward, and on which are about sixty hooks, irregularly arranged. The anterior portion of the parasite is very delicate, like a thread, and its segments are small, but as in the other species they become larger, as their distance from the head increases. The matured segments which have a reddish-white color are readily detached, and when separated they move about actively. This tænia is also an hermaphrodite, and a genital pore containing a double set of genital organs is located on each margin of the segment. The tænia elliptica inhabits the small intestines of the dog and cat, and many children in different localities have been affected with it.

Heller states that the segments of another and rare species of tænia, which were expelled from a child of nineteen months, are preserved in the Museum of Pathological Anatomy in Boston. Nearly in the middle of the posterior half of each segment, is a yellow spot, namely, the receptaculum, full of ova, and, therefore, the name flavo-punctata has been applied to this worm. Little is known in regard to the tænia nana and tænia Madagascariensis, since they occur in distant countries.

The *bothriocephalus latus* is the largest of the tape-worms, attaining the length of 15 to 24 feet. It is one of the most important of the intestinal parasites. The head has an almond-shape, or the shape of an elongated and somewhat flattened globe, its length being about one line, and its diameter from one third to one half a line. Running longitudinally along each flattened side of the head is a groove or fissure, containing the apparatus of suction. Those segments which are still in the process of growth, have a breadth three or four times greater than their length, while the matured segments are nearly square. The genital pore occurs in the centre of one side of the segment, and in the chain of segments all the pores are found on the same side. A brownish, rosette-shaped spot is observed at the site of each ripe pore produced by the convolutions of the uterus, and the numerous eggs which this organ contains.

The egg, which is oval, has a thin shell, a light-brown color, and at one end of it is a lid or operculum, which is separated from the rest of the egg by a well-defined line. At the hatching an embryo, provided with six hooks, escapes from the lid. When it has separated from the egg it is provided with an albuminous covering, from which cilia radiate in all directions, by the movement of which it is propelled. After a few days this covering is lost, and the embryo now moves about by amœboid extension and contraction. It is believed that in this embryonic state it enters an aquatic animal, a mollusk or fish, where it undergoes further development, and from which it is received into the stomach in the food. The bothriocephalus occurs not only in man, but also in some of the domestic animals which eat fish, as the dog. This parasite is believed to be rare outside of Europe, and in Europe it is chiefly met in countries bordering on inland lakes and seas.

The *trichocephalus dispar* is comparatively unimportant to the physician, since it is uncertain whether it materially impairs the health or produces symptoms. It inhabits the cæcum, but in rare instances it has been found in the ileum and appendix vermiformis. The number of these parasites is usually small, but as many as seventy to one hundred have been observed in the intestine of the adult.

The trichocephalus dispar occurs also in the monkey, and a very similar, if not identical, worm has been found in the pig. It is not frequent in children, and it has not been observed in very young children. It occurs in man in every part of the globe, and in some countries, as Egypt, Nubia, and Syria, it is said to be very common. This worm, which is also sometimes designated the whip-worm from its shape, attains the length of one and a half to two inches, the female being longer than the male. Its anterior two thirds are thin, delicate, and flexible, like a small thread. The posterior one third, which contains the generative organs and intestinal canal, is considerably thicker, and it ends abruptly. On the under surface, extending nearly the whole length of the body, is a longitudinal band, the width of which is about one third the circumference of the body. In the female, the posterior or thick portion of the worm is slightly bent or curved like the stock of a hunting-whip, while that of the male is rolled in the spiral form. The digestive tube consists of an œsophagus, which extends through the anterior thread-like part, and the stomach and rectum which lie in the posterior thick division. The genitals of the female lie in the commencement of the thick portion, and the uterus, when distended with eggs, occupies nearly the whole of this section. In the male, the pore, which contains the genitals, lies in the posterior extremity of the thick part, where it forms a cloaca with the termination of the intestinal canal. The eggs, which are numerous, are oval, brownish, and with a glistening protuberance at each extremity, giving them the shape of a lemon. They have great vitality, hatching after repeated desiccation and freezing. Their development from the egg is slow. It is believed that the trichocephalus is produced directly from the egg, which has lodged in the intestine, and, therefore, does not have or require an intermediate stage of preparation in another animal. This parasite resides in the cæcum, but when many are present, some are found in the ascending colon, and occasionally a few are observed in the small intestine.

The tænia is rare in early life, but it now and then occurs in young children. I have met cases in this city under the age of five years. Rosen and Bremser report cases between the ages of six and eleven years, and Hufeland one at the age of six months. Wawruch collected 206 observations of tænia, in 22 of which the age was less than fifteen years ; the youngest was a girl of three years. A most remarkable case of tænia is reported in the *Gazette Médicale* of Paris in 1837. M. Muller was called to treat

a foster child five days old for slight constipation. The bowels were evacuated by the use of rhubarb, manna, and a few grains of salt, and in the excrement a foot and a half of tænia were discovered. This worm had evidently existed during the fœtal life of the infant.

A similar case was treated by Prof. Skene, in the Long Island Hospital, in September, 1871, and reported by Dr. Armor, in the *New York Medical Journal*. The infant was born September 3d, of a hearty Irish servant girl. On the 7th it refused to nurse, and was observed to have a mild form of tetanus. On the 8th small doses of calomel having been given, followed by castor oil, two segments of a tænia solium were passed from the bowels, and on subsequent days ten more segments, after which the tetanus ceased. The remedies employed after September 8th were the oil of male fern and turpentine. The mother, who had presented no symptoms of tænia, was ordered an emulsion of pumpkin seeds, which "she faithfully took for twenty-four hours, at the end of which she passed over seventy segments of tænia." This case is interesting as throwing light on a possible mode of the production of tænia, quite different from the ordinary and recognized mode, and also as showing the causative relation of intestinal worms to tetanus infantum.

Causes.—It is obvious that intestinal worms are developed from eggs or embryo, which are introduced into the stomach in the ingesta. The eggs of the ascaris lumbricoides have been found by Mosler in drinking water (*Virchow's Arch.*, 1860), but it is probable that in most instances they are contained in fruits and vegetables which are eaten raw. The eggs of the oxyuris vermicularis are received from some one who is himself affected with the disease. Roth Zender and Heller state that they have frequently discovered ripe eggs of this worm around the nails of persons who were troubled with oxyurides, a fact readily explained from the itching which they cause. If these eggs are upon the fingers of the mother or nurse, it is easy to understand how they are acquired by the child. We can understand also why this worm is so common in degraded and filthy families. In reference to the etiology of the tape-worm nothing need be added to what has been stated above, and little is known in reference to the manner in which the eggs of the trichocephalus are received.

Certain conditions of the intestinal surface favor the occurrence of worms. Thus children in advanced typhoid fever are not unfrequently affected with the ascaris lumbricoides.

Symptoms of the Ascaris Lumbricoides.—These are in part constitutional and in part local, due to the mechanical effect of the entozoa on the coats of the intestines. Writers, especially Rilliet and Barthez, have described the symptoms supposed to indicate lumbrici with minuteness. Those of a constitutional character are the following: Features at one time flushed, at another pallid, and in some children of a leaden hue; lower eyelids swollen, and sometimes surrounded by a blue semicircle;

thirst, nausea, or even vomiting ; appetite diminished or augmented, or variable ; breath foul ; papillæ of the tongue red and projecting ; pulse accelerated and irregular. Rilliet and Barthez state that they observed this irregularity of the heart's action in a boy three years old, at the time he was passing a large number of lumbrici. The irregularity afterward disappeared. Acceleration of the pulse and increase in temperature are common symptoms of these worms, and hence the popular belief in a worm fever. This fever is often remittent and mild, but occasionally it is continuous and of a high grade.

The symptoms pertaining to the nervous system are important. In mild cases these may be absent, as when there are few lumbrici, and the child is robust, and over the age of five years, but in severe cases certain neuropathic symptoms are frequently present, such as dilatation of the pupils, especially inequality of dilatation, to which Munro attached diagnostic value, strabismus, twitching of the muscles, clonic convulsions, somnolence, headache, neuralgic pains, delirium. Rarely chorea, deafness, and paralysis, it is believed, may result. (M. Bouchut, *Gaz. des Hôpitaux*, 1867.) In the *Amer. Journ. of Med. Sci.* for July, 1869, Dr. Leedom, of Montgomery County, Pa., relates the case of a boy of seven years, who had night-blindness due to a large number of lumbrici in the intestines. By the employment of pinkroot and calomel these were expelled, and the blindness ceased. Hyperæsthesia of the abdominal surface was present in a case which I attended, and which subsided as soon as the lumbrici were expelled. Grinding the teeth in sleep, and picking the nostrils, are symptoms to which families attach great value. Observations, however, show that, though sometimes due to worms, they more frequently have another cause.

The local symptoms or disorders, in other words, those having a mechanical origin, are colicky pains, experienced chiefly in the umbilical region ; stools sometimes natural ; in other cases diarrhœa with fæcal or muco-sanguineous stools ; flatulence. M. Davaine, at a recent period, made the important discovery that the fæces of patients affected with worms contain the ova of the particular species present, in large numbers. These ova, which have been described above, can be seen through a lens magnifying 150 diameters.

In exceptional cases there are local symptoms, due to the presence of these worms in unusual situations, such as a crawling sensation in the œsophagus ; a sense of constriction in this tube or the pharynx ; nausea and vomiting ; a cough, especially if the worm have crawled to the upper part of the œsophagus ; rarely the most urgent dyspnœa, and probable suffocation, if a lumbricus have entered the larynx. Earache, and perhaps convulsions if the worm have entered the Eustachian tube (Case Davaine, p. 144). The most dangerous symptoms arise from the crawling of the worm into narrow openings.

The enteritis and colitis, to which these worms sometimes give rise, is ordinarily mild, but in rare instances ulceration occurs, which may be attended by profuse and even fatal hæmorrhage. Occasionally very painful and dangerous constipation results from an accumulation of worms, in a ball or mass too large to be expelled, unless with much delay and suffering, preventing the passage of fæcal matter, and producing severe abdominal pains. The symptoms in these cases resemble closely those of intussusception. A marked example of constipation produced in this way occurred in a family with whom I am acquainted, and who then resided in the interior of this State. A little girl of three or four years was suddenly affected with obstinate constipation. The physicians prescribed active purgatives, calomel among others, and finally croton oil, and various injections, without relief. There was great pain with distension of the abdomen, and death seemed inevitable, when, after the lapse of several days, a free evacuation occurred, and in the stool was a mass of worms firmly intertwined.

Children often have lumbrici without any appreciable impairment of the general health, but their presence may intensify the symptoms of intercurrent diseases, and greatly increase the danger. Thus I recollect two children of three and three and a half years, with pneumonitis, who, at the same time, had lumbrici, one passing in the course of a few days thirty and the other twelve of these entozoa. Both presented well-marked physical signs of pneumonitis, and, though they recovered, the febrile movement and nervous symptoms were apparently aggravated by the intestinal affection. One had convulsions in the commencement of the inflammation, followed by profound stupor and amaurosis, lasting two or three days.

Often the symptoms due to lumbrici coexist with those of a protracted and distinct intestinal disease. Thus, as we have seen, the intestinal secretions of typhoid fever and of chronic diarrhœal maladies afford a nidus for the growth of worms, and accordingly, at an advanced stage of these diseases, lumbrici are common.

The symptoms produced by the *oxyuris vermicularis* are somewhat different. These worms do not usually cause the fever, disturbed digestion, the colicky pains, or the dangerous nervous symptoms which arise from the presence of lumbrici. Nor do they, like lumbrici, endanger life by crawling into unusual situations. In one recent case, I could detect no other cause of chorea than the presence of oxyurides, and eclampsia has been attributed to them, but such a result is exceptional, if, indeed, the cause be rightly assigned.

Although the cæcum is the chosen abode of this worm, and here more than elsewhere it exists in its normal state, it is not certain that it produces any appreciable symptoms in this part of the intestinal tract.

The symptoms which render this the most annoying of all the intes-

tinal parasites are produced by those oxyurides, chiefly the females, which descend into the rectum, where by their active movements they produce intense itching. A small number of worms cause little inconvenience, but when many are present in the folds of the rectum their crawling produces such intense pruritus that the patient can with difficulty remain quiet. Usually this symptom is most marked in the early evening, when the child is warm in bed. It sometimes causes onanism in the girl as well as boy. This symptom may be nearly or quite absent during the day, but it returns so regularly at night as to resemble and be mistaken for a periodical nervous affection. So eminent a physician as Cruveilhier confesses that he has made this mistake of diagnosis. In the female child the oxyuris occasionally passes from the rectum to the vulva, producing leucorrhœa.

In many instances tape-worms exist in children as well as adults, who thrive and present no symptoms, but in other instances there is more or less disturbance of the digestive function, with an uncomfortable sensation in the abdomen. This sensation is more noticed after fasting, or after the use of certain kinds of food, and it is diminished by a full meal. Great hunger and a feeling of faintness are also common according to authorities, but I have not particularly remarked this in children. Irregular action of the bowels, vomiting, and various nervous symptoms, as itching of the nostrils and anus, headache, tinnitus aurium, cardialgia, numbness, deafness, blindness, etc., have with more or less correctness been attributed to the tape-worm. Certainly such symptoms occasionally arise from this cause, for they cease with the expulsion of the worm (see case of Chorea, *Medico-Chir. Rev.*, January, 1868). Intermittent colicky pains in the umbilical region were the only marked symptom in a child with tænia whom I recently treated. Since the cysticercus cellulosæ is the embryonic form of the tænia solium, it is quite possible that individuals possessing the latter may be infected from its ova with the former, so that symptoms which have been attributed to the intestinal parasite, have sometimes been due to the encysted embryo. We are unacquainted with the symptoms of the trichocephalus if any occur, and this worm is very rare in children.

Diagnosis.—Bremser long since made the remark, and it has been repeated by most writers on diseases of children, that there is no sign or symptom which affords positive proof of the presence of intestinal worms, except the expulsion of one or more. Late microscopic investigations have revealed, however, a pathognomonic sign, namely the presence of ova in the fæces, which indicate not only the nature of the disease, but the species of the worm.

The symptoms and disorders produced by lumbrici may all occur from other causes. Still, if several of them be present, and a careful examination disclose no other cause, the presence of worms should be suspected,

provided that the child be over the age of two years. The microscope may then be used for diagnosis. A little tentative treatment, entirely safe to the child, will also determine whether the suspicion be correct. One or two doses of medicine, administered under such circumstances, like the surgeon's exploring needle, may reveal the nature of the disease, and indicate the means of cure.

In case of the oxyuris vermicularis, the itching directs attention to the anus as the place of the disease, and here the offending entozoa may often be discovered by the eye.

Prognosis.—Intestinal worms produce a fatal result in only a small proportion of cases. Oxyurides never prove fatal, unless in rare instances, through convulsions. The manner in which death may be produced by lumbrici has already been pointed out.

In general, when the nature of the disease is ascertained, the worms are readily expelled by treatment, and the patient restored to health. Therefore, if there be no complicating disease, the prognosis is good.

Treatment.—Much injury has been done to children by the use of anthelmintics occasionally employed by physicians, but oftener by parents before the physician is called. Medicines of this kind are usually irritants, and, in many of those diseases which simulate the verminous affection, but are distinct from it, there is already an irritated if not an inflamed state of the intestinal mucous surface.

Vermifuges administered under such circumstances obviously do harm, and in all acute diseases in which they are not required, even if their action be harmless, their employment is to be regretted, since it consumes time which is very precious. It is thus that many lives are lost by the use of anthelmintic nostrums, which are extensively advertised and which command a ready sale, inasmuch as the belief in the presence of worms as a frequent cause of disease pervades all classes.

A safe rule, followed by many physicians, and it would be much better if it were general, is not to give anthelmintics unless the child have passed one or more worms, or their ova be found in the fæces, and not then if the symptoms seem to be referable to a coexisting disease. In doubtful cases in which the symptoms resemble those of worms, a purgative dose of calomel or calomel and rhubarb may be employed. It will generally bring away one or more lumbrici or a mass of ascaris vermicularis, if either species of entozoa be present. This purgative may be safely employed if there be no previous diarrhœa or debility. If after one or two doses and a free purgation no worms be passed, anthelmintic remedies should not be given, for it is almost certain that none exist.

A large number of medicines have, or have had, a reputation as anthelmintics. Santonin, the active principle of the European wormseed, is one of the best, and is much employed in this country and in Europe. It is nearly tasteless ; it may be given in powder, spread on bread with the

butter. It is kept in shops in one or two-grain lozenges, with and without calomel. It has the advantage of easy administration, and is destructive to both the round and thread worm. M. Bouchut considers it preferable to all other remedies in the treatment of the round-worm. "To children two years of age he administers it in doses of ten centigrammes (1.54 grains), and in patients above this age the quantity is increased by five centigrammes (0.8 grain) for every additional year." He gives in addition occasional doses of calomel or castor oil. In this country santonin is usually administered in one to three-grain doses, two or three times daily, with an occasional purgative. The purgative is required to aid not only in the expulsion of the worm, but also of the ova. In overdoses santonin causes vomiting, diarrhœa, and altered vision, so that objects appear yellow, but in medicinal doses it produces no unpleasant consequences. Other medicines are preferable if there be symptoms of enteritis. For many years the anthelmintic most employed in this country was the pinkroot, the root of the *Spigelia marilandica*, an indigenous plant. It was not only prescribed by physicians, but employed by families as a domestic remedy. It is apt to cause, if the dose be large, cerebral symptoms, as vertigo, dimness of sight, spasm of the facial muscles, stupor, and even convulsions. These effects less frequently occur if the pinkroot be given with a purgative, and it has been customary to administer it in combination with senna in an infusion. A half ounce of spigelia with an equal quantity of senna is macerated for two hours in a pint of boiling water, and then strained. For a child two or three years old the dose is half an ounce to one ounce. So popular has this vermifuge been in this country, that probably a majority of the native-born adults in the States recollect the nauseating doses of pinkroot administered by anxious parents. Pharmacy now provides us with the same medicine in a more convenient and acceptable form, that of the fluid extracts :

℞. Fluid ext. spigel., f ℥ j ;
Fluid ext. sennæ, f ℥ ss. Misce.
One teaspoonful to a child from three to five years.

The officinal fluid extract of spigelia and senna may be given in the same dose. Professor Procter recommends the addition of santonin to this extract :

℞. Fluid ext. spigel. et sennæ, f ℥ j ;
Santonin, gr. viij. Misce.

This is probably the best anthelmintic that can be employed for the destruction of the round-worm in uncomplicated cases, and it is also very useful in treating the ascaris vermicularis. Chenopodium is also a good anthelmintic. It is efficient, and at the same time one of the safest in case the mucous membrane be inflamed. If there be abdominal tenderness, with stools too frequent, and thin, or mucous, and tinged with

blood, I should prefer the chenopodium to most of the other vermifuges. To a child of three years five drops of the oil may be given three times daily. It may be continued for a longer period than would be safe for most of the other vermifuges. Twice a week, during its use, a mild purgative should be given, as castor oil, rhubarb, or magnesia, unless the bowels are open. It may be given dropped on sugar, or in a mucilaginous mixture.

Dr. J. F. Meigs says : "I myself rarely give any other remedy than *wormseed oil* in slight and especially in doubtful cases, unless this has already been tried and failed. From my own experience, I believe that this remedy is all-sufficient in a large majority of the cases that occur in this city, as these are almost always of a mild character, and as it not only produces the expulsion of the parasites when they exist, but also acts beneficially upon the forms of digestive irritation which simulate so closely the symptoms produced by worms. I am persuaded, indeed, that of all the cases that have come under my notice, in which it seemed probable that worms might be present, none were expelled in nearly half, and yet the signs of disturbed health have passed away under the use of the remedy." . . . . "The following is a very good formula for the administration of this remedy :

"℞. Ol. chenopodii, gtt. lx vel f ʒ j ;
P. g. acaciæ, ʒ ij ;
Syrup. simplic., ℥ j ;
Aq. cinnamom., ℥ ij. Misce.

"Give a dessertspoonful three times a day for three days, and repeat after several days."

In cases of protracted intestinal disease attended by an increased and vitiated secretion from the mucous surface, a state which often gives rise to worms, turpentine is one of the best anthelmintics. In fact, in some of these cases there is no good substitute for it. For example, a boy of about ten years, attended by myself, October, 1864, had reached or nearly reached the fourth week of typhoid fever, when he passed from his bowels a large quantity of blood. He was previously emaciated and weak, and there had been, as is usual in such cases, considerable diarrhœa. The hæmorrhage was attended with great prostration, from which, however, he partially rallied by the use of stimulants. On the following day an equally severe hæmorrhage occurred, attended with coldness of the face and extremities and great feebleness of pulse, so that death appeared imminent. Turpentine was now administered every six hours, a few lumbrici were passed, and the case thenceforth progressed favorably. The mechanical effect of the lumbrici on the ulcerated surface of intestine had probably given rise to the hæmorrhage. Turpentine may be given in doses of from five to ten minims three times daily to a child five years

old. Sweetened milk or sugar in powder is a good vehicle for it, or it may be given in a mucilaginous mixture.

℞. Spts. terebinth. rect., ʒ ij ;
Ol. limonis, gtt. v ;
Mucil. gum acac.,
Syr. simplic., āā ʒ vj ;
Aq. anisi, ℥ i–ij. Misce.
Dose, one teaspoonful every six hours.

The following formula for the employment of this agent is recommended by Dr. Condie :

℞. Mucil. gum acac., ℥ ij ;
Sacch. alb., ʒ x ;
Spir. æther. nitr., ʒ iij ;
Spir. terebinth. rect., ʒ iij ;
Magnes. calcinat., ℈ j ;
Aquæ menthæ, ℥ j. Misce.

It is useless to enumerate the many anthelmintic mixtures which have been extolled from time to time. Those mentioned above are the least nauseous, and will rarely disappoint the practitioner. One other antidote for the round-worm should be mentioned, as it has been much used and is efficient, namely cowhage. This consists of the bristles which cover the pods of the *Mucuna pruriens*, a tropical plant. The pods are dipped in plain syrup of the ordinary consistence, and the bristles are scraped off with the syrup. When enough of the medicine is added to render the syrup of the consistence of thick honey, it is ready for use. The dose is a teaspoonful every morning for three days, after which a cathartic should be administered. I have never prescribed cowhage, although it is not unfrequently ordered by physicians, and a popular nostrum consists chiefly of it.

One affected with tape-worm is obviously cured only when the head of the parasite is expelled ; but, in the majority of cases which I have observed, the head has not been found in the evacuations, even when the treatment had effected a complete cure, as shown by the subsequent history. The chain of expelled segments commonly terminated very near the head. This I believe is the common experience if we trust the friends of the patient with the examination of the stools. The physician himself should search for the worm's head, the evacuations being preserved. The nurse should be directed to add a little carbolic or salicylic acid, and a sufficient quantity of water to nearly fill the vessel. The liquid should not be roughly stirred with a stick, as physicians are in the habit of doing, since this breaks the worm into small portions, and renders the inspection more difficult, but it should be shaken frequently so as to detach the segments and head if, it be present, from the fæcal matter. After it has stood at

least five to ten minutes, the worm, which has greater specific gravity than water, sinks to the bottom, and the upper part should be poured off. This process must be repeated till the water is nearly colorless, after which search should be made for the fragments, and the head, if present, will be found.

Since entire expulsion of the tape-worm is effected with difficulty, preparatory treatment for about forty-eight hours should be employed before the vermifuge is administered. During this time the patient should take a mild purgative once or twice, and such food, in moderate quantity, should be allowed as leaves little residuum, as beef-tea, milk, etc., with some stimulant, if the patient feel exhausted. There are three articles of food which experience has shown to be especially useful in this preparatory treatment, perhaps from a sickening effect which they produce upon the worm, namely, salt herrings, onions, and garlic. These may therefore be taken as food in the twelve or eighteen hours preceding the employment of the vermifuge, which it is ordinarily most convenient to administer in the morning.

The various tænicides recommended in the books are probably all more or less efficient, but the one which has given most satisfaction in the Out Door Department at Bellevue, where probably a larger number of these cases are treated than in any other place in this country, is the oil of male fern ; but it is found necessary to employ a larger dose than is recommended in some of the books. For a child of six years the dose employed is one to two drachms in any convenient vehicle, as the syrupus aurantii florum. This should be followed in about four hours by a dose of castor oil, which completes the treatment. Heller, a very high German authority, recommends koosso or its active principle koossin, in the use of which I have had no personal experience. The pumpkin-seed has also been employed at Bellevue and in other parts of this city, but it seems to be less efficient than the oil of the fern. If the chain of segments break near the head, and the head be not seen, it will be necessary to wait two or three months in order to determine whether the cure is complete.

Since the symptoms produced by the *oxyuris vermicularis* are referable chiefly to the rectum, and are caused by the active movements of the worm, the prompt and thorough use of enemata, which causes their expulsion, is evidently required. Enemata are more effectual if used cool than if warm ; and since this worm inhabits the cæcum as well as rectum, large enemata given through a long tube or a large catheter are more effectual, causing the expulsion of a larger number of worms than are expelled by small enemata employed in the usual manner. Various substances have been used for this purpose, as lime-water, table salt in water, turpentine in milk, decoction of aloe, decoction of garlic, etc. Heller says : " Simple water would do well for this purpose, for in a short time

it causes the worm to swell up and burst ; but that is not altogether without an injurious effect on the intestinal mucous membrane. Hence, Vix recommends a solution of castile soap, in distilled water, or rain-water, of the strength of one to two and a half grains to the ounce. This has no unpleasant action on the intestinal mucous membrane, while at the same time it quickly destroys both the worms and their eggs. . . . . Vix has tested all the medicines usually used in enemata, and has found the above solution of castile soap to be the most effectual.'' The use of the enema in the evening, although only a small quantity of liquid be used, so as to wash out the rectum, insures relief from the itching and sleeplessness during the night.

But it is undeniable that enemata alone do not effect a complete and permanent cure in a large proportion of cases, and hence those affected with this worm remain sufferers for years, having only a temporary respite, unless medicines be administered by the mouth. Those medicines which produce free watery evacuations appear to be the most effectual in dislodging and expelling oxyurides whose attachment to the intestinal surface is not strong ; therefore Heller recommends the saline purgatives '' joined with copious draughts of water.''

CHAPTER XII.

GASTRO-INTESTINAL HÆMORRHAGE.

Hæmorrhage from the capillaries is more frequent in infancy than at any other period of life, whether in consequence of the irregularity of the circulation and frequent congestions in the infant, or the greater delicacy and feebleness of the minute vessels at this age. Hæmorrhage, generally capillary, from the gastro-intestinal mucous surface, occurs sufficiently often in the child, and especially in the infant, to render it a disease of some importance. It is more frequent the younger the individual.

This hæmorrhage occurs in three distinct pathological states : first, in the new-born infant from causes not fully ascertained ; secondly, from a pathological state of the blood or the vessels in which it circulates, and which is often connected with purpura hæmorrhagica ; thirdly, from a local cause.

First Variety.—In 49 cases, which I have collected from different writers, the hæmorrhage occurred in 38 under the age of six days, in 5 from six to ten days, and in 6 from ten to twenty days. Some authors cite cases which occurred at the age of several weeks, but hæmorrhage into the intestines at so late a period cannot be due to any cause operating

at birth, and it is proper to consider such as examples of one of the other varieties.

Passive congestion of the gastro-intestinal mucous membrane is not infrequent in the new-born. Billard speaks of twenty-five cases without hæmorrhage which he has examined. This anatomical state of the mucous membrane of the intestines, whether occurring as part of a general plethora or being simply a local affection with no hyperæmia of other parts, evidently requires only a certain increase and hæmorrhage inevitably results.

The cause of the abnormal congestion of the gastro-intestinal mucous membrane, so common in the new-born, has been referred by writers to the previous health of the parents, to circumstances attending the birth, especially to too speedy a ligature of the cord, to irritant matters in the intestines, to external violence, and to the two opposite extremes, namely, a plethoric and a feeble state. In my opinion, the chief cause, in many cases, is the tardy or incomplete establishment of the respiratory and circulatory functions, which gives rise to congestion in the cavities of the heart and in the lungs, and, consequently, in the capillaries of the systemic system. Evidently, this congestion is most intense in the full-blooded. Billard says of fifteen cases of intestinal hæmorrhage which he examined, most of them were remarkable for the plethoric condition of their bodies and the general congestion of their integuments. Some, on the contrary, were pale and feeble, as is common after abundant hæmorrhage.

In two infants who died soon after birth, and whose bodies I subsequently examined, there was apparently a plethoric state, which rendered a fatal result more certain, if it did not, indeed, produce it. In *one* of these, in addition to intense general congestion, meningeal apoplexy had occurred, although the birth of the child had been easy.

It is not difficult to understand in what way too speedy a ligature of the cord may be a cause of capillary congestion and hæmorrhage. At the moment of birth, the uterus is contracted, the placenta compressed, and, if the cord be now tied, more blood remains in the vessels of the infant than if tied a little later. A little later, in consequence of the temporary cessation of uterine contractions, and the re-establishment of circulation in the infant, blood flows through the cord toward the placenta. The cord thus acts as a safety-valve to the circulation. Any accoucheur who will take pains to witness the effect on the cord of the return of circulation, will observe what I have stated. Too speedy a ligature of the cord would not, however, be sufficient in the majority of cases to produce that amount of plethora which would give rise to intestinal hæmorrhage without other co-operating causes.

Tardy or incomplete establishment of respiration and circulation, which gives rise to intestinal congestion and hæmorrhage, may be due to disease

of the heart or lungs, as atelectasis or cyanosis, to feebleness of the infant, or to slow and difficult birth. In a large proportion of cases, however, the birth is easy. Thus, three of five patients with intestinal hæmorrhage, who were treated by M. Gendrin, were born of an easy labor, and the same was true of four infants observed by M. Kiwisch.

Although gastro-intestinal hæmorrhage in the new-born apparently results in certain instances from the conditions mentioned above, which produce congestion of the gastro-intestinal mucous surface, there are other cases in which the cause must be different. Dr. Silverman, of Breslau, has recently published the statistics of 42 cases (*Jähr. für Kinderk.*, Sept., 1877), 23 of which were fatal. In 25 of these the blood escaped both from the mouth and anus, in 10 from the anus alone, and in 7 from the mouth alone. The hæmorrhage, in a majority of the cases, began in the second day after birth, but in 11 it began on the first day, and in all prior to the eighth. It is suggested that the hæmorrhage, in certain instances at least, occurs from an ulcer in the gastro-intestinal surface, which is produced by an embolus in the umbilical vein, or its branches, or by suspension or incomplete establishment of the respiratory function in consequence of accidents of birth, atelectasis, etc. Ebstein, according to Silvermann, has demonstrated experimentally that the suspension of respiration in animals produces congestion, extravasation of blood, ulceration in the stomach. From the fœtal anatomy, it is evident that an embolus occurring in the umbilical vein near the liver, and extending into the branches of the vein, would be likely to cause congestion of the intestines by obstructing the portal circulation.

Dr. Lederer states (*Zeitung für Kinderk.*, Nov., 1877) that he has treated eight new-born infants for this disease, five of which died from the severe gastric and intestinal hæmorrhage, accompanied also by umbilical hæmorrhage. The age of the youngest was six hours. That of the oldest eleven days. They were all well developed ; of normal conformation, and were nourished with breast-milk. In the three who were cured, the hæmorrhage was arrested in twenty-four hours, but there was for a long time a tendency to intestinal catarrh. Dr. Lederer admits the obscurity of the cause, but does not think that it was an embolism in all the cases.

The *second* variety of gastro-intestinal hæmorrhage often occurs as a sequel of other and debilitating diseases. I have known it to occur as a sequel of measles, smallpox, scarlet fever, and in one case of typhoid fever. One of these patients, when apparently the period of danger was passed, began to lose blood from nearly all the mucous surfaces, from the nostrils and gums, as well as intestines, and the case, which but for the hæmorrhage would doubtless have had a favorable issue, terminated fatally in less than a week.

Patients with this variety of gastro-intestinal hæmorrhage sometimes

present the maculæ of purpura, and commonly their aspect is pallid and cachectic. The following was a fatal case of hemorrhage occurring from the ileum, in a mild form of purpura hæmorrhagica :

Case.—An infant, eight months old, of healthy parentage, nursing, with no previous sickness, and fleshy, vomited a small quantity of blood on the 25th of March, 1865 ; soon after it passed a stool consisting of almost pure blood. On the following day five or six patches of purpura hæmorrhagica were observed on the arms and legs. These maculæ continued till death. There was no more hæmatemesis, but the stools, which were from two to four daily, consisted largely of blood. Death occurred from exhaustion on March 31st.

Sectio Cadaver.—Head not examined ; thoracic organs healthy, but pale ; liver fatty ; stomach, upper part of small intestines, and entire colon of normal appearance, unless presenting a somewhat lighter color than the healthy intestine from deficiency of blood ; mucous membrane in the ileum to the extent of several inches, intensely injected without thickening. The blood had obviously escaped from this portion of the intestine, and a moderate amount of this fluid was found in the tube below the point of vascularity. This case is interesting not only on account of the development of purpura hæmorrhagica, but the subsequent intestinal hæmorrhage in a nursing child, apparently of healthy parentage, and without previous sickness.

In our remarks on internal convulsions, the case is related of a scrofulous infant who, to all appearance in her ordinary health, suddenly became affected with intestinal hæmorrhage in connection with external and internal convulsions. A point of interest in this case was the relation of the hæmorrhage to the neurosis. In one of the three cases of intestinal hæmorrhage described by West, there were also convulsions. In rare instances there is an hereditary hæmorrhagic diathesis to which the hæmorrhage is attributable. In the *New York Journal of Medicine and Surgery*, July, 1840, Prof. Swett relates the history of a hæmorrhagic family. Seventeen out of eighteen children of this family had died of hæmorrhages, and the survivor had had intestinal hæmorrhage with epistaxis.

In the *third* variety, among the local causes producing hæmorrhage may be mentioned ulceration, as in typhoid fever, or in severe intestinal inflammation, the mechanical effect of solid substances, lumbrici, invagination, obstruction to the portal circulation, polypus of the rectum. Occasionally at the post-mortem examination of young infants I have found blood with mucus in the duodenum and jejunum, these portions of the intestines being at the same time intensely congested. In one case of protracted entero-colitis occurring in the summer season, I found many small circular ulcers in the colon, nearly all containing points of extravasated blood. Such are the principal local causes of hæmorrhage from the bowels. Ordinary colitis may also be considered a cause, although the amount of blood evacuated in this disease is commonly small.

Of the three forms of intestinal hæmorrhage described above, that

arising from local causes is most frequent, while that occurring from a purpuric or hæmorrhagic diathesis is least frequent. In rare cases fatal intestinal hæmorrhage may occur in the new-born, and the blood be retained in the intestine, or if passed it may so closely resemble the meconium that its true nature is not discovered. Mr. Bednar relates the following case (*Krankheiten der Neugebornen*) : "On the eleventh day after birth the boy's skin (then of a pale yellow color) diminished in warmth, the impulse of the heart became dull and prolonged, the respiratory murmur scarcely perceptible. The child lay almost motionless and slumbering. The day following the surface could scarcely be kept warm, and the little patient had to be aroused to suck. On the twentieth day after birth it died. The brain was found to be anæmic, the lungs plethoric, while blood was effused into the duodenum and stomach."

Intestinal is more frequent than gastric hæmorrhage, and the flow, except when produced by a local cause, is usually from the small intestines. The blood, unless it come from a point near the anus, as the rectum or descending colon, is commonly dark, and sometimes partially decomposed, emitting an offensive odor. Admixture of the blood with the intestinal secretions prevents coagulation of the fibrin.

Gastro-intestinal hæmorrhage in itself produces few symptoms aside from the prostration which attends all hæmorrhages. The disease with which it is associated may give rise to many and severe symptoms.

Prognosis.—The result in the first and second varieties is much more unfavorable than in the third. Many new-born infants affected with gastro-intestinal hæmorrhage die, but some recover. Billard attended fifteen fatal cases. It is probable, however, that death in the first variety is often due more to some coexisting lesion, than to the intestinal hæmorrhage. Meningeal apoplexy, and the incomplete establishment of the circulatory and respiratory functions, may both operate as direct causes of death in this variety.

In the second variety, also, a very guarded prognosis should be given ; so great a change in the circulatory system as to cause rupture of the capillaries, or transudation of blood in the ordinary course of the circulation, is a serious state. When this hæmorrhage occurs as a sequel of the eruptive fevers, or in purpura hæmorrhagica, the patient is more apt to die than recover.

In the third form of intestinal hæmorrhage, the result depends on the nature of the cause, whether it be susceptible of removal. The majority of cases in this variety recover.

Treatment.—Billard recommends, as a means of preventing capillary congestion and hæmorrhage in the new-born, to allow a little blood to escape from the umbilical cord before its ligation, if the establishment of respiration and circulation be difficult or incomplete. This relieves the hyperæmia of the internal organs and facilitates the flow of blood. After

the commencement of internal hæmorrhage and the appearance of bloody stools, the same may be done if plethora be indicated by the florid and robust appearance of the infant, and the cord be not too much shrivelled.

The treatment, both therapeutic and regimenal, of intestinal hæmorrhage should vary according to the age and state of the infant, the profuseness of the hæmorrhage, and the nature of the cause. Perfect quietude, in the recumbent position, is requisite in all severe cases. Derivation to the extremities should be procured in the young infant, by heated dry flannel or flannel wrung out of hot water ; in the older infant, by the same with the addition of mustard. The nursing infant should remain at the breast, being allowed, perhaps, in addition to the breast-milk, a little cool barley or gum-water. Spoon-fed infants should be given food of the blandest quality, in the liquid form and cool. This is the proper diet, whatever the age, in the commencement of the hæmorrhage. If there be evidence of exhaustion, cool beef-tea, or essence, and alcoholic stimulants, are necessary. It has been advised, in certain forms of intestinal hæmorrhage, to apply leeches over the abdomen or around the anus. This treatment would, in my opinion, rarely be useful, but, on the contrary, in most cases, injurious. Hæmorrhage from a mucous surface, when once established, will generally quickly relieve the local hyperæmia, and leeching, unless very cautiously employed, would promote the prostration, in which the real danger in this disease consists. On the other hand, moderate counter-irritation over the abdomen may be attended with real benefit as a derivative.

The therapeutic treatment consists mainly in the use of astringents. Of the mineral astringents, acetate of lead and nitrate of silver have been used, but the liquor ferri subsulphatis is preferable to all other astringents in hæmorrhage from the stomach and upper part of the small intestine, but it is believed to be decomposed in its passage through the intestine, so that it has less astringent or styptic effect in the lower bowel than gallic acid. It may be given to a child five years of age, in doses of five drops, in sweetened water or in mucilage.

Astringent enemata are sometimes useful. M. Rilliet treated a case which recovered with enemata, each containing twelve grains of extract of rhatany, a strong decoction of the same astringent being applied externally to the abdomen. M. Bouchut recommends " cold water externally to the abdomen, internally by the mouth, or by enemata frequently repeated. These enemata should be composed of two or three large spoonfuls only. They may be rendered more active with three grains of tannin, or with seven grains of the extract of rhatany, or seven grains of catechu, or, lastly, with one grain of nitrate of silver. In this latter case, a small glass syringe and distilled water must be used, to avoid the premature decomposition of the medicine."

In the hæmorrhage occurring in purpura, or after exhausting constitu-

tional diseases, tonics should be given in addition to astringents. In chronic inflammatory disease of the intestinal mucous membrane, attended by a vitiated secretion of the follicles, the hæmorrhage may be best treated by turpentine. I have elsewhere related two cases of recovery by the use of this agent, in one of which (typhoid fever) lumbrici were expelled. Ergot, from the contracting influence which it exerts on the arterioles, is also useful in many cases. It is especially useful in purpura hæmorrhagica.

If the hæmorrhage be due to a local cause, as lumbrici or a rectal polypus, the treatment obviously should consist in the removal of this cause.

CHAPTER XIII.

INTUSSUSCEPTION.

Intussusception, or the passage of one portion of intestine into another, has long been known as an occasional accident. Hippocrates, though debarred from the study of morbid anatomy, appears to have had a pretty clear idea of this lesion, and he suggested a mode of treatment which has been employed till the present time.

Intussusception without Symptoms.

This is not properly a disease. It consists in a displacement without any other anatomical change. There is, therefore, no obstruction, inflammation, or even congestion present, and no symptoms. This form of invagination might ordinarily be reduced by the normal peristaltic and vermicular movements of the intestine.

Invagination of a portion of the small intestine into the part immediately below it is often observed at the post-mortem examination of young infants, who had presented no symptoms due to the displacement. The invaginated mass is usually from half an inch to two inches in length, and, as a rule, this accident is multiple. There may be ten or more distinct intussusceptions, at distances of a few inches from each other. The simple displacement is believed to occur ordinarily at or a short time prior to the moment of dissolution. It has been supposed to be most frequent in those who have died of cerebral or spasmodic diseases, but its occurrence is not unusual in other pathological states. I have often found it at the post-mortem examination of infants who have had subacute or chronic entero-colitis. Hevin states that he has seen it at the Salpétrière over three hundred times. Billard has seen it especially in infants who have been subject to constipation. Any irritant, mechanical or other, which

disturbs the regular movements of the intestines, doubtless may produce it. It has been caused in the rabbit by irritating the anus.

It is not improbable that simple intussusception occasionally occurs temporarily in children whose health remains good, when the regular movements of their intestines are disturbed by irritating ingesta or other causes. This form of displacement never takes place in the large intestine. Its usual seat is the lower part of the jejunum, and upper part of the ileum. Since it possesses little interest as regards pathology, and none whatever as regards symptomatology and therapeutics, it may be ignored in our description of intussusception.

Intussusception with Symptoms.

Intussusception, or invagination, is one of the most painful and dangerous of human maladies, but fortunately is not very frequent. I have the records of fifty-two cases occurring in children, from which the facts contained in this article are chiefly derived. The patients were under the age of twelve years.

Previous Health.—In thirty-four of the fifty-two cases, the state of the health previously to the invagination was recorded. From the following table it is seen that half, or seventeen, were previously well, the remaining half suffering from some disease or derangement :

	Previous Health.	
Age.	Good.	Disease or Derangement.
One year or under,	15	8
Over one year,	2	9
	17	17

MM. Rilliet and Barthez, whose views in reference to intussusception are derived from the examination of the records of twenty-five cases, state that the previous health is ordinarily good, and the intussusception is, therefore, primary. Their remark, according to the above statistics, is seen to be correct as regards patients under the age of one year, but incorrect for those over that age.

Most of the seventeen who had previous ill-health had diarrhœa, dysentery, or constipation, or diarrhœa alternating with constipation. Of those otherwise affected, one had thread-worms, two obscure abdominal pains, one nausea and vomiting, and one, whose age was four months, had had symptoms of invagination when ten weeks old, which soon passed off. It is seen that the pre-existing affections were ordinarily such as would be likely to accelerate the movements of the intestines and at the same time render them irregular.

Causes.—The above statistics, therefore, show that intussusception is often preceded by disease or functional derangement of the intestines.

The two opposite conditions, namely, constipation and the diarrhœal maladies, so often precede the displacement that they must be regarded as common causes. Another probable cause is intestinal worms, which, by their mechanical action, stimulate the intestines. They were present in three of the fifty-two patients, though two of the three seemed well till the occurrence of the intussusception, but the other patient had complained of irritation at the anus, and ascarides had been found on examination.

The use of irritating and indigestible food is an occasional cause. Thus, some who have had intussusception have been in the habit of taking fruits, candies, and pastries freely. Such ingesta may be an immediate cause by their irritating effect, or a remote cause giving rise to diarrhœa, which, in turn, produces intussusception.

Sex is a predisposing cause, since male patients are largely in excess. Of the twenty-five cases collated by Rilliet and Barthez, all but three were boys. In our own collection, the sex of thirty-four of the patients was recorded, and of these twenty-three were boys.

In rare instances external violence is the apparent exciting cause. One patient received a severe contusion of the abdomen two years before death, and from this time continued to complain at intervals of pain in the bowels. One writer also mentions the case of a child nine years old who received a blow from a comrade at school, and from this time had alternately diarrhœa and constipation till the invagination commenced. Rilliet and Barthez also relate the case of two children who were taken suddenly with invagination when their parents were tossing them in their arms.

Age.—Of the fifty-two cases embraced in our statistics, the ages were as follows:

3 were 3 months old.	1 was 10 months old.
12 " 4 " "	1 " 11 " "
3 " 5 " "	1 " 12 " "
5 " 6 " "	2 were from 1 to 2 years old.
1 was 7 " "	8 " " 2 " 5 " "
1 " 8 " "	8 " " 5 " 12 " "
3 were 9 " "	3 not given.

Therefore, no cases occurred under the age of three months, 23 cases were between the ages of three and six months, or nearly one half of the entire number, 8 between the ages of six months and one year, and only 18 between the ages of one year and twelve. These statistics correspond, in the main, with those of Rilliet and Barthez, in whose collection of 25 cases no one was under the age of four months. Leichtenstern says: "Half of all invaginations, according to my statistics of four hundred and seventy-three cases, occur during the first ten years. The first year

after the third month is remarkable for a special frequency—one fourth of all intussusceptions." (*Ziemssen's Encyclop.*)

The great liability to intussusception in infancy is due partly to the anatomical character of the intestine in this period of life, and partly, doubtless, to the fact that there are more frequent irregularities in the intestinal movements than in older children. In the infant the walls of the intestines are thin, the mucous and muscular coats and the connective tissue being much less developed than in those that are older ; the mesentery and meso-colon have also greater depth as compared with the same in other periods of life, except the meso-colon at the points where it passes over the kidneys, in which places it is very short, or even in some cases nearly absent. Moreover, the space occupied by the large intestine, in which part of the digestive tube intussusception commonly occurs, is much shorter relatively to the length of the intestine than in those that are older. In about thirty measurements which I have made of the length of the large intestine and the space occupied by it, the latter was found, in the average, about one third that of the former, which, of course, necessitates doubling of the intestine on itself. These peculiarities of structure in the infant obviously favor the occurrence of intussusception.

Seat and Pathological Anatomy.—While intussusception occurring without symptoms is usually multiple, that form which occurs with symptoms is ordinarily single. Two exceptional cases which I observed will be presently related. In one of the cases embraced in the statistics an invagination occurred with symptoms, and coexisting with it was another in the small intestines apparently without symptoms, and quickly reduced by handling.

While intussusception without symptoms occurs in the small intestine, the seat of intussusception with symptoms is, with occasional exceptions, the colon. The colon constitutes the entire invaginated mass, or else, and more frequently, it forms the exterior, while the incarcerated portion consists wholly or in part of the ileum.

Intussusception in the Small Intestines.

Bouchut says : " M. Rilliet states, in a recent treatise, that in infancy the intestinal invagination is always accomplished at the expense of the large intestine, and that there is never invagination of the small intestine. This is incorrect. I have observed the small intestine invaginated in the adjacent inferior part. Taylor has reported a case of this kind in a child twenty months old, who died after an attack of acute peritonitis. M. Marage has seen another case in a child thirteen months old, who recovered after having voided the invaginated portion furnished with two of those diverticula so frequent in the small intestine of the fœtus."

But, from all that appears, the case reported by M. Marage may have

been, and probably was, an example of the common form of intussusception, namely, of the ileum into the colon. In Mr. Taylor's case the invagination was really of the ileum into the colon, although a small portion of the ileum next to the valve had not been inverted, so that it constituted a little of the exterior of the mass.

Nevertheless, Bouchut is correct in stating that irreducible and fatal intussusception may occur in the small intestines. Probably the displacement is at first of the simple variety, but, continuing and increasing in extent, its return becomes impossible. The positive statement of so great an authority as M. Rilliet, that intussusception with symptoms does not occur in the small intestines, justifies the publication of the following cases, which establish the fact that there are instances, though not frequent, in which the displacement does have this location :

Case I.—Male. This patient's health had been uniformly good, and nothing unusual was observed in his condition till the age of four and a half months, when he became restless, as if in almost constant pain, with occasional exacerbations. Castor oil was prescribed, which operated freely, and then the following mixture :

℞. Magnes. calcinat., ℈j ;
Tinct. opii camphorat., ʒij ;
Tinct. asafœt., ʒss ;
Aq. anisi, ℥j. Misce.

Dose, ten to twenty drops, repeated according to the pain.

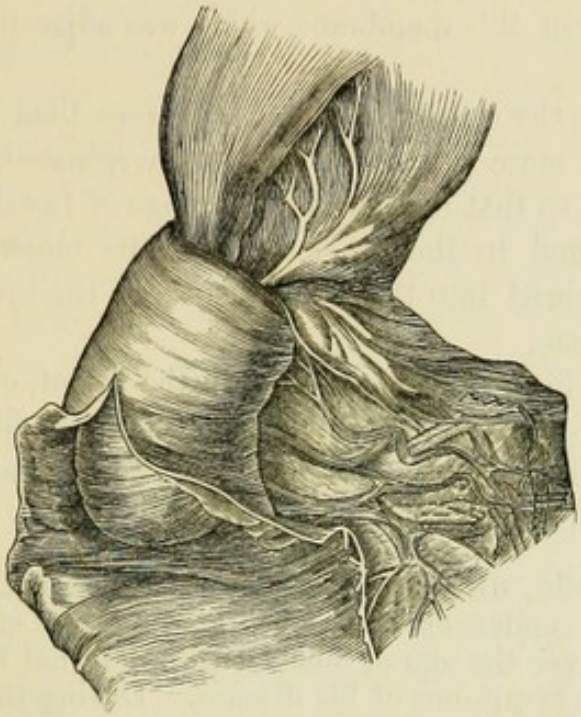
These remedies failed to give relief, as did also chloroform given in doses of two drops. After two or three days, another set of symptoms arose, those characteristic of pneumonitis, namely, hurried respiration, accelerated pulse, short suppressed cough, and expiratory moan. He was treated with the oiled silk jacket, and mild counter-irritation, and took an expectorant mixture containing carbonate of ammonium. In a few days the pulmonary disease was evidently subsiding, but the pain in the abdomen, with occasional exacerbations, continued. His countenance was pallid, and bore an expression of suffering. There was no distension or tenderness of abdomen, and no abdominal tumor. He took little nutriment, and seldom vomited. In the last part of his sickness the dejections were scanty, and the last three days his stools consisted mainly of mucus and a little blood. The pain seemed to be growing less, when he was seized with convulsions, and died the same day, precisely two weeks from the commencement of his sickness.

Sectio Cadaver.—Head not examined ; body slightly emaciated ; mucous membrane of trachea and bronchial tubes vascular ; posterior portion of the lower lobe of each lung solid, of greater specific gravity than water, and allowing only partial inflation ; it was in the second stage of pneumonitis. Stomach, duodenum, jejunum, healthy. In the upper part of the ileum was an intussusception two thirds of an inch long, presenting no trace of inflammation, either within or around it, and its vascularity, when it was examined externally, did not seem notably increased. Above the intussusception the intestine was empty ; below it, and chiefly in the small intestine, was a dark-colored substance evidently blood, and giving in a few hours the offensive odor of decaying animal

matter. There was a passage through the intussusception, at least two or three lines in diameter, as shown by a probe. The intussusception sustained the weight of sixteen inches of the intestine, and it would apparently have sustained considerably more. The remaining organs were healthy.

Case II.—F. S., a female infant, four months old, was treated at the New York Infant Asylum in June and July, 1865, for entero-colitis, the

Fig. 26.



usual epidemic of the summer season. The following records show the state of the bowels immediately before her death :

June 29th. Has five or six stools daily. 30th. Two stools in twenty-four hours. July 1st. Had two stools since the last record ; no vomiting. 3d. Four stools in last twenty-four hours. 4th. The diarrhœa continues as before ; the stools about four daily. On the 6th of July she died.

Her pulse during the time in which these records were taken generally numbered about 128 per minute. She was much emaciated, and the day before death she frequently struck her head with her hand. The medicines employed were mainly alkalies and astringents.

Sectio Cadaver.—Parietal bones united ; some serous effusion over the convolutions of the brain, under the arachnoid ; occipital bone depressed ; commencing at a point about two feet below the stomach were four intussusceptions two or three inches from each other. The invaginated masses were from one to one and a half inch in length, and three of them were found to be very vascular in their interior. Above, between, and immediately below the intussusceptions the intestine was healthy. One of the invaginations was tested by weight, and was found to sustain one and a half foot of intestine, and would have sustained more. Water poured above these intussusceptions escaped through them very slowly ; no fibrinous exudation ; descending colon vascular and thickened, and solitary glands enlarged.

The irreducible character of the intussusceptions in the above cases was shown by the fact that they sustained weights which doubtless produced greater traction than that exerted by the intestine in its normal action. That the displacement existed prior to the moment of death was shown by the symptoms in one of the cases and by the anatomical changes in both. In one the capillaries of the incarcerated mass were ruptured during the last days of life, so as to produce sanguineous stools ; while in the other there was intense congestion of the invaginated mucous membrane, while that portion of this membrane which was adjacent but not engaged was healthy.

In both patients the symptoms were less severe than in ordinary cases, and they came on more gradually, for the invaginated intestine was not completely closed, so that it allowed the passage of fæcal matter in one till the close of life, and in the other till near its close. At both of the autopsies water poured into the intestines above the invaginations passed slowly through them.

Intussusception in the small intestines in the infant, commencing as the simple form, may become irreducible, and yet remaining pervious may continue for weeks without giving rise to severe or dangerous symptoms. The following case was an example of this :

Case.—Male child, died at the age of nineteen months, the last eleven of which he was under observation. The mother states that he had never been well since the age of one month, and that there had been little variation in the symptoms of his disease. During the period in which he was under observation, he was ordinarily fretful, and frequently seemed to be in considerable pain. His stomach through this whole time was so irritable that he rarely took more than three or four spoonfuls of nutriment without vomiting. There was usually more or less diarrhœa, but no tenderness or distension of abdomen. He became slowly but gradually more emaciated, and finally died in a state of extreme emaciation and exhaustion. He had no convulsions, and was conscious to the last.

Sectio Cadaver.—Brain not examined ; lungs healthy, except a circumscribed portion which was inflamed at the summit of the right lung ; liver small and almost destitute of oily matter, as shown by the microscope. In the jejunum, about two feet below the stomach, was an intussusception two inches long, the intestine forming which seemed to have undergone no structural change. Above the intussusception the intestine was of small calibre, and entirely empty and pale ; below the intussusception the intestine was somewhat larger than above, but it seemed quite healthy. The invagination was sufficiently pervious to allow water to pass through it, and it readily sustained the weight of two feet of intestine. From eight to ten inches below this intussusception there was another, which was immediately drawn out the moment the intestine was disturbed. The other abdominal viscera were healthy.

There is uncertainty as to the duration of intussusception in the above case, but the symptoms indicated that it existed a considerable time prior

to death. There was no strangulation, nor indeed any appreciable anatomical alteration in the coats of the intestine, but the fact that the invaginated mass sustained two feet of intestine, and required considerable traction for its reduction, shows that it was not a case of simple displacement occurring at the moment of death and without symptoms, but was an example of the variety with symptoms.

Intussusception in Large Intestines.

In most cases of intussusception occurring in infancy and childhood, the ileum is invaginated in the colon, or the first part of the colon is invaginated in the part succeeding it. Intussusception not infrequently begins in the prolapse of the ileum through the ileo-cæcal valve, in the same way that prolapse of the rectum occurs through the sphincter ani. If death take place early, only a small portion of the ileum may have passed the valve. If the case be protracted, the tenesmus brings down more and more of the ileum, with its accompanying mesentery. The constriction of the valve, which acts as a ligature, soon prevents the further descent of the ileum ; and, the tenesmus continuing, the next step in the displacement is the inversion of the caput coli, which is drawn into the colon by the descending mass, and, unless the case terminate by sloughing or death, the ascending and transverse portions of the colon are successively invaginated. The records show that intussusception occurs as above stated in a large proportion of cases. In one case, among those which I have collated, the invagination began a few inches above the valve, so that the ileum constituted a small portion of the exterior of the mass. Occasionally the cæcum is the part primarily inverted and invaginated, and, descending along the colon, it draws after it the ileum, which sustains its natural relation to the ileo-cæcal valve. When this occurs the cæcum is found at the lower end of the mass, and two orifices are observed, one leading through the valve, and the other into the appendix vermiformis. These two forms of invagination—that in which the ileum, passing through the ileo-cæcal valve, successively inverts and draws after it the caput coli and the divisions of the colon ; and that in which the caput coli is primarily invaginated, and descending along the large intestines, inverts the latter, and draws after it the ileum—constitute the vast majority of cases of this disease in the first years of life.

I have notes of 45 fatal cases occurring under the age of twelve years, in which the portion of intestine first displaced is recorded. In four of these the displacement was entirely in the small intestine, involving in no way the colon ; in 38 cases it commenced either by prolapse of the ileum through the ileo-cæcal valve, or by inversion of the cæcum into the ascending colon, there being perhaps not much difference in the relative frequency of these two modes ; in one case the invagination was confined

to a segment of the transverse colon, in another to a segment of the descending colon, and in the remaining case to the lower part of the descending colon and the upper part of the rectum. In three instances the invaginated mass itself became invaginated, producing an intussusception of great thickness, and necessarily fatal.

As we have seen in regard to intussusception in the small intestines, so that occurring in the large intestine may be attended by so little constriction of the incarcerated portion that it remains pervious, though with diminished calibre. In such a case life may be protracted for weeks or even months, without reduction of the displacement or any material change in it, the passage of fæcal matter being sufficiently free for the maintenance of life. Death finally occurs in a state of exhaustion. Thus in one instance a child, four months old, lived six weeks after the symptoms of invagination commenced, and seventeen days "with a portion of the bowel protruding from the anus." It was found at the post-mortem examination that part of the ileum had descended through the entire colon, and had remained pervious. In a case related by Dr. Worthington in the *Amer. Jour. of Med. Sci.* for January, 1849, symptoms of intussusception were present for seven months before death, and during the last six weeks of life the invaginated intestine protruded frequently from the anus, and was replaced by the mother. In this case "the cæcum was inverted, and descending through the colon to the lower portion of the rectum, carried with it the ileum and the entire colon, except the last ten or twelve inches." In another case the symptoms indicated a continuance of the disease for three, if not eight, months. But such cases are exceptional. Ordinarily as the intestine becomes invaginated, its mesentery or meso-colon is also invaginated, and its veins compressed. The pathological state of the incarcerated mass soon becomes that of intense congestion. In infants, usually in a few hours, so great is the distension of the capillaries that they give way, blood escapes into the intestine, and passes from the bowels in scanty motions. On examining the invaginated intestine after death, if gangrene have not occurred, it is found of a uniformly intense red color, sometimes resembling to the naked eye a long and firm clot of blood. In those who die early no traces of inflammation are seen, but in more protracted cases the attrition between the serous surfaces excites local peritonitis. In none of the fifty-two cases which I have collated in which post-mortem examinations were made, did the inflammation extend more than a few lines beyond the invagination. Usually the intestine forming the exterior of the invaginated mass is much drawn together or puckered. In one case treated by myself, the entire large intestine which formed the exterior of the mass was compressed within a space of six inches or less, since about twelve inches of the ileum, doubled on itself, lay within the entire colon and protruded from the anus, the only part of the large intestine which was inverted

being the caput coli. In one case six or seven inches of the ileum, which formed a portion of the exterior of the mass, were compressed within the space of one inch.

The abdomen, at first of natural fulness and soft, usually becomes more and more distended till the close of life ; but in cases of much vomiting the distension is moderate. This fulness is due to gas and fæcal accumulation above the invagination. The portion of intestine below the displacement is ordinarily empty, except that in the infant it commonly contains mucus, mixed with more or less blood, which has escaped from the capillaries of the strangulated mass.

There are few anatomical changes in this disease, which do not arise directly from the intussusception, and are, therefore, located either within the mass or in its immediate vicinity. In those who recover by the process of sloughing, the cicatricial contraction may give rise to symptoms and lesions of greater or less gravity. Thus the late Sir James Y. Simpson examined a child aged 9 years, who recovered with loss of ten inches of intestine, and at the meeting of the Medical Society, before which the specimen was presented, remarked that there was unusual distension of the cutaneous veins of the patient, due probably to such compressions of the ascending vena cava by the cicatrix, that the venous circulation was obstructed. (*Trans. Medico-Chir. Soc.*, Edin.) In the *London Lancet* for 1854, Mr. Charles King relates the case of a child aged 6 years, who, on the eleventh day of the disease, voided the cæcum and a part of the colon. Two days subsequently pulsation ceased in the left leg, and all that part below the patella became gangrenous. The patient gradually recovered with loss of the leg. The cause of this unfortunate sequela was doubtless compression from the cicatricial contraction of the artery which supplied the leg, and probably the formation of a thrombus. In the *Lond. Med. and Phys. Jour.* for December 18, 1823, Dr. F. Bush relates a case in which he was enabled to observe the extent and appearance of the cicatrix. The patient, aged twelve years, discharged from the bowels fifteen to eighteen inches of the ileum on the eighth day of the intussusception, after which convalescence was rapid. Fourteen weeks later the child died from typhus fever, and at the autopsy " traces of the diseased bowels were visible by a contraction and puckering where the slough had taken place, and the parts united." But fortunately in most instances when the intestine sloughs and the child survives, no serious or permanent injury results from the cicatrization. The cicatrix stretches little by little, and accommodates itself to the surrounding parts.

Symptoms.—The symptoms vary according to the age of the patient and the degree of strangulation. Pain in the abdomen, usually paroxysmal, is among the first, and is one of the most conspicuous symptoms. It is often severe, resembling the pain of hernia, and abating only with the failing strength of the child. After the first few days, if inflammation

arise, the pain is continuous, though more severe in paroxysm. At first pressure upon the abdomen is tolerated, but afterward there is tenderness. This is due to the inflammation, which occurs in and around the invaginated mass, and it is, therefore, confined to the part of the abdomen in which the tumor lies. At this point also the abdomen is more full than elsewhere, and not infrequently the physician can feel the invaginated mass and detect its exact location, and approximately its extent. Sometimes, at an early period as well as late, cerebral symptoms occur, as in a case related by Dr. Coggswell in the London *Lancet* for July, 1853, which terminated in convulsions and death on the second day. Convulsions are, however, comparatively rare, and the mind is generally clear till the last moment. In infants the countenance, in the intervals of pain, in the first stages of the complaint, is often placid and not indicative of any serious disease, but in older patients constant and severe local symptoms, referable to the intussusception, commence early. At an advanced period, whatever the age, the countenance becomes anxious and haggard, the eyes hollow or sunken, the body loses its plumpness, and, if the case be protracted, becomes emaciated.

Vomiting is rarely absent ; in thirty-nine out of forty-seven cases it is stated to have been present, in seven cases there is no record of this symptom, while it is recorded absent in only one case ; but in this case, the records of which are very meagre, death occurred on the second day. The vomiting becomes stercoraceous in a few days, and it ordinarily continues with greater or less frequency till the period of collapse. It relieves partially the distension.

The appetite is impaired and often entirely lost. Infants at the breast commonly nurse, however, for several days, probably from thirst rather than hunger.

In most patients one natural evacuation occurs from the bowels after the intussusception commences, and then obstinate constipation succeeds. This evacuation consists of the excrementitious matter below the invagination. In children under the age of one year, scanty motions of blood mixed with mucus begin to occur in a few hours. In twenty-seven children under this age I find that twenty-four had such evacuations, occurring in most of them several times in the course of the day ; in two of the twenty-seven there is no record of this symptom, but in the remaining case it is stated to have been absent. Scanty evacuations of blood unmixed with fæcal matter have been considered pathognomonic of intussusception in the infant, and we see the ground for such belief, but in exceptional instances the invaginated mass is partly pervious, and although the dejections may contain blood, they are also excrementitious. In our collection of cases are three examples of this in infants under the age of one year. One has already been referred to. In this case there was the rare anomaly of so large an opening through the ileo-cæcal valve, as to allow

not only prolapse and descent of the ileum through the entire colon, so as to protrude six inches from the anus, but also fæcal passages through it daily.

In children above the age of one year, the capillaries of the invaginated intestine are not so frequently ruptured as under this age, and sanguineous evacuations are therefore less common. I have records of nineteen cases between the ages of one year and twelve, in only six of which it is stated that there were bloody motions, and in these the blood was not passed frequently, nor even in some cases daily, as in infants, nor in so pure a state, unless in two cases, the records of which are not explicit on this point. Two of these six patients passed moderate bloody evacuations after protracted periods of constipation, one had fæcal discharges with the blood through the entire sickness, and in one blood was passed at first, but finally the stools were entirely fæcal.

In those above the age of one year, obstinate constipation was ordinarily present, no dejections, whether bloody or fæcal, occurring for several days, but there were a few exceptions. In three cases the bowels were relaxed. The ileum, in these three, had descended through the entire colon, or the larger part of the colon, and being pervious, the fæces escaped from the anus without detention in the large intestine, or with detention only in its lower portion, and were therefore liquid.

Tenesmus is another symptom. It is not always present, but in a large proportion of cases, even when the invagination is in the upper part of the large intestine, it is a frequent and distressing symptom. It often does not commence till there is a considerable amount of displacement, and it ceases when the strength is much reduced.

The temperature of the surface is normal in the commencement of intussusception ; but finally, as febrile reaction comes on symptomatic of the inflammation, it rises and continues above the healthy standard till the intestine sloughs, or till the stage of collapse occurs which ushers in death. The pulse, especially in the infant, is tranquil at first, but, whatever the age, it soon becomes accelerated from the paroxysms of pain, and subsequently from the inflammation which occurs in the invaginated mass. There is no disturbance of respiration, except that it is somewhat hurried from the fever, and from the pain felt in advanced cases on full inspiration.

It will be seen that the symptoms vary in certain particulars, under the age of one year, from those occurring over that age, but differences in the symptoms depend more on the degree of invagination and constriction, than on the age and exact location of the disease.

Diagnosis.—The diagnosis of intussusception is not, in general, difficult, expect at its commencement. When the inversion has reached that degree at which obstruction occurs, the symptoms are, in most cases, such that the disease can be readily diagnosticated. In the cases whose

records I have collated a correct diagnosis was, with few exceptions, made, and at an early period. In the infant, the disease for which intussusception is most frequently mistaken is dysentery, on account of the tenesmus and the muco-sanguineous stools. In certain of the reported cases this mistake was not rectified until it was ascertained that purgatives produced no fæcal evacuations.

The symptoms which are commonly present, and which indicate the nature of the disease, are obstinate constipation, vomiting, paroxysmal pain referred to the seat of the disease, and tenesmus. In the infant, also, scanty evacuations from the bowels of mucus and blood, or of pure blood, is, as we have seen, an important diagnostic sign. It should be borne in mind, however, that in exceptional cases the displaced bowel may remain pervious, and the usual symptoms which possess diagnostic value therefore be absent. There may be no vomiting or tenesmus, and diarrhœa may even occur in place of constipation, as in the cases related above. As an aid to diagnosis, it should be stated that whatever the age of the child affected with intussusception, clysters are often administered with difficulty, and are quickly and forcibly returned, on account of the resistance opposed by the invaginated mass. We have stated above that the seat and even extent of displacement can be ascertained in a large proportion of cases by digital examination of the abdominal walls. The tumor can be felt hard, elongated, and tender on pressure, so that the diagnosis is clear. If the invagination have extended to the lower part of the large intestine, it can usually be discovered by an examination per rectum.

Duration.—In the following table, the duration of the intussusception in forty-nine cases is given, as nearly as it can be ascertained from the records :

2 died the 1st day.	1 died the 8th day.
6 " " 2d "	1 " " 10th "
14 " " 3d "	1 " " 14th "
2 " " 4th "	1 lived nearly a week.
5 " " 5th "	1 " 6 weeks.
2 " " 6th "	3, time of death not given.
2 " " 7th "	7 recovered.
1 lived over a week.	

In two of the three cases in which the duration is not stated, the patients lived much longer than the usual period. One of these two, a girl of six years, having eaten raw carrots, was seized with pain in the abdomen, which lasted eight months, when she died. During the last three months she passed mucus and blood. In this case the cæcum had descended to the anus, drawing with it the ileum, which remained pervious. The symptoms indicated the continuance of the invagination for three months if not eight. The other patient was a boy, aged 3 years

and 4 months, who complained of pain in the abdomen for many months, and occasionally vomited. During the last six weeks of his life, all the phenomena of invagination were present. In this case also, the inverted caput coli had descended along the entire length of the colon, and it lay at the autopsy in the rectum.

In West's *Treatise on Diseases of Children* (fifth edition, 1866, page 504), it is stated that death in this complaint always occurs within a week. The above statistics, however, show that there are exceptions to this statement, although a large majority do die within the first seven days. In thirty-three of the cases embraced in my statistics death occurred within the first week, and in no fatal case in which strangulation was complete was life prolonged beyond the eighth day. In these cases of complete strangulation the average duration was 3.7 days, and the largest number of deaths occurred on the third day. Death on the first day is rare, but it occurred in two instances. When so early it is often, if not generally, in convulsions and coma.

PROGNOSIS.—Intussusception is in its nature so grave an accident that the physician called to a case should always explain its gravity to the friends. But, while death is the common result, there are three different modes of termination in which life is preserved. First, the reduction of the incarcerated intestine, with immediate relief. There can be no doubt that it is possible for intussusception, when recent, to be reduced by the unaided action of the bowels, in the same way as the common, simple intussusception in the jejunum and ileum, or as hernia is reduced, through the vermicular action of the intestines, for sometimes, as in Dr. Coggswell's case (London *Lancet*, July, 1853), the patients at some previous time have experienced the same symptoms as those which accompanied the attack, and which subsiding, they remained for a time in perfect health. This termination is probably rare, if the symptoms be sufficiently marked to necessitate treatment. Again, the intussusception may be cured by early and well-applied treatment. The physician often succeeds in reducing the displaced intestine, even if the intussusception be in the upper part of the colon, if he be called sufficiently early, and employ the proper measures.

A second mode of favorable termination is alluded to by certain foreign writers. The intussusception continues for a considerable period with the characteristic symptoms, and then, as Bouchut expresses it, "the vomitings gradually cease, the intestinal hæmorrhage disappears, the strength returns, and the health becomes restored without the expulsion of fragments of the intestine." What changes the displaced intestine undergoes in these protracted cases, which gradually recover without sloughing, have not been clearly ascertained, although they have been the subject of conjecture. According to Rilliet, a large proportion of favorable cases terminate in this manner. It does not appear, however, from

the statistics which I have collected, that this is a common mode of recovery. The clinical history of intussusception establishes the fact that in a large majority of protracted cases there is either death or the third mode of favorable termination, namely, by sloughing.

But we cannot reasonably expect recovery in young children through sloughing and the expulsion of the intestine ; since few have the requisite strength for so tedious and exhaustive a process. The youngest child that recovered in this way, so far as I have been able to ascertain, was an infant thirteen months old, whose case was reported by M. Marage. With the exception of this case, the youngest was a boy, aged five years. The older the child, the greater, of course, the power of endurance, and the better the prospect of recovery. Of the fifty-two cases whose records I have collated, seven recovered by the sloughing and expulsion of the mass. These children were of the ages of five, six, six, nine, eleven, twelve, and twelve years. The separation of the invaginated mass occurred in six of these between the sixth and twelfth days, with an average of nine and a half days. In the remaining case the time is not given. If, then, the patient can be carried through the first week without too much exhaustion, we may each day look for the discharge of the slough, the reopening of the bowels, and ultimate recovery.

But in those cases in which the intussusception remains open, so as to allow the passage of fæcal matter, recovery is improbable unless the displacement be diagnosticated early and properly treated. If the intussusception continue, it becomes greater and greater from the absence of strangulation. Without inflammation and with little or no congestion of the displaced portion, and without the severe symptoms which occur in ordinary cases, the patient wastes away, having irregular evacuations and more or less abdominal pain, and finally dies in a state of emaciation and weakness. In the early stage of this form of displacement it is not improbable that injections or inflation, employed with sufficient force, will give relief, but, if the early period pass without such treatment, cure is impossible by the ordinary methods. It is in such instances especially, to wit, those in which the displacement occurs without strangulation or inflammation, and in which fæcal matter passes through the displaced mass more or less freely, that laparotomy is justifiable, and is likely to give relief, when injections and inflation have been employed in vain. Jonathan Hutchinson's successful performance of this operation in a child of two years, who had this kind of displacement, is known to most readers. (See London *Lancet*, November 22, 1873.)

The prognosis is most favorable when the displacement occurs in the lower part of the large intestine, for its reduction is then comparatively easy. An interesting case of this kind was observed and treated by Drs. O'Dwyer, Reid, and myself, in the New York Foundling Asylum, in 1875. The child was a female, aged two years, and had had previous

good health. The invaginated mass protruded like a prolapse, about four inches outside of the anus. It was cold, considerable hæmorrhage had occurred from it, and the infant seemed in collapse. When the mass was returned so far as it could be carried within the pelvis, by the index finger, the lower end of it could still be felt like an os uteri. It protruded four or five times within twenty-four hours, but, by replacement so far as possible with the fingers, and the use of simple water injections, with the hips elevated, it was finally permanently reduced, and, with the use of stimulants, she soon fully recovered.

Mode of Death.—This is different in different cases. It sometimes occurs from collapse. At a meeting of the New York Pathological Society, held December 10, 1873, I presented a specimen, showing intussusception occurring about one foot above the ileo-cæcal valve, in an infant aged thirteen months. On the day before its death, its previous health having been good, it seemed ill, and vomited once or twice, but did not appear to be in pain. It had two evacuations from the bowels, of the usual appearance, in the latter part of the day. On the following morning it was unexpectedly in collapse, and died within about twenty-four hours from the commencement of the sickness. At the post-mortem examination the cranium was not opened, but all the organs of the trunk were found normal except the intussusception. The mass involved in the displacement measured two and a half inches in length, and was slightly crescentic. The mucous membrane above and below it had the normal appearance, as did that of the external or incarcerating portion of the mass, while that of the incarcerated part was deeply injected. Water poured into the intestine above the invagination was wholly arrested by it. (*New York Med. Rec.*, April 1, 1874.) But in the majority of instances death occurs from asthenia, which comes on gradually, but increases rapidly in consequence of the pain, vomiting, and imperfect nutrition. Children dying in this way may have convulsive movements more or less marked, but the prevailing characteristic as death approaches is extreme exhaustion. In exceptional instances the life of the sufferer is cut short by convulsions before the stage of exhaustion is reached. Thus a child aged three years, whose case was reported by Dr. Isaac Thomas, in the *Amer. Med. Recorder*, in 1823, and another, aged two years, whose case was reported by Dr. Coggswell, in the London *Lancet*, July, 1853, died in convulsions on the second day.

Treatment.—It is unfortunate, in cases of intussusception, that the time in which treatment can be of most service is apt to pass by before the true condition of the intestine is detected. Invagination being comparatively rare, the patient is generally on the first day treated for colic or dysentery or some other common affection of the bowels; and it is often not till the second day, when the intestine has become incarcerated, that the physician accurately diagnosticates the disease. The purgative

medicines often given in the commencement injure the patient. In fact, both reason and experience teach us the impropriety of purgatives in this complaint. Cathartic remedies act as a *vis à tergo*, and may cause still further descent of the inverted intestine. Yet such powerful agents of this class as quicksilver have been employed. It was administered in two doses of one ounce each in one of the cases embraced in my statistics, but none of the mineral passed the bowels. At the post-mortem examination a considerable part of it was found in small globules, coated with a black layer consisting of the sulphuret or black oxide of mercury, in the intestine above the intussusception. It need not be added that the case was speedily fatal.

The proper treatment of intussusception consists in attempts to reduce the displacement by pressure from below. This pressure may be applied either by liquid injections into the rectum or by inflation of the lower intestine by air or gas.

Injections should be made with lukewarm water, for cold or hot water may cause contraction of the muscular fibres of the intestine, and increase the constriction. The child should be placed in bed, or in the nurse's lap, with the nates elevated 45°. With the common India-rubber, or better the fountain-syringe, and the aid of an assistant, the liquid should be gently thrown into the rectum until the abdomen is somewhat distended. By carrying the fingers, firmly but gently applied upon the abdominal walls, along the direction of the colon, the liquid is made to press against the lower end of the intussusception. The same gentleness and perseverance is required in kneading and pressing the abdominal walls as in the treatment of hernia, by taxis. If the invagination be in the descending colon, probably only a small quantity of the liquid can be injected, and it may be forcibly returned, but by repeating the injections, a sufficient quantity can ordinarily be introduced to obtain the full effect of the mode of treatment. There is also sometimes an increased irritability of the rectum, even when the intussusception is at the other extremity of the large intestine, so that tenesmus and expulsive efforts follow the introduction of the instrument. The assistant can aid in overcoming this by pressing the soft parts of the nates around the instrument.

If the injection fail to reduce the displacement, it may be repeated after allowing the patient to rest for a while. In the *New York Medical Journal* for May, 1875, is the history of an interesting case, which was treated by Drs. Church and Warren of this city, and is reported by the latter. The infant was seven months old and had the usual symptoms, such as frequent paroxysmal pain in abdomen, vomiting, tenesmus, scanty mucosanguineous stools. On the third day injections were twice employed without result, but on the fourth day an injection of ten or twelve ounces reduced the displacement, and the infant recovered. In a second case treated by Dr. Warren the age was nine months, and a tumor appeared a

little above the umbilicus a few hours after the commencement of the symptoms. The following is Dr. Warren's account of this interesting case, which will give a clear idea of the proper mode of treatment :

" The patient was looking very pale and prostrated, the pulse was quick and feeble, and the skin cold. I at once determined to use fluid injections, and, with the little patient placed in a semi-prone position in his mother's lap, with an ordinary Davidson's syringe I commenced injecting tepid soap and water, but after perhaps a gill had been thrown into the rectum, it was almost immediately rejected, very highly colored with blood, and mixed with it a very small quantity of mucus and fæcal matter ; the latter, by the way, not hardened, but of the consistency of soft putty. In a second attempt the fluid was retained longer, but was after a little while discharged, with more blood and mucus, but with much less tenesmus and pain.

" When, soon after, I made my third attempt, the child's chest was rested upon the side of its mother's lap, with the lower extremities elevated by an assistant, so that the position was at an angle of about 45°, anus upward. This time I injected the fluid very slowly, in order to avoid, if possible, the irritation caused generally by the frequent emptying and refilling of the syringe (which, by the way, is a very serious hindrance to the successful use of this syringe, and which renders it much inferior to the fountain or hydrostatic). In this manner I succeeded in injecting, as I estimated at the time, perhaps ten or twelve ounces, and during the operation the child gradually became more quiet, and had, when I ceased, fallen asleep. Then, with the direction that occasional doses of tinct. opii camph. should be administered during the ight, to control, if possible, the peristaltic action of the intestines, I left h. n.

" On the following morning, to my surprise, I found the child sleeping quietly and naturally, and I was informed that at about 5 A.M. (six hours after my visit) he had a movement of the bowels, which was saved for my inspection, and consisted simply of the enema, slightly colored with fæcal matter. From that time he seemed to be entirely free from pain, and six or seven hours later had a natural passage, after which recovery progressed rapidly, and in a few days he was discharged well."

The following case is interesting as showing success from the use of injections after the lapse of two days, in a severe case, which had resisted treatment on the first day. The good result was apparently in great part due to the manipulation which was made so as to press the water against the course which intussusceptions are known to take.

On September 10, 1876, I visited, with Dr. Gillette, a nursing infant, aged nine months, whose history was as follows : It was habitually constipated, but it continued in its usual health till September 8, on which day it was carried by its nurse to one of the city parks. After its return

it began to be fretful ; it vomited, and seemed to be in pain. It continued to vomit frequently, especially after nursing, or taking drinks, and in the ensuing night passed two scanty stools of mucus and blood without fæcal matter. In the morning of September 9th, Dr. G. was summoned, who found the pulse 180, and temperature 102°, and the matter vomited greenish like bile. In the evening the temperature was 102¾°. Dr. G. diagnosticated intussusception, and employed injections of water, but they were returned without bringing fæcal matter, and without apparent result. He also administered opiates by the mouth.

September 10th, temperature 102¾° ; features pallid, beginning to have a pinched or sunken appearance, and indicative of much suffering ; no nutriment is apparently retained on account of the frequent vomiting, and the bowels are obstinately constipated. As the symptoms indicated rapid sinking and collapse, consultation was called at 4 P.M. It was impossible to determine certainly, through the abdominal walls, on account of the distension, whether there was any tumor, but it was my opinion, and the opinion of one of the other physicians, that a tumor, hard and inelastic, could be felt nearly in the median line, between the umbilicus and the symphysis pubis. At about 5 P.M. the shoulders of the little patient were lowered, and the nates elevated, so that the trunk formed an angle of perhaps forty-five degrees with the horizontal, and a large quantity of tepid water was gently passed into the intestine through Davidson's syringe, with the vaginal nozzle attached. It was impossible to estimate the quantity retained, since a considerable part of it escaped, although the anus was firmly pressed around the instrument.

When the abdomen was distended as fully as seemed justifiable, the nates being still elevated, and the liquid retained, so far as possible, by firm pressure upon the anus, the abdomen was firmly and deeply kneaded by the hand, the movements being made chiefly from the right lumbar toward the right inguinal, and from the right inguinal toward the hypogastric region. The kneading was continued perhaps eight or ten minutes, and the water, which contained no perceptible amount of fæcal matter, blood, or mucus, was allowed to escape.

After this operation the child became quiet, slept, and the vomiting ceased. At our next visit at 7 P.M., although the severe symptoms had in great part abated, and the countenance had lost that pinched and suffering aspect which was so prominent before, it was deemed best, in consultation, to repeat the injection, and this time through a rectal tube, which was introduced further than the nozzle employed at the preceding visit. The body was placed in the same position as before, and the abdomen kneaded in the same manner. The water, when allowed to return, brought no fæcal matter, but the last that flowed contained two shreds, the largest about one inch in length by two lines in width, resembling matted and nucleated epithelial cells. It was believed that they were composed

of such cells, with perhaps some of the mucous membrane to which they were attached, and that they were detached from the invaginated portion. An opiate mixture was now prescribed, to be given sufficiently often to relieve any restlessness, and keep the patient quiet, and a flaxseed poultice was applied over the abdomen. On the following day the temperature was 103½°, pulse 158, and the abdomen somewhat distended ; but the vomiting had ceased, and there had been two fæcal evacuations since our last visit. The intussusception had been relieved, the inflammatory symptoms soon abated, and the infant's health was fully restored.

Injections in order to be effectual, and give promise of success, must be aided by gravitation. Unless the nates be so elevated as to obtain the benefit of this hydraulic principle, I am convinced that inflation is more likely to reduce the displacement, and if, after sufficient trial of injections, relief be not obtained inflation should be employed. Inflation produces an equable and effective distension of the external or incarcerating portion of intestine, and cases of cure by inflation have been reported after injections had failed. Treatment by inflation, which indeed ought to occur to any intelligent physician appreciating the anatomical condition of the parts, as the correct mode, was prominently brought to the notice of the profession in modern times by Mr. Samuel Mitchell, in a communication to the London *Lancet* for March 17, 1838.

"I take the liberty," he writes, "of suggesting to the profession, through the medium of your valuable periodical, the trial of inflating the bowels by means of a glyster-pipe attached to a common pair of bellows ; it has fallen to my lot to witness several of these most distressing cases in children ; the nature of the obstruction was foretold during life, and unfortunately verified by post-mortem examination. The last case of the kind which came under my care, about two years since, presented all the usual symptoms : intolerable restlessness, the most obstinate sickness, the singularly distressed state of countenance, and shrunken features. The usual remedies were had recourse to, viz., warm baths, glysters, anodyne frictions over the abdomen, etc., but without avail. As a forlorn hope I made trial of inflation by the above means, with the most happy result. The sickness immediately ceased ; the child within an hour passed a natural stool, and in the morning was almost without ailment."

This mode of treatment is termed novel in the *Lancet*, but it is really as old as the time of Hippocrates, who speaks of throwing air into the bowels, by which flatulence is imitated (flatus immitatur). (*Hippocrates' Works*, translated from the Greek by Grimm, 4 bd., page 198.) Haller also recommended the same treatment : "Flatus etiam immissus celerrime susceptionem dispellet." (*Physiologia Corporis Humani*, tom. vii., p. 95.) In the *Edinburgh Medical Journal*, October, 1864, Dr. David Greig relates five cases of successful treatment of intussusception by inflation. The first, an infant six months old, previously in good health,

suddenly became very fretful, apparently having severe paroxysmal pain in the abdomen. She had vomiting, and finally tenesmus, with bloody evacuations. Warm-water enemata could not be employed on account, the writer thinks, of the spasmodic action of the intestines, and an abdominal tumor could be distinctly felt near the umbilicus. Castor oil and a purgative powder, and enemata of water having been employed in vain, and the case becoming really critical on the second day, inflation was resorted to. The writer says : " The nozzle of a small pair of bellows was introduced into the anus, and air injected to a considerable extent. Contrary to our expectation, the air passed readily into the bowel, and seemed to give the child great relief. After the injection it lay very quiet, as if asleep, and evidently quite free from pain. In about twenty minutes from the time the air injection was administered, a slight rumbling noise was heard in the child's abdomen, followed by a crack so loud and distinct as to alarm the attendants in the room, who thought something had burst in the child's bowels. The child, however, continued as if asleep, and free from pain, and in about half an hour a large feculent stool, slightly mixed with blood and mucus, was passed without pain. During the night the child rested pretty well, had no return of vomiting, took the breast as usual, and in two days was quite well."

Another child, nine months old, treated by Dr. Greig, presenting nearly the same symptoms and the abdominal tumor, also obtained relief by inflation, after castor oil and enemata had failed to produce any benefit.

An apparatus for the production and injection of carbonic-acid gas has been invented by Schultz and Warker, of this city, and is manufactured by them. It consists essentially of two glass chambers, one over the other. In the lower one a bicarbonate is placed, and in the upper an acid in a liquid state. By the gradual admixture of the two, carbonic acid set free. An elastic tube conveys the gas from the lower chamber. The apparatus has been used by physicians of the city for the reduction of intussusception and other purposes, and is a useful invention.

The same firm, and several others in this city, prepare for the shops large bottles of highly charged carbonic-acid water, from which when inverted a powerful current of carbonic-acid gas can be obtained. Two or three of these bottles, with a portion of the tube from Davidson's syringe, which can be readily attached to the stem from which the gas escapes, constitute all that is required for an ordinary case.

The following cases, which I treated with Dr. Büchler of this city, in 1871, show what may be achieved by inflation, and also the unfavorable result which must inevitably occur in certain cases. A German infant, five months old, nursing, began to be fretful, crying often, on March 7th, and before night passed a scanty motion of blood. The symptoms continuing, I was asked to examine the infant on the 10th, and learned the following facts : It had vomited daily, had had daily scanty but infre-

quent stools, consisting chiefly of blood, accompanied at first by tenesmus, but not within the last day ; it continued to nurse, but was becoming thinner and weaker, and was evidently in pain. The symptoms indicating the nature of the disease, the abdomen, which was not distended, was examined for the tumor, which was found in the right side in the site of the ascending colon, apparently about one and a half to two inches in length ; pulse 124 in sleep ; no cough. An ineffectual attempt was made to reduce the intussusception by a very rude and imperfectly constructed apparatus (the bellows), when from the lateness of the hour further treatment was postponed till early the following morning. 11th. Tumor still detected in the right lumbar region ; pulse 120 asleep, 150 awake. By means of Schultz and Warker's apparatus, the intestines were inflated so as to produce very decided prominence of the abdomen, and the abdomen gently kneaded. After some minutes the gas was allowed to escape, when the tumor had disappeared. In a few hours, a natural evacuation occurred from the bowels, and the infant has remained well since.

The second case ended unfavorably, although the symptoms were apparently no more grave than in the case just related, and had continued a shorter time. This infant was also of German parentage. The tumor, firm and elongated, could be distinctly felt in the left lumbar region. In this case the inverted bottles of carbonic-acid water were employed, and when, after considerable delay and kneading of the abdomen, the gas was allowed to escape from the intestine, the tumor had disappeared. A few hours afterward convulsions occurred, ending fatally. At the autopsy the invaginated mass, which was too firmly strangulated to admit of reduction by inflation, was found in the epigastric region, having been carried up from its former position by the inflation of the intestine below. It consisted of the terminal part of the ileum, which had passed through the ileo-cæcal orifice, and become incarcerated in the ascending colon, and, as is not unusual in these cases, the action of the intestines had changed the location of the tumor in the abdomen from the right to the left side.

Whether air or carbonic acid be employed, it is necessary to produce distension of the intestine to its fullest extent below the seat of the complaint, without endangering rupture, and of course the sooner it is used the better the chance of success. In a few days the displaced intestine has, in a large proportion of cases, become so firmly incarcerated, and has descended so far, that attempts to replace it, either by injections or inflation, are unsuccessful ; still, even at a late period, a persevering attempt should be made if it have not previously been tried. If injections and inflation fail to effect the desired result, the employment of quicksilver, by the rectum with the thighs elevated, has been suggested to me as worthy of trial by a physician of large practice in this city, who has had consid-

erable experience with intussusceptions. This may be a useful suggestion, especially if the invagination be in the descending colon.

If the modes of treatment which I have recommended above, fail to give relief when perseveringly and sufficiently employed in a case of acute intussusception, the patient's state is one of extreme peril, and the prognosis is unfavorable. Yet recovery is possible in one of two ways, namely, by incision through the abdominal walls (laparotomy), and reduction of the displacement by the fingers within the abdominal cavity; and secondly, by sloughing of the invaginated mass, and union by adhesive inflammation of the ends of the intestine which have preserved their vitality. Atrophy of the imprisoned part so seldom occurs in a case which has resisted injections and inflation, that it need not be considered in this connection, as a mode of recovery.

Laparotomy has been successfully performed in a child aged two years, as I have stated above, by Dr. Jonathan Hutchinson, of London. The case was one of those exceptional ones in which great displacement had occurred without strangulation. It had continued as indicated by the symptoms about one month, and a portion of the intestine terminating in the ileo-cæcal valve had extended several inches from the anus. "The patient was anæsthetized by chloroform, and the abdomen was opened in the middle line below the umbilicus. The intussusception was then easily found, and as easily reduced. The after-treatment consisted only in the administration of a few mild opiates, and the child made a rapid recovery." (See London *Lancet,* November 22, 1873.) In a case of this kind, there can be no doubt of the propriety and necessity of laparotomy as a last resort, for there being no strangulation, sloughing could not occur, and death sooner or later, from exhaustion, must be the probable result. Cases of this sort have usually been left to perish, after the ordinary modes of relief have failed. Thus as far back as 1784, M. Robin published in the *Mém. de l'Acad. de Chirurg.*, the case of a child aged 3½ years, who died after the lapse of three months, with a cæcum protruding from the anus. And in the *Amer. Journ. of Med. Sci.* for 1849, Dr. Worthington published a similar case, in which a child aged three years and four months lived even a longer time. In these days of anæsthetics, and with the brilliant success of Hutchinson, a physician would in my opinion be reprehensible if he allowed a child aged two years or over, with this form of the displacement, to perish without strongly advising laparotomy.

But the question arises, whether in those more frequent cases of intussusception in young children, in which after the displacement has continued a few hours, there is such firm constriction of the invaginated mass, that the patient suffers much pain and constitutional disturbance, and probably passes bloody stools, and injections and inflation have failed to reduce the displacement, laparatomy is justifiable. This operation, in

the case of infants, has heretofore been regarded as so dangerous, and so likely in itself to prove fatal, that the profession have generally considered it unjustifiable, believing that, although death was nearly certain without it, the performance of it did not increase the chances of a favorable result. Dr. J. B. Sands, of New York, has recently shown that laparotomy is justifiable, as a last resort, for the relief of this form of intussusception, even in the youngest infants ; and in the following case, recorded in the *New York Medical Journal*, June, 1877, saved the patient, who doubtless would otherwise have perished.

On March 11, 1877, an infant of six months suddenly presented the characteristic symptoms of intussusception, such as tenesmus, abdominal pain, vomiting, and bloody stools. A few hours later, when Dr. Sands was called, the pulse was rapid and feeble, with symptoms of collapse. An elongated tumor could be felt in the abdomen, extending from the left iliac region to the left hypochondrium, inelastic, tender on pressure, and dull on percussion. The lower end of the invaginated mass could be readily touched by the finger introduced into the rectum. The usual methods to effect reduction were at once employed with partial success, for the tumor disappeared from the site where it had been discovered, and was reduced to a small and firm mass, on a level with the umbilicus, but it resisted any further attempts to effect its reduction.

Dr. Sands then, having etherized the patient, made an incision in the median line of the abdomen, extending downward about two inches from a point a little below the umbilicus. Through this opening, proceeding cautiously, and using as little violence as possible, he was able after some delay to reduce the displacement. The invaginated mass, which was only one and a half inches in length, consisted of the terminal portion of the ileum and the cæcum, which had entered the ascending colon. The wound was closed by five silver sutures, which embraced the peritoneum, and the patient made a good recovery. The operation was performed eighteen hours after the commencement of symptoms.

Dr. Sands has collected the statistics of twenty cases of laparotomy for intussusception occurring at different ages, in which the result was stated. Of these, seven recovered, or one in three ; but he judiciously remarks, considering the gravity of the operation, that it is doubtful whether future statistics will show so favorable a result of laparotomy for this displacement, as to justify the frequent use of the knife. For facts and statistics relating to this subject the reader is referred to an able and elaborate paper by Dr. Ashhurst, published in the *American Journal of the Medical Sciences* for July, 1874.

It is obvious that the earlier the displacement is recognized, the greater the probability of the reduction by the judicious use of injections and inflation, and it is seen from cases related above that this treatment may be successful as late as the second or third day, after previous attempts to

reduce the intussusception by the same means have failed, and when there is that degree of strangulation that bloody stools occur. But as my own experience has shown me, there is also inevitably a large proportion of cases in which the use of injections and inflation, however judiciously and perseveringly made, totally fail, and it seems to me, in the light of present experience, that when pressure from below by water, air, or gas, which is the only efficient mode of treatment short of the knife, has been tried sufficiently long and often without result, that it is the duty of the physician to seek surgical advice in reference to laparotomy, as he would in a case of hernia, especially since, under Lister's antiseptic method, the danger from severe operations appears to be considerably diminished. It may be added that laparotomy performed on the first or second day, will be much more likely to save life in ordinary cases than if performed later, since the strangulated intestine is soon badly damaged, and a local peritonitis is apt to be developed any time after the first forty-eight hours.

When an intussusception has reached that stage in which active interference is no longer proper, the physician can only prescribe opiates, with sustaining measures and an emollient poultice over the abdomen, and must await the result. The diet should consist of beef juice and other concentrated nutriment, which leaves little residuum. Vomiting, which is so common, is best controlled by bismuth and opiates; convulsions require the bromide of potassium, and an enema of three to five grains of chloral hydrate, dissolved in a little water.

SECTION IV.

DISEASES OF THE CIRCULATORY SYSTEM.

CHAPTER I.

CYANOSIS.

Certain of the diseases which pertain to the circulatory system have been treated of in other parts of this book (umbilical hæmorrhage, gastro-intestinal hæmorrhage, etc.). It remains to consider that general condition of the blood which is designated morbus cæruleus or cyanosis.

In 1863, I read before the New York Academy of Medicine a statistical paper on cyanosis, which was published in the Transactions of that Society. This paper contains an analysis of 191 cases, collated from the various European and American medical journals, and to these cases I am indebted for most of the following facts pertaining to this disease.

The term cyanosis or blue disease is differently employed by writers. Some apply it to cases of transient lividity occurring in the course of acute diseases, as well as to those cases which depend on permanent structural changes, or on malformations. I apply this term, as do most pathologists, only to the latter cases.

Some are inclined to discard the consideration of cyanosis as a disease, regarding it rather as a symptom. Their view is, in my opinion, correct in reference to the cyanotic state which occurs in certain acute diseases, but not in reference to cyanosis, as I have defined the term and employ it. The propriety of considering cyanosis a disease is more apparent if we are not misled by the term which designates it. Lividity is not its most important or its essential characteristic. It is simply a sign, although conspicuous, and, indeed, the only one by which the disease can be readily recognized. Cyanosis is, in reality, a blood disease, its pathological state consisting in a deficient oxygenation of this fluid, or in an excess in it of carbonic acid, and probably of carbonaceous products. It should be placed in the same category with leucocythæmia and melanæmia.

Statistics show that cyanosis is, with very few exceptions, due to mal-

formation in the circulatory system, and at the centre of circulation, namely, in the heart and in the large vessels which arise from this organ. In exceptional cases the cause of the cyanosis is located in the lungs, and is in all or nearly all instances either extensive emphysema in both lungs, firm and thick fibrinous exudation over both lungs, compressing them by its contraction and causing, perhaps, carnification in parts of them, or the cause is compression of the lungs from caries of the vertebræ, and consequent depression of the ribs. These causes pertain to youth and manhood rather than to infancy and childhood. On account of this fact and the rarity of such cases they need not be considered in this connection.

Literature of Cyanosis.

The ancient physicians, so far as can be ascertained from their writings still extant, were ignorant of cyanosis; whether they overlooked it, or whether those early ages were exempt from it and the malformation on which it depends is peculiar to a posterity physically degenerate. The blue disease described by Hippocrates (*De Morbis*, lib. ii., sec. v., page 485, Ed. de Foë's, 1621) was probably some acute febrile affection. Galen, whose voluminous writings, with an excellent index, are still extant, and whose comprehensive mind embraced the whole range of medical science of the second century, makes no mention of it, so far as I can find. In the middle ages, as appears from the remark of Boerhaave (*Diseases of the Humors*, Acad. Lect., § 732), the common people believed the cyanotic to be the victims of evil spirits; and it is probable that physicians, during this long period of superstition and intellectual lethargy, embraced the popular belief.

On the revival of learning, pathological anatomy began to be more thoroughly and intelligently studied; but it is evident that before the great discovery of Harvey, in the 17th century, it was impossible to refer cyanosis to its true cause. In the latter part of the century so favorably opened by Harvey's genius, malformations of the heart were observed and described by some pathologists on the continent, in cases in which cyanosis must have been present; but it is uncertain, from the brief records which they have left, whether any of them understood the dependence of this disease on the abnormal state of the heart. Boerhaave, in the beginning of the 18th century, attributes "a livid or black color diffused throughout the whole skin," evidently referring to cyanosis, to "1, a relaxation of the vessels, while the *vis a tergo* remains the same, or, 2, to a too sudden increased pressure behind, without a relaxation of the vessels." Vieussens, who was a contemporary of Boerhaave, and was more thorough in the examination of morbid as well as healthy structures, narrated the history of a cyanotic patient, with a description of the malformation, but the one who first gave particular attention to

the blue disease was Morgagni. This Paduan professor, excelling his predecessors in thoroughness of observation and accuracy of deduction, published a theory in explanation of the disease which now, after the lapse of more than a century, has many adherents. In the same century with Morgagni, the 18th, but subsequently to his time, Drs. Pulteney, Wm. Hunter, Baillie, Wilson, and Abernethy in Great Britain, and Jurine and Sandifort on the continent, may be mentioned among those who contributed to a knowledge of cyanosis, by the publication of cases, with a description of the malformations. Yet, when the present century commenced, no monograph or dissertation had appeared on this disease, and, notwithstanding the publication of cases from time to time, the profession generally were almost totally unacquainted with its nature. No better idea can be given of the prevailing ignorance, in reference to cyanosis at this period, than by quoting from a case related by Ribes in 1814. (*Bull. de la Fac. de Méd.*, 1815.) The patient had some time previously received an injury of the finger. "Many physicians of Amsterdam," says he, "were at different times consulted on the subject of this affection, no one of whom understood its true cause, its essential character. One considered it as partaking of the nature of epilepsy, and caused by the irritation in the nervous system which the wound in the finger had produced. Others attributed it to the presence of intestinal worms. Some physicians pronounced it an injury of the liver or spleen. Many held it to be a scorbutic affection. One only believed it to be the result of an unknown organic disease."

Since the commencement of the present century the blue disease has received a large share of attention. According to *Forbes's Medical Biography*, the first dissertation on this subject appeared in 1805, from the pen of Seiler, and from this time till 1832 no fewer than twenty-eight dissertations or monographs were published, either on cyanosis or on malformations which produce it or at least relate to it. In the list of writers are some of the most eminent names in the profession, as Louis and Bouillaud. The number who have written on this subject since 1852 probably exceeds the number of previous writers. Of those who have contributed most to our knowledge of the disease may be mentioned Farre, Chevers, and Peacock in Great Britain, Gintrac on the continent, and Moreton Stillé in this country. Farre, Chevers, and Peacock wrote on malformations of the heart, alluding incidentally to cyanosis, but their writings contain valuable matter for statistics bearing on the latter subject. Farre's book was published in 1814, and is out of print; Chevers published his papers in the *London Med. Gazette*, commencing in the year 1845 and running through several successive volumes. Peacock's treatise was published in 1858. It contains several original cases, previously narrated by him to the London Pathological Society. The paper by Moreton Stillé, which has attracted much attention, especially in

Europe, was his inaugural thesis, and was published in the *Amer. Med. Journ. of Med. Sci.*, in 1844.

This paper relates entirely, in the words of the author, to "the laws of the causation of cyanosis." The only really complete statistical paper on the blue disease is that by M. Gintrac, published in 1824, in Paris, and embracing all the cases which had been accurately reported up to that time, namely, fifty-three. He, indeed, exhausted the subject for the period in which he wrote, but on account of the accumulation of material since, his monograph now seems incomplete.

Two theories in explanation of the occurrence of cyanosis have divided the profession: the one attributing it to obstruction at the centre of circulation, and consequent venous congestion; the other, to admixture of venous and arterial blood through openings in the septa of the heart, or through the ductus arteriosus. The former of these theories originated with Morgagni more than one hundred years ago, and is essentially the same as that advocated by Stillé. Stillé errs in placing Morgagni among the advocates of the other system. The second theory, or that which attributes cyanosis to admixture of venous and arterial blood, is said by Dr. Peacock to have originated with Hunter, but its ablest supporter was Gintrac. Of late there are some pathologists who do not believe that either theory is sufficient to explain the cause of cyanosis, but that the true explanation lies somewhere between the two. Among the most conspicuous of these is Prof. Walshe, of London. These theories will be considered in the proper places.

Sex.—Writers on cyanosis state that there is a preponderence of males to females affected with it. Aberle, of Vienna, says that two-thirds were males in an aggregate of 180 cases which he collated. In Gintrac's cases, 28 were males and 16 females; in Stillé's, 41 were males and 31 females. The sex is recorded in 134 of the cases collected by me, of which 78 were males, 56 females; and if those cases are excluded in which cyanosis was due to obstruction at the mouth of the pulmonary artery, the number of the two sexes is the same. In the five years commencing with 1858, according to the mortuary returns, 207 died in this city from cyanosis, of which number 117 were males, 90 females. In England, for two years, 418 males died of cyanosis, and 273 females. Although statistics of different cities and countries agree in the fact of an excess of males over females, there does not appear to be that great preponderance of males which the earlier writers on this disease believed to exist.

Causes of the Malformations.—Mothers sometimes attribute the malformations, and probably correctly, to strong mental impressions felt during utero gestation. The mother of a patient treated by Dr. Peacock stated that "two months before her confinement, she was frightened by seeing a child killed, and never recovered from the shock she sustained."

(*Malf. of Heart*, p. 37.) In another case "the mother was much out of health, and stated that, when pregnant with the child, she was greatly alarmed by seeing a man who was dying of asthma." (Op. cit., page 57.) In another instance the mother was frightened at the fifth month of pregnancy (page 41); and in still another case, recorded by Dr. Peacock, the mother, four or five months before her confinement, "was greatly alarmed by her husband, who was insane, standing over her for two hours with a loaded pistol." (Page 43.)

Occasionally the malformation appears to be due to some vice or taint in the system of one or both parents. In a case quoted in the *Gazette Médicale*, for December 28, 1850, from another continental journal, it is stated that "the mother, who had formerly suffered from rickets, gave birth to five children, all of whom died immediately or shortly after birth with symptoms of cyanosis. The father died at the age of thirty-six of phthisis." Dr. Peacock relates a case in which the father was livid, and had the "pigeon-breast" common in the cyanotic. In the history of a patient, which was communicated by Cooper to Farre, it is related that "vices of conformation of the heart appeared to have been inherent in the family. Of 12 infants only 4 survived, and more presented signs of heart disease." Dr. Buchanan relates the history of a child which was the second that had suffered and died in the same family in the same way. A patient treated by Mr. Leonard was the sixth child of a family, who had died at about the same age, with symptoms of cyanosis. Such instances are, however, exceptional. Ordinarily, the cyanotic have not only healthy parents but healthy brothers and sisters.

A patient whose history is given by Dr. William Hunter was born at the eighth month, but in nearly all other cases the full period of intra-uterine existence was reached.

The opinion was expressed by Gintrac that the number affected with cyanosis to the entire population, varies in different countries. It is probable that the occurrence of the blue disease is not greatly, if at all, influenced by the nationality, but it is certainly dependent to a considerable extent on the condition of society. It is less frequent in a community in comfortable circumstances, and engaged in wholesome and quiet occupations. Pure air and outdoor exercise, plain, nutritious diet, freedom from cares and anxieties, in fine, causes which promote the physical well-being, diminish the liability to an ill-formed and cyanotic offspring. And, conversely, impure air, improper and insufficient diet, grief, etc., increase the percentage of cyanotic cases. Hence, it is a rare disease in the rural districts, and comparatively frequent in the cities, especially in a large city like New York, which contains a numerous indigent and care-worn population, living from year to year in the midst of agencies which operate stealthily but certainly to enervate the system and undermine the health.

These remarks are abundantly substantiated by statistics. In New York City for the six years ending with 1860, one death resulted from cyanosis to 436 deaths from all causes ; and in Brooklyn the proportion estimated for two years was about the same. On the other hand, in the State of Kentucky, which contains few large cities, and in the death reports of which cyanosis is included in the general term malformation, there was, during a period of five years, one death from malformation to 2469 from all causes. In the State of South Carolina, for three years, one death resulted from cyanosis to 5018 from all causes. In the State of Massachusetts, for two years, there was one death from cyanosis to 1136 from all causes, and two thirds of the cyanotic cases occurred in the counties of Suffolk, Essex, and Worcester, which contain large cities. In London one death occurred from cyanosis to 755 from all causes during a period of three years. On the other hand, in England, including the city of London, there was, for the ten years ending with 1857, one death from cyanosis to 1589 from all causes ; and in the rural districts of Monmouth and Wales only one death occurred from cyanosis to 5578 deaths from all causes during a period of two years.

Time of Commencement.—It is an interesting and somewhat remarkable fact that cyanosis, though dependent on a malformation, does not always commence at birth, or, at least, that it does not exist in degree sufficient to produce the cyanotic hue till some time has elapsed after birth. In 138 of the cases of cyanosis which I have collected, the time at which lividity was first observed is stated as follows : In 97 it was within the first week, and generally within a few hours of birth. In the remaining 41 cases it commenced as follows :

In 3 at 2 weeks.	In 6 from 2 years to 5 years.
" 1 " 3 "	" 1 " 5 " " 10 "
" 2 " 1 month.	" 6 " 10 " " 20 "
" 7 from 1 to 2 months.	" 1 " 20 " " 40 "
" 5 " 2 " 6 "	" 1 over 40 years.
" 5 " 6 " 12 "	—
" 3 " 1 year to 2 years.	41

In these 41 cases, in which blueness did not occur till after the age of one week, if the patient were less than two years old when it commenced there was frequently no obvious exciting cause, but above this age, with three exceptions, such a cause is known to have been present. It is interesting to observe how trivial the exciting cause frequently is, and equally interesting to note how long patients have enjoyed good health, not having the least lividity, although the anatomical vice, to which the final development of cyanosis was due, had existed from birth.

Dr. Theophilus Thompson relates, in the *Medico-Chir. Trans.*, vol. xxv., the history of a lady, thirty-eight years old, who was well till an attack of Asiatic cholera, after which her health was permanently im-

paired. Two years before her death she passed through a course of fever, and from this time was cyanotic. In the *Philadelphia Medical Examiner*, June, 1850, Dr. Waters relates a case in which cyanosis began at the age of six years in an attack of measles. In a case published by Mr. Napper, in the *London Medical Gazette*, 1841, the child fell at the age of six months, and from this time had cyanosis. A female, whose history is given by Prof. Tommasini, of Bologna, and quoted by Bouillaud, became cyanotic at the age of twenty-five in consequence of difficult parturition. In the London *Lancet*, 1842, Mr. Stedman relates a case, in which cyanosis began at the age of ten weeks in an attack of convulsions. In the *American Journal of Medical Sciences*, 1847, Dr. John P. Harrison published the history of a baker, twenty years old, in whom cyanosis began five years previously after great effort in carrying wood. Louis and Bouillaud quote from M. Caillot the case of a child, who became cyanotic at the age of two months in an attack of hooping-cough. Louis also narrates a case in which hooping-cough had the same effect at the age of twelve years. Ribes treated a child in whom the blue disease began at the age of three years from a severe contusion of the fingers. In a case related by Marx it commenced at the age of ten months from a blow on the back, inflicted by the mother. In the *Medical Times and Gazette*, for 1855, Mr. Speer gives the history of a female, who at the age of thirteen years was put in a place requiring considerable exertion, and from this time was cyanotic. A patient, whose case is related by Cherrier, fell into a deep ditch in the winter season, and immediately after had a low fever, from which the blue disease commenced. In a case published by Tacconus the exciting cause was believed to be fright, in consequence of a fall from a great height, and in another, related by Bouillaud, it was a blow received on the epigastrium after the patient had passed the age of fifty years. Similar cases are related by Mayo and Peacock.

It will be seen that the exciting cause of cyanosis is usually such as produces a profound impression on the system, and affects the action of the heart. Precisely in what way it operates to develop the disease has not been satisfactorily explained. Mr. Mayo conjectures, that in the case related by him there was previously some compensation which ceased, or became inadequate in consequence of some change produced in the economy. Although cyanosis may not appear for months or even years, there is rarely improvement when it is once established. Appearances of amendment are deceptive. The disease when not stationary is progressive, and this explains the fact that few survive the middle period of life.

Symptoms.—The symptoms in cyanosis vary in intensity in different patients, and in the same patient at different times, being milder if he be quiet and the mind calm, more severe if active, or if the mind be agitated. In mild cases, in a state of rest, they nearly or quite disappear, so that a

stranger would not suspect that there was any serious ailment. They are aggravated by any cause which accelerates the action of the heart. In some patients, cyanosis is increased by the most trivial disturbing influences, among which may be mentioned nursing, dentition, crying, coughing, and slight emotions of joy, sorrow, or anger. In more than one case it has been perceptibly increased by the stimulus of digestion, the color being deeper after a full meal than before.

The cyanotic hue varies in different individuals from duskiness to a deep purple, almost black color. It is usually most marked in the visage, especially the palpebræ, cheeks, nose, and lips, in the ears, fingers, and toes, and upon the mucous surfaces. It is sometimes, without any assignable cause, confined to a portion of the body. In a case related by Mr. Steel in the London *Lancet*, 1838, the upper part of the body was livid and œdematous, and the lower part pallid and shrunken, and yet the malformation was of the kind which is commonly present in cyanosis. In the *London Medical Times*, March 8, 1845, copied from the *Gazette Médicale*, is the history of a child six years old, in whom the color was deeper on the right than left side. There had been, however, hemiplegia of this side in infancy, but this had entirely passed off. On the other hand, in a case of rare malformation communicated by Cooper to Farre, in which the upper part of the system was supplied chiefly by arterial and the lower by venous blood, the discoloration was general. In exceptional instances livid maculæ, like those of purpura, have been observed upon the skin.

Those affected with cyanosis have generally at birth been well formed and of the usual size, and in most cases, for a considerable period after birth, the appetite is good, bowels regular, and the system well nourished. But when cyanosis becomes so severe, as it does sooner or later, that its symptoms are rarely absent, digestion is imperfectly performed, and the body becomes either emaciated or stunted and puny. It may be stated, as a rule, that nutrition is in inverse proportion to the gravity of cyanosis. In thirty-three out of forty-one cases, in which the condition of the system, as regards nutrition, was recorded either a short time previously to death or at the autopsy, the body was either considerably emaciated or else diminutive, and those who were well nourished were usually such as had died early, or of some intercurrent disease.

In this connection may be mentioned two abnormalities which have been observed in the cyanotic. The chest is often flattened laterally, with a projecting sternum, so as to present an appearance generally described in the records as "pigeon-breasted." Sometimes the most prominent part is directly over the heart, and in one or two cases the sternum was observed to be deflected toward the left. In the majority of the records, however, no mention is made of the external appearance of the chest.

The other abnormality is frequently observed in chronic diseases of the

heart and lungs, in which there is sluggish circulation and consequent altered nutrition in the fingers and toes. In twenty-eight cases it is stated that the tips of the fingers or toes, or both, were bulbous. This hypertrophy, if slight, is likely to be overlooked, and that it was observed and recorded in so many cases renders it probable that it was present in a much larger number. In one case the anatomical character of this enlargement was examined, and was found to consist chiefly of hypertrophied connective tissue.

The nails are often incurvated over the deformity. At a meeting of the Lond. Path. Soc., in 1859, Mr. Ogle narrated the history of a laborer, fifty years old, who had swelling, numbness, and lividity of the left arm, from pressure of an aneurism, and the fingers on this side were clubbed as in cyanosis. A patient whose history is related in the *Glasgow Medical Journal*, and who was believed to be cyanotic in consequence of a highly emphysematous state of the lungs, had a similar development of the tips of both fingers and toes.

An interesting feature in cyanosis is the low grade of animal heat. The temperature of the body is in all cases below that of health. This is especially noticeable in the extremities. There has not been a sufficient number of accurate thermometric observations to determine whether the internal heat is usually reduced. The following only have been recorded : Mr. Fletcher relates the history of a young man in the *Medico-Chir. Trans.*, vol. xxv., in whom the thermometer placed in the mouth did not stand above 80° Fahrenheit. Hodgson reports the case of a man, twenty-five years old, in whom the thermometer placed under the tongue rose to 100°, while in his own case it was two or three degrees below that term. In an experiment, recorded by Nasse, the instrument placed in the mouth fell little if at all below the healthy standard ; applied to external parts, it stood at about 21° Reaumur.

The lack of heat is the source of great discomfort to a cyanotic patient. In mild weather he requires a fire to keep him warm, or an amount of clothing which to others would be intolerable, and in cold weather slight exposure strikes him with a chill. Nor can he increase his heat by active exercise, since his infirmity disqualifies him for this.

Although the temperature of the surface is so low, the occurrence of perspiration, sometimes profuse, is mentioned in several of the records.

In severe cases of cyanosis the generative system is imperfectly developed. In the female, menstruation is scanty or delayed, and in the male signs of puberty are feebly manifest. If the disease be so mild that the symptoms are absent when the patient is in a state of repose, these organs attain nearly or quite their normal development. The catamenia have appeared as early as the age of sixteen years ; and a cyanotic patient treated by Cherrier had two children, but they both died of scrofulous affections.

The action of the heart is necessarily much involved. In mild forms of the disease, if the patient be quiet, this organ may beat with considerable slowness and regularity, but in all cases exercise or excitement, which in a state of health would scarcely have any appreciable effect on the pulse, embarrass its movements, and produce palpitation. In severe cases palpitation is rarely absent, and the pulse is frequent, feeble, and often intermittent. In a large proportion of patients bruits are produced by the irregular circulation through the heart.

The respiration corresponds with the action of the heart. It is accelerated in proportion to the frequency of the pulse. The suffering in this disease is largely due to paroxysms of palpitation and dyspnœa. These occur sometimes without any apparent exciting cause, and when the patient is quiet, but they are commonly induced by those causes which we have already mentioned as aggravating the symptoms of cyanosis. They come on suddenly, and are attended by increase of lividity, distension of the jugulars, and sometimes of the cutaneous veins, and by a sensation of present suffocation. They last only a few minutes, and are succeeded by great depression of the vital powers. In infants, on account of greater nervous irritability, and feeble power of endurance, these paroxysms often end in convulsions, which occasionally are fatal. A cough is sometimes present, but is usually slight.

Pain is not a common symptom. Some of the patients complain occasionally of headache, with or without vertigo, and occasionally also of pain in the chest, but it is uncertain to what extent or whether these symptoms are dependent on the cyanotic disease. The secretions do not appear to be affected, so far as has been ascertained. The same may be said of the intellectual and moral faculties. In a case related by Dr. Chevers, the child was even said to be precocious. (*Lond. Med. Gaz.*, vol. xxxviii.) The mind is capable of steady application and acquisition, as in health, provided that the emotions are not unduly excited.

Those who are affected with cyanosis are liable to various forms of hæmorrhage, but this liability, if we may judge from recorded cases, is greater in youth and adult life than in infancy. In two cases blood was vomited, in one passed by stool, in one it escaped from the gums, in two from the mouth, in eight from the nostrils, and in sixteen it was expectorated. Pulmonary phthisis was, however, usually present in these last cases. In the *Western Journal of Medicine* for 1829, an interesting case is related by Dr. Wm. M. Voris of a girl, nine years old, in whom hæmorrhage occurred under the scalp, producing great tumefaction, and nearly closing the eyelids. An incision was made, from which a pint and a half of dark blood escaped, and it was estimated that more than half a gallon was lost during the ensuing two weeks, at the expiration of which time the incision closed. The patient recovered from the hæmorrhage, but not from the cyanosis.

Toward the close of life more or less anasarca occasionally occurs, especially around the ankles, sometimes in the eyelids and face, and rarely to a certain extent over the whole body. In certain patients it coexists with effusion in the serous cavities.

It is evident that one who is affected with the severer form of cyanosis is disqualified for the duties of active life. The sports of childhood and the useful labors of mature years require an exertion for which he is physically unfit. He has not the ability even to engage in animated conversation, for he is overcome by emotions, whether of joy or sorrow. He lives almost an idle spectator of the world around him, prevented by his infirmity from engaging in its pursuits.

Intercurrent diseases, especially those of childhood, are badly tolerated ; but hooping-cough is the one which these patient are especially ill-fitted to endure. Still, they sometimes pass safely, not only through hooping-cough, but through some of the most dangerous febrile diseases. It is a question of interest, but about which little is known with certainty, whether these intercurrent maladies are influenced by the cyanotic or venous condition of the blood. The symptoms of these maladies are no doubt more alarming, mainly on account of the embarrassed action of the heart, and not on account of the state of the blood ; still it is reasonable to suppose that malignant and asthenic diseases are rendered worse by the lack of oxygen, and excess of carbonic acid in the circulating fluid.

Probably cyanosis does not furnish immunity from any other disease, although this statement has been made by a high authority. Rokitansky says : "*All forms of cyanosis, or rather all the diseases of the heart, great vessels, and lungs, adapted to produce cyanosis, in a greater or less degree, cannot coexist with tuberculosis. Cyanosis affords a complete protection against it, and in this circumstance may be found an explanation of the immunity from tuberculosis which many conditions of the system, apparently very different in their character, afford.*" (*Handb. der Pathol. Anat.* II. Bd.) This opinion of the distinguished pathologist, notwithstanding his ample opportunities for observation and known accuracy as an observer, is not substantiated by statistics. So far from its being true, the low degree of vitality in cyanosis appears to favor the occurrence of tubercles. I have records of twenty-six cases of cyanosis in which tuberculosis was also present, in several of which the lungs contained cavities. This is about thirteen per cent of the whole number in my collection—a large proportion, since so many die in early infancy, at which period the tubercular disease is not apt to occur. Cyanosis appears, also, to favor the development of cerebral diseases, especially congestion and coma, as will be seen presently.

PROGNOSIS.—This is unfavorable. Most cyanotic individuals die young. The age which they attain has been made the subject of statis-

tical inquiry by Aberle. He states that in an aggregate of 159 cases, 57, or 35 per cent, died before the end of the first year ; 108, or more than two thirds, died before the age of eleven years ; 30 between the ages of eleven and twenty-five years ; and of the remaining 21, only 5 lived more than forty-five years.

The age at which death occurred, is given, in 186 of the cases collected by myself, as follows :

In 17 under the age of 1 week.	In 21 from 5 years to 10 years.
" 10 from 1 week to 1 month.	" 41 " 10 " " 20 "
" 12 " 1 month to 3 months.	" 20 " 20 " " 40 "
" 11 " 3 months to 6 months.	" 4 over 40 "
" 17 " 6 " to 12 "	——
" 12 " 1 year to 2 years,	186
" 21 " 2 years to 5 "	

Sixty-seven, then, or more than one third, died before the close of the first year ; 121, or more than three fifths, before the age of ten years ; only 24 survived the age of twenty years, and four the age of forty years. Of course, the duration of life depends on the nature and extent of the malformations. Some of these are such as render a speedy death inevitable.

Mode of Death.—The mode of death is recorded in ninety-five cases, as follows :

19 died in a paroxysm of dyspnœa.
10 " suddenly (the exact manner not stated).
14 " in convulsions (infants).
2 " of apoplexy.
7 " from hæmorrhage.
6 " of phthisis (though, as we have seen, twenty others had this disease).
2 " of exhaustion, without hæmorrhage.
10 " of coma.
2 " of abscesses in the brain.

One died of each of the following diseases : cerebral irritation, congestion of brain, effusion in the cranial cavity, acute hydrocephalus, paralysis from acute softening of the brain, dysentery, inflammation of heart, syncope, mucus in the air-passages, thoracic inflammation, choleraic diarrhœa, pneumonitis, bronchitis, scarlet fever, croup. One died in trying to walk, one after a spasmodic cough in pertussis, one after a long agony, one after an agony of ten or eleven hours ; one is recorded to have died gradually, and three quietly.

The ten who are stated to have died suddenly probably died in paroxysms of palpitation and dyspnœa, which, we have seen, are easily excited,

and of common occurrence in cyanosis. If so this was the mode of death in 29 cases. Infants, with few exceptions, so far as appears from the records, died in convulsions. Nineteen died of cerebral affections, exclusive of convulsions, and in thirteen of these the cause of death was congestion, apoplexy, or coma. The hæmorrhage of which seven died was probably, in most instances, dependent on phthisis, and six are said to have died directly of phthisis. We may, then, regard paroxysms of palpitation and dyspnœa, convulsions, congestive affections of the brain, and phthisis, as common modes or causes of death in cyanosis.

The malformations of the heart and great vessels which give rise to cyanosis are quite numerous. The following table exhibits their character and relative frequency :

	Cases.
1. Pulmonary artery absent, rudimentary, impervious, or partially obstructed,	97
2. Right auriculo-ventricular orifice impervious or contracted,	5
3. Orifice of the pulmonary artery, and the right auriculo-ventricular aperture impervious or contracted,	6
4. Right ventricle divided into two cavities by a supernumerary septum,	11
5. One auricle and one ventricle,	12
6. Two auricles and one ventricle,	4
7. A single auriculo-ventricular opening ; inter-auricular and inter-ventricular septa incomplete,	1
8. Mitral orifice closed or contracted,	3
9. Aorta absent, rudimentary, impervious, or partially obstructed,	3
10. Aortic and the left-auriculo-ventricular orifices impervious or contracted,	1
11. Aorta and pulmonary artery transposed,	14
12. The cavæ entering the left auricle,	1
13. Pulmonary veins opening into the right auricle or into the cavæ or azygos veins,	2
14. Aorta impervious or contracted above its point of union with the ductus arteriosus ; pulmonary artery wholly or in part supplying blood to the descending aorta through the ductus arteriosus,	2
Total,	162

From the above table it appears that in more than one half of the cases of cyanosis the congenital vice which gives rise to it is located in the pulmonary artery. It is located also, in general, in that part of the artery which is nearest the heart. Its character is different in different cases. Sometimes there is an arrested development of this vessel, and in its place we find simply a ligamentous cord extending from the heart as far as the ductus arteriosis, while beyond this point the artery and its branches are pervious ; rarely the entire artery is ligamentous, and of course impervious ; in other cases this vessel is open through its whole extent, but the part nearest the heart is so small as to be properly considered rudimentary ; in others still there is adhesion of the valves to each other as the chief congenital defect, and, finally, in rare instances the obstruction in the pulmonary artery is due to an adventitious mem-

brane, which stretches across the vessel like a diaphragm. These last malformations, namely, adhesion of the valves and the formation of an adventitious membrane, are doubtless due to inflammation occurring in the artery before birth, and some attribute the arrested development and ligamentous state of the vessel to the same cause.

In most cases of cyanosis, due to obstructive malformations, the inter-auricular and inter-ventricular septa are more or less deficient. This deficiency obviously results from the obstruction, for the septa are formed in the heart after fœtal circulation is established, and the blood, being prevented by the vicious formation from flowing in its proper channel, necessarily passes to the opposite side of the heart. More or less blood being forced from one auricle or one ventricle to the opposite cavity, it is evident that a permanent aperture must result in the septum. The aperture in the septum ventriculorum is ordinarily at its base ; in the septum auriculorum it corresponds with the foramen ovale.

In most of the obstructive malformations one and rarely two abnormal cardiac murmurs have been observed. The single murmur accompanies the ventricular contraction. As it has been observed in cases of complete as well as incomplete obstruction, it seems to be due mainly to the flow of blood through the apertures in the septa.

Modes of Compensation.—In most cases of cyanosis the congenital defect is partially obviated by modes of compensation. In the most frequent malformation, that in which there is obstruction in the pulmonary artery, and a considerable part if not all the blood flows directly from the right to the left side of the heart, the ductus arteriosus not only remains open, but is greatly enlarged, through which a current of blood enters the pulmonary artery from the aorta, and passing to the lungs is oxygenated The bronchial arteries have also been found greatly enlarged, and it is believed that though they are the nutrient arteries of the lungs, the blood which they convey to these organs is decarbonized in its circuit through them. In a case published by Mr. Le Gros Clark, in the *Medico-Chir. Trans.*, vol. xxx., the bronchial arteries were not only enlarged, but a "branch from the internal mammary artery, which accompanied the phrenic nerve, was nearly equal in size to the parent trunk, and expended itself principally in the adjacent adherent lung." Branches of the intercostal arteries have also been found enlarged, and entering the lungs, or connecting with vessels which enter the lungs. By such modes of compensation cyanosis is rendered milder, and life is prolonged. To these we must attribute the fact that some have very considerable malformation, and yet do not become cyanotic.

Morbid Anatomy.—This, as regards the circulatory system, has been sufficiently dwelt upon. No chemical analysis, so far as I am aware, has yet been made of cyanotic blood. We know that it is dark, its coagulability feeble, that it contains an excess of carbonic acid, and is deficient

in oxygen. From the nature of cyanosis, it would be inferred that in many cases there is a degree of passive congestion in the cavities of the heart, and consequently in the capillaries of the systemic system, giving rise to more or less serous effusion. Statistics show that this is so. The quantity of pericardial fluid is in some patients increased. I have records relating to this fluid in fifty-one cases. Usually it was pure serum. In seventeen the quantity was half an ounce or less, if we include in the number those in which the amount is expressed in such terms as "due quantity," "usual amount," and "small amount." In twenty-four cases the pericardial fluid (serum) exceeded half an ounce, usually estimated at from one to six ounces, but in two it exceeded the latter quantity. In one of the twenty-four this fluid was stained with blood. In two patients the records state that there was a small quantity of pure blood in the pericardium, and in one the two pericardial surfaces were agglutinated by inflammation.

In some of the autopsies serum was found in the pleural cavities, usually in connection with pericardial effusion, and in at least one instance this fluid was tinged with blood. Old adhesions between the costal and pulmonary pleura were observed in a few instances. The condition of the lungs was recorded with more or less minuteness in one hundred and ten cases. Mention has already been made of the large number affected with tubercular disease, which was either confined to the lungs, or was chiefly exhibited in these organs. In thirty-five patients the records state that the lungs were of small size, either by compression, or sometimes, apparently, from the continuance of the fœtal state over a greater or less portion of the organ. The compression was produced either by the distended pericardium or by effusion in the pleural cavities. In thirty-five cases the lungs presented a dark color. This hue in some specimens accompanied the unexpanded or fœtal state of the organ, but in others there was the normal inflation, and the dark color was due to engorgement or congestion. In other cases the lungs are stated to have been natural, except the color. In nine emphysema was present in a part of the lungs, in two pneumonitis ; in two the color of the lungs was pale, in one a bright crimson ; in one the lungs were larger than natural, in one the right lung was absent, and in seventeen these organs were recorded healthy.

I have records of the state of the liver in twenty-six cases, in sixteen of which it was enlarged, and in four of these it was congested. Congestion of the liver was present in eight other cases, in which no mention is made of its volume. The parenchyma of this organ had a natural appearance in nine cases, but in some of these there was enlargement. From these statistics it is probable that the liver is commonly enlarged in cyanosis, and not infrequently congested. In a few cases the condition of the other abdominal viscera is mentioned ; in some as healthy, in others as congested.

Fifteen examinations of the brain were made, in seven of which congestion is recorded, and in three abscesses in the cerebral substance, in one of which cases the lateral ventricle was also filled with pus ; in two softening of a portion of the brain had occurred, in three the brain was firm or compact, in three the quantity of fluid in the cranial cavity exceeded the normal amount, and in one it was less than normal.

Theories Relating to the Etiology of Cyanosis.—Although in nearly all cyanotic patients there are direct communications between the two sides of the heart, it is shown by many observations that these communications or apertures are not sufficient in themselves to produce cyanosis. This opinion was expressed half a century ago by Louis, who published an excellent monograph on the subject of these communications, basing his remarks on an analysis of twenty cases. Since the publication of this paper, the belief has been pretty general in the profession, and observations continue to substantiate it, that, although the apertures may be of considerable size, if the two sides of the heart, with their orifices and vessels, are in their normal state, so that they act symmetrically and without obstruction, cyanosis will not occur. In proof of the correctness of this opinion many cases might be cited of a pervious, and some of a largely dilated foramen ovale, without the cyanotic hue, cases which have been published in the journals since the appearance of Louis's monograph. Still, in cases of obstructive malformation, unless the obstruction be complete, cyanosis is more apt to occur in consequence of these apertures, for were they absent a larger amount of blood would be propelled through the narrowed orifice, and a larger amount consequently be oxygenated.

Allusion has already been made to the two theories which prevail in the profession ; the one attributing cyanosis to the intermingling of venous and arterial blood ; the other to obstruction at the centre of circulation, and consequent venous congestion. There are serious objections to the acceptance of either theory as an explanation for all cases. That admixture of the two kinds of blood is not essential to the production of cyanosis, is apparent from the following facts. In one case in the *Fourth Malformation*, there was no communication between the two sides of the heart, and the ductus arteriosus was closed, so that admixture was impossible. Again, in the *Eleventh Malformation*, or that in which the aorta and pulmonary artery are transposed, the blue disease evidently does not depend on the admixture of the two currents. On the other hand, in this curious state of the heart, the more the admixture the less the cyanosis, since the only way in which the systemic current of blood can be arterialized is by passing to the opposite side of the heart. An argument against this doctrine may also be found in the fact that the modes of compensation are not such as in any way diminish or obviate the admixture. It is admitted that in the more frequent malformations cyanosis is increased by

the apertures, which allow the intermingling of the venous and arterial currents, but it is more reasonable to consider the intermingling and the cyanosis as the direct results of the malformation, neither having the precedence of the other, than to consider that they are related to each other as cause and effect, or as proximate and remote results. Viewed in this light, the admixture must be considered simply a concomitant of the cyanosis.

The second theory, that of venous congestion, has numbered among its advocates many who have given special attention to the subject, as Morgagni, Louis, and Stille, but it seems to have even less claim for acceptance than the theory of admixture. It has been seen that in nearly all cases of cyanosis the two sides of the heart communicate freely, so that if the current of blood meet with an obstruction, as it commonly does, it readily escapes to the opposite side where the artery is large and gives it free passage. In this way congestion, if no prevented, is greatly diminished. Again, it will be seen that, although certain of the viscera are frequently found at the autopsy more or less congested, congestion is not uniformly present in the organs, as it would probably be were it the proximate cause in all cases of cyanosis.

Moreover, in some patients the malformation is not obstructive. The cavities and their orifices are of the normal size, and cyanosis is due entirely to malposition of the vessels. It cannot be said that in these cases there is venous congestion from arrest at the centre of circulation. If there be any congestion, it must be due to the fact that venous blood does not circulate as readily as the arterial in the capillaries. It is true that in the paroxysms of dyspnœa there is sometimes more or less congestion ; the distension of the jugulars show this, but it subsides with the paroxysms, and it probably is no more than usually occurs when the respiration is greatly embarrassed

In fine, attempts to express the immediate pathological state producing cyanosis in the terms of a general law have failed. However plausible the above theories may appear in regard to certain cases, there are others to which they are manifestly inapplicable. Those who advocate these theories seem to lose sight of the obvious fact that the chief want of the economy in cyanosis is decarbonization of the blood, and it is hardly supposable that there can be any correct theory of its causation which is not founded on this fact. With this physiological state in view, it does not seem difficult to express a theory in comprehensive terms which is applicable to all cases, such as the following : *Cyanosis is due to vices or defects in the organism, usually congenital, which prevent the free and regular flow of blood to, through, or from the lungs.* So comprehensive a statement includes not only cases of malformation and malposition of the heart and its vessels, but also those few cases in which the lungs are in fault. In most patients, as we have seen, the current of blood *toward* the lungs

is obstructed, and the current of blood *from* the lungs, in those comparatively rare cases in which the malformation is on the left side.

Treatment.—From the nature of cyanosis it is evident that the treatment should be more hygienic than medicinal. The patient should be warmly clad and kept in a warm room, and all agencies calculated to embarrass or disturb the functions of the body or excite the emotions, and thereby accelerate the heart's action, should be studiously avoided. The diet should be nutritious, but simple and easily digested.

Those who have attributed cyanosis wholly to apertures in the interauricular and inter-ventricular septa, and the consequent flow of blood from the right to the left side of the heart, have considered it an important part of the treatment to keep the patient reclining on the right side, so as to diminish this flow by the effect of gravitation. The reader, however, must be convinced from the nature of the malformations that little benefit can accrue from following such advice. Still, patients are sometimes less cyanotic and more comfortable in one position than another. In a case reported by Mr. Howship (*Edin. Med. Jour.*, 1813), "the only easy and indeed comfortable position in which the child could remain was that usual in nursing. When erect, the dusky color of the face and neck became a dark-blue." In a case related by Mr. Spackman (*Lond. Med. Gaz.*, 1833), the patient was easiest on the hands and knees. Louis reports a case (*de la Commun. des Cav., etc.*) in which the selected position was with the head elevated; Wm. Hunter a case (*Med. Obs. and Enq.*, vol. vi.) in which the patient avoided paroxysms by lying on the left side. Struthers and King each report a case in which the patients seemed most comfortable while lying on the right side (*Monthly Jour. of Med. Sci.*), while, on the other hand, Professor White, of Buffalo (*Buf. Med. Jour.*, 1855), and Dr. Jas. Carson (*Amer. Jour. of Med. Sci.*, 1857), report cases in which position on the right side failed to produce any alleviation of symptoms. Other similar observations might be cited, but enough have been mentioned to show that no one position should be recommended for cyanotic patients. Some obtain most relief by lying on the back, others on the right side, others on the left, some when on the hands and knees, some when reclining on either sike indifferently, while, finally, others suffer least when erect.

There was a time when the paroxysms were treated by venesection, but depletion has long since been abandoned. Physicians now rely on stimulants, antispasmodics, friction to the chest, and mustard pediluvia, to relieve the urgent symptoms, although this treatment is but partially successful. It is probable that of all internal remedies digitalis is the most useful, from the fact that it is an efficient heart tonic, and more than any other medicine gives strength and equality to the heart beats. In the cities where oxygen gas can be procured for daily inhalation, it seems not improbable that the urgent symptoms might in some instances be partially relieved by the use of this agent.

SECTION V.

SKIN DISEASES.

CHAPTER I.

ERYTHEMATOUS DISEASES.

Under this head are included erythema, roseola, and urticaria. They consist in an active congestion, inflammatory it is believed, of the skin, which soon declines, with or without slight furfuraceous desquamation. The color of the affected cuticle is bright-red in erythema, rosy in roseola, and pale-red in urticaria. Febrile symptoms often precede for a few hours the occurrence of the eruption, and they abate as it appears.

Erythema.

The eruption of erythema occurs in patches of different sizes, the largest ordinarily not exceeding four or five inches in length, and most of them have considerably smaller dimensions, their margins being in some instances diffused, and in others circumscribed and well defined. The patches are slightly swollen from engorgement of the capillaries of the skin and slight serous effusion, and are accompanied by a sensation of heat and itching.

Erythema is idiopathic or symptomatic. The *idiopathic* form is subdivided into erythema simplex, intertrigo, and læve. Erythema simplex is produced by external agencies of an irritating nature, as heat, cold, friction, chemical and mechanical irritants, applied to the skin. A common example of this form of the disease is the efflorescence about the anus in cases of infantile diarrhœa due to acidity of the evacuations. Erythema intertrigo is produced by the friction of opposing surfaces of the skin, and it therefore occurs mainly in the folds of the neck, about the groins, and behind the ears. This inflammation is sometimes slight, disappearing in two or three days with proper treatment; in other cases the epidermis becomes denuded, the surface is tender and moist, and even superficial excoriations occur. In severe cases the ulcers extend more

deeply and give rise to considerable purulent discharge, the skin and even subcutaneous connective tissue being more or less infiltrated and indurated. The confinement of the perspiration, and the moisture, which is exuded between the folds of the skin, increase the inflammation. The effused liquid does not in ordinary cases stiffen linen, as in eczema. Erythema læve is the name applied to the inflammatory hyperæmia of the skin, which often occurs over œdematous parts. Its most common seat is about the ankles and upon the legs. In children it is most frequently observed in the œdema which results from scarlatinous nephritis and from heart disease.

Symptomatic erythema, which results from a general or constitutional cause of a pyrexial character, has several subdivisions. The simplest and mildest form of it is erythema fugax, which comes and goes quickly. The erythema which occurs upon the features in acute meningitis is a typical example. It is common in various inflammatory and febrile affections. If the erythematous patch be circular, with normal skin in its centre, it is sometimes designated erythema circinatum, and, if the margin be well defined, marginatum. Erythema papulatum, tuberculatum, and nodosum are applied to the same form of the disease, one or the other term being employed according to the stage or size of the eruption. In erythema papulatum the eruption begins as small red spots, which soon become papular, and attain a size varying from that of a pin's head to a split pea. It occurs especially on the neck, breast, arm, and back of the hand, and fades away, with a slight desquamation, in about three weeks. In erythema tuberculatum and nodosum the eruptions have a greater diameter, and are usually more prominent. In the latter variety they often have a diameter of two or more inches, and occur most frequently upon the anterior aspect of the leg. These three forms of erythema, which might be described as one, occur chiefly in young people. Erythema tuberculatum is most common in servants, especially those recently from the country. The tumefaction is due to the effusion of serum in the corium, and, when the eruption has considerable prominence, also in the subcutaneous connective tissue. The color is at first a bright-red, then dark-red or purple, and it fades away like the discoloration of a bruise as the eruption declines. Rheumatism is often and diarrhœa occasionally associated with these forms of erythema, and rheumatic pains are occasionally present, as well as more or less febrile movement.

Prognosis.—This, as regards the erythema, is always good. An unfavorable result in any case is due to cachexia, or some coexisting disease. The duration of the milder cases is only a few hours, while those of a more severe type, as erythema nodosum, last two or three weeks.

Diagnosis.—The ordinary forms of erythema are distinguished from *erysipelas*, by the absence of any very decided burning pain, and tumefaction of the integument, and tendency to spread, and by less marked

constitutional symptoms. In those cases of erythema in which there is infiltration and swelling of the skin and subcutaneous connective tissue, the patches are distinguished from those of erysipelas by being multiple, of smaller size, less hot and painful, not extending, and presenting as they disappear the phenomena of a bruise. In *urticaria* the wheals that come and go suddenly with a peculiar stinging sensation, and the irritability of the skin in consequence of which these wheals are produced by slight friction, differ so much from the symptoms and appearances of erythema that the differential diagnosis of the two is easy. In *roseola* the eruption ordinarily occurs over a large part, if not the entire surface, in points and small patches with healthy skin between, and presenting a rosy instead of a bright-red color, characters which sufficiently distinguish it from erythema. Erythema when extensive is sometimes mistaken for the scarlatinous eruption, but the redness of the fauces, graver constitutional symptoms, vomiting, persistence of the eruption, etc., serve to distinguish the latter from the former affection. In cases of doubt it is proper to defer the diagnosis for a day or two, when if the rash be erythematous it will fade. Erythema sometimes occurs in the initial stage of variola, when, on account of the grave general symptoms, it may be mistaken for scarlatina. I have more than once known this mistake to be made in the hurried visit of the physician. A more careful examination would prevent this error. There is little danger of confounding erythema with measles, or the various papular, vesicular, or pustular skin diseases.

Treatment.—Erythema fugax requires no special treatment, unless occasional dusting the surface with lycopodium or powdered starch. These forms of erythema which are due to mechanical or chemical irritants soon disappear when the cause is removed. In erythema around the anus, produced by the irritation of the urinary and alvine evacuations, the diaper should be changed as soon as soiled, and if the stools be frequent and acid, the alkaline treatment proper for the diarrhœa is useful also for the erythema. In inflammation from this cause as well as in erythema intertrigo, the following prescriptions for external use will be found beneficial :

℞. Bismuthi subnitrat., ʒj;
Glyceriti amyli, ℥j. Misce.

℞. Lycopodii, ℥ss;
Pulv. bismuthi subnitratis, ℥iss. Misce.

℞. Pulv. zinc oxid.,
Lycopodii, āā ℥j. Misce.

To be frequently dusted upon the inflamed surface. It is better to apply vaseline first, and dust upon this.

℞. Zinci oxid., ʒij;
Glycerinæ, ʒij;
Liq. plumb. subacetatis, ʒiss;
Aquæ calcis, ℥vj to viij. Misce.

In obstinate cases a weak solution of nitrate of silver, sulphate of copper, or better, as it does not stain the linen, sulphate of zinc, will frequently be followed by immediate improvement.

℞. Zinci sulphat., gr. vj ;
Glycerinæ, ʒ ij ;
Aq. rosæ, ʒ iv. Misce.
To be constantly applied between the folds of the skin on linen.

Potassium chlorate, internally, to correct the acidity of the transpiration from the skin in protracted and obstinate cases, and in certain instances cod-liver oil and the syrup of iodide of iron, are called for. If the derangement of the system upon which the erythema depends appear to be of a rheumatic character, colchicum or alkalies may be required. Erythema papulatum, tuberculatum, and nodosum occur most frequently in reduced states of the system, and therefore need tonics.

Roseola.

The term roseola is applied to rose-colored spots or patches of greater or less extent, accompanied by a degree of febrile reaction, and often by redness, with little or no swelling of the faucial surface. It is attended by a sensation of warmth and slight itching. The following groups and subdivisions embrace the recognized varieties of this disease :

Roseola.

Idiopathic.	*Symptomatic.*
Infantilis.	Variolosa.
Æstiva.	Vaccinia.
Autumnalis.	Miliaris.
Annulata.	Rheumatica.
Punctata.	Arthritica.
	Cholerica.
	Febris continuæ.
	Syphilitica.

The color of the eruption gradually fades from a rose-red to a duller hue, and often disappears in two or three days. In other instances the eruption lasts a week or more. Roseola may occur in any season, but it is most common, especially the idiopathic form, in the warm months. Those varieties of the idiopathic disease which are designated infantilis, æstiva, and autumnalis are the most common in early life. They are in reality identical, or nearly so, and may be described as one disease.

Symptoms.—Roseola infantilis, æstiva, or autumnalis may be partial, appearing upon the arms, and legs, or general. It is often preceded by

febrile movement, languor, and in those old enough to describe their sensations, pain in head, back, and limbs. There is great difference, however, in different cases as regards the severity of the prodromic symptoms. They may be absent or so slight as scarcely to be appreciable. Occasionally vomiting, diarrhœa, or other symptoms of derangement of the digestive apparatus immediately precede the eruption.

The eruption of roseola, when general, usually commences upon or about the neck and face, and in the course of twenty-four to thirty-six hours appears upon the rest of the surface. It bears considerable resemblance to that of measles. The patches are irregular in shape, a quarter to half an inch in diameter, and, though of a rose color at first, they soon present a dusky hue as they begin to fade ; by pressure the redness disappears. In the majority of cases the eruption has nearly faded by the fifth day. The redness of the faucial surface, together with the itching or tingling, disappears with the subsidence of the rash.

Roseola annulata is a rare disease. It commences with constitutional symptoms, which are slight or pretty severe, and which cease when the eruption appears, this occurs in the form of red circular spots, which enlarge to the diameter of an inch or thereabout and assume the shape of rings inclosing healthy skin. The rash fades in a few days, often leaving a bruised appearance. The ordinary location of this form of erythema is upon the abdomen, and about the thighs. In roseola punctata the eruption is of small size, and it occurs upon a large part of the surface.

Symptomatic roseola, which appears in the course of various diseases, need only be alluded to. The diseases in which it is developed are, with the exception of syphilis, chiefly of an acute febrile or inflammatory character. This eruption is often really, as stated by Tilbury Fox, a rose-colored erythema, but in other instances it presents the typical form and appearance of roseola. Thus I have known it to occur about the eighth or ninth day of vaccinia in rose-colored spots over the whole surface, and producing much anxiety on the part of parents, lest impure virus had been employed.

Causes.—These are in a measure obscure. The delicacy of the skin in infancy and the active cutaneous circulation no doubt predispose to roseola and erythema, and hence the frequency of their occurrence in acute febrile and inflammatory affections. Summer weather, with the derangements of system which it produces, has been in my experience much the most frequent cause of idiopathic roseola in young children in this city. In certain summers, as in that of 1868, a large proportion of the infants have been affected by it, and I have been led to consider it a favorable prognostic sign as regards the diarrhœal affections which are so common in the warm months.

Prognosis.—Roseola is always a mild and favorable disease.

Diagnosis.—Roseola is distinguished from measles, by the absence of

catarrhal symptoms, a less degree of fever, less uniformity in the size of the eruption, and the absence of any history of contagion. Roseola is distinguished from erythema by the smaller size of the eruption and its rosy or dusky red color. The boundary line, however, between the two diseases is not well defined, and certain forms of roseola might be described as erythema. The general but punctiform efflorescence, increase of temperature, acceleration of pulse, and the peculiar appearance of the tongue and fauces, serve to distinguish scarlet fever from roseola. There is little danger of confounding roseola with urticaria, since the wheals of the latter appear in no other disease.

Treatment.—This is simple. If roseola occur in connection with gastro-intestinal derangement or disease, the remedies which relieve the latter exert a curative effect upon the former. In all cases the state of the system should be inquired into, and any departure from a state of health corrected. Roseola needs no farther constitutional treatment. If there be itching or tingling of the surface, a lukewarm lotion, containing equal parts of liq. ammon. acetat. and mistura camphoræ, has been recommended, or a lotion containing a drachm of hydrocyanic acid to a pint of an emulsion of bitter almonds, used warm. The purpose of such lotions is simply to relieve the unpleasant sensation. Cold applications, or others which would repel the eruption, should be avoided ; such an effect might be injurious. In cases of acidity of stomach alkaline remedies are useful, and in certain cases tonic treatment is indicated.

Urticaria.

The name by which this disease is designated is derived from the term *urtica*, the nettle, the sting of which produces this form of eruption. The eruption occurs suddenly in wheals or pomphi, attended by tingling and burning, and suddenly disappearing. Urticaria is often accompanied by no very decided general symptoms, but in other cases there are febrile movement, and lassitude, with perhaps epigastric pain and headache. The wheals may occur over the whole body, but more frequently are confined to a portion of it. Their shape may be round, oval, irregular, or band-like, and their length varies from a few lines to several inches. In one affected by urticaria the wheals can be readily produced by scratching or rubbing the surface. The eruption is thus clearly described by a recent writer : "At first a bright flush appears, the centre of this becomes slightly elevated, and pales, hence appears of lighter color ; the tint may be rosy, but more generally it is whitish." The margin of the wheal, the diameter of which varies, always remains red. This eruption appears to be produced by active congestion of the cutaneous capillaries, some serous effusion, and spasm of the muscular fibres of the skin. The effusion of serum in certain localities is quite apparent from the œdema which occurs.

The subsidence of the eruption is without desquamation. Urticaria is ordinarily an acute disease. It is sometimes chronic in the adult, but rarely so in children. Several varieties of it are described by dermatologists, according to the cause, appearance, and duration.

Causes.—These are external and internal. Various irritants apart from the nettle applied to the surface produce the wheals, as the bites of certain insects and sometimes turpentine. The following are the principal internal causes, as summarized by Hillier : 1st, profound and sudden mental emotion ; 2d, certain articles of diet, as shell-fish, pork, sausage, cheese, etc. ; 3d, certain medicinal substances, as copaiba, valerian, and turpentine ; 4th, intestinal worms, though it is probable that these seldom operate as a cause ; 5th, uterine ailments, as hysteria.

Prognosis—Diagnosis.—The prognosis is good, though the chronic form is sometimes tedious and troublesome. The occurrence of the wheals and the possibility of producing them by friction serve to distinguish this disease from all others.

Treatment.—In urticaria due to any recent ingesta of an irritating or indigestible character, an emetic of ipecacuanha is useful, followed by a saline, and better also alkaline aperient, as Rochelle salts. An aperient of this character is useful ordinarily in acute cases, attended by febrile reaction. The diet for several days should be simple, and such as is readily digested, as fresh beef, bread, or other farinaceous food, and milk. Occasionally the wheals appear periodically, when a few doses of quinine effect a prompt cure. After the above measures have been employed, the subsequent treatment, whether tonic or otherwise, depends on the condition of the patient. Little benefit accrues from local measures. Sponging the surface with cool water to which a little vinegar is added relieves, in a measure, the heat and tingling of the wheals.

CHAPTER II.

PAPULAR DISEASES.

STROPHULUS.

The three papulæ, namely, lichen, prurigo, and strophulus, which are characterized by small and firm elevations upon the skin, occur in children ; but the two former are not common, and, as they do not differ in any essential particular from the same diseases in the adult, they will not be treated of in this connection. Strophulus, on the other hand, is a disease peculiar to children. It is known as the red gum or white gum, according to its appearance, and also as the tooth rash. This eruption

appears usually on parts which are exposed, as the face, neck, and extremities, the papules being in some patients of the size of, or even smaller than, a pin's head, while in other cases they are as large as a millet-seed.

The varieties of strophulus described by dermatologists are :

S. intertinctus.	S. candidus.
" confertus.	" volaticus.
" albidus.	" pruriginosus.

The following are the characters of these varieties : S. intertinctus, papules bright red, and occurring chiefly upon the cheeks, forearm, and back of hand ; often *intertinctured* with blushes of erythema ; it lasts from two to four weeks, and is most common in young infants. S. confertus, papules numerous, and closely aggregated, paler, continuing longer than in strophulus intertinctus, and likely to recur, appearing about the time of dentition, and most frequently upon the arm. Sometimes certain of the patches become chronic, slowly disappearing, and leaving the skin rough and dry. S. volaticus appears usually upon the arms and cheeks in patches of about a dozen, fewer or more, papules, which soon disappear. These patches reappear at intervals for two or three weeks, and are attended by heat and itching, though not intense. S. albidus, so called, should really be placed among the diseases of the sebaceous glands, and described under another name. It appears in the form of small white elevations as large as a pin's head, commonly upon the face and neck, and produced by distension of the sebaceous glands with the secreted product. The term strophulus candidus is applied to large whitish papules, which appear upon the sides of the trunk, shoulders, and arms of infants of one year or thereabouts, and disappear in about one week. They are apt to be associated with the papules of strophulus confertus. S. pruriginosus is really a form of lichen, occurring chiefly over the age of one, and under that of eight or nine years. The papules, which are small and discrete, usually appear over a large extent of surface, ordinarily upon the back, front of the chest, the face and arms, and, as they are scratched from the itching, minute dark points of blood collect and dry upon their apices. This form of strophulus is more protracted than the others, and, in consequence of the irritation produced by the scratching, pustules of ecthyma often occur among the papules. The apparent cause of strophulus pruriginosus is a mode of life which impoverishes and vitiates the blood, such as uncleanliness, residence in damp, dark, overheated, and overcrowded apartments. Atmospheric heat also operates as a cause, and it is a not infrequent disease in the cities during the summer months.

The various eruptions included under the term strophulus have such different anatomical characters, that a proper classification would locate some of them in other groups of skin diseases. One form of it, as we

have seen, is produced by distension of the sebaceous glands ; in other, and the majority of cases, as appears from the recent observations of Mr. Fox, its seat is the sweat glands, and in others still the papillary layer of the skin, as in lichen, the papules being produced by an exudation.

Treatment.—Personal cleanliness, with frequent change of linen, and daily ablution without the use of soap, should be enjoined. Local irritants, which might aggravate or cause the disease, should, so far as practicable, be removed. Alkalies in cases of acidity of the *primæ viæ*, and occasionally mild aperients, are required ; the food should be bland, but nutritious, and if the child be nursing, it may be necessary to attend to the health of the wet-nurse. Favorable hygienic conditions, important for the successful treatment of all forms of strophulus, are especially required in strophulus pruriginosus. Nutritious diet, fresh air, quinine, iron, cod-liver oil, etc., should be prescribed for those affected by it. The following formula is recommended for sponging the surface in cases of strophulus :

℞. Sodii carbonat., ʒj ;
Glycerinæ, ʒij ;
Aq. rosæ, ℥vj. Misce.

CHAPTER III.

ECZEMA.

This is one of the most common maladies of the skin. It constituted one third of Devergie's cases, and one sixth of Hillier's. In the commencement of the eczematous eruption the skin presents a superficial redness, and upon this inflamed area numerous minute and closely aggregated papules, vesicles, or, more rarely, pustules, soon appear. These are very fragile, so that they soon rupture, the epidermis is broken and destroyed, and the surface is moistened by an effusion which appears to be serum, and cannot be distinguished from it by the microscope. This liquid when dry stiffens linen. As it dries thin crusts form, of a light yellow color, in most localities, but thicker, and of a deeper yellow color upon the scalp. The crusts consist mainly of pus, epithelial cells, and granular matter.

Anatomy.—Biesiadecki has described the formation of the eczematous eruption. According to him the papules are produced from the papillæ, which increase in size by cell formation in their interior. The connective-tissue corpuscles enlarge, and are unusually "rich in fluid," and their number increases. Under the microscope spindle-shaped corpuscles are observed, filling the papillæ, and extending up from them into the rete Malpighii, crowding apart the cells of this layer, and reaching and

elevating the epidermis. The epithelial cells in the immediate vicinity of the papillæ also become swollen. This cell-growth produces the eczematous papule.

If the cell formation continues within a papilla, certain of the cells are ruptured, and as they are very moist a liquid is effused, which raises the epidermis over the summit of the papilla. This produces the eczematous vesicle. Occasionally pus mixes with this liquid, and the eruption is then vesico-pustular.

In acute eczema the upper part of the true skin is infiltrated and swollen, while the lower part is commonly unaffected, except in the most severe cases. The older the eczema the greater the extent of the infiltration, so that in chronic eczema the whole thickness of the skin is more apt to be involved than in acute forms of the malady. The discharge of the eczematous surface is irritating, and healthy skin, with which it may come in contact, is often reddened by it and made eczematous, from its irritating effect. This eczema occurring upon a part of the surface which is in contact with an opposite surface of sound skin, commonly affects the latter, and as Neumann has stated, a nurse, by carrying an infant having eczema upon its nates, may contract the same disease upon her arm, although there is no contagious principle in this malady.

Etiology.—Eczema is often produced by irritating substances applied to the skin. Croton oil, certain soaps, the finger nails in scratching, a hat, truss, or belt, by pressure may produce it. Those having a tender and delicate skin are more liable to it than others. The constitutional causes are often obscure. It is sometimes obviously due to indigestion, or a diet which disagrees, for we see it occur in nursing infants as a result of sickness of the mother. Anæmia and scrofula are occasional causes. Among the city poor eczema is common, and many of the children who have it are scrofulous, but a large proportion show no evidence of struma, and in the better classes of society a majority do not.

Varieties—Symptoms—Course.—Eczema is sometimes designated according to its location as *E. faciei*, *capitis*, etc. Another designation, which has more scientific value, is according to the form and stage of the eruption, by which we have the following recognized varieties, to wit : Eczema papulosum, vesiculosum, pustulosum, rubrum, impetiginosum, and squamosum. A simpler and still more convenient classification is into eczema simplex, rubrum, impetiginosum, and squamosum.

Eczema of the scalp is common in infancy, occurring as an eczema rubrum or impetiginosum. The eczematous exudation mingling with the secretion of the sebaceous glands, which are numerous upon the scalp, forms a thick yellow crust. It is apt to extend beyond the hairy portion to the forehead and around the ears. This extension aids in establishing the diagnosis between eczema and certain other cutaneous eruptions of the scalp. Eczema of the external ear is sometimes primary, but in

other instances it is consecutive to that of the scalp, and due to the extension of the latter. Its common seat is in the angle behind the ear, and upon the lobe of the ear, whence it often extends along the auditory meatus, narrowing its calibre, and impairing the hearing temporarily, or even for years. Eczema upon the forehead commonly occurs in children from extension of the eruption from the scalp. The cheeks, lips, and chin are often also affected by eczema, which in this situation is commonly eczema rubrum, and is attended by redness, swelling, and troublesome itching. The swollen and red appearance with the crusts and marks produced by scratching often greatly disfigure the countenance. In children, when eczema occurs upon other parts, it is usually associated with that of the scalp, face, or ears—that in the latter situations being the most severe and obstinate.

Eczema simplex is common in the summer months, being produced by the heat of the atmosphere, aided perhaps by other causes. The patient may appear well, or be somewhat indisposed, having febrile symptoms, and soon an erythematous patch of greater or less extent appears, upon which a cluster of the characteristic papules or vesicles soon occurs. These break, forming slight crusts, which are detached, and the eczema declines, or it may continue longer, with successive crops of the eruption.

In eczema *rubrum*, since it is a more severe form of the disease, the febrile movement and the local symptoms are greater than in the preceding variety, and the eczematous patch presents the appearance of a more intense inflammation. The papules or vesicles are often so minute as to be with difficulty recognized. They are soon broken, when they form with the secretion and exudation from the surface yellowish or brownish-yellow scabs. The discharge is more irritating, as it is more abundant than in eczema simplex, and the adjacent skin is usually more inflamed from its contact.

Eczema *impetiginodes* is common in young debilitated children, in whom, in consequence of the cachexia, inflammations, of whatever character, are apt to be suppurative. This form of eczema presents at first the symptoms and features of eczema rubrum, but the transparent liquid of the vesicles soon becomes opaque, from the generation and admixture of pus-corpuscles. The crusts, which form from the rupture and desiccation of the vesiculo-pustular eruptions, are thick and greenish-yellow, and in infants the sebaceous glands, which are involved in the inflammation, pour out an abundant secretion, increasing the thickness of the crusts. This form of eczema is most common in infancy, and its usual seat is upon the scalp.

Diagnosis.—Eczema presents in different instances so different an appearance that it is not always readily diagnosticated. It will aid in its diagnosis to recollect that it is in its nature a catarrh, affecting primarily and chiefly the upper portion of the derma and the Malpighian layer,

and although it may now present a dry or scaly appearance (E. squamosum), yet its history will show that there has been a discharge or moisture. In a large proportion of cases, the physician is not able to detect papules or vesicles, since they are fragile and transient, breaking in the first thirty-six hours, and not reappearing. Still, when they are absent, we sometimes observe around the margin of the patch an appearance which indicates that they have been there. Their minuteness is occasionally such that they may escape notice, on a cursory inspection, when they are present and well defined. Acute eczema, affecting a considerable extent of surface, is often attended by febrile movement, and might be mistaken for one of the eruptive fevers, but the absence of certain distinctive appearances, which characterize these fevers, and the speedy appearance of the eruption and moisture, establish the diagnosis. Eczema can be readily diagnosticated from ordinary erythema, which is a superficial inflammation without moisture. The location of erythema intertrigo serves for its diagnosis, as it is evidently produced by the attrition of opposite surfaces of the skin. Moreover it lacks the elevated papillæ, and the discharge does not stiffen linen like that of eczema. Lichen, when acute, presents some resemblance to eczema, but it is dry and papular, the papules, though small, being detected by the finger as well as sight. The large and irregular phlyctenulæ, intense inflammation and œdema, and mode of extension of erysipelas ; large, scattered, and non-inflammatory vesicles of sudamina ; scattered and acuminate vesicles, without surrounding inflammation, of scabies ; are so different from the eczematous eruption that the differential diagnosis is readily made. Herpes circinatus can be distinguished from eczema by its circular shape, larger size, and greater permanence of the vesicles, and the delicate, branny scales, which consist rather of epithelial cells than the product of exudation as in eczema.

Treatment.*—Every case of eczema should be cured as quickly as possible, as we know that there is no danger of any other disease arising from too rapid cure of any skin affection, and also know that a long-continued eczema may not only seriously interfere with the general health of a child from the constant irritation and restlessness which it produces, but also that from the cutaneous irritation the neighboring lymphatic glands may become inflamed and undergo a caseous degeneration, which in turn can produce a tubercular formation in the lungs or meninges. The treatment of eczema is both local and constitutional. Some cases do well with local treatment alone, but in the majority internal treatment is of great assistance, even when we are unable to detect any dyscrasia or special condition of the blood or general system. If any special dyscrasia be present, as scrofula, etc., then the child must be treated with the appro-

* Revised by Dr. A. R. Robinson, of the Dermatological Society.

priate agents for this in addition to the means employed against the eczema. No one line of treatment is suitable for every case, and therefore a large number of remedies have been used and recommended. Among the city poor strumous cases are common, and cases also in which without any pronounced diathetic state the cause is apparently a reduced state of the system from innutritious diet and other anti-hygienic conditions. Such cases require better diet and a mode of life more in accordance with sanitary requirements. On the other hand, I have observed cases of eczema which seemed to be produced by a plethoric state of the system in the nursing infant, when the milk of the mother or wet-nurse was unusually rich and abundant. While, therefore, ill-nourished and weakly children require better regimen, with perhaps vegetable and ferruginous tonics, the plethoric require reducing treatment, though of a gentle kind. For the latter the following prescription will be found useful :

℞. Pulv. rhei, ʒ ss ;
Sodii bicarb., ʒ j ;
Aquæ menth. piperitæ, ℥ iv. Misce.
Dose, one teaspoonful three or four times a day for a child of two years of age.

In such cases also, an occasional purgative dose of calomel has been recommended by some dermatologists. In addition to measures designed to meet the special indications of a case, there is one internal remedy, arsenic, which has been found of signal benefit, whatever may have been the fault of system from which the eruption originated. As I have stated in the chapter relating to therapeutics, children tolerate arsenic much better than adults do, consequently it can be given to them in larger proportionate doses. A most useful combination is that of arsenic with alkaline diuretics, as the latter exert a marked beneficial influence upon eczema, frequently not inferior to that of arsenic. In fact, at the commencement of an acute eczema, it is better to give the alkaline diuretics alone, and, later in the disease, when there is less redness and irritation of the skin, to combine the arsenic with them. The dose of the latter is to be regulated according to its effect upon the child and also upon the eruption. Always give as large a dose as the child will bear well, so as to obtain the best results from its action. The following formula is for a child one year old :

℞. Potassii acetatis, ʒ iss ;
Liq. potassii arsenitis, gtt. xxiv ;
Spits. etheris nitrosi, ʒ ij ;
Syrupi aurantii, ʒ vj ;
Aquæ carui, 9, s. ad. ℥ iij. Misce.
Dose, one teaspoonful three times a day.

If the arsenic produce intestinal irritation, paregoric should be added to it.

Local Treatment.—This varies according to the condition of the skin

at the seat of the eruption. In all cases of acute eczema with irritable skin, soothing applications must be employed, and not irritating salves. The part should not be washed with water, as it irritates and aggravates the eruption. When the surface is red, angry-looking, and discharging a thin watery secretion, lead or alkaline lotions are useful, as the following :

℞. Liq. plumbi subacet., ʒj ;
Glycerini,
Aquæ, āā ʒiv. Misce.

To be applied two to four times a day with a camel's-hair pencil.

One of the most useful applications for the treatment of acute eczema in children is a salve made of equal parts of vaseline and simple lead plaster. If this proportion be too strong for an individual case, it can be made milder by increasing the amount of vaseline. It should be applied twice a day by spreading it either on linen or waxed paper. Sometimes the oxide of zinc ointment answers very well for the early stages of the disease. The ointment of the pharmacopœia is, however, generally too strong, so that it may irritate—five grains to the ounce of simple salve being frequently strong enough. Sometimes the part is so tender that only a dusting powder can be used to protect the surface from the air while internal treatment is employed. When the discharge has become thicker and more purulent, and forms scabs, the above-mentioned ointments are to be used. If the scabs are very thick they can be removed by soaking the part with oil and washing once with soap and water. In eczema of the scalp, if the hair be long it should be cut as short as possible, otherwise a salve cannot be applied with any benefit. When the eruption has arrived at that stage when almost all discharge has ceased, and the surface is simply hyperæmic, with more or less branny scales, some tar preparation should be used. These remove the last traces of the eruption, and stop the itching which is present.* They are to be used as long as any itching or trace of the disease is present, since, until they both disappear, there is danger of a return of the eruption to an acute condition. The oil of cade can be used of full strength or diluted with alcohol or mixed with cod-liver oil to any desired extent. It must be well rubbed into the part, and applied about once a day. In eczema rubrum situated in the flexures of the joints, we have obtained good results by the constant wearing of a solid rubber bandage on the part until cured. If the eczema occupy a large portion of the surface of the body, then it is advisable to endeavor to cure the eruption by the internal use of the potash and arsenic mixture given above, combined or not, according to the effect produced, with alkaline or bran baths. In cases of inter-

* The Sisters in the New York Foundling Asylum employ the tar soap in these cases, with, they state, an almost uniform good result.

trigo, either the lead lotion can be used or the part kept as dry as possible with lycopodium powder, to which can be added some subcarbonate of bismuth. Flannel should on no account be worn next the inflamed surface, since woollen material irritates and keeps up the eruption. On account of this irritating action it should not be worn next the skin after the eruption has disappeared, lest it might cause a return of the disease. The following formulæ have been recommended by dermatologists.

For internal use :

℞. Vini ferri (Br. Ph.), ℥ iss ;
Syrup tolutan., ʒ iij ;
Liq. potassii arsenit., ʒ j ;
Aq. anethi, ℥ ij. Misce.

Recommended by E. Wilson. Half a teaspoonful may be given three times daily to an infant of one year.

℞. Ol. morrhuæ, ℥ ij ;
Vitel. ovi no i ;
Liq. sodii arseniat., ʒ j ;
Syrupi, ʒ ij ;
Aquæ, ℥ iv.

Half a teaspoonful three times daily to an infant of one year.

External.—The prescriptions recommended on a preceding page for erythema intertrigo are useful for many cases of eczema :

℞. Picis liquidæ, ʒ ij ;
Potassæ, ʒ j ;
Aquæ, ʒ v. Misce. (*Bulkley.*)

The quantity of water may be doubled for children.

℞. Bismuthi subnitrat., ʒ ij ;
Glycerini, ℥ j. Misce. (*Pardee.*)

Scabies.

The diseases of the skin previously considered are non-contagious. Scabies, on the other hand, is one of the most contagious diseases by contact. It is produced by an animal parasite, known as the itch-mite, or *acarus scabiei.* The inflammation is caused by the female only, which burrows, making for itself a canal, or cuniculus, in which its eggs are deposited. The male does not burrow, but conceals itself under the scales or crusts which result from the inflammation produced by its partner, or it burrows only sufficiently to produce a covering and shelter. From observations made by Eichstedt, Gudden, and others, the female has been found within half an hour after being placed upon the skin to have concealed herself in the epidermis, and the burrow which she constructs is arched and tortuous, and four or five lines in length, shorter or longer. The acarus has the shape of a tortoise. It can when fully grown be detected by the eye as a minute whitish point. The young acarus has six, the mature eight, articulated legs, with suckers upon the two anterior

pairs, and hairs on the posterior. The head, which can be elongated or retracted, is provided with two jaws. The upper surface is covered with spines directed backward so as to prevent retrogression in the burrow. She leaves behind her in the cuniculus, as she advances, her moulted skin, excreta, and eggs, which hatch on the eleventh day. The mother acarus is always found at the remote end of the burrow, where it can be seen by the unassisted eye as a minute whitish or sometimes brownish speck, and from which it can be lifted by the point of a needle to which it clings.

Fig. 27. Fig. 28. Fig. 29.





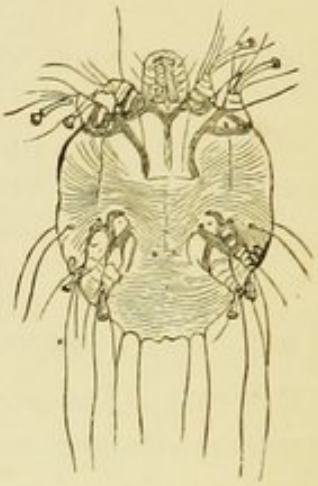


Fig. 30.

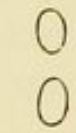


Fig. 27. The itch animalcule, acarus scabiei, viewed upon the back, showing its figure and the arrangement of its spines and filaments. The female, which is somewhat larger than the male, has a length of 1-80th to 1-60th of an inch.

Fig. 28. The foot and last joints of the leg of the itch animalcule.

Fig. 29. The male itch animalcule, viewed upon the under surface, showing its legs and lobulated feet.

Fig. 30. Ova of the itch animalcule.

The cuniculi can also be seen by the naked eye, looking, says Niemeyer, like the "scars of needle scratches," and containing the young acari in various stages of growth.

The acarus by its burrowing produces an irritation and troublesome itching, which is the chief cause of the suffering of the patient. At the point where the acarus penetrates the cuticle the inflammation gives rise to a single, small, and acuminate vesicular or papular eruption, the cuniculus extending away from it. We often find ecthymatous pustules and abrasions intermingled with the vesicles, the result of the frequent scratching. The itching is most intense, and the acarus most active, at night, when the patient is warm in bed. Scabies most frequently appears, especially in adults, first upon the hands, between the fingers, where the skin is thin, and it extends thence along the forearm, and over the thighs and abdomen. In children it not infrequently occurs upon the buttocks, thighs, feet, etc., while the hands and forearm escape.

Diagnosis.—Correct diagnosis is important, because the treatment re-

quired is different from that in any other exanthem, and because the suspicion of having this disease always renders one solicitous to know the exact nature of the eruption. Scabies can be diagnosticated from those diseases for which it might be mistaken by the following characters : its occurrence where the cuticle is thin and delicate, as between the fingers, along the anterior aspect of the forearm, upon the abdomen, thighs, and inside of the feet ; small size, acuminate shape, and isolated position of vesicles ; the intermingling with the vesicles of other forms of eruption, as papules and pustules, and the presence of linear scars and abrasions produced by the scratching ; itching most intense at night ; absence of fever ; absence of the disease from posterior aspect of body and arms, and from head and face. Scabies may be distinguished by the vesicular character of the eruption from all other exanthematic affections except eczema, sudamina, and herpes. Eczema is most common on the scalp and face, where scabies does not occur, and unlike scabies its vesicles are round and thickly aggregated in clusters ; in eczema there is a smarting or prickling sensation very different from the intense itching of scabies. In herpes the vesicles are large, rounded, and in clusters, and attended by a burning or pricking sensation, with but little itching. The eruption in sudamina is vesicular and discrete, as in scabies, but it is globular, and accompanied by no itching or other local symptoms.

Treatment.—As scabies is due to a species of acarus which burrows in the epidermis, it can only be treated successfully by measures which destroy this animalcule. If it be destroyed, the disease gets well of itself. Sulphur has been employed for a long period for this purpose, since sulphurous acid, which is evolved from the sulphur, is destructive to the animalcule. The unguentum sulphuris, if thoroughly applied, will rarely fail to eradicate scabies. The internal use of sulphur aids the external treatment, since a portion of the gas which is generated escapes through the pores of the skin. The chief objection to the employment of sulphur is its exceedingly unpleasant odor, which is noticeable, however disguised by perfume. Sulphur or any other substance employed externally has more effect if it be preceded by a bath, which softens the epidermis, and therefore favors the entrance of the remedy into the pores of the skin and the cuniculi.

Helmerich's ointment is very effectual in the treatment of scabies. It consists of two parts of sulphur, one of carbonate of potassium, and eight of lard. "M. Hardy afterward perfected the method, so as radically to cure the disease in two hours. He proceeded in the following manner : The patient first undergoes a friction of his whole body for half an hour with soft soap, in order to cleanse the skin and break up the burrows ; a warm bath of an hour's duration follows, during which the skin is thoroughly rubbed, in order to complete the destruction of the burrows ; after which frictions for half an hour and upon the whole surface are

practised with Helmerich's ointment. This completes the cure. Out of four hundred patients subjected to this treatment, only four returned to the hospital." (Stillé's *Therapeutics, etc.*, vol. ii. p. 516.)

M. Albin Gras experimented with different substances, in order to ascertain their relative destructiveness to the acarus. The following table gives some of the results of his experiments :

Immersed in pure water the acarus was alive after three hours.
" saline water the acarus moved freely after three hours.
" Goulard's solution the acarus lived after one hour.
" olive, almond, or castor oil the acarus lived more than two hours.
" lime-water the acarus died in three-fourths of an hour.
" vinegar " " twenty minutes.
" alcohol " " " "
" turpentine " " nine "
" iodide of potassium the acarus died in four to six minutes.

It is seen that vinegar, lime-water, alcohol, turpentine, and iodide of potassium destroy the acarus in a short time. They may be employed in the same manner as the sulphur ointment. Camphor is also destructive to this animalcule, and the linimentum camphoræ, thoroughly applied, is a good remedy for uncomplicated scabies.

In order to avoid the odor of sulphur, which is so offensive, one of the following ointments may be employed, if the patient be fastidious :

℞. Unguent. hydrarg. ammoniat., ℥ j ;
Moschi, gr. ij ;
Ol. lavendul., gtt. ij ;
Ol. amygdal., ʒ j. Misce. (From *Wilson.*)

If scabies be extensive this should not be used, as its application over considerable area might endanger salivation, but the following, which is recommended by Bazin, and is said to cure the disease with three applications, may be used instead :

℞. Anthemis pulv.,
Adipis,
Ol. olivæ, āā ℥ j. Misce.

In cases which have been protracted, and in which ecthymatous and other secondary eruptions have occurred, the scabies can ordinarily be readily cured, while the other eruptions remain and disappear more slowly. A knowledge of this is important, since the sulphur, or other ointment employed for the cure of scabies, should be discontinued when the itching ceases and vesicles no longer appear, and tonic, or other treatment appropriate to cure these secondary eruptions, should be employed instead. The sulphur ointment continued, after the scabies is cured, does harm, as it irritates the cuticle. It is essential in the treatment of scabies that the linen be frequently changed.

INDEX.

ACEPHALUS, 377
anatomical characters, 377
symptoms, prognosis, 378
Allin, Dr. C. M., on retro-pharyngeal abscess, 662
Apnœa neonati, 74
causes, 74
treatment, 74, 75
Artificial feeding, 61
Ascaris lumbricoides, 745
Asphyxia neonati, 74
Atelectasis, 569
acquired, 569
anatomical characters, symptoms, 571
treatment, 572

BARKER, Prof. Fordyce, on the use of turpeth mineral in croup, 548
Bathing, 68
Bigelow, Dr. W S., cases of diphtheria, 248
Blue disease, 793
Bothriocephalus latus, 751
Brain in infancy and childhood, 376
absence of, 377
Brain, imperfect, 379
case, 379
symptoms, prognosis, 380
atrophy of, 380
Brain, hypertrophy of, pathological anatomy, 382
nature of, 383
symptoms, case, 384
diagnosis, 385
prognosis, treatment, 386
Brain, congestion of, 391
causes, 392
symptoms, anatomical characters, prognosis, 394
treatment, 395
Brain, hæmorrhage in and upon, 396
Brain, dropsy of, acquired, 412
congenital, 406
Bronchitis, 556
causes, anatomical characters, 557
symptoms, 560
diagnosis, prognosis, 563
treatment, 564
Bulkley, Dr. L. D., on dactylitis syphilitica, 174
Byrd, Prof. H. L., on mode of resuscitation, 76

CANCRUM oris, 643
Cancer, aqueous, of infants, 643
Caput succedaneum, 76
Caries, vertebral, 523
Case, deformity of child from injury of mother, 23
Cephalæmatoma, 76
Cerebro-spinal fever, 328
cause, 330
its non-contagiousness, 331
sex, 333
age, symptoms, 334
cases, 335
mode of commencement, 336
symptoms pertaining to the nervous system, 337
digestive system, 339
pulse, 340
temperature, 341
respiratory system, cutaneous system, 342
organs of special senses, the eye and ear, 344–346
nature, 346
prognosis, 348
diagnosis, 350
anatomical characters, 351
treatment, preventive, curative, 355
Cerebro spinal meningitis, 328
Cerebro-spinal system, diseases of, 375
Chadbourne, Dr., on quantity of food required, 56, 57, 58
instrument for performing thoracentesis, 520
Chapman, Dr. E. M., on alcoholic stimulants in diphtheria, 285
Chicken-pox, 246
Childhood, 19
changes of organs in, 19
Cholera infantum, causes, 721
symptoms, 722
anatomical characters, 723
nature, cases, 724, 725
diagnosis, prognosis, 726

Cholera infantum—
treatment, 727
Chorea, 481
age, 482
causes, sex, 483
uterine irritation, anæmia, rheumatism, 484
embolism, 486
case, 487, 488
fright, irritation, 489
intestinal irritation, lesions of spinal cord, 489
anatomical characters, 491
symptoms, 492
prognosis, course, 494
diagnosis, treatment, 495
Church, Dr. A. S., case of intussusception, 784
Circulatory system, 94
change from fœtal to infantile, 18
Clothing, 69
Colitis in childhood, 718
Colostrum, 34
constituents of, 35
Congestion of stomach, 674
Constipation, 728
symptomatic; causes, congenital stenosis, 729
intestinal displacement, 729
obstructive substances, abscesses, tumors, peritonitis, 730
idiopathic; diseases of the cerebro-spinal system, 732
causes, 732
symptoms, 734
treatment, 738
hygienic measures, 739
therapeutic measures, 742
Consumption (*see* Tuberculosis), 143
Convulsions, clonic, 442
Convulsions, internal, 473
causes, 474
anatomical characters, symptoms, 476
case, 477
diagnosis, 478
prognosis, mode of death, treatment, 479
Coryza, 529
anatomical characters, symptoms, prognosis, 530
treatment, 531
Cough, nervous, treatment, 630
Cranial sinuses, thrombosis in, 387
Craniotabes, 111
Croup, false, spasmodic, 535
true, pseudo-membranous, 540
Cyanosis, 793
its literature, 794
sex, causes of the malformation, 796
time of the commencement, 798
symptoms, 799
prognosis, 803
mode of death, 804
nature of the malformations, 805
Cyanosis—
modes of compensation, morbid anatomy, 806
theories relating to the etiology of cyanosis, 808
treatment, 810

DACTYLITIS, scrofulous, 127
Dalton, Prof. John C., effect of maternal emotions on the fœtus, 22
quantity of food required, 60
Deformity of child from injury to mother, 23
Delafield, Prof. Francis, dissection of rachitic case, 103
Dentition, 650
pathological results from, 651
diagnosis, treatment, 654
second dentition, 657
Diagnosis of infantile diseases, 89
features, appearance of head, trunk, and limbs in disease, 89
attitude, movements, voice, 91
Diarrhœa, 685
symptoms, 686
anatomical characters, 687
prognosis, treatment, 688
Diet a cause of infantile mortality, 28
quantity of food required, 55
artificial, 61
Digestion, post-mortem, 680
Digestive apparatus, diseases of, 632
Digestive system, its state as a means of diagnosis, 98
Diphtheria, 248
age, 248
incubation, 249
nature, 250
bacteria as a cause, 252
facts showing its constitutional nature, 256–260
anatomical characters, 260
Prof. Rindfleisch's views, 262
cases, 263–268
symptoms, 272
of invasion, 273
respiratory apparatus, 274
diphtheritic croup, 275
kidneys, 376
paralysis, 276
diagnosis, 278
prognosis, 279
causes of death, 279
treatment, 281
stimulants, 285
local treatment, 288
the use of the atomizer, 289
general treatment, 286–289
diphtheritic croup, 289
its treatment, 292, 293
preventive measures, 294
Dress, 69
Duchenne's disease, 511
Dyspepsia, 669

ECLAMPSIA, 442
causes, 443
premonitory stage, 444
symptoms, 445
partial eclampsia, 446
anatomical characters, 447
diagnosis, 448
prognosis, treatment, 450
Eczema, anatomy, 819
etiology, varieties, symptoms, course, 820
simplex, rubrum, impetiginoides, 821
diagnosis, 821
treatment, 822
Elliot, Prof. George S., case of peri-pharyngeal abscess, 662
Entero-colitis of infancy, 690
Enteritis in childhood, colitis in childhood, 718
cause, symptoms, 718
diagnosis, prognosis, treatment, 719
Erysipelas, 361
table of cases, 366, 367
age, point of commencement, causes, 368
vaccination as a cause, 369
erysipelas of the new-born, 370
premonitory symptoms, symptoms, 371
prognosis, 372
duration, modes of death, pathological anatomy, 373
treatment, 374
Erythema, 811
idiopathic, 811
symptomatic, prognosis. diagnosis, 812
treatment, 813
Ewing, Dr., case of diphtheria, 249
Exercise, 72

FACIAL paralysis, 510
Feeding, artificial, 54, 61
Feeding, improper, a cause of infantile mortality, 28
Fever, cerebro-spinal, 328
Fever, intermittent, 313
Fever and ague, 313
remittent, 318
typhoid, 320
Flint, Prof. A., Jr., on diet of infants, 27–64
Flint, Prof. A., Sr., 233
Fœtus, how affected by the state of the mother in pregnancy, 20

GALACTORRHŒA, its treatment, 47
Gangrene of the mouth, 643
Gangrene, anatomical characters, 643
age, causes, 644
symptoms, 645
diagnosis, 646
prognosis, treatment, 647
Gastritis, 675
cause, age, 676
case, symptoms, 677
anatomical characters. diagnosis, prognosis, 678
treatment, 679
Gastritis, follicular, diphtheritic, 679, 680
Gastro-intestinal hæmorrhage, 762
German measles, 216
Gilfillan, Dr., on the use of the castor oil plant as a galactogogue, 47
Glottic spasms, 473
Greuning, Dr., experiments upon the auditory nerve in cerebro-spinal fever, 346
Growth of infants, 29

HÆMORRHAGE, umbilical, 85
Hæmorrhage, intra-cranial (meningeal, cerebral), 396
causes, 396
anatomical characters, 397
cerebral, 399
symptoms, 400
capillary form, 402
symptoms in meningeal hæmorrhage, 403
diagnosis, prognosis, 404
treatment, 405
Hæmorrhage, gastro-intestinal, 762
three varieties, 1st variety, 762
2d variety, 764
3d variety, 765
prognosis, treatment, 766
Hall, Prof., case of unnatural lactation, 44
Hammond, Prof. Wm. A., on maternal emotions, 22
Hassell, Dr., on mode of preparing Liebig's food, 65
Hawley's Liebig's food, 65, 66
Heitzman, Dr., microscopic examination of a case of diphtheria, 263
Heitzman, Dr. D. S., on the etiology of rachitis, 107
Hooping cough, 295
Horlick's Liebig's food, 65
Hydrocephalus, acquired, causes, 413
anatomical characters, symptoms, 414
case, 415
prognosis, treatment, 416
Hydrocephalus, congenital, anatomical characters, 406
cases, 407–409
symptoms, 410
diagnosis, prognosis, treatment, 412
Hydrocephalus, spurious, 437
anatomical characters, case, 437
symptoms, 438
cases, 439–441
diagnosis, 441
treatment, 442
Hydrocephaloid disease, 437

ICTERUS neonati, 87–89
Imagination, 769
Indigestion, causes, 669
symptoms, 670
prognosis, treatment, 672
Infancy, 17
skin and sebaceous glands in, 17
organs in, 18
stomach in, 18
kidneys in, 18
mental faculties in, 18
brain in, 18
Infantile paralysis, 498
Intermittent fever, 313
in what way contracted, period of incubation, 314
symptoms, 315
treatment, 317
Intestinal worms, 744
Intestines, inflammation of, in infancy, 690
causes, 691
dietetic, atmospheric, 692–698
dentition as a cause, 698
age, 699
symptoms, 700
anatomical characters, 702
diagnosis, prognosis, 708
treatment, 709
Intussusception, without symptoms, 768
with symptoms, previous health, cases, 769
sex, age, 770
seat, pathological anatomy, intussusception in small intestine, 771
cases, 772, 773
in large intestine, 775
symptoms, 777
diagnosis, 779
duration, 780
prognosis, 781
mode of death, treatment, 783
cases, 784–787
laparotomy by Dr. Jonathan Hutchinson, 790
laparotomy by Dr. Henry B. Sands, 791

JACKSON, Dr. James, on second dentition, 657
Jacobi, Prof. A., case of craniotabes, 103
Jacobi, Prof. A., on infant diet, 64
Jacobi, Dr Mary P., on infant diet, 64
Jacobi, Prof. A., statistics of tracheotomy, 551
Jaundice in the new-born, 87–89
Jenkins, Dr. J. Foster, on umbilical hæmorrhage, 86

KERATITIS, 138
Knapp, Prof., on the state of the ear in cerebro-spinal fever, 346
Krackowizer, Dr. Ernst, statistics of tracheotomy, 552

LACTATION, 29
mode of determining capability for, 29
hindrances to, 30
tender nipples, 31
ill-health of mother, 31
syphilis, 32
inflammations, 33
suppuration of breast, 33
erysipelas in mother, 33
course of, 52
weaning, 52
Laparotomy, by Dr. Jonathan Hutchinson, 790
by Dr. Henry B. Sands, 791
Laryngismus stridulus, 473
Laryngitis, catarrhal, symptoms, 532
chronic, 533
anatomical characters, treatment, 534
Laryngitis, spasmodic, causes, symptoms, 535
anatomical character, pathology, 536
diagnosis, 537
prognosis, treatment, 538
Laryngitis, pseudo-membranous, 540
causes, anatomical characters, 541
symptoms, 544
pathological characters, diagnosis, 546
prognosis, treatment, 547
tracheotomy, 551–556
Leaming, Dr. J. R., case of erysipelas, 370
Liebig's food, 65
Livingston, Dr. W. C., case of peri-pharyngeal abscess, 667
Lockjaw, 453
Lung, collapse, 569
Lung, inflammation of, 573

MEASLES, German, 216
Measles, 178
Measles, symptoms, 178
complications, 181
anatomical characters, nature, 184
diagnosis, prognosis, treatment, 185
Meningeal hæmorrhage, 396
Meningitis, tubercular and non-tubercular, 417
age, pathological anatomy, 419
causes, 424
premonitory stage, 426
case, 430
diagnosis, prognosis, 431, 432
treatment, 434
Microcephalus, 380
Milk, human, 36
its composition, 36–61
its modification from diet, 37
its modification from insufficient food, 38
its modification from retention in the breast, 38

Milk—
its modification by age and mental impression, 39
its modification by the catamenial function and pregnancy, 39
differences in quantity and quality of milk, 41
loss of milk (galactorrhœa), 42
scantiness, 42
modes of increasing the milk, 43
lactation, 43
the electrical current, 45
diet, 46
use of the castor-oil plant, 46
treatment of galactorrhœa, 47
quantity required, 56, 57
use of cow's and goat's, 62
cow's, how prepared, 63
condensed, 68
Minot, Dr. Francis, on umbilical hæmorrhage, 86
Morbilli, 178
Morbus cæruleus, 793
Mortality of early life, 24
its causes, 25
internal malformations, 25
feebleness of system, 25
hereditary disease, 25
infectious diseases, 25
anti-hygienic conditions, 25
sudden change of temperature, 25
diet, 25
Mother, care of, in pregnancy, 19
diet, 19
exercise, 20
diseases, 20
mental excitement, 20
its effect on the fœtus, 20
effect of injury on fœtus, 23
Mouth, gangrene of, 643
Muguet, 638
Mumps, 310

NECROSIS infantilis, 643
Nervous cough, 630
Nervous system, its condition as a means of diagnosis, 100
Noma, 643
Noyes, Prof. H. D., on the use of the ophthalmoscope, 375

O'DWYER, Dr., on solvents of pseudo-membranes, 549
Œsophagitis, 667
anatomical characters, 668
treatment, 669
Oidium albicans, 639
Ophthalmia neonati, 77
causes, 77
catarrhal form, 79
treatment, 79
blennorrhœal form, 78
symptoms, 78
treatment, 79–82
Ophthalmia, strumous, 138
Ophthalmia—
herpetic or phlyctenular keratitis, 138
its duration, diagnosis, prognosis, 139
treatment, 140
parenchymatous or diffuse keratitis, 141
treatment, 142
Oxyuris vermicularis, 747

PARALYSIS, infantile, 498
case, 499, 500
symptoms, 501
muscles affected, 502
prognosis, progress, etiology, 503
anatomical characters, 507
diagnosis, prognosis, treatment, 508
Paralysis, facial, causes, symptoms, 510
prognosis, treatment, 511
Paralysis, with pseudo-hypertrophy, 511
anatomical characters, 513
causes, 514
prognosis, treatment, 515
Paralysis, reflex, 516
Parker, Dr. Kate, on the weight and growth of infants, 29
on quantity of food required, 56
Parker, Prof. Willard, case of peri-pharyngeal abscess, 666
Parotiditis, 310
Parotitis, 310
nature, diagnosis, treatment, 311
Peaslee, Prof. Edmund R., on treatment of croup, 551
Peri-pharyngeal abscess, 661
its cause, 663
diagnosis, treatment, 666, 667
Pertussis, 295
age, causes, 296
pathological anatomy, 297
symptoms, first period, second period, 298
third or declining period, 299
complications, convulsions, 300
bronchitis, pneumonitis, 301
emphysema, pulmonary collapse, 302
diagnosis, 304
prognosis, 305
treatment, belladonna, 306
quinia, the bromides, 307, 308
use of the atomizer, 308
prophylaxis, 309
Pharangitis, catarrhal, anatomical characters, 658
causes, symptoms, prognosis, 659
diagnosis, treatment, 660
Phelps, Dr. A. M., instrument for performing thoracentesis, 520
Phlebitis, 387
Phthisis (*see* Tuberculosis), 143
Pleuritis, its frequency, 588
causes, 590
anatomical characters, 595

Pleuritis—
plastic or adhesive, 596
sero-fibrinous, purgative, 597
hæmorrhagic, 598
symptoms, 603
physical signs, palpation, percussion, auscultation, 606–610
diagnosis, prognosis, 610, 611
treatment, 614
thoracentesis, 618
Pneumonitis, catarrhal, croupal, interstitial, causes, 573
anatomical characters, 576
cheesy pneumonitis, 579
symptoms, 580
physical signs, 583
diagnosis, 584
prognosis, treatment, 585
Pomeroy, O. D., M.D., on ophthalmia neonati, 80
Post, Prof. Alfred, case of peri-pharyngeal abscess, 666
Post-mortem digestion, 680
gelatinous softening of stomach, 681
case, 682
Pseudo-hypertrophy paralysis, 511
Pulse in health, 95
in disease, 97

RACHITIS, 103
age, 103
causes, 105
anatomical characters, 108
craniotabes, 111
symptoms, 116
complications, diagnosis, 118
laryngismus stridulus, 118
prognosis and treatment, 119
Remittent fever, 318
symptoms, diagnosis, treatment, 319
Respiration in infancy, 92
in health, 93
in disease, 94
Respiratory system, its diseases, 529
Reynolds, Dr. J. B., case of diphtheritic paralysis, 267
case of empyæma, 598
Rheumatism, acute, 359
causes, 360
symptoms, 361
duration, prognosis, 362
diagnosis, 363
treatment, 364, 365
Rickets (*see* Rachitis), 103
Ripley, Dr. John H., statistics of tracheotomy, 553, 554
Roseola, symptoms, 814
causes, prognosis, diagnosis, 815
treatment, 816
Rötheln, 216
premonitory stage, symptoms, 218
the skin, mucous membrane, 218, 219
respiratory system, digestive system, pulse, temperature, 220
Rötheln—
complications, prognosis, nature, incubative period, contagiousness, 221
Rubeola, 178.

SATTERTHWAITE, microscopic examination of a case of diphtheria, 263
Seguin, Prof. E C., effect of maternal emotions on the fœtus, 22
Sewell, Dr. J. G., cases of cerebro-spinal fever, 331–336
Scabies, 825
itch animalcule, diagnosis, 826
treatment, 827, 828
Scarlatina, 40
Scarlet fever, 187
regular form, symptoms, 188
irregular form, 191
malignant form, 192
complications, 193
eclampsia, diphtheria, 192, 193
gangrene of mouth, entero-colitis, 194
articular rheumatism, cardiac inflammation, 194, 195
nephritis, dropsy, 196, 197
otitis, 196
anatomical characters, 200
nature, 201
incubative period, 202
diagnosis, prognosis, 203, 204
prophylaxis, 214
treatment, 206
of nephritis ; of otitis, 210–212
Scrofula, 120
causes, 120
vaccination as a cause of, 122
anatomical characters, 124
dactylitis, 127
symptoms, 127
relation of, to tuberculosis, 131
prognosis, 131
treatment, 132
treatment of scrofulous diseases of the joints, 137
Scrofulous ophthalmia, 138
Skin diseases, 811
Sleep, 71
Smith, Prof. Stephen, 86
Spasm of the glottis, 473
Spinal irritation, 516
Spinal cord and its coverings, diseases of, 515
and its membranes, congestion of, 517
anatomical characters, 517
symptoms, treatment, 518
Spina bifida, 519
diagnosis, prognosis, treatment, 521
Splenization, 572
Sprue, 638
Starch, its digestion by infants, 64

Stomach, congestion of, 674
inflammation of, 675
Stomach, post-mortem, softening, 680
Stomatitis, simple ulcerous follicular, 632
simple or catarrhal, causes, 632
symptoms, appearances, treatment, 633
ulcerous, causes, 634
symptoms, prognosis, treatment, 635
aphthous, 636
causes, symptoms, diagnosis, prognosis, treatment, 637
Strophulus, 817
varieties, 818
treatment, 819
Struma (*see* Scrofula), 120
disease of joints, 137
Strumous ophthalmia, 138
St. Guy's dance, 481
St. Vitus' dance, 481
Syphilis, 167
etiology, 167
clinical history, 168
coryza ; mucous patches, 170
roseola, pemphigus, acne, impetigo, ecthyma, 171
visceral lesions, 172
osseous lesions, 173
dactylitis syphilitica, 174
dwarfing of incisor teeth ; interstitial keratitis, 175
prognosis, treatment, 175

TAYLOR, Dr. R. W., on dactylitis syphilitica, 173
Tænia solium, 748
Tænia saginata, 750
Tænia elliptica, 750
Temperature in health and disease, 97
Teething, 650
Tetanus infantum, 453
cases, 454, 455
period of commencement, 455
frequency in certain localities, 456
causes, 457
symptoms, 466
mode of death, prognosis, duration of fatal cases, 469
duration in favorable cases, diagnosis, preventive treatment, 470
treatment, 471
Therapeutics of infancy and childhood, 101
Thoracentesis, indications for it, 618, 619
instruments to be used, and mode of operating, 620
for sero-fibrinous exudations, 621
for empyema, 623
admission of air into pleural cavity, 624
puncturing the lungs, 625
Thoracentesis—
washing out the pleural cavity, 626
use of tent and drainage-tube, 628
exsection of a portion of one or more ribs, 629
Thrombosis in the cranial sinuses, 387
anatomical characters, 387, 388
causes, 389
symptoms, 390
diagnosis, prognosis, treatment, 391
Thrush, 638
anatomical characters, 638
symptoms, causes, 640
diagnosis, prognosis, treatment, 641
Triocephalus dispar, 752
Trismus infantum, 453
Tuberculosis, 143
etiology, 143
general anatomical characters, 145
anatomical characters in infancy and childhood, 146
Tubercles in lungs, 146
cavities, emphysema, 150
Tubercles in abdominal viscera, 153
stomach and intestines, 153
general symptoms of tubercles, 155
symptoms in cerebral tuberculosis, 156
in tubercles of bronchial glands, 158
physical signs, 159
in tubercles of lungs, 159
physical signs, 161
in tubercles of pleura, 162
in tubercles of stomach and intestines, 162
prognosis, treatment, 165
Tubercular bronchial glands, 151
Typhoid fever, causes, anatomical characters, 320
symptoms, 322
complications, enteritis, intestinal hæmorrhage, peritonitis, otitis, parotiditis, muguet, 324
diagnosis, 325
duration, prognosis, treatment, 326

UMBILICUS, diseases of, 83
inflammation of umbilical vein and arteries, 83
inflammation and ulceration, 84
umbilical granulations, 85
hæmorrhage of, 85
sex, age, causes, 86
symptoms, prognosis, treatment, 88
Urticaria, causes, prognosis, diagnosis, treatment, 818

VACCINIA, 236
appearances, symptoms, 239
anomalies, complications, sequels, 240
erysipelas, syphilis, 241
subsequent vaccinations, 242

Vaccinia—
protection from vaccination, 243
selection of virus, 245
Vaccination a cause of scrofula, 122
Varicella, symptoms, 246
diagnosis, prognosis, 247
Variola, 225
incubative period, 225
stage of invasion, stage of eruption, 226
stage of desiccation, 228
varioloid, 229
mode of death, 230
anatomical characters, complications, 231
prognosis, diagnosis, 232
treatment, 233
local treatment, 234
Vertebral caries, causes, 523
symptoms, 525
diagnosis, 526
prognosis, treatment, 527
Voss, Dr., statistics of tracheotomy, 552

WARREN, Dr., case of intussusception, 784
Weaning, 52, 54
Weight of infants, 29
Wet-nursing, 29
Wet-nurse, selection of, 48
syphilis in, 48
character of good milk, 49
the lactometer, 49
the lactoscope, 50
use of microscope, 50
micro-organisms in milk, 50
return of the catamenia, 51
weighing the infant, 51
Whooping cough, 295
Worms, intestinal, 744
ascaris lumbricoides, 745
oxyuris vermicularis, 747
tænia solium, 748
tænia saginata, or medio-canellata, 750
tænia elliptica, or cucumerina, 750
bothriocephalus latus, 751
trichocephalus dispar, 752
causes, symptoms of the ascaris lumbricoides, 753
symptoms from the oxyuris vermicularis, 755
symptoms from tænia, diagnosis, 756
prognosis, treatment, 757

HENRY C. LEA'S SON & CO.'S

(LATE HENRY C. LEA)

CLASSIFIED CATALOGUE

OF

MEDICAL AND SURGICAL

PUBLICATIONS.

In asking the attention of the profession to the works advertised in the following pages, the publishers would state that no pains are spared to secure a continuance of the confidence earned for the publications of the house by their careful selection and accuracy and finish of execution.

The large number of inquiries received from the profession for a finer class of bindings than is usually placed on medical books has induced us to put certain of our standard publications in half Russia, and that the growing taste may be encouraged, the prices have been fixed at so small an advance over the cost of sheep, as to place it within the means of all to possess a library that shall have attractions as well for the eye as for the mind of the reading practitioner.

The printed prices are those at which books can generally be supplied by booksellers throughout the United States, who can readily procure for their customers any works not kept in stock. Where access to bookstores is not convenient, books will be sent by mail post-paid on receipt of the price, and as the limit of mailable weight has been removed, no difficulty will be experienced in obtaining through the post-office any work in this catalogue. No risks, however, are assumed either on the money or on the books, and no publications but our own are supplied, so that gentlemen will in most cases find it more convenient to deal with the nearest bookseller.

A handsomely illustrated catalogue will be sent to any address on receipt of a three cent stamp.

HENRY C. LEA'S SON & CO.

Nos. 706 and 708 SANSOM ST., PHILADELPHIA, February, 1883.

PROSPECTUS FOR 1883.

A NEW WEEKLY MEDICAL JOURNAL.

SUBSCRIPTION RATES.

THE MEDICAL NEWS	Five Dollars.
THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES .	Five Dollars.

COMMUTATION RATES.

THE MEDICAL NEWS THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES	Nine Dollars per annum, in advance.

THE MEDICAL NEWS.

A NATIONAL WEEKLY MEDICAL PERIODICAL, EACH NUMBER CONTAINING 28 TO 32 DOUBLE-COLUMNED QUARTO PAGES EXCLUSIVE OF ADVERTISEMENTS.

THE unprecedented growth of the subscription list of THE MEDICAL NEWS during 1882, is gratifying to all concerned in its publication, not only as assuring its continued success, but as proving that they were not mistaken in supposing that the profession felt the need of and would generously support a weekly journal, national in the fullest sense of the word, devoted to the best interests of medical science, and conducted with the forethought, energy and ability necessary to devise and execute every available plan for enhancing its usefulness. Encouraged by this approbation, renewed efforts will be made during 1883 by those in charge of THE NEWS to strengthen in every way

its hold upon the respect and esteem of the profession. Advocating the highest standard of morals and honor, THE NEWS will be an unsparing opponent of quackery, in its countless forms. As the recognized national organ of the regular profession, it is the chosen vehicle for the conveyance of the most important intelligence from all parts of the country.

The general plan of THE NEWS affords ample space for the presentation of articles upon all branches of medical science. The opening pages are devoted to ORIGINAL LECTURES by the ablest teachers of the day, which are invariably revised by their authors before publication, thus insuring an authenticity and exactitude otherwise unattainable. In the department of ORIGINAL ARTICLES, THE NEWS will endeavor, as heretofore, to surpass its contemporaries, both in the intrinsic value of the contributions and in the reputation of their authors. Under the caption of HOSPITAL NOTES is laid open the vast and rich store of clinical information developed in the chief hospitals of the globe. The department of MEDICAL PROGRESS consists of condensations of articles of importance appearing in the leading medical, pharmaceutical, and scientific journals of the world. The EDITORIAL ARTICLES are from the pens of a large and able EDITORIAL BOARD, and discuss living subjects in all departments of medical science in a thoughtful, independent and scholarly manner. Important subjects, requiring unusually elaborate consideration, are treated in SPECIAL ARTICLES. The PROCEEDINGS OF SOCIETIES in all parts of the country afford a means of imparting valuable information, for which due space is reserved. For the collection of NEWS ITEMS, and for CORRESPONDENCE, THE NEWS enjoys an organization similar to that of a daily newspaper, and by mail and telegraph receives notice of all professional events of interest through special correspondents, located in the following cities: In the United States: Portland, Boston, New York, Baltimore, Pittsburgh, Washington, Charleston, New Orleans, Cincinnati, Chicago, Detroit, Kansas City and San Francisco. In Canada: Montreal. In Great Britain: London and Edinburgh. In Continental Europe: Paris, Berlin, Vienna and Florence. In Asia: Yokohama, Canton, Hong Kong and Calcutta. In South America: Rio Janeiro and Valparaiso. In Cuba: Havana. Due attention will be paid to NEW PUBLICATIONS, NEW INSTRUMENTS and NEW PHARMACEUTICAL PREPARATIONS, and a column will be devoted to NOTES and QUERIES. Space is reserved each week for accurate reports of all changes in the Army and Navy Medical Service.

THE MEDICAL NEWS will appear in a double-columned quarto form, printed by the latest improved Hoe speed presses, on handsome paper, from a clear, easily read type, specially cast for its use.

It will thus be seen that THE MEDICAL NEWS employs all the approved methods of modern journalism in its efforts to render itself indispensable to the profession, and in the anticipation of an unprecedented circulation, its subscription has been placed at the exceedingly low rate of $5 per annum, in advance. At this rate it ranks as the cheapest medical periodical in the world, and when taken in connection with the AMERICAN JOURNAL at NINE DOLLARS per annum, it is confidently asserted that a larger amount of material of the highest class is offered than can be obtained elsewhere, even at a much higher price.

THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES.

Edited by I. MINIS HAYS, A.M., M.D.,

IS PUBLISHED QUARTERLY, ON THE FIRST DAYS OF JANUARY, APRIL, JULY AND OCTOBER, EACH NUMBER CONTAINING OVER THREE HUNDRED OCTAVO PAGES, FULLY ILLUSTRATED.

In commencing the sixty-fourth consecutive year of the publication of the AMERICAN JOURNAL, the publishers announce, with no little pride, that its prospects of continued usefulness and attractiveness never were brighter. Being the only periodical in the

English language capable of presenting extensive and elaborate articles—the form in which the most important discoveries have always been communicated to the profession, THE AMERICAN JOURNAL cannot fail to be of the utmost value to physicians who would keep themselves *au courant* with the medical thought of the day. It may justly claim that it numbers among its contributors all the most distinguished members of the profession, that its history is identified with the advances of medical knowledge, and that its circulation is co-extensive with the use of the English language.

During 1883 THE JOURNAL will continue to present those features which have long proved so attractive to its readers.

The ORIGINAL DEPARTMENT will consist of elaborate and richly illustrated articles from the pens of the most eminent members of the profession in all parts of the country.

The REVIEW DEPARTMENT will maintain its well-earned reputation for discernment and impartiality, and will contain elaborate reviews of new works and topics of the day, and numerous analytical and bibliographical notices by competent writers.

Then follows the QUARTERLY SUMMARY OF IMPROVEMENTS AND DISCOVERIES IN THE MEDICAL SCIENCES, which, being a classified and arranged condensation of important articles appearing in the chief medical journals of the world, furnishes a compact digest of medical progress abroad and at home.

The subscription price to the AMERICAN JOURNAL OF THE MEDICAL SCIENCES has never been raised during its long career. It is still sent free of postage for Five Dollars per annum in advance.

Taken together the JOURNAL and NEWS combine the advantages of the elaborate preparation that can be devoted to a quarterly, with the prompt conveyance of intelligence by the weekly; while, by special management, duplication of matter is rendered impossible.

It will thus be seen that for the very moderate sum of NINE DOLLARS in advance the subscriber will receive free of postage a weekly and a quarterly journal, both representing the most advanced condition of the medical sciences, and containing an equivalent of more than 4000 octavo pages, stored with the choicest material, original and selected, that can be furnished by the best medical talent of both hemispheres. It would be impossible to find elsewhere so large an amount of matter of the same value offered at so low a price.

Gentlemen desiring to avail themselves of the advantages thus offered will do well to forward their subscriptions at an early day, in order to insure the receipt of complete sets for 1883.

☞ The safest mode of remittance is by bank check or postal money order, drawn to the order of the undersigned; where these are not accessible remittances for subscriptions may be made at the risk of the publishers by forwarding in *registered* letters. Address,

HENRY C. LEA'S SON & CO., Nos. 706 and 708 Sansom St., Philadelphia, Pa.

*** Communications to both these periodicals are invited from gentlemen in all parts of the country. Original articles contributed exclusively to either periodical are liberally paid for upon publication. When necessary to elucidate the text illustrations will be furnished without cost to the author.

All letters pertaining to the *Editorial Department* of THE MEDICAL NEWS and THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES should be addressed to the EDITORIAL OFFICES, 1004 Walnut Street, Philadelphia.

All letters pertaining to the *Business Department* of these journals should be addressed *exclusively* to HENRY C. LEA'S SON & CO., 706 and 708 Sansom Street, Phila., Pa.

DUNGLISON (ROBLEY), M.D.,

Late Professor of Institutes of Medicine in Jefferson Medical College, Philadelphia.

MEDICAL LEXICON; A DICTIONARY OF MEDICAL SCIENCE:

Containing a concise explanation of the various Subjects and Terms of Anatomy, Physiology, Pathology, Hygiene, Therapeutics, Pharmacology, Pharmacy, Surgery, Obstetrics, Medical Jurisprudence and Dentistry. Notices of Climate and of Mineral Waters; Formulæ for Officinal, Empirical and Dietetic Preparations; with the Accentuation and Etymology of the Terms, and the French and other Synonymes; so as to constitute a French as well as an English Medical Lexicon. A New Edition thoroughly Revised, and very greatly Modified and Augmented. By RICHARD J. DUNGLISON, M.D. In one very large and handsome royal octavo volume of over 1100 pages. Cloth, $6 50; leather, raised bands, $7 50; very handsome half Russia, raised bands, $8.

The object of the author from the outset has not been to make the work a mere lexicon or dictionary of terms, but to afford, under each, a condensed view of its various medical relations, and thus to render the work an epitome of the existing condition of medical science. Starting with this view, the immense demand which has existed for the work has enabled him, in repeated revisions, to augment its completeness and usefulness, until at length it has attained the position of a recognized and standard authority wherever the language is spoken.

Special pains have been taken in the preparation of the present edition to maintain this enviable reputation. During the ten years which have elapsed since the last revision, the additions to the nomenclature of the medical sciences have been greater than perhaps in any similar period of the past, and up to the time of his death the author labored assiduously to incorporate everything requiring the attention of the student or practitioner. Since then, the editor has been equally industrious, so that the additions to the vocabulary are more numerous than in any previous revision. Especial attention has been bestowed on the accentuation, which will be found marked on every word. The typographical arrangement has been much improved, rendering reference much more easy, and every care has been taken with the mechanical execution. The work has been printed from new type, small but exceedingly clear, with an enlarged page, so that the additions have been incorporated with an increase of but little over a hundred pages, and the volume now contains the matter of at least four ordinary octavos.

A book well known to our readers, and of which every American ought to be proud. When the learned author of the work passed away, probably all of us feared lest the book should not maintain its place in the advancing science whose terms it defines. Fortunately, Dr. Richard J. Dunglison, having assisted his father in the revision of several editions of the work, and having been, therefore, trained in the methods and imbued with the spirit of the book, has been able to edit it, not in the patchwork manner so dear to the heart of book editors, so repulsive to the taste of intelligent book readers, but to edit it as a work of the kind should be edited—to carry it on steadily, without jar or interruption, along the grooves of thought it has travelled during its lifetime. To show the magnitude of the task which Dr. Dunglison has assumed and carried through, it is only necessary to state that more than six thousand new subjects have been added in the present edition.—*Phila. Med. Times*, Jan. 3, 1874.

About the first book purchased by the medical student is the Medical Dictionary. The lexicon explanatory of technical terms is simply a *sine qua non*. In a science so extensive, and with such collaterals as medicine, it is as much a necessity also to the practising physician. To meet the wants of students and most physicians, the dictionary must be condensed while comprehensive, and practical while perspicacious. It was because Dunglison's met these indications that it became at once the dictionary of general use wherever medicine was studied in the English language. In no former revision have the alterations and additions been so great. More than six thousand new subjects and terms have been added. The chief terms have been set in black letter, while the derivatives follow in small caps; an arrangement which greatly facilitates reference. We may safely confirm the hope ventured by the editor "that the work, which possesses for him a filial as well as an individual interest, will be found worthy a continuance of the position so long accorded to it as a standard authority."—*Cincinnati Clinic*, Jan. 10, 1874.

It has the rare merit that it certainly has no rival in the English language for accuracy and extent of references.—*London Medical Gazette*.

As a standard work of reference, as one of the best, if not the very best, medical dictionary in the English language, Dunglison's work has been well known for about forty years, and needs no words of praise on our part to recommend it to the members of the medical, and, likewise, of the pharmaceutical profession. The latter especially are in need of such a work, which gives ready and reliable information on thousands of subjects and terms which they are liable to encounter in pursuing their daily avocations, but with which they cannot be expected to be familiar. The work before us fully supplies this want.—*Am. Journ. of Pharm.*, Feb. 1874.

A valuable dictionary of the terms employed in medicine and the allied sciences, and of the relations of the subjects treated under each head. It reflects great credit on its able American author, and well deserves the authority and popularity it has obtained.—*British Med. Journ.*, Oct. 31, 1874.

Few works of this class exhibit a grander monument of patient research and of scientific lore. The extent of the sale of this lexicon is sufficient to testify to its usefulness, and to the great service conferred by Dr. Robley Dunglison on the profession, and indeed on others, by its issue.—*London Lancet*, May 13, 1875.

HOBLYN (RICHARD D.), M.D

A DICTIONARY OF THE TERMS USED IN MEDICINE AND THE COLLATERAL SCIENCES.

Revised, with numerous additions, by ISAAC HAYS, M.D., late Editor of The American Journal of the Medical Sciences. In one large royal 12mo. volume of 520 double-columned pages. Cloth, $1 50; leather, $2 00

It is the best book of definitions we have, and ought always to be upon the student's table.—*Southern Med. and Surg. Journal.*

RODWELL (G. F.), F.R.A.S., &c.

A DICTIONARY OF SCIENCE: Comprising Astronomy, Chemistry, Dynamics, Electricity, Heat, Hydrodynamics, Hydrostatics, Light, Magnetism, Mechanics, Meteorology, Pneumatics, Sound and Statics. Preceded by an Essay on the History of the Physical Sciences.

In one handsome octavo volume of 694 pages, with many illustrations. Cloth, $5.

A *CENTURY OF AMERICAN MEDICINE*, 1776–1876. By Doctors E. H. Clarke, H. J. Bigelow, S. D. Gross, T. G. Thomas and J. S. Billings. In one very handsome 12mo. volume of about 350 pages. Cloth, $2 25.

This work appeared in the pages of the American Journal of the Medical Sciences during the year 1876. As a detailed account of the development of medical science in America, by gentlemen of the highest authority in their respective departments, the profession will no doubt welcome it in a form adapted for preservation and reference.

NEILL (JOHN), M.D., and SMITH (FRANCIS G.), M.D.,
Prof. of the Institutes of Medicine in the Univ. of Penna

AN ANALYTICAL COMPENDIUM OF THE VARIOUS BRANCHES OF MEDICAL SCIENCE; for the Use and Examination of Students. A New Edition, revised and improved. In one very large and handsomely printed royal 12mo. volume, of 974 pages, with 374 wood-cuts. Cloth, $4; strongly boundin leather, with raised bands, $4 75.

HARTSHORNE (HENRY), M.D.,
Late Professor of Hygiene in the University of Pennsylvania.

A CONSPECTUS OF THE MEDICAL SCIENCES; containing Handbooks on Anatomy, Physiology, Chemistry, Materia Medica, Practical Medicine, Surgery and Obstetrics. Second Edition, thoroughly revised and greatly improved. In one large royal 12mo. volume of 1028 closely printed pages, with 477 illustrations on wood. Cloth, $4 25; leather, $5 00.

We can say with the strictest truth that it is the best work of the kind with which we are acquainted. It embodies in a condensed form all recent contributions to practical medicine, and is therefore useful to every busy practitioner throughout our country, besides being admirably adapted to the use of students of medicine. The book is faithfully and ably executed.—*Charleston Med. Journ.*, April, 1875.

The work is intended as an aid to the medical student, and as such appears to fulfil admirably its object by its excellent arrangement, the full compilation of facts, the perspicuity and terseness of language, and the clear and instructive illustrations in some parts of the work.—*American Journ. of Pharmacy*, Philadelphia, July, 1874.

The volume will be found useful, not only to students, but to many others who may desire to refresh their memories with the smallest possible expenditure of time.—*N. Y. Med. Journal*, Sept. 1874.

The student will find this the most convenient and useful book of the kind on which he can lay his hand.—*Pacific Med. and Surg. Journ.*, Aug. 1874.

This is the best book of its kind that we have ever examined. It is an honest, accurate and concise compend of medical sciences, as fairly as possible representing their present condition. The changes and the additions have been so judicious and thorough as to render it, so far as it goes, entirely trustworthy. If students must have a conspectus, they will be wise to procure that of Dr. Hartshorne.—*Detroit Rev. of Med. and Pharm.*, Aug. 1874.

The work before us has many redeeming features not possessed by others, and is the best we have seen. Dr. Hartshorne exhibits much skill in condensation. It is well adapted to the physician in active practice, who can give but limited time to the familiarizing of himself with the important changes which have been made since he attended lectures. The manual of physiology has also been improved and gives the most comprehensive view of the latest advances in the science possible in the space devoted to the subject. The mechanical execution of the book leaves nothing to be wished for.—*Peninsular Journal of Medicine*, Sept. 1874.

After carefully looking through this conspectus, we are constrained to say that it is the most complete work, especially in its illustrations, of its kind that we have seen.—*Cincinnati Lancet*, Sept. 1874.

The favor with which the first edition of this Compendium was received, was an evidence of its various excellences. The present edition bears evidence of a careful and thorough revision. Dr. Hartshorne possesses a happy faculty of seizing upon the salient points of each subject, and of presenting them in a concise and yet perspicuous manner.—*Leavenworth Med. Herald*, Oct. 1874

LUDLOW (J. L.), M.D.

A MANUAL OF EXAMINATIONS upon Anatomy, Physiology, Surgery, Practice of Medicine, Obstetrics, Materia Medica, Chemistry, Pharmacy and Therapeutics. To which is added a Medical Formulary. Third Edition, thoroughly revised and greatly extended and enlarged. In one handsome royal 12mo. volume of 816 large pages, with 370 illustrations. Cloth, $3 25; leather, $3 75.

The arrangement of this volume in the form of question and answer renders it especially suitable for the office examination of students, and for those preparing for graduation.

TANNER (THOMAS HAWKES), M.D., &c.

A MANUAL OF CLINICAL MEDICINE AND PHYSICAL DIAGNOSIS. Third American from the Second London Edition. Revised and Enlarged by TILBURY FOX, M. D., Physician to the Skin Department in University College Hospital, London, &c. In one small 12mo. volume of about 375 pages. Cloth, $1 50.

SHARPEY AND QUAIN'S HUMAN ANATOMY. Revised by JOSEPH LEIDY, M.D., Prof of Anat. in Univ. of Penn In two octavo vols. of about 1300 pages, with 511 illustrations.

HEATH'S PRACTICAL ANATOMY. From Second London Edition, with additions by W W. KEEN, M.D. In one 12mo. volume of 578 pages, with 247 woodcuts.

GRAY (HENRY), F.R.S.,
Lecturer on Anatomy at St. George's Hospital, London.

ANATOMY, DESCRIPTIVE AND SURGICAL. The Drawings by H. V. CARTER, M.D., and Dr. WESTMACOTT. The Dissections jointly by the AUTHOR and Dr. CARTER. With an Introduction on General Anatomy and Development by T. HOLMES, M.A., Surgeon to St. George's Hospital. A New American, from the Eighth Enlarged and Improved London Edition. To which is added the Second American from the latest English Edition of "LANDMARKS, MEDICAL AND SURGICAL," by LUTHER HOLDEN, F.R.C.S., author of "Human Osteology," "A Manual of Dissections," etc. In one magnificent imperial octavo volume of 993 pages, with 523 large and elaborate engravings on wood. Cloth, $6; leather, raised bands, $7; half Russia, raised bands $7 50.

The author has endeavored in this work to cover a more extended range of subjects than is customary in the ordinary text-books, by giving not only the details necessary for the student, but also the application of those details in the practice of medicine and surgery, thus rendering it both a guide for the learner and an admirable work of reference for the active practitioner. The engravings form a special feature in the work, many of them being the size of nature, nearly all original, and having the names of the various parts printed on the body of the cut, in place of figures of reference, with descriptions at the foot. They thus form a complete and splendid series, which will greatly assist the student in obtaining a clear idea of Anatomy, and will also serve to refresh the memory of those who may find in the exigencies of practice the necessity of recalling the details of the dissecting room. Combining, as it does, a complete Atlas of Anatomy, with a thorough treatise on systematic, descriptive and applied Anatomy, the work will be found of great service to all physicians who receive students in their offices, relieving both preceptor and pupil of much labor in laying the groundwork of a thorough medical education.

To the present edition has been appended the recent work by the distinguished anatomist, Mr. Luther Holden—"Landmarks, Medical and Surgical"—which gives in a clear, condensed and systematic way, all the information by which the practitioner can determine from the external surface of the body the position of internal parts. Thus complete, the work, it is believed, will furnish all the assistance that can be rendered by type and illustration in anatomical study. Notwithstanding the increase of size, amounting to over 100 pages and 57 illustrations, it will be kept, as heretofore, at a price rendering it one of the cheapest works ever offered to the American profession.

The addition of the recent work of Mr. Holden, as an appendix, renders this the most practical and complete treatise available to American students, who find in it a comprehensive chapter on minute anatomy, about all that can be taught on general and special anatomy, while its treatment of each region, from a surgical point of view, in the valuable section by Mr. Holden, is all that will be essential to them in practice.—*Ohio Medical Recorder*, Aug 1878.

It is difficult to speak in moderate terms of this new edition of "Gray." It seems to be as nearly perfect as it is possible to make a book devoted to any branch of medical science. The labors of the eminent men who have successively revised the eight editions through which it has passed, would seem to leave nothing for future editors to do. The addition of Holden's "Landmarks" will make it as indispensable to the practitioner of medicine and surgery as it has been heretofore to the student. As regards completeness, ease of reference, utility, beauty and cheapness, it has no rival. No student should enter a medical school without it; no physician can afford to have it absent from his library.—*St. Louis Clin. Record*, Sept. 1878.

ALSO FOR SALE SEPARATE—

HOLDEN (LUTHER), F.R.C.S.,
Surgeon to St. Bartholomew's and the Foundling Hospitals.

LANDMARKS, MEDICAL AND SURGICAL. Second American, from the Latest Revised English Edition, with additions by W. W. KEEN, M.D., Professor of Artistic Anatomy in the Pennsylvania Academy of the Fine Arts, formerly Lecturer on Anatomy in the Philadelphia School of Anatomy. In one handsome 12mo. volume, of about 140 pages. Cloth, $1.00. (*Just Ready.*)

This little book is all that can be desired within its scope and its contents will be found simply invaluable to the young surgeon or physician, since they bring before him such data as he requires at every examination of a patient. It is written in language so clear and concise that one ought almost to learn it by heart. No student, once he has seen this little volume, will refrain from purchasing it. It teaches diagnosis by external examination, ocular and palpable, of the body, with such anatomical and physiological facts as directly bear on the subject. It is eminently the student's and young practitioner's book.—*Physician and Surgeon*, Nov. 1881.

SMITH (HENRY H.), M.D., *Prof. of Surgery in the Univ. of Penna., &c.* *and* *HORNER (WILLIAM E.), M.D.,* *Late Prof. of Anatomy in the Univ. of Penna.*

AN ANATOMICAL ATLAS; Illustrative of the Structure of the Human Body. In one volume, large imperial octavo, cloth, with about six hundred and fifty beautiful figures. $4 50.

BELLAMY'S STUDENT'S GUIDE TO SURGICAL ANATOMY: A Text-book for Students preparing for their Pass Examination. With engravings on wood. In one royal 12mo. volume. Cloth, $2 25.

CLELAND'S DIRECTORY FOR THE DISSECTION OF THE HUMAN BODY. In one small volume, royal 12mo. of 182 pages. Cloth, $1 25.

HARTSHORNE'S HANDBOOK OF ANATOMY AND PHYSIOLOGY. Second Edition, revised. In one royal 12mo. vol., with 220 woodcuts. Cloth, $1 75.

HORNER'S SPECIAL ANATOMY AND HISTOLOGY. Eighth Edition, extensively revised and modified. In 2 vols. 8vo., of over 1000 pages, with 320 wood-cuts. Cloth, $6 00.

ALLEN (HARRISON), M.D.

Professor of Physiology in the Univ. of Pa.

A SYSTEM OF HUMAN ANATOMY: INCLUDING ITS MEDICAL and Surgical Relations.

For the Use of Practitioners and Students of Medicine With an Introductory Chapter on Histology. By E. O. SHAKESPEARE, M D, Ophthalmologist to the Phila. Hosp. In one large and handsome quarto volume of about 600 double-columned pages, with 380 illustrations on 109 lithographic plates, many of which are in colors, and about 250 engravings in the text. In six Sections, each in a portfolio. Section I. HISTOLOGY (*Just Ready*). Section II. BONES AND JOINTS (*Just Ready*). Section III. MUSCLES AND FASCIÆ (*Just Ready*). Section IV. ARTERIES, VEINS AND LYMPHATICS (*Nearly Ready.*) Section V. NERVOUS SYSTEM (*In Press*). Section VI. ORGANS OF SENSE, OF DIGESTION AND GENITO-URINARY ORGANS (*In Press*). Price per section, $3 50. *For sale by subscription only.*

EXTRACT FROM INTRODUCTION.

It is the design of this book to present the facts of human anatomy in the manner best suited to the requirements of the student and the practitioner of medicine. The author believes that such a book is needed, inasmuch as no treatise, as far as he knows, contains, in addition to the text descriptive of the subject, a systematic presentation of such anatomical facts as can be applied to practice.

A book which will be at once accurate in statement and concise in terms; which will be an acceptable expression of the present state of the science of anatomy; which will exclude nothing that can be made applicable to the medical art, and which will thus embrace all of surgical importance, while omitting nothing of value to clinical medicine,—would appear to have an excuse for existence in a country where most surgeons are general practitioners, and where there are few general practitioners who have no interest in surgery.

Among other matters, the book will be found to contain an elaborate description of the tissues; an account of the normal development of the body; a section on the nature and varieties of monstrosities; a section on the method of conducting post-mortem examinations; and a section on the study of the superficies of the body taken as a guide to the position of the deeper structures. These will appear in their appropriate places, duly subordinated to the design of presenting a text essentially anatomical.

A book like this is an ideal rarely realized. It will do, we have no doubt, what its accomplished author hopes, "make anatomy - what unfortunately it rarely is—an *interesting study*." It has long been an opprobrium to America that our anatomical text-books were all foreign, but this work will remove the stigma. It is a mine of wealth in the information it gives. It differs from all preceding anatomies in its scope, and is, we believe, a vast improvement upon them all. The chief novelty about the book, and really one of the greatest needs in anatomy, is the extension of the text to cover not only anatomical descriptions, but the uses of anatomy in studying disease. This is done by stating the narrower topographical relations, and also the wider clinical relations of the more remote parts, by giving a brief account of the uses of the various organs, and by quoting cases which illustrate the "localization of diseased action." Dr. Shakespeare has furnished the Section on Histology, and it is well done. The Section on the Bones and Joints shows on every page evidences of Dr. Allen's wide learning and judicious selection of material, embarrassing by its very richness. The plates are beautiful specimens of work by one who long since won a deserved reputation as an artist.—*The Medical News*, October 21, 1882

It is to be considered a study of applied anatomy in its widest sense—a systematic presentation of such anatomical facts as can be applied to the practice of medicine as well as of surgery. Our author is concise, accurate and practical in his statements, and succeeds admirably in infusing an interest into the study of what is generally considered a dry subject. The department of Histology is treated in a masterly manner, and the ground is travelled over by one thoroughly familiar with it. The illustrations are made with great care, and are simply superb. It would be impossible, except in a general way, to point out the excellence of the work of the author in the second section, that devoted to the consideration of the Bones and Joints. There is as much of practical application of anatomical points to the every-day wants of the medical clinician as to those of the operating surgeon. In fact, few general practitioners will read the work without a feeling of surprised gratification that so many points concerning which they may never have thought before are so well presented for their consideration. It is a work which is destined to be the best of its kind in any language.—*Medical Record*, Nov. 25, 1882.

ELLIS (GEORGE VINER).

Emeritus Professor of Anatomy in University College, London.

DEMONSTRATIONS OF ANATOMY; Being a Guide to the Knowledge of the Human Body by Dissection.

By GEORGE VINER ELLIS, Emeritus Professor of Anatomy in University College, London. From the Eighth and Revised London Edition. In one very handsome octavo volume of over 700 pages, with 249 illustrations. Cloth, $4.25; leather, $5.25.

Ellis' Demonstrations is the favorite text-book of the English student of anatomy. In passing through eight editions it has been so revised and adapted to the needs of the student that it would seem that it had almost reached perfection in this special line. The descriptions are clear, and the methods of pursuing anatomical investigations are given with such detail that the book is honestly entitled to its name.—*St. Louis Clinical Record*, June, 1879.

As a dissector, or a work to have in hand and study while one is engaged in dissecting, we regard it as the very best work extant, which is certainly saying a very great deal. As a text-book to be studied in the dissecting-room, it is superior to any of the works upon anatomy.—*Cincinnati Med. News*, May 24, 1879.

We most unreservedly recommend it to every practitioner of medicine who can possibly get it.—*Va. Med. Monthly*, June, 1879.

WILSON (ERASMUS), F.R.S.

A SYSTEM OF HUMAN ANATOMY, General and Special.

Edited by W. H. GOBRECHT, M.D., Professor of General and Surgical Anatomy in the Medical College of Ohio. Illustrated with three hundred and ninety-seven engravings on wood. In one large and handsome octavo volume, of over 600 pages. Cloth, $4; leather, $5.

DALTON (JOHN C.), M.D.,

Professor of Physiology in the College of Physicians and Surgeons, New York, &c.

A TREATISE ON HUMAN PHYSIOLOGY. Designed for the use of Students and Practitioners of Medicine. Seventh Edition, thoroughly revised and rewritten. In one very beautiful octavo volume, of 722 pages, with 252 beautiful engravings on wood. Cloth, $5 00; leather, $6 00; very handsome half Russia, raised bands, $6 50. (*Just Ready.*)

The reputation which this work has acquired, as a compact and convenient summary of the most advanced condition of human physiology, renders it only necessary to state that the author has assiduously labored to render the present edition worthy a continuance of the marked favor accorded to previous issues, and that every care has been bestowed upon the typographical execution to make it, as heretofore, one of the handsomest productions of the American press.

The merits of Prof. Dalton's text-book, his smoo h and pleasing style, the remarkable clearness of his descriptions, which leave not a chapter obscure, his cautious judgment and the general correctness of his facts, are perfectly known. They have made his text-book the one most familiar, perhaps, to American students.—*Med. Record*, March 4, 1882.

This very popular work appears in its present edition somewhat diminished in size from condensation of certain sections, but increased in availability for every-day use. It has undergone very close revision, and expounds the science up to the latest discoveries. The author, as in former editions, serves his material in highly assimilable style.—*Louisville Med. News*, Feb. 25, 1882.

Certainly no physiological work has ever issued from the press that presented its subject matter in a clearer and more attractive light. A most every page bears evidence of the exhaustive revision that has taken place. The material is placed in a more compact form, yet its delightful charm is retained, and no subject is thrown into obscurity. Altogether this edition is far in advance of any previous one, and will tend to keep the profession posted as to the most recent additions to our physiological knowledge.—*Michigan Medical News*, April, 1882.

This text-book of physiology has always been a great favorite. The clear descriptions, the easy mode of writing, the handsome black-ground woodcuts, have each had their share in winning this popularity. That it has now reached its seventh edition is proof enough of the value placed upon it by the profession.—*Canada Medical and Surgical Journal*, June, 1882.

CARPENTER (WILLIAM B.), M.D., F.R.S., F.G.S., F.L.S.,

Registrar to University of London, etc.

PRINCIPLES OF HUMAN PHYSIOLOGY; Edited by HENRY POWER, M.B. Lond., F.R.C.S., Examiner in Natural Sciences, University of Oxford. A New American from the Eighth Revised and Enlarged English Edition, with Notes and Additions, by FRANCIS G. SMITH, M.D., Professor of the Institutes of Medicine in the University of Pennsylvania, etc. In one very large and handsome octavo volume, of 1083 pages, with two plates and 373 engs. on wood. Cloth, $5 50; leather, $6 50; half Russia, $7.

We have been agreeably surprised to find the volume so complete in regard to the structure and functions of the nervous system in all its relations, a subject that, in many respects, is one of the most difficult of all, in the whole range of physiology, upon which to produce a full and satisfactory treatise of the class to which the one before us belongs. The additions by the American editor give to the work as it is a considerable value beyond that of the last English edition. In conclusion, we can give our cordial recommendation to the work as it now appears. The editors have, with their additions to the only work on physiology in our language that, in the fullest sense of the word, is the production of a philosopher as well as a physiologist, brought it up as fully as could be expected, if not desired, to the standard of our knowledge of its subject at the present day. It will deservedly maintain the place it has always had in the favor of the medical profession.—*Journ. of Nervous and Mental Disease*, April, 1877.

Such enormous advances have recently been made in our physiological knowledge, that what was perfectly new a year or two ago, looks now as if it had been a received and established fact for years. In this encyclopædic way this work is unrivalled. Here, as it seems to us, is the great value of the book; one is safe in sending a student to it for information on almost any given subject, perfectly certain of the fulness of information it will convey, and well satisfied of the accuracy with which it will there be found stated.—*London Med. Times and Gazette*, Feb. 17, 1877.

The merits of "Carpenter's Physiology" are so widely known and appreciated that we need only allude briefly to the fact that in the latest edition will be found a comprehensive embodiment of the results of recent physiological investigation. Care has been taken to preserve the practical character of the original work. In fact the entire work has been brought up to date, and bears evidence of the amount of labor that has been bestowed upon it by its distinguished editor, Mr. Henry Power. The American editor has made the latest additions, in order fully to cover the time that has elapsed since the last English edition.—*N. Y. Med. Journal*, Jan. 1877.

FOSTER (MICHAEL), M.D., F.R.S.,

Professor of Physiology in Cambridge University, England.

TEXT-BOOK OF PHYSIOLOGY. Second American from the Latest English Edition. Edited, with Extensive Notes and Additions, by EDWARD T. REICHERT, M.D., Late Demonstrator of Experimental Therapeutics in the University of Pennsylvania. In one handsome royal 12mo. volume of about 1000 pages, with 259 illustrations. Cloth, $3 25; leather, $3 75. (*Just Issued.*)

It is a pleasing sign to observe the appreciation of so thoroughly scientific a work as Foster's "Physiology" by the American student, an appreciation which is amply proven by the fact of the exhaustion of the first American edition within a twelvemonth. In its present shape, the work will be found thoroughly up to the times, recent advances in physiology having been duly noticed by the American editor.—*Med. Record*, Nov. 26, 1881.

The first American edition having been exhausted in the short period of one year, the editor has availed himself of the opportunity to revise carefully the material added to the text of the former edition, and to make such additions as recent advances in experimental physiology call for. This work will long hold its place as a standard text-book on physiology.—*Phila. Med. and Surg. Reporter*, Nov. 26, 1881.

The readers of the former American edition will doubtless agree that there is no better text-book on physiology than this, in print. Besides being clear and simple in its statements, it is abreast with the very latest researches, and these are presented in an instructive, and, indeed, in an entertaining style. A most admirable work, this new edition of it will prove acceptable, not only to younger students, but also to physicians who still wish to base their treatment of the abnormal on a knowledge of normal conditions of the body.—*Buffalo Med. and Surg. Journ.*, Dec 1881.

CARPENTER'S PRIZE ESSAY ON THE USE AND ABUSE OF ALCOHOLIC LIQUORS IN HEALTH AND DISEASE. New Edition, with a Preface by D. F. CONDIE, M.D., and explanations of scientific words. In one small 12mo. volume of 178 pages. Cloth, 60 cents.

ATTFIELD (JOHN), Ph.D.,

Professor of Practical Chemistry to the Pharmaceutical Society of Great Britain, &c.

CHEMISTRY, GENERAL, MEDICAL AND PHARMACEUTICAL;

Including the Chemistry of the U. S. Pharmacopœia. A Manual of the General Principles of the Science, and their Application to Medicine and Pharmacy. Eighth Edition, revised by the author. In one handsome royal 12mo. volume of 701 pages, with 87 illustrations. Cloth, $2 50; leather, $3 00.

We have repeatedly expressed our favorable opinion of this work, and on the appearance of a new edition of it, little remains for us to say, except that we expect this eighth edition to be as indispensable to us as the seventh and previous editions have been. While the general plan and arrangement have been adhered to, new matter has been added covering the observations made since the former edition. The present differs from the preceding one chiefly in these alterations and in about ten pages of useful tables added in the appendix.—*Am. Journ. of Pharmacy*, May, 1879.

A standard work like Attfield's Chemistry needs only be mentioned by its name, without further comments. The present edition contains such alterations and additions as seemed necessary for the demonstration of the latest developments of chemical principles, and the latest applications of chemistry to pharmacy. The author has bestowed arduous labor on the revision, and the extent of the information thus introduced may be estimated from the fact that the index contains three hundred new references relating to additional material.—*Druggists' Circular and Chemical Gazette*, May, 1879.

This very popular and meritorious work has now reached its eighth edition, which fact speaks in the highest terms in commendation of its excellence. It has now become the principal text-book of chemistry in all the medical colleges in the United States. The present edition contains such alterations and additions as seemed necessary for the demonstration of the latest developments of chemical principles, and the latest applications of chemistry to pharmacy. It is scarcely necessary for us to say that it exhibits chemistry in its present advanced state.—*Cincinnati Medical News*, April, 1879.

The popularity which this work has enjoyed is owing to the original and clear disposition of the facts of the science, the accuracy of the details, and the omission of much which freights many treatises heavily without bringing corresponding instruction to the reader. Dr. Attfield writes for students, and primarily for medical students; he always has an eye to the pharmacopœia and its officinal preparations; and he is continually putting the matter in the text so that it responds to the questions with which each section is provided. Thus the student learns easily, and can always refresh and test his knowledge.—*Med. and Surg. Reporter*, April 19, '79.

We noticed only about two years and a half ago the publication of the preceding edition, and remarked upon the exceptionally valuable character of the work. The work now includes the whole of the chemistry of the pharmacopœia of the United States, Great Britain and India.—*New Remedies*, May, 1879.

GREENE (WILLIAM H.), M.D.,

Demonstrator of Chemistry in Medical Department, University of Pennsylvania.

A MANUAL OF MEDICAL CHEMISTRY. For the Use of Students.

Based upon Bowman's Medical Chemistry. In one royal 12mo. volume of 310 pages, with 74 illustrations. Cloth, $1 75. (*Just Issued.*)

is well written, and gives the latest views on vital chemistry, a subject with which most physicians are not sufficiently familiar. To those who may wish to improve their knowledge in that direction, we can heartily recommend this work as being worthy of a careful perusal.—*Phila. Med. and Surg. Reporter*, April 24, 1880.

The little work before us is one which we think will be studied with pleasure and profit. The descriptions, though brief, are clear, and in most cases sufficient for the purpose. This book will, in nearly all cases, meet general approval.—*Am. Journ. of Pharmacy*, April, 1880.

CLASSEN (ALEXANDER),

Professor in the Royal Polytechnic School, Aix-la-Chapelle.

ELEMENTARY QUANTITATIVE ANALYSIS. Translated with

notes and additions by EDGAR F. SMITH, Ph.D., Assistant Prof. of Chemistry in the Towne Scientific School, Univ. of Penna. In one handsome royal 12mo. volume, of 324 pages, with 36 illustrations. Cloth, $2 00.

It is probably the best manual of an elementary nature extant, insomuch as its methods are the best. It teaches by examples, commencing with single determinations, followed by separations, and then advancing to the analysis of minerals and such products as are met with in applied chemistry. It is an indispensable book for students in chemistry.—*Boston Journal of Chemistry*, Oct. 1878.

GALLOWAY (ROBERT), F.C.S.,

Prof of Applied Chemistry in the Royal College of Science for Ireland, etc.

A MANUAL OF QUALITATIVE ANALYSIS. From the Sixth Lon-

don Edition. In one handsome royal 12mo. volume, with illustrations. (*Preparing.*)

REMSEN (IRA), M.D., Ph.D.,

Professor of Chemistry in the Johns Hopkins University, Baltimore.

PRINCIPLES OF THEORETICAL CHEMISTRY, with special reference

to the Constitution of Chemical Compounds. New Edition. In one handsome royal 12mo. volume of about 250 pages. (*Preparing.*)

BOWMAN'S INTRODUCTION TO PRACTICAL CHEMISTRY, INCLUDING ANALYSIS. Sixth American, from the Sixth London Edition. In one royal 12mo. volume, with illustrations.

WÖHLER AND FITTIG'S OUTLINES OF ORGANIC CHEMISTRY. Translated, with additions, from the Eighth German Edition. By IRA REMSEN, M.D., Ph.D., Prof. of Chemistry and Physics in Williams College, Mass. In one royal 12mo. volume of 550 pages. Cloth, $3.

LEHMANN'S MANUAL OF CHEMICAL PHYSIOLOGY. Translated from the German, with Notes and Additions, by J. CHESTON MORRIS, M.D. With illustrations on wood. In one octavo volume of 336 pages. Cloth, $2 25.

FOWNES (GEORGE), Ph.D.

A MANUAL OF ELEMENTARY CHEMISTRY; Theoretical and Practical.

Revised and corrected by HENRY WATTS, B.A., F R.S., author of "A Dictionary of Chemistry," etc. A New American, from the Twelfth and Enlarged London Edition. Edited by ROBERT BRIDGES, M.D. In one large royal 12mo. volume, of 1031 pages, with 177 illustrations and a colored plate. Cloth, $2 75; leather, $3 25.

This work, inorganic and organic, is complete in one convenient volume. In its earliest editions it was fully up to the latest advancements and theories of that time. In its present form, it presents, in a remarkably convenient and satisfactory manner, the principles and leading facts of the chemistry of *to-day*. Concerning the manner in which the various subjects are treated, much deserves to be said, and mostly, too, in praise of the book. A review of such a work as *Fownes' Chemistry* within the limits of a book-notice for a medical weekly is simply out of the question.—*Cincinnati Lancet and Clinic*, Dec. 14, 1878.

When we state that, in our opinion, the present edition sustains in every respect the high reputation which its predecessors have acquired and enjoyed, we express therewith our full belief in its intrinsic value as a text-book and work of reference.—*Am. Journ. of Pharm.*, Aug. 1878.

The conscientious care which has been bestowed upon it by the American and English editors renders it still, perhaps, the best book for the student and the practitioner who would keep alive the acquisitions of his student days. It has, indeed, reached a somewhat formidable magnitude with its more than a thousand pages, but with less than this no fair representation of chemistry as it now is can be given. The type is small but very clear, and the sections are very lucidly arranged to facilitate study and reference.—*Med. and Surg. Reporter*, Aug 3, 1878.

The work is too well known to American students to need any extended notice; suffice it to say that the revision by the English editor has been faithfully done, and that Professor Bridges has added some fresh and valuable matter, especially in the inorganic chemistry. The book has always been a favorite in this country, and in its new shape bids fair to retain all its former *prestige*.—*Boston Jour. of Chemistry*, Aug. 1878.

It will be entirely unnecessary for us to make any remarks relating to the general character of Fownes' Manual. For over twenty years it has held *the* foremost place as a text-book, and the elaborate and thorough revisions which have been made from time to time leave little chance for any wide awake rival to step before it.—*Canadian Pharm. Jour.*, Aug. 1878.

As a manual of chemistry it is without a superior in the language.—*Md. Med. Jour.*, Aug. 1878.

BLOXAM (C. L.),

Professor of Chemistry in King's College, London.

CHEMISTRY, INORGANIC AND ORGANIC.

New Edition. In one very handsome octavo volume, of about 700 pages, with about 300 illustrations. (*Preparing.*)

CLOWES (FRANK), D.Sc., London.

Senior Science-Master at the High School, Newcastle-under-Lyme, etc.

AN ELEMENTARY TREATISE ON PRACTICAL CHEMISTRY AND QUALITATIVE INORGANIC ANALYSIS.

Specially adapted for Use in the Laboratories of Schools and Colleges and by Beginners. Second American from the Third and Revised English Edition. In one very handsome royal 12mo. volume of 372 pages, with 47 illustrations. Cloth, $2 50. (*Just Issued.*)

The book is eminently a practical one, and we can cordially recommend it as one of the best text-books for practical instruction in the laboratory. The analytical reactions and methods are those which experience has proved to be the most accurate, and the directions for working are given so fully as to be perfectly intelligible to the student without extended verbal explanation from the instructor.—*Boston Med. and Surg. Journ.*, March, 1881.

A compact manual of qualitative inorganic analysis, well suited for class use or for the private student. The book has been carefully revised throughout, and some processes have been materially simplified.—*Boston Journ. of Chemistry*, March, 1881.

This is a valuable work for those about to commence chemistry, the more so as by its use they are simultaneously acquainted with the manipulation of chemical analysis, a method which is the most valuable to impart a thorough knowledge of chemistry. It is a very good little book, and will make for itself many warm friends and supporters. It treats the subject well and the tables are very clear and valuable.—*St Louis Med. and Surg. Journ.*, Mar. 1881.

This work is not only well adapted for use as a text-book in medical colleges, but is also one of the best that a practitioner can have for convenient reference and instruction in his library. As a rule, such volumes are too technical and abstruse for study without some didactic aid, but the volume presented is easy of comprehension, and will be of great value to college students and busy practitioners.—*Am. Med. Bi-Weekly*, April 9, 1881.

The tables particularly demand praise, for they are admirably formed, both for convenience of reference and fulness of information. In short, we do not remember to have met with a book which could better serve the student as a guide to the systematic study of inorganic chemistry.—*Louisville Med. News*, March 12, 1881.

HOFFMANN (FRED.), A.M., Ph.D., and POWER (FRED. B.), Ph.D.,

Prof of Anal. Chem. in Phil. Coll. of Pharmacy.

A MANUAL OF CHEMICAL ANALYSIS, as Applied to the Examination of Medicinal Chemicals and their Preparations.

Being a Guide for the Determination of their Identity and Quality, and for the Detection of Impurities and Adulterations. For the Use of Pharmacists, Physicians, Druggists and Manufacturing Chemists, and Pharmaceutical and Medical Students. Third Edition, entirely rewritten and much enlarged. In one very handsome octavo volume, fully illustrated. (*In Press.*)

HERMANN (L.).

Professor of Physiology in the University of Zürich.

EXPERIMENTAL PHARMACOLOGY. A Handbook of Methods for Determining the Physiological Actions of Drugs.

Translated, with the author's permission, and with extensive additions, by ROBERT MEADE SMITH, M.D., Demonstrator of Physiology in the University of Pennsylvania. (*In a few days.*)

PARRISH (EDWARD),

Late Professor of Materia Medica in the Philadelphia College of Pharmacy.

A TREATISE ON PHARMACY. Designed as a Text-Book for the Student, and as a Guide for the Physician and Pharmaceutist. With many Formulæ and Prescriptions. Fourth Edition, thoroughly revised, by THOMAS S. WIEGAND. In one handsome octavo volume of 985 pages, with 280 illustrations; cloth, $5 50; leather, $6 50; half Russia, $7

Perhaps one of the most important, if not the most important book upon pharmacy which has appeared in the English language has emanated from the transatlantic press. "Parrish's Pharmacy" is a well-known work on this side of the water, and the fact shows us that a really useful work never becomes merely local in its fame. Thanks to the judicious editing of Mr. Wiegand, the posthumous edition of "Parrish" has been saved to the public with all the mature experience of its author, and perhaps none the worse for a dash of new blood.—*Lond. Pharm. Journal*, Oct. 17, 1874

The work is eminently practical, and has the rare merit of being readable and interesting, while it preserves a strictly scientific character. The whole work reflects the greatest credit on author, editor and publisher.—*Med. Press and Circular*, Aug. 12, 1874.

GRIFFITH (R. EGLESFIELD), M.D.

A UNIVERSAL FORMULARY, Containing the Methods of Preparing and Administering Officinal and other Medicines. The whole adapted to Physicians and Pharmaceutists. Third Edition, carefully revised and much enlarged, by JOHN M. MAISCH, Phar. D., Professor of Materia Medica in the Philadelphia College of Pharmacy. In one large and handsome octavo volume of about 800 pages. Cloth, $4 50; leather, $5 50.

A more complete formulary than it is in its present form the pharmacist or physician could hardly desire. To the first some such work is indispensable, and it is hardly less essential to the practitioner who compounds his own medicines. Much of what is contained in the introduction ought to be committed to memory by every student of medicine. As a help to physicians it will be found invaluable, and doubtless will make its way into libraries not already supplied with a standard work of the kind. —*The American Practitioner*, July, 1874.

STILLÉ (ALFRED), M.D., LL.D.

Professor of Theory and Practice of Medicine in the University of Pennsylvania.

THERAPEUTICS AND MATERIA MEDICA; a Systematic Treatise on the Action and Uses of Medicinal Agents, including their Description and History. Fourth Edition, revised and enlarged. In two large and handsome octavo volumes of about 2000 pages. Cloth, $10; leather, $12; half Russia, raised bands, $13.

For all who desire a complete work on therapeutics and materia medica for reference, in cases involving medico-legal questions, as well as for information concerning remedial agents, Dr. Stillé's is "*par excellence*" the work. Being out of print, by the exhaustion of former editions, the author has laid the profession under renewed obligations, by the careful revision, important additions, and timely reissuing a work not exactly supplemented by any other in the English language, if in any language. The mechanical execution handsomely sustains the well-known skill and good taste of the publisher.—*St. Louis Med. and Surg. Journal*, Dec 1874.

The rapid exhaustion of three editions and the universal favor with which the work has been received by the medical profession, are sufficient proof of its excellence as a repertory of practical and useful information for the physician. The edition before us fully sustains this verdict, as the work has been carefully revised and in some portions rewritten, bringing it up to the present time.—*American Journal of Pharmacy*, Feb. 1875.

We can hardly admit that it has a rival in the multitude of its citations and the fulness of its research into clinical histories, and we must assign it a place in the physician's library; not, indeed, as fully representing the present state of knowledge in pharmacodynamics, but as by far the most complete treatise upon the clinical and practical side of the question.—*Boston Med. and Surg. Journal*. Nov 5, 1874.

FARQUHARSON (ROBERT), M.D.,

Lecturer on Materia Medica at St. Mary's Hospital Medical School.

A GUIDE TO THERAPEUTICS AND MATERIA MEDICA. Third American Edition, specially revised by the Author. Enlarged and adapted to the U. S Pharmacopœia. By FRANK WOODBURY, M.D. In one very handsome 12mo. volume o 524 pages. Cloth, $2 25. (*Just Ready.*)

FROM THE EDITOR'S PREFACE TO THE THIRD EDITION.

The present volume is an intelligent effort to present, in moderate compass, such well-digested facts concerning the physiological and therapeutical action of remedies as are reasonably established up to the present time. By a convenient arrangement the corresponding effects of each article in health and disease are presented in parallel columns, not only rendering reference easier, but also impressing the facts more strongly upon the mind of the reader. The author has thought it advisable to introduce the metric system in addition to the old form of writing prescriptions, in deference to the demands of scientific progress and uniformity of observation. A ready reference table of Poisons has been placed at the end of the book, and in the text itself the tests of the prominent poisons have been inserted. It is hoped that the very careful revision and additions that have been made to the work (which have increased its size nearly one-third) have proportionally increased its value to the student

The general arrangement, the excellent manner in which the individual articles are presented, the eminently practical character together with the positiveness of expression in both the physiological and therapeutical indications of special remedies, and the fact that it is fully abreast with the most recent developments of scientific investigations, all tend to make this little volume peculiarly valuable. It is throughout complete in all the necessary details, clear and lucid in its explanations, and not only a handy little volume but may be regarded as authority.—*The Southern Practitioner*, Dec. 1882.

That a third edition of this work should be demanded within five years after the appearance of the first, is conclusive proof that the book is a popular one. That its popularity is deserved no one can doubt who carefully reads the book. The double-column arrangement beautifully shows the relations between the physiological and therapeutical action of the drugs. As a text-book for students we know of nothing so concise and clear. As a hasty reference book for practitioners it has no superior.—*Cincinnati Lancet and Clinic*, Nov. 25, 1882.

STILLÉ (ALFRED), M.D., LL.D., and MAISCH (JOHN M.), Phar.D.,
Prof. of Theory and Practice of Medicine and of Clinical Med. in Univ. of Pa.
Prof. of Mat. Med. and Bot. in Phila. Coll. Pharmacy, Secy. to the American Pharmaceutical Association.

THE NATIONAL DISPENSATORY: Containing the Natural History, Chemistry, Pharmacy, Actions and Uses of Medicines, including those recognized in the Pharmacopœias of the United States, Great Britain and Germany, with numerous references to the French Codex. Second Edition, thoroughly revised, with numerous additions. In one very handsome octavo volume of 1692 pages, with 239 illustrations. Extra cloth, $6 75; leather, raised bands, $7 50; half Russia, raised bands and open back, $8 25. (*Now Ready.*)

In the recent announcement of the UNITED STATES PHARMACOPŒIA of 1880, a list is given of new material inserted, and of the 102 items under the head of NEW DRUGS, OILS AND EXTRACTS, all are in the NATIONAL DISPENSATORY excepting 6, while of the FLUID EXTRACTS quite a large proportion is included. Besides embracing practically the whole UNITED STATES PHARMACOPŒIA the NATIONAL DISPENSATORY contains a long list of unofficinal drugs and preparations, and also selections from the recent German and French Pharmacopœias. Purchasers will therefore find that the NATIONAL DISPENSATORY, second edition, is, for all practical purposes, a commentary on the UNITED STATES PHARMACOPŒIA of 1880.

FROM THE PREFACE TO THE SECOND EDITION.

The opportunity for a revision has enabled the authors to scrutinize the work as a whole, and to introduce alterations and additions wherever there has seemed to be occasion for improvement or greater completeness. The principal changes to be noted are the introduction of several drugs under separate headings, and of a large number of drugs, chemicals and pharmaceutical preparations classified as allied drugs and preparations under the heading of more important or better known articles; these additions comprise in part nearly the entire German Pharmacopœia and numerous articles from the French Codex. All new investigations which came to the authors' notice up to the time of publication have received due consideration.

The series of illustrations has undergone a corresponding thorough revision. A number have been added, and still more have been substituted for such as were deemed less satisfactory.

While numerous additions have been made to the sections which relate to the physiological action of medicines and their use in the treatment of disease, great care has been taken to make them as concise as was possible without rendering them incomplete or obscure. The doses have been expressed in the terms both of troy weight and of the metrical system, for the purpose of making those who employ the Dispensatory familiar with the latter, and paving the way for its introduction into general use.

The Therapeutical Index has been extended by about 2250 new references, making the total number in the present edition about 6000.

This evidence of success, seldom paralleled, shows clearly how well the authors have met the existing needs of the pharmaceutical and medical professions. Gratifying as it must be to them, they have embraced the opportunity offered for a thorough revision of the whole work, striving to embrace within it all that might have been omitted in the former edition, and all that has newly appeared of sufficient importance during the time of its collaboration, and the short interval elapsed since the previous publication. After having gone carefully through the volume we must admit that the authors have labored faithfully, and with success, in maintaining the high character of their work as a compendium meeting the requirements of the day, to which one can safely turn in quest of the latest information concerning everything worthy of notice in connection with Pharmacy, Materia Medica, and Therapeutics.—*Am. Jour. of Pharmacy*, Nov. 1879.

It is with great pleasure that we announce to our readers the appearance of a *second* edition of the National Dispensatory. The total exhaustion of the first edition in the short space of six months, is a sufficient testimony to the value placed upon the work by the profession. The rapid sale of the first edition must have induced both the editors and the publisher to make preparations for a new edition immediately after the first had been issued, for we find a large amount of new matter added and a good deal of the previous text altered and improved, which proves that the authors do not intend to let the grass grow under their feet, but to keep the work up to the time.—*New Remedies*, Nov. 1879.

This is a great work by two of the ablest writers on materia medica in America. The authors have produced a work which, for accuracy and comprehensiveness, is unsurpassed by any work on the subject. There is no book in the English language which contains so much valuable information on the various articles of the materia medica. The work has cost the authors years of laborious study, but they have succeeded in producing a dispensatory which is not only *national*, but will be a lasting memorial of their learning.—*Edinburgh Medical Journal*, Nov. 1879.

It is by far more international or universal than any other book of the kind in our languages, and more comprehensive in every sense.—*Pacific Med. and Surg. Journ.*, Oct. 1879.

The National Dispensatory is beyond dispute the very best authority. It is throughout complete in all the necessary details, clear and lucid in its explanations, and replete with references to the most recent writings, where further particulars can be obtained, if desired. Its value is greatly enhanced by the extensive indices—a general index of materia medica, etc., and also an index of therapeutics. No practising physician can afford to be without the National Dispensatory.—*Canada Med. and Surg. Journ.*, Feb. 1880.

MAISCH (JOHN M.), Phar. D.,

Prof. of Materia Medica and Botany in the Phila. Coll. of Pharmacy.

A MANUAL OF ORGANIC MATERIA MEDICA.

Being a Guide to Materia Medica of the Vegetable and Animal Kingdoms. For the use of Students, Druggists, Pharmacists and Physicians. In one handsome royal 12mo. volume of 451 pages, with 194 beautiful illustrations on wood. Cloth, $2 75. (*Just Ready.*)

A book evidently written for a purpose, and not simply for the purpose of writing a book. It is comprehensive, inasmuch as it refers to all, or nearly all, that is of essential value in organic materia medica, clear and simple in its style, concise, since it would be difficult to find in it a superfluous word, and yet sufficiently explicit to satisfy the most critical. The text is freely illustrated with woodcuts, which cannot fail to be valuable in familiarizing students with the physical, microscopic, and macroscopic appearance of drugs. The work is preceded by a table of contents, and completed with that, without which no book should be considered complete, *i. e.*, an index. In fact, the little book is just what it pretends to be, and is worthy of unqualified commendation. — *Chicago Medical Journal and Examiner*, Aug. 1882.

The above manual, by a well known authority in this department and one of the authors of the *National Dispensatory*, is a work for which students of pharmacy should be grateful. The subject is one in which the beginner needs the guidance of a good classification in order to avoid the bewilderment which follows the attempt to grasp a subject having so many details. This condition the book fulfils, the classification adopted being a simple and practical one; the notice of each drug is brief and clear, non-essentials being omitted. It is fully illustrated by some two hundred woodcuts.—*Boston Med. and Surg. Journ.*, Jan 19, 1882.

Besides being of value to the student, the work will be a great aid to the druggist in his purchases, enabling him to detect adulterations. The work is from a master in his department, and is an evidence of the truly scientific study that is now being pursued in pharmacology.—*Physician and Surgeon*, Feb. 1882.

CORNIL (V.), AND RANVIER (L.),

Prof. in the Faculty of Med. of Paris. *Prof in the College of France.*

A MANUAL OF PATHOLOGICAL HISTOLOGY.

Translated, with Notes and Additions, by E. O. SHAKESPEARE, M.D., Pathologist and Ophthalmic Surgeon to Philada. Hospital, Lecturer on Refraction and Operative Ophthalmic Surgery in Univ. of Penna., and by J. HENRY C. SIMES, M.D., Demonstrator of Pathological Histology in the Univ. of Pa. In one very handsome octavo volume of 800 pages, with 360 illustrations. Cloth, $5 50; leather, $6 50; half Russia, $7. (*Now Ready.*)

Every student of pathology—and every practitioner ought to be a student of pathology—should have Cornil and Ranvier amongst his books, and he will find it invaluable for reference in working up his cases; in fact, a great deal of well-condensed matter is collected together here which is not easily found in the same form anywhere else.—*Can. Med. and Surg. Journal*, June, 1880.

Their book is not a collection of the works of others, but has been written in the laboratory beside the microscope. It bears the marks of personal knowledge and investigation upon every page, controlled by and controlling the work of others. In short, its translation has made it the best work in pathology attainable in our language, one that every student certainly ought to have.—*Archives of Medicine*, April, 1880.

We have no hesitation in cordially recommending the translation of Cornil and Ranvier's "Pathological Histology" as the best work of the kind in any language, and as giving to its readers a trustworthy guide in obtaining a broad and solid basis for the appreciation of the practical bearings of pathological anatomy.—*Am. Journ. of Med. Sciences*, April, 1880.

This important work, in its American dress, is a welcome offering to all students of the subjects which it treats. The great mass of material is arranged naturally and comprehensively. The classification of tumors is clear and full, so far as the subject admits of definition, and this one chapter is worth the price of the book. The illustrations are copious and well chosen. Without the slightest hesitation, the translators deserve honest thanks for placing this indispensable work in the hands of American students.—*Phila. Med. Times*, April 24, 1880.

This volume we cordially commend to the profession. It will prove a valuable, almost necessary, addition to the libraries of students who are to be physicians, and to the libraries of students who are physicians.—*American Practitioner*, June, 1880.

The best and most complete work ever issued on the subject from the press of any country.—*London Medical Press and Circular.*

SCHÄFER (EDWARD ALBERT), M.D.,

Assistant Professor of Physiology in University College, London.

A COURSE OF PRACTICAL HISTOLOGY:

Being an Introduction to the Use of the Microscope. In one handsome royal 12mo. volume of 308 pages, with numerous illustrations. Cloth, $2 00.

GREEN (T. HENRY), M.D.,

Lecturer on Pathology and Morbid Anatomy at Charing-Cross Hospital Medical School, etc.

PATHOLOGY AND MORBID ANATOMY.

Fifth American, from the Sixth Enlarged and Revised English Edition. In one very handsome octavo volume of about 350 pages, with about 150 fine engravings. (*Preparing.*)

A few notices of the previous edition are appended.

No late discovery or investigation has been overlooked, and the illustrations are the best that ever accompanied any book on the subject. In few departments of medicine has so much progress been made of late as in that of pathology, supported as it is by the promising sciences of biology and physiological chemistry, and these lie at the basis of scientific treatment. It will repay most practitioners to peruse this book at least two or three times — *Chicago Med. Journ. and Examiner*, Feb., 1882.

If the practitioner has an ambition to excel or a desire to advance in truth the science of medicine, he should be familiar with pathological and morbid anatomy as described in the book now on our table. —*Va. Med. Monthly*, July, 1881.

All the good things that have been said and written of previous editions apply with added force to this, and we know not how to recommend the book too highly to all students and to those practitioners who have not a recent edition, and who care to know the why and wherefore of those processes which fall under their daily observation.—*Can. Journ. of Med. Science*, Aug. 1881.

We have long considered this the best guide yet presented to the student for the identification of various morbid tissues. We have found it more satisfactory than any other. The present edition has been thoroughly revised, and much new matter has been added. To the physician, as a guide in diagnosis, we recommend this volume.—*Physician and Surgeon*, May, 1881.

BRISTOWE (JOHN SYER), M.D., F.R.C.P.,

Physician and Joint Lecturer on Medicine at St. Thomas' Hospital.

A TREATISE ON THE PRACTICE OF MEDICINE. Second American Edition, revised by the Author. Edited, with Additions, by JAMES H. HUTCHINSON, M.D., Physician to the Penna. Hospital. In one handsome octavo volume of 1085 pages, with illustrations. Cloth, $5 00; leather, $6 00; half Russia, raised bands, $6 50. (*Lately Issued.*)

The second edition of this excellent work, like the first, has received the benefit of Dr. Hutchinson's annotations, by which the phases of disease which are peculiar to this country are indicated, and thus a treatise which was intended for British practitioners and students is made more practically useful on this side of the water. We see no reason to modify the high opinion previously expressed with regard to Dr. Bristowe's work, except by adding our appreciation of the careful labors of the author in following the latest growth of medical science. —*Boston Medical and Surgical Journal*, February, 1880.

What we said of the first edition, we can, with increased emphasis, repeat concerning this: "Every page is characterized by the utterances of a thoughtful man. What has been said, has been well said, and the book is a fair reflex of all that is *certainly known* on the subjects considered."—*Ohio Med. Recorder*, Jan. 7, 1880.

The reader will find every conceivable subject connected with the practice of medicine ably presented, in a style at once clear, interesting and concise. The additions made by Dr. Hutchinson are appropriate and practical, and greatly add to its usefulness to American readers.—*Buffalo Med. and Surg. Journ.*, March, 1880.

We regard it as an excellent work for students and for practitioners. It is clearly written, the author's style is attractive, and it is especially to be commended for its excellent exposition of the pathology and clinical phenomena of disease.—*St. Louis Clin. Record*, Feb. 1880.

FENWICK (SAMUEL), M.D.,

Assistant Physician to the London Hospital.

THE STUDENT'S GUIDE TO MEDICAL DIAGNOSIS. From the Third Revised and Enlarged English Edition. In one very handsome royal 12mo. volume of 328 pages, with 87 illustrations on wood. Cloth, $2 25.

FOTHERGILL (J. MILNER), M.D. Edin., M.R.C.P. Lond.,

Asst. Phys. to the West Lond Hosp.; Asst. Phys. to the City of Lond. Hosp., etc.

THE PRACTITIONER'S HANDBOOK OF TREATMENT; Or, The Principles of Therapeutics. Second Edition, revised and enlarged. In one very handsome octavo volume of about 650 pages. Cloth, $4 00; very handsome half Russia, raised bands, $5 50. (*Just Issued.*)

A book which can give correctly and interestingly as well as scientifically, the method of prescribing and the rationale of the best therapeutics in the treatment of disease, is manifestly just the work, which each physician desires. It is not extravagant eulogy to say that the physician will find in this work of Fothergill the guide which he seeks for his therapeutics; nor not only is the treatment which he seeks already indicated herein, but the rationale of the treatment is as clearly explained. —*Gaillard's Med. Journ.*, Sept. 1880.

The author merits the thanks of every well-educated physician for his efforts toward rationalizing the treatment of diseases upon the scientific basis of physiology. Every chapter, every line, has the impress of a master hand, and while the work is thoroughly scientific in every particular, it presents to the thoughtful reader all the charms and beauties of a well-written novel. No physician can well afford to be without this valuable work, for its originality makes it fill a niche in medical literature hitherto vacant.—*Nashville Journ. of Med. and Surg.*, Oct. 1880.

The junior members of the profession will find in it a work that should not only be read, but carefully studied. It will assist them in the proper selection and combination of therapeutical agents best adapted to each case and condition, and enable them to prescribe intelligently and successfully. To do full justice to a work of this scope and character will be impossible in a review of this kind. The book itself must be read to be fully appreciated —*St. Louis Courier of Medicine*, Nov. 1880.

Both in matter and manner the book is most thoroughly excellent.—*Ohio Med. Recorder*, Oct. 1880.

HABERSHON (S. O.), M.D.

Senior Physician to and late Lecturer on the Principles and Practice of Medicine at Guy's Hospital, etc.

ON THE DISEASES OF THE ABDOMEN, COMPRISING THOSE of the Stomach, and other parts of the Alimentary Canal, Œsophagus, Cæcum, Intestines and Peritoneum. Second American, from the Third Enlarged and Revised English Edition. With illustrations. In one handsome octavo volume of 554 pages, with illustrations. Cloth, $3 50. (*Lately Issued.*)

This valuable treatise on diseases of the stomach and abdomen has been out of print for several years, and is therefore not so well known to the profession as it deserves to be. It will be found a cyclopædia of information, systematically arranged, on all diseases of the alimentary tract, from the mouth to the rectum. A fair proportion of each chapter is devoted to symptoms, pathology and therapeutics. The present edition is fuller than former ones in many particulars, and has been thoroughly revised and amended by the author. Several new chapters have been added, bringing the work fully up to the times, and making it a volume of interest to the practitioner in every field of medicine and surgery. Perverted nutrition is in some form associated with all diseases we have to combat, and we need all the light that can be obtained on a subject so broad and general. Dr. Habershon's work is one that every practitioner should read and study for himself.—*N. Y. Med. Journ.*, April, 1879.

GLUGE'S ATLAS OF PATHOLOGICAL HISTOLOGY. Translated, with Notes and Additions, by JOSEPH LEIDY, M. D. In one volume, very large imperial quarto, with 320 copper-plate figures, plain and colored. Cloth, $4 00.

HOLLAND'S MEDICAL NOTES AND REFLECTIONS. 1 vol. 8vo., pp. 500. Cloth, $3 50.

BARLOW'S MANUAL OF THE PRACTICE OF MEDICINE. With Additions by D. F. CONDIE, M. D. 1 vol. 8vo. pp. 600. Cloth, $2 50.

LA ROCHE ON YELLOW FEVER, considered in its Historical, Pathological, Etiological and Therapeutical Relations. In two large and handsome octavo volumes of nearly 1500 pp. Cloth, $7 00.

LA ROCHE ON PNEUMONIA. 1 vol. 8vo. of 490 pages. Cloth, $3 00.

PAVY'S TREATISE ON THE FUNCTION OF DIGESTION: its Disorders and their Treatment. From the Second London Edition. In one handsome volume, small octavo. Cloth, $2 00.

FLINT (AUSTIN), M.D.,

Professor of the Principles and Practice of Medicine in Bellevue Med. College, N. Y.

A TREATISE ON THE PRINCIPLES AND PRACTICE OF MEDICINE;

designed for the use of Students and Practitioners of Medicine. Fifth Edition, entirely rewritten and much improved. In one large and closely printed octavo volume of 1150 pages. Cloth, $5 50; leather, $6 50; very handsome half Russia, raised bands, $7. (*Just Issued.*)

This work has been so long and favorably known, and has obtained so high a position amongst modern treatises on medicine, that it is hardly necessary to do more than announce the publication of this fifth edition. All who peruse it must be struck by the extensive research which has been undertaken in the revision of this edition, combined with much original thought. There is hardly a subject which does not receive fresh illustration and discussion, opening up new lines of inquiry which had not been thought of when the previous edition appeared. We cannot conclude this notice without expressing our admiration of this volume, which is certainly one of the standard text-books on medicine, and we may safely affirm that, taken altogether, it exhibits a fuller and wider acquaintance with recent pathological inquiry than any similar work with which we are acquainted, whilst at the same time it shows its author to be possessed of the rare faculties of clear exposition, thoughtful discrimination, and sound judgment.—*London Lancet*, July 23, 1881.

Practically, this edition is a new work; for so many additions and changes have been made that one well acquainted with previous editions would hardly recognize this as an old friend. The size of the volume is somewhat increased. An entire new section and several new chapters have been added. It is universally conceded that no text book upon this subject was ever published in this country that can at all compare with it. It has long been at the very head of American text-book literature, and there can be no doubt but that it will be many years before it yields the place to others.—*Nashville Journ. of Med. and Surg.*, Feb. 1881.

"Flint's Practice" is recognized to be a standard treatise of high rank upon the principles and the practice of medicine wherever the English language is read. The opinions everywhere reveal the man of extensive experience, diligent study, calm judgment, and unbiassed criticism. The work should be in the hands of every practitioner.—*New York Med. Record*, Feb. 26, 1881.

The style and character of this work are too well known to the profession to require an introduction. For a number of years this volume has occupied a leading position as a text-book in the majority of medical schools, and the high position accorded to it in the past is a guarantee of a hearty welcome in this new edition. The book may be said to represent the present state of the science of medicine as now understood and taught. It is a safe guide to students and practitioners of medicine.—*Maryland Medical Journal*, March 1, 1881.

The author has, in this edition, revised and rewritten a great part and made it accord with the more advanced ideas which have been developed within the past few years. He is the more fitted to do so, as he is actively engaged in his profession, and can make deductions, not from the work of others, but from his own labors. It is a treatise which every American physician should have upon his table, and which he should consult on occasions when his leisure permits him to do so.—*St. Louis Med. and Surg. Journal*, March, 1881.

BY THE SAME AUTHOR.

CLINICAL MEDICINE;

a Systematic Treatise on the Diagnosis and Treatment of Diseases. Designed for Students and Practitioners of Medicine. In one large and handsome octavo volume of 799 pages. Cloth, $4 50; leather, $5 50; half Russia, $6. (*Lately Issued.*)

The eminent teacher who has written the volume under consideration has recognized the needs of the American profession, and the result is all that we could wish. The style in which it is written is peculiarly the author's; it is clear and forcible, and marked by those characteristics which have rendered him one of the best writers and teachers this country has ever produced. We have not space for so full a consideration of this remarkable work as we would desire.—*St. Louis Clin. Record*, Oct. 1879.

It is here that the skill and learning of the great clinician are displayed. He has given us a storehouse of medical knowledge, excellent for the student, convenient for the practitioner, the result of a long life of the most faithful clinical work, collected by an energy as vigilant and systematic as untiring, and weighed by a judgment no less clear than his observation is close.—*Archives of Medicine*, Dec. 1879.

To give an adequate and useful conspectus of the extensive field of modern clinical medicine is a task of no ordinary difficulty; but to accomplish this consistently with brevity and clearness, the different subjects and their several parts receiving the attention which, relatively to their importance, medical opinion claims for them, is still more difficult. This task we feel bound to say has been executed with more than partial success by Dr. Flint, whose name is already familiar to students of advanced medicine in this country as that of the author of two works of great merit on special subjects, and of numerous papers, exhibiting much originality and extensive research.—*The Dublin Journal*, Dec. 1879.

There is every reason to believe that this book will be well received. The active practitioner is frequently in need of some work that will enable him to obtain information in the diagnosis and treatment of cases with comparatively little labor. Dr. Flint has the faculty of expressing himself clearly, and at the same time so concisely as to enable the searcher to traverse the entire ground of his search, and at the same time obtain all that is essential, without plodding through an interminable space.—*N. Y. Med. Jour.*, Nov. 1879.

The great object is to place before the reader the latest observations and experience in diagnosis and treatment. Such a work is especially valuable to students. It is complete in its special design, and yet so condensed, that he can by its aid, keep up with the lectures on practice without neglecting other branches. It will not escape the notice of the practitioner that such a work is most valuable in culling points in diagnosis and treatment in the intervals between the daily rounds of visits, since he can in a few minutes refresh his memory, or learn the latest advance in the treatment of diseases which demand his instant attention.—*Cincinnati Lancet and Clinic*, Oct. 25, 1879.

BY THE SAME AUTHOR.

ESSAYS ON CONSERVATIVE MEDICINE AND KINDRED TOPICS.

In one very handsome royal 12mo. volume. Cloth, $1 38.

DAVIS' CLINICAL LECTURES ON VARIOUS IMPORTANT DISEASES; being a collection of the Clinical Lectures delivered in the Medical Wards of Mercy Hospital, Chicago. Edited by FRANK H. DAVIS, M.D. Second Edition, enlarged. In one handsome royal 12mo. volume. Cloth, $1 75.

CHAMBERS' MANUAL OF DIET AND REGIMEN IN HEALTH AND SICKNESS. In one handsome octavo volume. Cloth, $2 75.

STURGES' INTRODUCTION TO THE STUDY OF CLINICAL MEDICINE. Being a Guide to the Investigation of Disease. In one handsome 12mo. volume. Cloth, $1 25.

TODD'S CLINICAL LECTURES ON CERTAIN ACUTE DISEASES. In one octavo volume, of 320 pages. Cloth, $2 50.

RICHARDSON (BENJ. W.), M.A., M.D., LL.D., F.R.S., F.S.A.,

Fellow of the Royal College of Physicians, London.

PREVENTIVE MEDICINE. In one octavo volume of about 500 pages. (*Preparing.*)

HARTSHORNE (HENRY), M.D.,

Late Professor of Hygiene in the University of Pennsylvania

ESSENTIALS OF THE PRINCIPLES AND PRACTICE OF MEDICINE. A handy book for Students and Practitioners Fifth Edition, thoroughly revised and rewritten. In one handsome royal 12mo. volume, of 669 pages, with 144 illustrations. Cloth, $2.75; half bound, $3.00. (*Just Ready*)

The very great success which has exhausted four large editions of this work shows that the author has succeeded in supplying a want felt by a large portion of the profession. It has also enabled him in successive revisions to perfect the details of his plan, and to render the work still more worthy of the favor with which it has been received. In the present edition several hundred brief additions have been made, a number of new subjects have been written upon, especially in connection with the Pathology of the Nervous System, the illustrations have been considerably increased, and a large number of new and carefully selected formulæ for the administration of medicines have been introduced. An account is given, also, in this edition for the first time, of the method of prescribing according to the metrical system, and a section is added upon Eyesight, its Examination and Correction. In presenting this edition, therefore, the publishers feel that it is in every way worthy a continuance of the favor hitherto accorded this work.

The author of this book seems to have spared no pains to bring it up to the modern standpoint, for as we turn over its pages we find many subjects introduced which have only lately been brought before the profession. Certainly amongst books of its class it deserves and has obtained a good position. On the whole it is a careful and conscientious piece of work, and may be commended.—*Lancet*, June 24, 1882.

As to the popularity of the fifth edition of a medical work, nothing need be said. Concerning the one before us, we need only to say that the author has exercised the same good judgment as was apparent in former editions, and that all recent additions to this field have been laid under contribution to fill its pages. As a brief compend of the essentials of practical medicine, we have never seen the superior to this work Used in a proper manner it will be of great service to both medical students and practitioners. So thoroughly has he digested his materials, and so attractively has he arranged them, that it is a real pleasure to read his work We can cordially commend it to the favorable attention of such as may desire the aid of its pages. That it will be even more helpful in its present form than it was in former editions we fully believe.—*Detroit Lancet*, Dec 1881.

The style is condensed and terse, yet simple and perspicuous. The author has skilfully picked out the kernel from the nut and thrown aside the shells. To the every-day practitioner it is a ready help, and a thorough study of the subject, will be greatly facilitated by a previous perusal of the essentials. The present edition is a great improvement on its predecessors—in fact almost a new book.—*Pacific Med. and Surg Journal*, Jan. 1882.

WOODBURY (FRANK), M.D.,

Physician to the German Hospital, Philadelphia; late Chief Assistant to the Medical Clinic in Jefferson College Hospital, etc.

A HANDBOOK OF THE PRINCIPLES AND PRACTICE OF Medicine; for the use of Students and Practitioners. In one royal 12mo. volume, with illustrations. (*Preparing.*)

FINLAYSON (JAMES), M.D.,

Physician and Lecturer on Clinical Medicine in the Glasgow Western Infirmary, etc.

CLINICAL DIAGNOSIS; A Handbook for Students and Practitioners of Medicine. In one handsome 12mo. volume, of 546 pages, with 85 illustrations. Cloth, $2 63. (*Lately Issued.*)

The book is an excellent one, clear, concise, convenient, practical. It is replete with the very knowledge the student needs when he quits the lecture-room and the laboratory for the ward and sick-room, and does not lack in information that will meet the wants of experienced and older men.—*Phila. Med. Times*, Jan. 4, 1879.

This is one of the really useful books. It is attractive from preface to the final page, and ought to be given a place on every office table, because it contains in a condensed form all that is valuable in semeiology and diagnostics to be found in bulkier volumes, and because in its arrangement and complete index, it is unusually convenient for quick reference in any emergency that may come upon the busy practitioner. —*N. C. Med. Journ.*, Jan. 1879.

WATSON (THOMAS), M.D.

LECTURES ON THE PRINCIPLES AND PRACTICE OF PHYSIC. Delivered at King's College, London. A New American, from the Fifth English Edition, revised and enlarged. Edited, with additions, and 190 illustrations, by HENRY HARTSHORNE, A.M., M.D., late Professor of Hygiene in the University of Pennsylvania. In two large and handsome octavo volumes. Cloth, $9 00; leather, $11 00.

WILLIAMS ON PULMONARY CONSUMPTION; Its Nature, Varieties and Treatment. With an Analysis of One Thousand Cases to exemplify its duration. In one octavo volume of about 350 pages. Cloth, $2 50.

SLADE ON DIPHTHERIA; Its Nature and Treatment, with an account of the History of its Prevalence in various Countries. Second and Revised Edition. In one royal 12mo. volume. Cloth, $1 25.

WALSHE ON THE DISEASES OF THE HEART AND GREAT VESSELS. Third American Edition. In 1 vol. 8vo., 420 pp. Cloth, $3 00.

SMITH ON CONSUMPTION; ITS EARLY AND REMEDIABLE STAGES. 1 vol. 8vo., pp. 254. $2 25.

FULLER ON DISEASES OF THE LUNGS AND AIR-PASSAGES. Their Pathology, Physical Diagnosis, Symptoms and Treatment. From the Second and Revised English Edition. In one handsome octavo volume of about 500 pages. Cloth, $3 50.

REYNOLDS (J. RUSSELL), M.D.,

Prof. of the Principles and Practice of Medicine in Univ. College, London.

A SYSTEM OF MEDICINE, WITH NOTES AND ADDITIONS BY HENRY HARTSHORNE, A.M., M.D., late Professor of Hygiene in the University of Penna. In three large and handsome octavo volumes, containing 3056 closely printed double-columned pages, with 317 illustrations. Price per vol., cloth, $5.00; sheep, $6.00: very handsome half Russia, raised bands, $6.50. Per set, cloth, $15; sheep, $18; half Russia, $19.50. (*Sold only by subscription.*)

VOLUME I. (*now ready*) contains GENERAL DISEASES and DISEASES OF THE NERVOUS SYSTEM.

VOLUME II. (*now ready*) contains DISEASES OF RESPIRATORY and CIRCULATORY SYSTEMS.

VOLUME III. (*now ready*) contains DISEASES OF THE DIGESTIVE and BLOOD-GLANDULAR SYSTEMS, OF THE URINARY ORGANS, OF THE FEMALE REPRODUCTIVE SYSTEM, and OF THE CUTANEOUS SYSTEM.

Reynolds' SYSTEM OF MEDICINE, recently completed, has acquired, since the first appearance of the first volume, the well-deserved reputation of being the work in which modern British medicine is presented in its fullest and most practical form. This could scarce be otherwise in view of the fact that it is the result of the collaboration of the leading minds of the profession, each subject being treated by some gentleman who is regarded as its highest authority—as for instance, Diseases of the Bladder by Sir HENRY THOMPSON, Malpositions of the Uterus by GRAILY HEWITT, Insanity by HENRY MAUDSLEY, Consumption by J. HUGHES BENNET, Diseases of the Spine by CHARLES BLAND RADCLIFFE, Pericarditis by FRANCIS SIBSON, Alcoholism by FRANCIS E. ANSTIE, Renal Affections by WILLIAM ROBERTS, Asthma by HYDE SALTER, Cerebral Affections by H CHARLTON BASTIAN, Gout and Rheumatism by ALFRED BARING GARROD, Constitutional Syphilis by JONATHAN HUTCHINSON, Diseases of the Stomach by WILSON FOX, Diseases of the Skin by BALMANNO SQUIRE, Affections of the Larynx by MORELL MACKENZIE, Diseases of the Rectum by BLIZARD CURLING, Diabetes by LAUDER BRUNTON, Intestinal Diseases by JOHN SYER BRISTOWE, Catalepsy and Somnambulism by THOMAS KING CHAMBERS, Apoplexy by J. HUGHLINGS JACKSON, Angina Pectoris by Professor GAIRDNER, Emphysema of the Lungs by Sir WILLIAM JENNER, etc etc. All the leading schools in Great Britain have contributed their best men in generous rivalry, to build up this monument of medical science. St. Bartholomew's, Guy's, St. Thomas', University College, St. Mary's, in London, while the Edinburgh, Glasgow and Manchester schools are equally well represented, the Army Medical School at Netley, the military and naval services, and the public health boards. That a work conceived in such a spirit, and carried out under such auspices should prove an indispensable treasury of facts and experience, suited to the daily wants of the practitioner, was inevitable, and the success which it has enjoyed in England, and the reputation which it has acquired on this side of the Atlantic, have sealed it with the approbation of the two pre-eminently practical nations.

Its large size and high price having kept it beyond the reach of many practitioners in this country who desire to possess it, a demand has arisen for an edition at a price which shall render it accessible to all. To meet this demand the present edition has been undertaken. The five volumes and five thousand pages of the original have, by the use of a smaller type and double columns, been compressed into three volumes of over three thousand pages, clearly and handsomely printed, and offered at a price which renders it one of the cheapest works ever presented to the American profession.

But not only is the American edition more convenient and lower priced than the English; it is also better and more complete. Some years having elapsed since the appearance of a portion of the work, additions are required to bring up the subjects to the existing condition of science. Some diseases, also, which are comparatively unimportant in England, require more elaborate treatment to adapt the articles devoted to them to the wants of the American physician; and there are points on which the received practice in this country differs from that adopted abroad. The supplying of these deficiencies has been undertaken by HENRY HARTSHORNE, M.D., late Professor of Hygiene in the University of Pennsylvania, who has endeavored to render the work fully up to the day, and as useful to the American physician as it has proved to be to his English brethren. The number of illustrations has also been largely increased, and no effort spared to render the typographical execution unexceptionable in every respect.

Really too much praise can scarcely be given to this noble book. It is a cyclopædia of medicine written by some of the best men of Europe. It is full of useful information such as one finds frequent need of in one's daily work As a book of reference it is invaluable. It is up with the times. It is clear and concentrated in style, and its form is worthy of its famous publisher.—*Louisville Med. News*, Jan. 31, 1880.

"Reynolds' System of Medicine" is justly considered the most popular work on the principles and practice of medicine in the English language The contributors to this work are gentlemen of well-known reputation on both sides of the Atlantic. Each gentleman has striven to make his part of the work as practical as possible, and the information contained is such as is needed by the busy practitioner.—*St. Louis Med. and Surg. Journ.*, Jan. '80.

Dr. Hartshorne has made ample additions and revisions, all of which give increased value to the volume, and render it more useful to the American practitioner. There is no volume in English medical literature more valuable, and every purchaser will, on becoming familiar with it, congratulate himself on the possession of this vast storehouse of information, in regard to so many of the subjects with which he should be familiar.—*Gaillard's Med. Journ.*, Feb. 1880.

There is no medical work which we have in times past more frequently and fully consulted when perplexed by doubts as to treatment, or by having unusual or apparently inexplicable symptoms presented to us than "Reynolds' System of Medicine." Among its contributors are gentlemen who are as well known by reputation upon this side of the Atlantic as in Great Britain, and whose right to speak with authority upon the subjects about which they have written, is recognized the world over. They have evidently striven to make their essays as practical as possible, and while these are sufficiently full to entitle them to the name of monographs, they are not loaded down with such an amount of detail as to render them wearisome to the general reader. In a word, they contain just that kind of information which the busy practitioner frequently finds himself in need of. In order that any deficiencies may be supplied, the publishers have committed the preparation of the book for the press to Dr. Henry Hartshorne, whose judicious notes distributed throughout the volume afford abundant evidence of the thoroughness of the revision to which he has subjected it.—*American Journal of the Medical Sciences*, Jan. 1880.

BARTHOLOW (ROBERTS), A.M., M.D., LL.D.,

Prof. of Materia Medica and General Therapeutics in the Jefferson Med. Coll. of Phila., etc.

A PRACTICAL TREATISE ON ELECTRICITY IN ITS APPLICATION TO MEDICINE.

Second Edition. In one very handsome octavo volume of 296 pages, with 109 illustrations. Cloth, $2 50. (*Just Ready.*)

FROM THE PREFACE TO THE SECOND EDITION.

In the present edition I have made many additions and improvements to render the work more useful to those for whom it is intended. At the same time, in response to what seems to me an increasing desire for scientific treatment, I have developed more fully the modern methods of ascertaining and expressing current strength, tension, resistances, etc. I have also entered more fully into the polar method, and into the action and uses of the magnet. Notwithstanding an increase in the number of lines to the page, and the condensation of the matter new and old, the work has been enlarged by the addition of thirty pages. Thus improved, I may be permitted to hope that the new edition will continue to enjoy the favor so largely bestowed on the first.

The second edition of this work following so soon upon the first, would in itself appear to be a sufficient announcement; nevertheless, the text has been so considerably revised and condensed, and so much enlarged by the addition of new matter, that we cannot fail to recognize a vast improvement upon the former work. The author has prepared his work for students and practitioners; for those who have never acquainted themselves with the subject, or having done so, find that after a time their knowledge needs refreshing. We think he has accomplished his object The book is not too voluminous, but is thoroughly practical, simple, complete and comprehensible. It is, moreover, replete with numerous illustrations of instruments, appliances, etc., is printed on fine paper, and handsomely bound in cloth.—*Med. Record*, Nov. 15, 1882.

It is fortunately not such an interminable treatise as most electro-therapeutists like to write. It is not burdened with a needlessly learned terminology, and is written more from the point of view of the physician than the specialist. The second edition has been considerably increased over the first, and has been brought up to the most recent advances of the science. It can in every way be recommended to those who wish to read a lucid, manageable monograph on this form of therapeutics.—*Med. and Surg. Reporter*, Nov. 4, 1882.

MITCHELL (S. WEIR), M.D.,

Phys. to Orthopædic Hospital and the Infirmary for Dis. of the Nervous System, Phila., etc. etc.

LECTURES ON DISEASES OF THE NERVOUS SYSTEM, ESPECIALLY IN WOMEN.

Second Edition. In one very handsome 12mo. volume of about 250 pages. (*Preparing.*)

The life-long devotion of the author to the subjects discussed in this volume has rendered it eminently desirable that the results of his labors should be embodied for the benefit of those who may experience the difficulties connected with the treatment of this class of disease. Many of these lectures are fresh studies of hysterical affections; others treat of the modifications his views have undergone in regard to certain forms of treatment, while, throughout the whole work, he has been careful to keep in view the practical lessons of his cases.

A few notices of the previous edition are appended:—

It is a record of a number of very remarkable cases, with acute analyses and discussions, clinical, physiological and therapeutical It is a book to which the physician meeting with a new hysterical experience, or in doubt whether his new experience is hysterical, may well turn with a well-grounded hope of finding a parallelism; it will be a new experience, indeed, if no similar one is here recorded.—*Phila. Med. Times*, June 4, 1881.

The book throughout is not only intensely entertaining, but it contains a large amount of rare and valuable information. Dr. Mitchell has recorded not only the results of his most careful observation, but has added to the knowledge of the subjects treated by his original investigation and practical study. The book is one we can commend to all of our readers.—*Maryland Med. Journal*, May 1, 1881.

HAMILTON (ALLAN McLANE), M.D.,

Attending Physician at the Hospital for Epileptics and Paralytics, Blackwell's Island, N.Y., and at the Out-Patients' Department of the New York Hospital.

NERVOUS DISEASES; THEIR DESCRIPTION AND TREATMENT.

Second Edition, thoroughly revised and rewritten. In one handsome octavo volume of 598 pages, with 72 illustrations. Cloth, $4. (*Just Ready.*)

We are glad to welcome a second edition of so useful a work as this, in which Dr. Hamilton has succeeded in condensing into convenient limits the most important of the recent developments in regard to diseases of the nervous system. Of recent years nervous pathology has attained to such importance as to necessitate very careful description in special works, and among these this volume must take a high place. This volume is on the whole excellent, and is devoid of that spirit of plagiarism which we have unfortunately seen too much of in certain recent English works on nervous disease.—*Edinburgh Med. Journal*, May, 1882.

When the first edition of this good book appeared we gave it our emphatic endorsement, and the present edition enhances our appreciation of the book and its author, as a safe guide to students of clinical neurology. One of the best and most critical of English neurological journals, *Brain*, has characterized this book as the best of its kind in any language, which is a handsome endorsement from an exalted source. The improvements in the new edition, and the additions to it, will justify its purchase even by those who possess the old.—*Alienist and Neurologist*, April, 1882.

The author's aim is to write a treatise on Nervous Diseases which is both concise and practical, while it is, at the same time, sufficiently comprehensive. We have pleasure in bearing testimony to the fact that his efforts have been crowned with success. The various diseases have been well described, the directions as to how to arrive at a correct diagnosis are very clear, and the hints in treatment are plain, practical and sound. Such a book should be considered a necessity in every medical library, as the ailments described are among the most common that come under observation in the every-day work of the general physician. To him, therefore, we recommend it with pleasure; in fact, we may go further and say that, all things considered, it is for his purpose the best work of the kind now available.—*Can. Journ Med. Sciences*, April, 1882.

This work is well adapted to the wants of the general practitioner, for whom it seems to have been especially written. It is a thoroughly practical book, the careful study of which will render the diagnosis of nervous affections the more easy, and their treatment more successful. The book is very useful as a reference work to the busy practitioner, to whom we can commend it.—*Med. and Surg. Reporter*, Jan. 21, 1882.

CLINICAL OBSERVATIONS ON FUNCTIONAL NERVOUS DISORDERS.

By C. HANDFIELD JONES, M.D. Second American Edition. In one handsome octavo volume of 348 pages. Cloth, $3 25.

MORRIS (MALCOLM), M.D.,

Joint Lecturer on Dermatology, St. Mary's Hospital Med. School.

SKIN DISEASES, Including their Definitions, Symptoms, Diagnosis, Prognosis, Morbid Anatomy and Treatment. A Manual for Students and Practitioners. In one 12mo. volume of over 300 pages, with illustrations. Cloth, $1 75. (*Just Issued.*)

To physicians who would like to know something about skin diseases, so that when a patient presents himself for relief they can make a correct diagnosis and prescribe a rational treatment, we unhesitatingly recommend this little book of Dr. Morris. The affections of the skin are described in a terse, lucid manner, and their several characteristics so plainly set forth that diagnosis will be easy. The treatment in each case is such as the experience of the most eminent dermatologists advises.—*Cincinnati Medical News*, April, 1880.

This is emphatically a learner's book; for we can safely say, so far as our judgment goes, that in the whole range of medical literature of a like scope, there is no book which for clearness of expression, and methodical arrangement is better adapted to promote a rational conception of dermatology, a branch confessedly difficult and perplexing to the beginner.—*St. Louis Courier of Medicine*, April, 1880.

The author's task has been well done and has produced one of the best recent works upon the difficult subject of which it treats. There is no work published which gives a better view of the elementary facts and principles of dermatology.—*New Orleans Medical and Surgical Journal*, April, 1880.

HYDE (J. NEVINS), M.D.,

Professor of Dermatology and Venereal Diseases in Rush Medical College, Chicago.

A PRACTICAL TREATISE ON DISEASES OF THE SKIN. For the Use of Students and Practitioners. In one handsome octavo volume of about 600 pages, with numerous illustrations. (*In Press.*)

FOX (TILBURY), M.D., F.R.C.P., and T. C. FOX, B.A., M.R.C.S.,

Physician to the Department for Skin Diseases, University College Hospital

AN EPITOME OF SKIN DISEASES. WITH FORMULÆ. FOR STUDENTS AND PRACTITIONERS. Third Edition, specially revised by the Author, and greatly enlarged. In one very handsome 12mo. volume. (*Preparing.*)

FLINT (AUSTIN), M.D.,

Professor of the Principles and Practice of Medicine in Bellevue Hospital Med. College, N. Y.

A MANUAL OF AUSCULTATION AND PERCUSSION; of the Physical Diagnosis of Diseases of the Lungs and Heart, and of Thoracic Aneurism. Third Edition. In one handsome royal 12mo. volume. (*Preparing.*)

A notice of the previous edition is appended.

The little work before us has already become a standard one, and has become extensively adopted as a text-book. There is certainly none better. It contains the substance of the lessons which the author has for many years given, in connection with practical instruction in auscultation and percussion, to private classes, composed of medical students and practitioners.—*Cincinnati Med. News*, Feb. 1880.

BY THE SAME AUTHOR.

PHTHISIS: ITS MORBID ANATOMY, ETIOLOGY, SYMPTOMATIC EVENTS AND COMPLICATIONS, FATALITY AND PROGNOSIS, TREATMENT AND PHYSICAL DIAGNOSIS; in a series of Clinical Studies. By AUSTIN FLINT, M.D., Prof. of the Principles and Practice of Medicine in Bellevue Hospital Medical College, New York. In one handsome octavo volume of 142 pages. Cloth, $3 50.

BY THE SAME AUTHOR.

A PRACTICAL TREATISE ON THE DIAGNOSIS, PATHOLOGY AND TREATMENT OF DISEASES OF THE HEART. Second revised and enlarged Edition. In one octavo volume of 550 pages, with a plate. Cloth, $4.

BY THE SAME AUTHOR.

A PRACTICAL TREATISE ON THE PHYSICAL EXPLORATION OF THE CHEST AND THE DIAGNOSIS OF DISEASES AFFECTING THE RESPIRATORY ORGANS. Second and Revised Edition. In one handsome octavo volume of 591 pages. Cloth, $4 50.

BROWNE (LENNOX), F.R.C.S. Ed.,

Senior Surgeon to the Central London Throat and Ear Hospital, etc.

THE THROAT AND ITS DISEASES. Second American, from the Second English Edition, thoroughly revised. With one hundred typical illustrations in colors, and fifty wood engravings, designed and executed by the author. In one very handsome imperial octavo volume of about 350 pages. (*Preparing.*)

SEILER (CARL), M.D.,

Lecturer on Laryngoscopy at the University of Pennsylvania, Chief of the Throat Dispensary at the University Hospital, Philadelphia, etc.

A HANDBOOK OF DIAGNOSIS AND TREATMENT OF DISEASES OF THE THROAT AND NASAL CAVITIES. Second Edition. In one handsome royal 12mo. volume of about 150 pages, with about 50 illustrations. (*In Press.*)

WILSON'S STUDENT'S BOOK OF CUTANEOUS MEDICINE and DISEASES OF THE SKIN. In one very handsome royal 12mo volume. Cloth, $3 50.

HILLIER'S HANDBOOK OF SKIN DISEASES, for Students and Practitioners. Second Am Ed In one royal 12mo. vol. of 358 pp, with illustrations. Cloth, $2 25.

CORNIL (V.),

Professor to the Faculty of Medicine of Paris, and Physician to the Lourcine Hospital.

SYPHILIS, ITS MORBID ANATOMY, DIAGNOSIS AND TREATMENT.

Specially revised by the Author, and translated with notes and additions by J. HENRY C. SIMES, M.D, Demonstrator of Pathological Histology in the University of Pennsylvania and Surgeon to the Episcopal Hospital, Philadelphia, and J. WILLIAM WHITE, M.D., Lecturer on Venereal Diseases and Demonstrator of Surgery in the University of Pennsylvania, and Surgeon to the Philadelphia Hospital In one handsome octavo volume of 461 pages, with 84 very beautiful illustrations. Cloth, $3 75. (*Just Ready.*)

It is with the special purpose of showing the evolution of the disease as indicated by histological changes that the author has prepared this volume. In this respect it is much better than any other we could name, and merits the close reading of syphilologists. The translation is well done, and the reader will not regret the considerable additions which the translators have inserted in the text.—*Medical and Surgical Reporter*, Aug. 5, 1882.

The original form of lectures has been changed into chapters in the present issue, and a large amount of additional matter has, with the consent of the author, been inserted by the translators These interpolations deal mainly with the clinical aspects of the disease, and contain much valuable and well-digested material. Of the series of researches contained in the present work, it is needless to say that they are worthy of the high reputation the author has gained in other branches of pathological anatomy. The volume differs in one respect from the many excellent treatises on the subject, which have appeared in recent years, both in this country, in France and in America, and supplies a deficiency in the bibliography of the affection, by giving especial prominence to its minute anatomy. The microscopical sections were, as far as possible, made from portions of tissue removed during life, so as to eliminate appearances due to post-mortem change, and excellent drawings of the chief lesions are scattered throughout the volume. We can strongly recommend the work to all who are interested in the study of the intimate pathology of syphilis.—*London Med. Times and Gaz.*, Nov. 18, 1882.

The characteristic feature of M. Cornil's work is the attention paid to the minute anatomy of the syphilitic lesions. The histological evolution of the various phases of the disease, from the initial chancre to the gumma, including the mucous patch, the superficial and deep cutaneous syphilides, the osseous and visceral affections—is considered with a detail that is in striking contrast to that of other works upon the same subject. The translation has been made with his consent and approval, and he is fortunate in the selection of his translators, for they have added materially to the interest and value of the volume —*Maryland Med. Journ.*, Aug. 15, 1882.

BUMSTEAD (F. J.), M.D., LL.D., and TAYLOR (R. W.), A.M., M.D.,

Late Professor of Venereal Diseases at the Coll. of Phys. and Surg., New York, etc

Professor of Dermatology in the University of Vermont; Attending Surgeon to Charity Hospital, etc.

THE PATHOLOGY AND TREATMENT OF VENEREAL DISEASES.

Including the results of recent investigations upon the subject. Fifth Edition, revised and largely rewritten. In one large and handsome octavo volume of about 900 pages, with about 150 illustrations. (*In Press.*)

A few notices of the previous edition are appended.

We have to congratulate our countrymen upon the truly valuable addition which they have made to American literature. The careful estimate of the value of the volume, which we have made, justifies us in declaring that this is the best treatise on venereal diseases in the English language, and we might add, if there is a better in any other tongue we cannot name it; there are certainly no books in which the student or the general practitioner can find such an excellent *résumé* of the literature of any topic, and such practical suggestions regarding the treatment of the various complications of every venereal disease. We take pleasure in repeating that we believe this to be the best treatise on venereal disease in the English language, and we congratulate the authors upon their brilliant addition to American medical literature.—*Chicago Med. Journal and Examiner*, February, 1880.

It is, without exception, the most valuable single work on all branches of the subject of which it treats in any language. The pathology is sound, the work is, at the same time, in the highest degree practical, and the hints that the practitioner will get from it for the management of any one case, at all obscure or obstinate, will more than repay him for the outlay.—*Archives of Medicine*, April, 1880.

It is one of the best general treatises on venereal diseases with which we are acquainted, and is especially to be recommended as a guide to the treatment of syphilis.—*London Practitioner*, March, 1880.

GROSS (SAMUEL W.), A.M., M.D.,

Professor of the Principles of Surgery and of Clinical Surgery in the Jefferson Med. College, Phila.

A PRACTICAL TREATISE ON IMPOTENCE, STERILITY,

AND ALLIED DISORDERS OF THE MALE SEXUAL ORGANS. In one very handsome octavo volume of 166 pages, with 16 illustrations. Cloth, $1 50. (*Just Ready.*)

The author has devoted much time to the hardest study of this most trying class of diseases, and this labor, together with the fruit of laborious research into the scattered literature of the subject, constitutes the result of his investigations. We can earnestly commend it to the practitioner as the very best work upon the subject in the English language. —*Nashville Journ. of Med. and Surg.*, Oct. 1881.

The author is a clear and concise writer, and every page of this treatise gives evidence of his thorough familiarity with recent research, and with the latest journal literature. The book is a thoroughly scientific exposition of our present knowledge of the subjects treated of; its pages are rich in information of high value to the practitioner, and once read, will be frequently referred to.—*St. Louis Courier of Med.*, Nov. 1881.

CULLERIER (A.), and BUMSTEAD (F. J.), M.D., LL.D.,

Surgeon to the Hôpital du Midi.

late Professor of Venereal Diseases in the College of Physicians and Surgeons, N. Y

AN ATLAS OF VENEREAL DISEASES.

Translated and Edited by FREEMAN J. BUMSTEAD. In one large imperial 4to. volume of 328 pages, double-columns, with 26 plates, containing about 150 figures, beautifully colored, many of them the size of life. Strongly bound in cloth, $17 00; also, in five parts, stout wrappers, at $3 per part.

A specimen of the plates and text sent free by mail, on receipt of 25 cents.

LEE'S LECTURES ON SYPHILIS AND SOME FORMS OF LOCAL DISEASE AFFECTING PRINCIPALLY THE ORGANS OF GENERATION. In one handsome octavo volume. Cloth, $2 25.

HILL ON SYPHILIS AND LOCAL CONTAGIOUS DISORDERS. In one handsome octavo volume. Cloth, $3 25.

SMITH (*J. LEWIS*), *M.D.*,

Clinical Professor of Diseases of Children in the Bellevue Hospital Med. College, N.Y.

A COMPLETE PRACTICAL TREATISE ON THE DISEASES OF CHILDREN. Fifth Edition, thoroughly revised and rewritten. In one handsome octavo volume of 836 pages, with illustrations. Cloth, $4 50; leather, $5 50; very handsome half Russia, raised bands, $6. (*Just Ready.*)

That a book professing to treat of diseases of children should have reached a fifth edition is in itself fair evidence of its worth, the more especially as it has not the field to itself, but has to compete with several other excellent manuals. The chapter on Rachitis is excellent, and well up to the day—a remark which may with equal justice be applied to the chapter on Scrofula, which is one of the best we remember to have read. The diseases of the nervous system are well described, and so, for the most part, are those of the lungs. Dr. Smith would appear to be quite *au courant* with the work done on this side of the world, and refers freely to English and foreign authors, as well as to periodicals especially devoted to children's diseases.—*British Medical Journal*, May 6, 1882.

Dr. Smith is a careful observer and painstaking writer. He has enjoyed unusual facilities which would enable him to write a practical and useful book, and that he has succeeded is attested by the appearance of successive editions of his work. There is no doubt but that it will long retain its place as a standard text-book among students and practitioners.—*American Journal of Obstetrics*, Jan. 1882.

There is no book published on the subjects of which this one treats that is its equal in value to the physician. While he has said just enough to impart the information desired by general practitioners on such questions as etiology, pathology, prognosis, etc., he has devoted more attention to the diagnosis and treatment of the ailments which he so accurately describes, and such information is exactly what is wanted by the vast majority of "family physicians."—*Virginia Med. Monthly*, Feb. 1882.

The appearance of a fifth edition of this work is sufficient attestation of its great value to the practitioners of the country, and of the use they are disposed to make of it. Unquestionably it is the best work on the maladies of childhood in the English language, and in any foreign language we know of no work which will compare with it. That the fifth edition has been thoroughly revised and brought up to date an attentive (or even careless) perusal will abundantly disclose.—*Canadian Journal of Med Science*, Feb. 1882.

The improvements that have been added bring the work fully abreast of the times. We can assure our readers that they can procure no better work on infancy and childhood for reference and study than this one.—*Cincinnati Med. News*, Jan. 1882.

KEATING (*JOHN M.*), *M.D.*,

Lecturer on the Diseases of Children at the University of Pennsylvania, etc.

THE MOTHER'S GUIDE IN THE MANAGEMENT AND FEEDING OF INFANTS. In one handsome 12mo. volume of 118 pages. Cloth, $1 00. (*Now Ready.*)

The title of this little book is well chosen, and Dr. Keating has written a work which should be read, and its precepts followed by every intelligent mother in this country. It is free from all technical terms, the language is clear and distinct, and so carefully written that it cannot fail to become popular. It has always been a mooted question how far it is well to instruct the public, but works like this one will aid the physician immensely, for it saves the time he is constantly giving his patients in instructing them on the subjects here dwelt upon so thoroughly and practically. Dr. Keating has written a practical book, has carefully avoided unnecessary repetition, and, I think, successfully instructed the mother in such details of the treatment of her child as devolve upon her; he has studiously omitted giving prescriptions, and instructs the mother when to call upon the doctor, as his duties are totally distinct from hers.—*American Journal of Obstetrics*, October 1881.

RAMSBOTHAM (*FRANCIS H.*), *M.D.*

THE PRINCIPLES AND PRACTICE OF OBSTETRIC MEDICINE AND SURGERY, in Reference to the Process of Parturition. A new and enlarged Edition, thoroughly revised by the author. With additions by W. V. KEATING, M. D., Professor of Obstetrics, &c., in the Jefferson Medical College, Philadelphia. In one large and handsome imperial octavo volume of 640 pages, with sixty-four beautiful plates, and numerous wood-cuts in the text, containing in all nearly 200 large and beautiful figures. Strongly bound in leather, with raised bands. $7 00.

WEST (*CHARLES*), *M.D.*,

Physician to the Hospital for Sick Children, London, &c.

LECTURES ON THE DISEASES OF INFANCY AND CHILDHOOD. Fifth American from the Sixth revised and enlarged English Edition. In one large and handsome octavo volume of 686 pages. Cloth, $4 50; leather, $5 50.

BY THE SAME AUTHOR. (*Lately Issued.*)

ON SOME DISORDERS OF THE NERVOUS SYSTEM IN CHILDHOOD; being the Lumleian Lectures delivered at the Royal College of Physicians of London, in March, 1871. In one volume, small 12mo. Cloth, $1 00.

BY THE SAME AUTHOR.

LECTURES ON THE DISEASES OF WOMEN. Third American, from the Third London Edition. In one octavo volume of about 550 pages. Cloth, $3 75; leather, $4 75.

WINCKEL (*F.*).

A COMPLETE TREATISE ON THE PATHOLOGY AND TREATMENT OF CHILDBED, for Students and Practitioners. Translated, with the consent of the author, from the Second German Edition, by JAMES READ CHADWICK, M.D. In one octavo volume of 484 pages. Cloth, $4 00.

SMITH'S PRACTICAL TREATISE ON THE WASTING DISEASES OF INFANCY AND CHILDHOOD. Second American, from the Second English Edition. In one octavo volume. Cloth, $2 50.

THOMAS (T. GAILLARD), M.D.,

Professor of Obstetrics, &c., in the College of Physicians and Surgeons, N. Y., &c

A PRACTICAL TREATISE ON THE DISEASES OF WOMEN. Fifth Edition, thoroughly revised and rewritten. In one large and handsome octavo volume of 810 pages, with 266 illustrations. Cloth, $5; leather, $6; very handsome half Russia, raised bands, $6 50. (*Now Ready.*)

The words which follow "fifth edition" are in this case no mere formal announcement. The alterations and additions which have been made are both numerous and important. The attraction and the permanent character of this book lie in the clearness and truth of the clinical descriptions of diseases; the fertility of the author in therapeutic resources and the fulness with which the details of treatment are described; the definite character of the teaching; and last, but not least, the evident candor which pervades it. We would also particularize the fulness with which the history of the subject is gone into, which makes the book additionally interesting and gives it value as a work of reference.—*London Med. Times and Gaz.*, July 30, 1881.

An examination of the work will prove that it is one of great merit. It is not a mere compilation from other works, but is the fruit of the ripe thought, sound judgment, and critical observations of a learned, scientific man. It is a treasury of knowledge of the department of medicine to which it is devoted. In its present revised state it certainly holds a foremost position as a gynæcological work, and will continue to be regarded as a standard authority.—*Cincinnati Med. News*, Dec 1880.

This work needs no introduction to any of the civilized nations of the world. The edition before us adds to the strength of former volumes. With the wisdom of a master teacher he here gives the results that, in his judgment, are most trustworthy at the present time. In its own place it has no rival, because the author is the best teacher on this subject to the masses of the profession. As hitherto this work will be the text-book on diseases of women. We only wish that in other branches of medicine as capable teachers could be found to write our text-books.—*Detroit Lancet*, Jan. 1881.

It has been enlarged and carefully revised. The author has brought it fully abreast with the times, and as the wave of gynæcological progression has been widespread and rapid during the twelve years that have elapsed since the issue of the first edition, one can conceive of the great improvement this edition must be upon the earlier. It is a condensed encyclopædia of gynæcological medicine. The style of arrangement, the masterly manner in which each subject is treated, and the honest convictions derived from probably the largest clinical experience in that specialty of any in this country, all serve to commend it in the highest terms to the practitioner. —*Nashville Journ. of Med. and Surg.*, Jan. 1881.

GYNECOLOGICAL TRANSACTIONS.

Being the Transactions of the American Gynecological Society for the Year 1881.

VOLUME VI. (*Just Ready*) Contains Essays by Doctors W. H. Byford, S. C. Busey, H. J. Garrigues, G. H. Lyman, Nathan Bozeman, E. Van de Warker, I. E. Taylor, W. Goodell, H. F. Campbell, T. G. Thomas, T. A. Reamy, A. H. Smith, A. D. Sinclair, J. W. Underhill, E. W. Jenks, LL.D., W. M. Polk, W. R. Gillette, C. C. Lee, F. P. Foster, E. W. Sawyer and B. B. Browne.

With Indexes of Vol. VI., of the Gynecological and Obstetric Literature of all Countries for the Year 1880, of Obstetric and Gynecological Journals, and of Obstetric and Gynecological Societies.

The six volumes completing the series will be sent by mail postpaid on receipt of $30, or if single copies are desired they will be furnished at the rate of $5 each, excepting Vol. II. for the year 1877, the price of which is $6.50.

EDIS (ARTHUR W.), M.D. Lond., F.R.C.P., M.R.C.S.,

Assist. Obstetric Physician to Middlesex Hospital, late Physician to British Lying-in Hospital.

THE DISEASES OF WOMEN. Including their Pathology, Causation, Symptoms, Diagnosis and Treatment. A manual for Students and Practitioners. In one handsome octavo volume of 576 pages, with 148 illustrations. Cloth, $3; leather, $4. (*Just Ready.*)

It is a pleasure to read a book so thoroughly good as this one. The special qualities which are conspicuous are thoroughness in covering the whole ground, clearness of description, and conciseness of statement. Another marked feature of the book is the attention paid to the details of many minor surgical operations and procedures, as, for instance the use of tents, application of leeches, and use of hot-water injections. These are among the more common methods of treatment, and yet very little is said about them in many of the text-books. The book is one to be warmly recommended, especially to students and general practitioners, who need a concise but complete résumé of the whole subject. Specialists, too, will find many useful hints in its pages. —*Boston Med. and Surg. Journ.*, March 2, 1882.

The greatest pains have been taken with the sections relating to treatment. A liberal selection of remedies is given for each morbid condition, the strength, mode of application, and other details being fully explained. The descriptions of gynæcological manipulations and operations are full, clear, and practical. Much care has also been bestowed on the parts of the book which deal with diagnosis: we note especially the pages dealing with the differentiation, one from another of the different kinds of abdominal tumors. The practitioner will therefore find in this book the kind of knowledge he most needs in his daily work, and he will be pleased with the clearness and fulness of the information there given.—*The Practitioner*, Feb. 1882.

BARNES (ROBERT), M.D., F.R.C.P.,

Obstetric Physician to St. Thomas' Hospital, &c.

A CLINICAL EXPOSITION OF THE MEDICAL AND SURGICAL DISEASES OF WOMEN. In one handsome octavo volume, with numerous illustrations. (*New Edition Preparing.*)

HODGE (HUGH L.), M.D.,

Emeritus Professor of Obstetrics, &c., in the University of Pennsylvania.

ON DISEASES PECULIAR TO WOMEN; including Displacements of the Uterus. Second Edition, revised and enlarged. In one beautifully printed octavo volume of 519 pages, with original illustrations. Cloth, $4 50.

EMMET (*THOMAS ADDIS*), *M.D., LL.D.*,

Surgeon to the Woman's Hospital, New York, etc.

THE PRINCIPLES AND PRACTICE OF GYNÆCOLOGY, for the use of Students and Practitioners of Medicine. Second Edition. Thoroughly Revised.

In one large and very handsome octavo volume of 879 pages, with 133 illustrations. Cloth, $5; leather, $6; half Russia, raised bands, $6 50. (*Just Issued.*)

In no country of the world has gynæcology received more attention than in America. It is, then, with a feeling of pleasure that we welcome a work on diseases of women from so eminent a gynæcologist as Dr. Emmet. The work is essentially clinical, and leaves a strong impress of the author's individuality. To criticize, with the care it merits, the book throughout, would demand far more space than is at our command. In parting, we can say that the work teems with original ideas, fresh and valuable methods of practice, and is written in a clear and elegant style, worthy of the literary reputation of the country of Longfellow and Oliver Wendell Holmes.—*Brit. Med. Journ.* Feb. 21, 1880.

No gynæcological treatise has appeared which contains an equal amount of original and useful matter; nor does the medical and surgical history of America include a book more novel and useful. The tabular and statistical information which it contains is marvellous, both in quantity and accuracy, and cannot be otherwise than invaluable to future investigators. It is a work which demands not careless reading but profound study. Its value as a contribution to gynæcology is, perhaps, greater than that of all previous literature on the subject combined.—*Chicago Med. Gaz.*, April 5, 1880

The wide reputation of the author makes its publication an event in the gynæcological world; and a glance through its pages shows that it is a work to be studied with care. . . . It must always be a work to be carefully studied and frequently consulted by those who practise this branch of our profession.—*Lond. Med. Times and Gaz.*, Jan. 10, 1880.

The character of the work is too well known to require extended notice—suffice it to say that no recent work upon any subject has attained such great popularity so rapidly. As a work of general reference upon the subject of Diseases of Women it is invaluable. As a record of the largest clinical experience and observation it has no equal. No physician who pretends to keep up with the advances of this department of medicine can afford to be without it.—*Nashville Journ. of Medicine and Surgery*, May, 1880.

AN AMERICAN SYSTEM OF GYNÆCOLOGY.

A SYSTEM OF GYNÆCOLOGY IN TREATISES BY VARIOUS AUTHORS. (*In Active Preparation.*)

DUNCAN (*J. MATTHEWS*), *M.D., LL.D., F.R.S.E., etc.*

CLINICAL LECTURES ON THE DISEASES OF WOMEN,

Delivered in Saint Bartholomew's Hospital. In one handsome octavo volume of 175 pages. Cloth, $1 50. (*Just Issued.*)

They are in every way worthy of their author; indeed, we look upon them as among the most valuable of his contributions. They are all upon matters of great interest to the general practitioner. Some of them deal with subjects that are not, as a rule, adequately handled in the text-books; others of them, while bearing upon topics that are usually treated of at length in such works, yet bear such a stamp of individuality that, if widely read, as they certainly deserve to be, they cannot fail to exert a wholesome restraint upon the undue eagerness with which many young physicians seem bent upon following the wild teachings which so infest the gynæcology of the present day.—*N. Y. Med. Journ.*, March, 1880.

PARRY (*JOHN S.*), *M.D.*,

Obstetrician to the Philadelphia Hospital, Vice-Prest. of the Obstet. Society of Philadelphia.

EXTRA-UTERINE PREGNANCY: ITS CLINICAL HISTORY, DIAGNOSIS, PROGNOSIS AND TREATMENT.

In one handsome octavo volume of 272 pages. Cloth, $2 50.

TANNER (*THOMAS H.*), *M.D.*

ON THE SIGNS AND DISEASES OF PREGNANCY. First American from the Second and Enlarged English Edition.

With four colored plates and illustrations on wood. In one handsome octavo volume of about 500 pages. Cloth, $4 25.

GUSSEROW (*A.*),

Professor of Midwifery and the Diseases of Children at the University of Berlin.

A PRACTICAL TREATISE ON UTERINE TUMORS. Specially revised by the Author, and translated with Notes and Additions by EDMUND C. WENDT, M D., Pathologist to the St. Francis Hospital, N. Y., etc., and revised by NATHAN BOZEMAN, M.D., Surgeon to the Woman's Hospital of the State of New York.

In one handsome octavo volume, with about 40 illustrations. (*Preparing.*)

CHADWICK (*JAMES R.*), *A.M., M.D.*

A MANUAL OF THE DISEASES PECULIAR TO WOMEN. In one handsome royal 12mo. volume, with illustrations. (*Preparing.*)

ASHWELL'S PRACTICAL TREATISE ON THE DISEASES PECULIAR TO WOMEN. Third American from the Third and revised London Edition. In one 8vo. vol., pp. 528. Cloth, $3 50.

CONDIE'S PRACTICAL TREATISE ON THE DISEASES OF CHILDREN. Sixth Edition, revised and augmented. In one large octavo volume of nearly 800 closely-printed pages. Cloth, $5 25; leather, $6 25.

CHURCHILL ON THE PUERPERAL FEVER AND OTHER DISEASES PECULIAR TO WOMEN. In one octavo volume of 450 pages. Cloth, $2 50.

MEIGS ON THE NATURE, SIGNS AND TREATMENT OF CHILDBED FEVER. In one 8vo. vol. pp. 346. Cloth, $2 00.

MONTGOMERY'S EXPOSITION OF THE SIGNS AND SYMPTOMS OF PREGNANCY. With two exquisite colored plates, and numerous wood cuts. In one vol. 8vo., of nearly 600 pp. Cloth, $3 75.

LEISHMAN (WILLIAM), M.D.,

Regius Professor of Midwifery in the University of Glasgow, &c.

A SYSTEM OF MIDWIFERY, INCLUDING THE DISEASES OF PREGNANCY AND THE PUERPERAL STATE.

Third American Edition, revised by the Author, with additions by JOHN S. PARRY, M.D., Obstetrician to the Philadelphia Hospital, &c. In one large and very handsome octavo volume, of 740 pages, with 205 illustrations. Cloth, $4 50; leather, $5 50; half Russia, $6. (*Just Issued*)

Few works on this subject have met with as great a demand as this one appears to have. To judge by the frequency with which its author's views are quoted, and its statements referred to in obstetrical literature, one would judge that there are few physicians devoting much attention to obstetrics who are without it. The author is evidently a man of ripe experience and conservative views, and in no branch of medicine are these more valuable than in this.—*New Remedies*, Jan. 1880.

We gladly welcome the new edition of this excellent text-book of midwifery. The former editions have been most favorably received by the profession on both sides of the Atlantic. In the preparation of the present edition the author has made such alterations as the progress of obstetrical science seems to require, and we cannot but admire the ability with which the task has been performed. We consider it an admirable text-book for students during their attendance upon lectures, and have great pleasure in recommending it. As an exponent of the midwifery of the present day it has no superior in the English language.—*Canada Lancet*, Jan. 1880.

To the American student the work before us must prove admirably adapted, complete in all its parts, essentially modern in its teachings and with demonstrations noted for clearness and precision, it will gain in favor and be recognized as a work of standard merit. The work cannot fail to be popular, and is cordially recommended.—*N. O. Med. and Surg. Journ.*, March, 1880.

PLAYFAIR (W. S.), M.D., F.R.C.P.,

Professor of Obstetric Medicine in King's College, etc. etc.

A TREATISE ON THE SCIENCE AND PRACTICE OF MIDWIFERY.

Third American Edition, revised by the author. Edited, with additions, by ROBERT P. HARRIS, M.D. In one handsome octavo volume of 659 pages, with 183 illustrations. Cloth, $4; leather, $5; half Russia, $5 50. (*Just Issued*)

The medical profession has now the opportunity of adding to their stock of standard medical works one of the best volumes on midwifery ever published. The subject is taken up with a master hand. The part devoted to labor in all its various presentations, the management and results, is admirably arranged, and the views entertained will be found essentially modern, and the opinions expressed trustworthy. The work abounds with plates, illustrating various obstetrical positions; they are admirably wrought, and afford great assistance to the student.—*N. O. Med. and Surg. Journ.*, March, 1880.

The rapidity with which one edition of this work follows another is proof alike of its excellence and of the estimate that the profession has formed of it. It is indeed so well known and so highly valued that nothing need be said of it as a whole. All things considered, we regard this treatise as the very best on Midwifery in the English language.—*N. Y. Medical Journal*, May, 1880.

It certainly is an admirable exposition of the Science and Practice of Midwifery. Of course the additions made by the American editor, Dr. R. P. Harris, who never utters an idle word, and whose studious researches in some special departments of obstetrics are so well known to the profession, are of great value.—*The American Practitioner*, April, 1880.

BY THE SAME AUTHOR.

THE SYSTEMATIC TREATMENT OF NERVE PROSTRATION AND HYSTERIA.

In one handsome volume, small 12mo. (*In a few days.*)

KING (A. F. A.), M.D.,

Professor of Obstetrics and Diseases of Women in the Medical Department of the Columbian University, Washington, D.C., and in the University of Vermont, &c.

A MANUAL OF OBSTETRICS.

In one very handsome 12mo. volume of 321 pages, with 58 illustrations. Cloth, $2. (*Just Ready.*)

Though the book appears small externally, it contains as complete a consideration of obstetric subjects as many larger volumes, and this is chiefly owing to a directness of expression, and an avoidance of repetition, and of waste of words. The author endeavors to place theories, causes of disease, and methods of treatment in that order which, by weight of authority, they merit. His excellent judgment has availed him well in this effort. While, in one sense, the book is an excellent obstetric dictionary, and well suited to the student, it is also of value to the general practitioner, who often desires to find a *résumé* of information upon a given subject. It will be of further value to the latter, as, in our opinion, the author holds most sensible views on practical matters. The book is admirably arranged for reference, being well paragraphed, with suitable subdivisions, and well indexed.—*American Journal of Obstetrics*, Aug. 1882.

PARVIN (THEOPHILUS), M.D.,

Prof. of Obstetrics and of the Med. and Surg. Diseases of Women in the Med. Coll. of Indiana.

A TREATISE ON MIDWIFERY.

In one very handsome octavo volume of about 550 pages, with numerous illustrations. (*Preparing.*)

BARNES (FANCOURT), M.D.,

Physician to the General Lying-in Hospital, London.

A MANUAL OF MIDWIFERY FOR MIDWIVES AND MEDICAL STUDENTS.

With 50 illustrations. In one royal 12mo. volume of 200 pages. Cloth, $1 25. (*Lately Issued.*)

HODGE (HUGH L.), M.D.,

Emeritus Professor of Midwifery, &c., in the University of Pennsylvania, &c.

THE PRINCIPLES AND PRACTICE OF OBSTETRICS.

Illustrated with large lithographic plates containing one hundred and fifty-nine figures from original photographs, and with numerous wood-cuts. In one large and beautifully printed quarto volume of 550 double-columned pages. Strongly bound in cloth, $14.

*** Specimens of the plates and letter-press will be forwarded to any address, free by mail, on receipt of six cents in postage stamps.

HAMILTON (FRANK H.), M.D., LL.D.,

Surgeon to the Bellevue Hospital, New York.

A PRACTICAL TREATISE ON FRACTURES AND DISLOCATIONS Sixth Edition, thoroughly revised, and much improved. In one very handsome octavo volume of 909 pages, with 352 illustrations. Cloth, $5 50; leather, $6 50; half Russia, raised bands, $7 00. (*Just Issued.*)

So many kind expressions of welcome have been showered upon each successive edition of this valuable treatise, that scarcely anything remains for us to do but to extend the customary cordial greeting. It is the only complete work on the subject of Fractures in the English language We congratulate the accomplished author on the deserved success of his work, and hope that he may live to have many succeeding editions pass under his skilled supervision.—*Coll. and Clin Rec.*, Nov. 15, 1880.

Universal verdict has pronounced it, humanly speaking, a perfect treatise upon this subject. As it is the only complete and illustrated work in any language treating of fractures and dislocations, it is safe to affirm that every wide-awake surgeon and general practitioner will regard it as indispensable to the safe and pleasant conduct of their professional work.—*Detroit Lancet*, Nov. 18, 1880.

Dr Hamilton has devoted great labor to the study of these subjects. His large experience, extended research, and patient investigation have made him one of the highest authorities among living writers in this branch of surgery. This work is systematic and practical in its arrangement, and presents its subject matter clearly and forcibly to the reader or student.—*Maryland Med. Journ.*, Nov. 15, 1880.

The only complete work on its subject in the English tongue, and, indeed, may now be said to be the only work of its kind in any tongue. It would require an exceedingly critical examination to detect in it any particulars in which it might be improved. The work is a monument to American surgery, and will long serve to keep green the memory of its venerable author.—*Michigan Med. News*, Nov. 10, 1881.

ASHHURST (JOHN, Jr.), M.D.,

Prof. of Clinical Surgery, Univ. of Pa., Surgeon to the Episcopal Hospital, Philadelphia.

THE PRINCIPLES AND PRACTICE OF SURGERY. Third Edition, enlarged and revised. In one very large and handsome octavo volume of 1060 pages, with 555 illustrations. Cloth, $6; leather, $7; very handsome half Russia, raised bands, $7 50. (*Just Ready.*)

The author, long known as a thorough student of surgery, and one of the most accomplished scholars in the country, aims to give in this work "a condensed but comprehensive description of the modes of practice now generally employed in the treatment of surgical affections, with a plain exposition of the principles upon which these modes of practice are based." In this he has so well succeeded that it will be a surprise to the reader to know how much practical knowledge extending over such a wide range of research is compressed in a volume of this size. This feature of the work must be its best claim for continued popularity with students and practitioners. In fact, in this respect it is without any equal in any language. In the present edition many novelties in surgical practice are introduced, many modifications of previous statements made, and several new illustrations added.—*Med. Record*, Nov. 18, 1882.

A good student's book, thoroughly reliable, brief, and to the point, abundantly illustrated. The position in medical literature of Ashhurst's Surgery needs only the announcement of the appearance of a new edition without an extending notice of its peculiar merits.—*College and Clinical Record*, Nov. 15, 1882.

ROBERTS (JOHN B.), A.M., M.D.,

Lecturer on Anatomy and on Operative Surgery at the Philadelphia School of Anatomy, Fellow of the Philadelphia Academy of Surgery, etc.

THE PRINCIPLES AND PRACTICE OF SURGERY. For the Use of Students and Practitioners of Medicine and Surgery. In one very handsome octavo volume of about 500 pages, with many illustrations. (*Preparing.*)

STIMSON (LEWIS A.), B.A., M.D.,

Professor of Pathological Anatomy at the University of the City of New York, Surgeon and Curator to Bellevue Hospital, Surgeon to the Presbyterian Hospital, New York, etc.

A PRACTICAL TREATISE ON FRACTURES. In one very handsome octavo volume of 582 pages, with 360 beautiful illustrations. Cloth, $4 75; leather, $5 75. (*Just Ready.*)

In the preparation of this volume the author has aimed to present a treatise on fractures which should by means of terseness of expression and perspicuity of arrangement, give a full and satisfactory exposition of its subject within convenient compass. The opening chapters discuss the varieties of fractures, their causes, diagnosis and method of repair, their complications, remote consequences and treatment, delayed, deformed, faulty or vicious union, and general prognosis. The fractures of the various parts of the body are then taken up in regular order, and their causes, diagnosis, prognosis and treatment are considered with exceptional fulness. The series of illustrations is large and remarkable for beauty and accuracy.

BY THE SAME AUTHOR.

A MANUAL OF OPERATIVE SURGERY. In one very handsome royal 12mo. volume of about 500 pages, with 332 illustrations; cloth, $2 50.

The work before us is a well printed, profusely illustrated manual. The novice, by a perusal of the work, will gain a good idea of the general domain of operative surgery, while the practical surgeon has presented to him within a very concise and intelligible form the latest and most approved selections of operative procedure. The precision and conciseness with which the different operations are described enable the author to compress an immense amount of practical information in a very small compass.—*N. Y. Medical Record*, Aug. 3, 1878.

This volume is devoted entirely to operative surgery, and is intended to familiarize the student with the details of operations and the different modes of performing them. The work is handsomely illustrated, and the descriptions are clear and well drawn. It is a clever and useful volume; every student should possess one. The preparation of this work does away with the necessity of pondering over larger works on surgery for descriptions of operations, as it presents in a nut-shell just what is wanted by the surgeon without an elaborate search to find it.—*Md. Med Journal*, Aug. 1878.

The author's conciseness and the repleteness of the work with valuable illustrations entitle it to be classed with the text-books for students of operative surgery, and as one of reference for the practitioner. —*Cincinnati Lancet and Clinic*, July 27, 1878.

GROSS (SAMUEL D.), M.D., LL.D., D.C.L., Oxon., LL.D., Cantab.

Emeritus Professor of Surgery in the Jefferson Medical College of Philadelphia.

A SYSTEM OF SURGERY: Pathological, Diagnostic, Therapeutic and Operative.

Sixth Edition, greatly enlarged and thoroughly revised by the Author and SAMUEL W. GROSS, A.M., M.D., Professor of the Principles of Surgery and of Clinical Surgery in the Jefferson Medical College. In two large and beautifully printed imperial octavo volumes containing 2382 pages, illustrated by 1623 engravings. Strongly bound in leather, raised bands, $15; half Russia, raised bands, $16. (*Just Ready.*)

EXTRACT FROM PREFACE TO THE SIXTH EDITION.

The object of this work, as set forth in the first edition, issued in 1859, is to furnish a systematic and comprehensive treatise on the art and science of surgery, considered in the broadest sense; one that shall serve the practitioner as a faithful and available guide in his daily routine of duty. My aim has been to embrace the whole domain of surgery, and to allot to every subject its legitimate claim to notice in the great family of external diseases and accidents. Special attention has also been bestowed upon the discrimination of diseases; and an elaborate chapter on general diagnosis has been introduced. Upon the edition now issued much time and labor have been expended, rendered necessary by the astonishing progress made during the last ten years in every branch of surgery. Every chapter has been thoroughly revised, many portions have been entirely rewritten, and a large amount of new matter has been introduced, in order to place the work fully abreast of the existing state of our knowledge.

The work as a whole needs no commendation. Many years ago it earned for itself the enviable reputation of the leading American work on surgery, and it is still capable of maintaining that standard. The reason for this need only to be mentioned to be appreciated. The author has always been calm and judicious in his statements, has based his conclusions on much study and personal experience, has been able to grasp his subject in its entirety, and, above all, has conscientiously adhered to truth and fact, weighing the evidence, *pro* and *con*, accordingly. A considerable amount of new material has been introduced, and altogether the distinguished author has reason to be satisfied that he has placed the work fully abreast of the state of our knowledge.—*Medical Record*, Nov. 18, 1882.

This great work by Professor Gross is undoubtedly the most magnificent work upon surgery in the English language. It is a treatise upon surgery that is really encyclopædic in its character as regards fully treating every topic of the science, and minutely detailing all that is known in regard to it. There is scarcely a department to which he has not either added something, or elucidated better that which was already known. Without stopping to record actual discoveries we can truly say that his learning, experience and research, more than that of almost any other great surgeon, has elevated surgery to the high pinnacle which it has attained. In the sixth edition of this great work every chapter has been thoroughly revised, many portions have been entirely rewritten and a large amount of new matter has been introduced in order to place the work fully abreast of the existing state of our knowledge.—*Cincinnati Med. News*, Nov. 1882.

BY THE SAME AUTHOR.

A PRACTICAL TREATISE ON THE DISEASES, INJURIES and Malformations of the Urinary Bladder, the Prostate Gland and the Urethra.

Third Edition, thoroughly revised and much condensed, by SAMUEL W. GROSS, M.D., Surgeon to the Philadelphia Hospital. In one handsome octavo volume of 574 pages, with 170 illustrations. Cloth, $4.50.

For reference and general information, the physician or surgeon can find no work that meets their necessities more thoroughly than this, a revised edition of an excellent treatise, and no medical library should be without it. Replete with handsome illustrations and good ideas, it has the unusual advantage of being easily comprehended, by the reasonable and practical manner in which the various subjects are systematized and arranged. We heartily recommend it to the profession as a valuable addition to the important literature of diseases of the urinary organs.—*Atlanta Med. Journ.*, Oct. 1876.

BY THE SAME AUTHOR.

A PRACTICAL TREATISE ON FOREIGN BODIES IN THE AIR-PASSAGES.

In 1 vol. 8vo., with illustrations, pp. 452. Cloth, $2 75.

COLEMAN (ALFRED), L.R.C.P., F.R.C.S., Exam. L.D.S., etc.

Senior Dental Surgeon and Lecturer on Dental Surgery to St. Bartholomew's Hospital and the Dental College of London.

A MANUAL OF DENTAL SURGERY AND PATHOLOGY.

Thoroughly revised and adapted to the use of American students, by Thomas C. Stellwagen, M.A., M.D., D.D.S., Prof. of Physiology at the Philadelphia Dental College. In one handsome volume of 412 pages, with 331 illustrations. Cloth, $3 25. (*Just Ready.*)

This volume presents a highly creditable appearance, and deserves to rank among the most important of recent contributions to dental literature. Mr. Coleman has presented his methods of practice, for the most part, in a plain and concise manner, and the work of the American editor has been conscientiously performed. He has evidently labored to present his convictions of the best modes of practice for the instruction of those commencing a professional career, and he has faithfully endeavored to teach to others all that he has acquired by his own observation and experience. The book deserves a place in the library of every dentist.—*Dental Cosmos*, May, 1882.

The author brings to his task a large experience acquired under the most favorable circumstances. There have been added to the volume a hundred pages by the American editor, embodying the views of the leading home teachers in dental surgery. The work, therefore, may be regarded as strictly abreast with the times, and as a very high authority on the subject of which it treats.—*Amer. Prac.*, July, 1882.

It should be in the possession of every practitioner in this country. The part devoted to first and second dentition and irregularities in the permanent teeth is fully worth the price. In fact, price should not be considered in purchasing such a work. If the money put into some of our *so-called* standard textbooks could be converted into such publications as this, much good would result.—*Southern Dental Journal*, May, 1882.

SCROFULA AND ITS GLAND DISEASES.

AN INTRODUCTION TO THE GENERAL PATHOLOGY OF SCROFULA, WITH AN ACCOUNT OF THE HISTOLOGY, DIAGNOSIS AND TREATMENT OF ITS GLANDULAR AFFECTIONS. By FREDERICK TREVES, F.R.C.S. Eng., Assistant Surgeon to and Senior Demonstrator of Anatomy at the London Hospital. Complete in one octavo volume. In paper covers. Price, 10 cents.

HOLMES (TIMOTHY), M.A.,

Surgeon and Lecturer on Surgery at St. George's Hospital, London.

A SYSTEM OF SURGERY; THEORETICAL AND PRACTICAL.

IN TREATISES BY VARIOUS AUTHORS. AMERICAN EDITION, THOROUGHLY REVISED AND RE-EDITED by JOHN H PACKARD, M.D., Surgeon to the Episcopal and St. Joseph's Hospitals, Philadelphia, assisted by a large corps of the most eminent American surgeons. In three large and very handsome imperial octavo volumes containing 3137 double-columned pages, with 979 illustrations on wood and thirteen lithographic plates, beautifully colored. Price per volume, cloth, $6 00; leather, $7 00; half Russia, $7 50. Per set, cloth, $18 00; leather, $21 00; half Russia, $22 50. (*Sold only by subscription.*)

VOLUME I. (*now ready*) contains GENERAL PATHOLOGY, MORBID PROCESSES, INJURIES IN GENERAL, COMPLICATIONS OF INJURIES AND INJURIES OF REGIONS.

VOLUME II. (*now ready*) contains DISEASES OF ORGANS OF SPECIAL SENSE, CIRCULATORY SYSTEM, DIGESTIVE TRACT AND GENITO-URINARY ORGANS.

VOLUME III. (*just ready*) contains DISEASES OF THE RESPIRATORY ORGANS, BONES, JOINTS AND MUSCLES, DISEASES OF THE NERVOUS SYSTEM, GUNSHOT WOUNDS, OPERATIVE AND MINOR SURGERY, AND MISCELLANEOUS SUBJECTS (including an essay on HOSPITALS).

This great work, issued some years since in England, has won such universal confidence wherever the language is spoken, that its republication here, in a form more thoroughly adapted to the wants of the American practitioner, has seemed to be a duty owing to the profession.

To accomplish this, the aid has been invited of thirty-three of the most distinguished gentlemen, in every part of the country, and for more than a year they have been assiduously engaged upon the task. Each article has been placed in the hands of a gentleman specially competent to treat its subject, and no labor has been spared to bring each one up to the foremost level of the times, and to adapt it thoroughly to the practice of the country. In certain cases, this has rendered necessary the substitution of an entirely new essay for the original, as in the case of the articles on Skin Diseases, and on Diseases of the Absorbent System, where the views of the authors have been superseded by the advance of medical science, and new articles have therefore been prepared by Drs. ARTHUR VAN HARLINGEN and S. C. BUSEY, respectively. So also in the case of Anæsthetics, in the use of which American practice differs from that of England, the original has been supplemented with a new essay by J. C. REEVE, M.D., treating not only of the employment of ether and chloroform, but of the other anæsthetic agents of more recent discovery. The same careful and conscientious revision has been pursued throughout, leading to an increase of nearly one-fourth in matter, while the series of illustrations has been nearly trebled, and the whole is presented as a complete exponent of British and American Surgery, adapted to the daily needs of the working practitioner

In order to bring it within the reach of every member of the profession, the five volumes of the original have been compressed into three, by employing a double-columned imperial octavo page, and in this improved form it is offered at less than one half the price of the original. It is beautifully printed on handsome laid paper and forms a worthy companion to REYNOLDS' SYSTEM OF MEDICINE, which has met with so much favor in every section of the country.

The work will be sold by subscription only, and in due time every member of the profession will be called upon and offered an opportunity to subscribe.

It is a subject for congratulation that the idea of an American edition, incorporating all recently acquired knowledge and experience, should have been conceived, and its execution intrusted to such able hands as Packard's. The names of coadjutors in the edition of the 1st volume, which has come to hand, afford a sufficient guarantee that the work has not only been brought fully up to date, but also that it has been accomplished in that large, thorough, and scientific spirit which characterized the contributions to the original edition.—*Can. Journ. of Med. Science*, Nov. 1881.

The authors of the original English edition are men of the front rank in England, and Dr. Packard has been fortunate in securing as his American coadjutors such men as Bartholow, Hyde, Hunt, Conner, Stimson, Morton, Hodgen, Jewell and their colleagues. They have revised and added to all the articles except three, which were found so complete as not to require any additions. The new matter varies considerably in amount and character, but is always judicious and useful. In some cases it is very slight, while in others the additions are large in amount and radical in character. As a whole, the work, if we may judge by this first volume, will be solid and substantial, and a valuable addition to the library of any medical man. It is more wieldy and more useful than the five volume English edition; and with its companion work—"Reynolds' System of Medicine"—will well represent the present state of our science. One who is familiar with those two works will be fairly well furnished head-wise and hand-wise.—*The Medical News*, Jan. 7, 1882.

Great credit is due to the American editor and his co-laborers for revising and bringing within easy reach of American surgeons, a work which has been received with such universal favor on the other side of the Atlantic as Holmes' System of Surgery. In the list of English contributors to the first volume, we find the names of such well-known surgeons as Sir James Paget, Simon, Savory, Callender, Barclay and others equally distinguished; while among the American revisers we recognize men of no less celebrity. With regard to the mechanical execution of the work, neither pains nor money seem to have been spared by the publishers.—*Med. and Surg. Reporter*, Sept. 14, 1881.

In the revision of the work for the American edition, not only has provision been made for a recognition of the advances made in our knowledge during the ten years since its first publication, but also for a presentation of the variations in practice which characterize American surgery, and distinguish it from that of Great Britain. The work is one which we take pleasure in commending to the notice of our readers as an encyclopædia of surgical knowledge and practice.—*St. Louis Courier of Medicine*, Nov. 1881.

DRUITT (ROBERT), M.R.C.S., &c.

THE PRINCIPLES AND PRACTICE OF MODERN SURGERY.

A new and revised American, from the Eighth enlarged and improved London Edition. Illustrated with four hundred and thirty-two wood engravings. In one very handsome octavo volume, of nearly 700 large and closely printed pages. Cloth, $4 00; leather, $5 00.

BRYANT (*THOMAS*), *F.R.C.S.*,
Surgeon to Guy's Hospital.

THE PRACTICE OF SURGERY. Third American, from the Third and Revised English Edition. Thoroughly revised and much improved, by John B. Roberts, A.M., M.D. In one large and very handsome imperial octavo volume of 1009 pages, with 735 illustrations. Cloth, $6 50; leather, $7 50; very handsome half Russia, raised bands, $8 00. (*Just Issued.*)

Mr. Bryant's work has long been a favorite one with surgeons. As its name indicates, it is of a thoroughly practical character. It is distinctly individual in that it gives the results of the author's large and varied experience as an operator and clinical teacher, and is on that account prized deservedly high as an original work. The style is necessarily condensed, the descriptions of surgical diseases brief and to the point. The illustrations are well chosen, and the typical cases of the author's experience are full of interest, and are of more than ordinary value to the working surgeon.—*N. Y. Medical Record*, March 5, 1881.

It is a work especially adapted to the wants of students and practitioners. While not prolix, it affords instruction in sufficient detail for a full understanding of surgical principles and the treatment of surgical diseases. It embraces in its scope all the diseases that are recognized as belonging to surgery, and all traumatic injuries. In discussing these it has seemed to be the aim of the author rather to present the student with practical information, and that alone, than to burden his memory with the views of different writers, however distinguished they might have been. In this edition the whole work has been carefully revised, much of it has been rewritten, and important additions have been made to almost every chapter.—*Cincinnati Med. News*, Jan. 1881.

The English edition, from which this is printed, has been carefully revised and rewritten; almost every chapter has received additions, and nearly one hundred new cuts introduced. The labors of the American editor, Dr. John B. Roberts, have very much increased the value of the book. He has introduced many new illustrations and much new material not found in the English edition. He has written, too, with great conciseness, which is a rare virtue in an American editor of an English work. If one could procure or wished only one surgery, this volume would certainly be selected. If he desired two, Erichsen's Surgery would be added, and if he wished a third, Gross' Surgery would justly be the work selected. As the great work of Gross is amply sufficient for the wants of any surgeon, the priority given to Erichsen, and above all others, to this work of Bryant, is no labored eulogy of the last volume, but a simple and just statement of its demonstrable and pre-eminent merits.—*Am. Med. Bi-Weekly*, Feb. 25, 1881.

ERICHSEN (*JOHN E.*), *F.R.S., F.R.C.S.*
Professor of Surgery in University College, London, etc.

THE SCIENCE AND ART OF SURGERY; being a Treatise on Surgical Injuries, Diseases and Operations. Carefully revised by the Author from the Seventh and enlarged English Edition. In two large and beautiful octavo volumes of nearly 2000 pages, illustrated by eight hundred and sixty-two engravings on wood. Cloth, $8 50; leather, $10 50; half Russia, raised bands, $11 50. (*Lately Issued.*)

Of the many treatises on Surgery which it has been our task to study, or our pleasure to read, there is none which in all points has satisfied us so well as the classic treatise of Erichsen. His polished, clear style, his freedom from prejudice and hobbies, his unsurpassed grasp of his subject, and vast clinical experience, qualify him admirably to write a model text-book. When we wish, at the least cost of time, to learn the most of a topic in surgery, we turn, by preference, to his work. It is a pleasure, therefore, to see that the appreciation of it is general, and has led to the appearance of another edition.—*Med. and Surg. Reporter*, Feb. 2, 1878.

Notwithstanding the increase in size, we observe that much old matter has been omitted. The entire work has been thoroughly written up, and not merely amended by a few extra chapters. A great improvement has been made in the illustrations. One hundred and fifty new ones have been added, and many of the old ones have been redrawn. The author highly appreciates the favor with which his work has been received by American surgeons, and has endeavored to render his latest edition more than ever worthy of their approval. That he has succeeded admirably, must, we think, be the general opinion. We heartily recommend the book to both student and practitioner.—*N. Y. Med. Journal*, Feb. 1878.

The seventh edition is before the world as the last word of surgical science. There may be monographs which excel it upon certain points, but as a conspectus upon surgical principles and practice it is unrivalled. It will well reward practitioners to read it, for it has been a peculiar province of Mr. Erichsen to demonstrate the absolute interdependence of medical and surgical science. We need scarcely add, in conclusion, that we heartily commend the work to students that they may be grounded in a sound faith, and to practitioners as an invaluable guide at the bedside.—*Am. Practitioner*, April, 1878.

For the past twenty years Erichsen's Surgery has maintained its place as the leading text-book, not only in this country, but in Great Britain. That it is able to hold its ground, is abundantly proven by the thoroughness with which the present edition has been revised, and by the large amount of valuable material that has been added. Aside from this, one hundred and fifty new illustrations have been inserted, including quite a number of microscopical appearances of pathological processes. So marked is this change for the better, that the work almost appears as an entirely new one.—*Med. Record*, Feb. 23, 1878.

HOLMES (*TIMOTHY*), *M.A.*,
Surgeon to St. George's Hospital, London.

SURGERY, ITS PRINCIPLES AND PRACTICE. In one handsome octavo volume of 968 pages, with 411 illustrations. Cloth, $6; leather, $7; half Russia, $7 50.

It will be found a most excellent epitome of surgery by the general practitioner who has not the time to give attention to more minute and extended works, and to the medical student. In fact, we know of no one we can more cordially recommend. The author has succeeded well in giving a plain and practical account of each surgical injury and disease, and of the treatment which is most commonly advisable. It will no doubt become a popular work in the profession, and especially as a text-book.—*Cincinnati Med. News*, April, 1876.

This is a work which has been looked for on both sides of the Atlantic with much interest. Mr. Holmes is a surgeon of large and varied experience, and one of the best known, and perhaps the most brilliant writer upon surgical subjects in England. It is a book for students—and an admirable one—and for the busy general practitioner. It will give a student all the knowledge needed to pass a rigid examination. The book fairly justifies the high expectations that were formed of it. Its style is clear and forcible, even brilliant at times, and the conciseness needed to bring it within its proper limits has not impaired its force and distinctness.—*N. Y. Med. Record*, April 14, 1876.

WELLS (J. SOELBERG), F.R.C.S.

Professor of Ophthalmology in King's College Hospital, London, &c.

A TREATISE ON DISEASES OF THE EYE. Third American, from the Third London Edition. Thoroughly revised, with copious additions, by Charles S. Bull, M.D., Surgeon and Pathologist to the New York Eye and Ear Infirmary. In one large and very handsome octavo volume of 883 pages, with 254 illustrations on wood, six colored plates, and selections from the Test-types of Jaeger and Snellen. Cloth, $5; leather, $6; half Russia, raised bands, $6 50.

This new edition of Dr. Wells's great work on the eye will be welcomed by the profession at large as well as by the oculist It contains much new matter relating to treatment and pathology, and is brought thoroughly up with the present status of ophthalmology. Its chapter on refraction and accommodation—a subject much discussed of late years, and of great importance—is exceedingly complete.—*Louisville Med. News*, Nov. 13, 1880.

The merits of Wells's treatise on diseases of the eye have been so universally acknowledged, and are so familiar to all who profess to have given any attention to ophthalmic surgery, that any discussion of them at this late day will be a work of supererogation. Very little that is practically useful in recent ophthalmic literature has escaped the editor, and the third American edition is well up to the times. As a text-book on ophthalmic surgery for the English-speaking practitioner, it is without a rival.—*Am. Journ. of Med. Sci.*, Jan. 1881.

The work has justly held a high place in English ophthalmic literature, and at the time of its first appearance was the best treatise of its kind in the language. In the second edition, the author showed industrious research in adding new material from every quarter, and his spirit was eminently candid. A work thus built up by honest effort should not be suffered to die, and we are pleased to receive this third edition from the hands of Dr. Bull. His labor has been arduous, as the very great number of additions bracketed with his initial testify. Under the editorship which the third edition has enjoyed, the work is sure to sustain its good reputation, and to maintain its usefulness.—*N. Y. Med. Journ.*, Jan. 1881.

NETTLESHIP (EDWARD), F.R.C.S.,

Ophthalmic Surg. and Lect. on Ophth. Surg. at St. Thomas' Hospital, London.

THE STUDENT'S GUIDE TO DISEASES OF THE EYE. New Edition. With a Chapter on the Detection of Color-Blindness. By WILLIAM THOMSON, M.D., Ophthalmologist to the Jefferson Medical College. In one royal 12mo vol. of about 400 pages, with 138 illustrations. (*Nearly Ready.*)

This new edition of an excellent handbook embodies several improvements. A brief but clear introduction to the principles of geometrical optics so far as they concern the ophthalmist, will be hailed by many a student whose preliminary scientific lessons are fading from his mind. The advantage to all readers of having this *résumé* of physical principles thus readily at hand is manifest. We confidently recommended the first edition; we have only now to congratulate the author on his assured success.—*The Practitioner*, Nov. 1882.

CARTER (R. BRUDENELL), F.R.C.S.,

Ophthalmic Surgeon to St. George's Hospital, etc.

A PRACTICAL TREATISE ON DISEASES OF THE EYE. Edited, with test-types and Additions, by JOHN GREEN, M.D. (of St. Louis, Mo.). In one handsome octavo volume of about 500 pages, and 124 illustrations.

BROWNE (EDGAR A.),

Surgeon to the Liverpool Eye and Ear Infirmary, and to the Dispensary for Skin Diseases.

HOW TO USE THE OPHTHALMOSCOPE. Being Elementary Instructions in Ophthalmoscopy, arranged for the Use of Students. In one small volume, royal 12mo., of 116 pages, with 35 illustrations. Cloth, $1.

ESMARCH (Dr. FRIEDRICH),

Professor of Surgery at the University of Kiel, etc.

EARLY AID IN INJURIES AND ACCIDENTS. Five Ambulance Lectures. Translated by H. R. H. PRINCESS CHRISTIAN. In one handsome volume, small 12mo. of 109 pages with 24 illustrations. Cloth, 75 cents. (*Just Ready*)

LAURENCE'S HANDY-BOOK OF OPHTHALMIC SURGERY, for the use of Practitioners. Second Edition, revised and enlarged With numerous illustrations. In one very handsome octavo volume. Cloth, $2 75.

LAWSON ON INJURIES TO THE EYE, ORBIT AND EYELIDS: Their Immediate and Remote Effects. With about one hundred illustrations. In one very handsome octavo volume. Cloth, $3 50.

GIBSON'S INSTITUTES AND PRACTICE OF SURGERY. Eighth Edit'n, improved and altered. With thirty-four plates. In two handsome octavo volumes, about 1000 pp. Leather, $6 50.

MILLER'S PRINCIPLES OF SURGERY. Fourth American, from the Third Edinburgh Edition. In one large 8vo. vol. of 700 pages, with 340 illustrations, Cloth, $3 75.

MILLER'S PRACTICE OF SURGERY. Fourth American, from the last Edinburgh Edition. Revised by the American editor. In one large 8vo. vol. of nearly 700 pages, with 364 illustrations. Cloth, $3 75.

SARGENT ON BANDAGING AND OTHER OPERATIONS OF MINOR SURGERY. New Edition, with an additional chapter on Military Surgery. One 12mo. vol. of 383 pages with 184 wood-cuts. Cloth, $1 75.

THE PRINCIPLES AND PRACTICE OF SURGERY By WILLIAM PIRRIE, F.R.S.E., Profes'r of Surgery in the University of Aberdeen. Edited by JOHN NEILL, M.D., Professor of Surgery in the Penna. Medical College, Surg'n to the Pennsylvania Hospital, &c. In one very handsome octavo vol. of 780 pages, with 316 illustrations. Cloth, $3 75.

SKEY'S OPERATIVE SURGERY. In 1 vol. 8vo. of 661 pages, with 81 woodcuts. Cloth, $3 25.

COOPER'S LECTURES ON THE PRINCIPLES AND PRACTICE OF SURGERY. In 1 vol. 8vo. 750 p. Cl'h $2.

ASHTON ON THE DISEASES, INJURIES, AND MALFORMATIONS OF THE RECTUM AND ANUS: with remarks on Habitual Constipation. Second American, from the Fourth and Enlarged London Edition. With illustrations. In one 8vo. vol. of 287 pages. Cloth, $3 25.

BURNETT (CHARLES H.), A.M., M.D.,

Aural Surg. to the Presb. Hosp., Surgeon-in-charge of the Infir. for Dis. of the Ear, Phila.

THE EAR, ITS ANATOMY, PHYSIOLOGY AND DISEASES.

A Practical Treatise for the Use of Medical Students and Practitioners. In one handsome octavo volume of 619 pages, with eighty-seven illustrations: Cloth, $4 50; leather, $5 50; very handsome half Russia, raised bands, $6 00.

On account of the great advances which have been made of late years in otology, and of the increased interest manifested in it, the medical profession will welcome this new work, which presents clearly and concisely its present aspect, whilst clearly indicating the direction in which further researches can be most profitably carried on. Dr. Burnett from his own matured experience, and availing himself of the observations and discoveries of others, has produced a work which, as a text-book, stands *facile princeps* in our language. We had marked several passages as well worthy of quotation and the attention of the general practitioner, but their number and the space at our command forbid. Perhaps it is better, as the book ought to be in the hands of every medical student, and its study will well repay the busy practitioner in the pleasure he will derive from the agreeable style in which many otherwise dry and mostly unknown subjects are treated. To the specialist the work is of the highest value, and his sense of gratitude to Dr. Burnett will, we hope, be proportionate to the amount of benefit he can obtain from the careful study of the book, and a constant reference to its trustworthy pages.—*Edinburgh Med. Jour.*, Aug. 1878.

POLITZER (ADAM), M.D.,

Imperial-Royal Professor of Aural Therapeutics in the University of Vienna, Chief of the Imperial-Royal University Clinic for Diseases of the Ear in the General Hospital, Imperial-Royal Public Aurist to the city of Vienna.

A TEXT-BOOK OF THE EAR AND ITS DISEASES.

Translated at the Author's request, by JAMES PATTERSON CASSELLS, M.D., F.F.P.S. In one handsome octavo volume of 800 pages, with 257 illustrations. Cloth, $5 50. (*Just Ready.*)

TAYLOR (ALFRED S.), M.D.,

Lecturer on Med. Jurisp. and Chemistry in Guy's Hospital.

A MANUAL OF MEDICAL JURISPRUDENCE.

Eighth American from the Tenth London Edition, thoroughly revised and rewritten. Edited by JOHN J. REESE, M.D., Professor of Medical Jurisprudence and Toxicology in the University of Pennsylvania. In one large octavo volume of 937 pages, with 70 illustrations. Cloth, $5; leather, $6; half Russia, raised bands, $6 50. (*Lately Issued.*)

The American editions of this standard manual have for a long time laid claim to the attention of the profession in this country; and that the profession has recognized this claim with favor is proven by the call for frequent new editions of the work. This one, the eighth, comes before us as embodying the latest thoughts and emendations of Dr. Taylor, upon the subject to which he devoted his life, with an assiduity and success which made him *facile princeps* among English writers on medical jurisprudence. Both the author and the book have made a mark too deep to be affected by criticism, whether it be censure or praise. In this case, however, we should only have to seek for laudatory terms.—*Am. Journ. of Med. Sci.*, Jan. 1881.

It will suffice to remark that this new edition shows the signs of judicious revision. A great number of illustrative medico-legal cases which have occurred since the last edition was published are cited in their proper connection, and add much to the interest and value of the work. There is ample evidence that this admirable book will maintain its high place as a standard authority concerning the matters of which it treats.—*Boston Medical and Surgical Journal*, Jan. 13, 1881.

BY THE SAME AUTHOR.

THE PRINCIPLES AND PRACTICE OF MEDICAL JURISPRUDENCE.

Third Edition. In two handsome octavo volumes. (*In Press.*)

BY THE SAME AUTHOR.

POISONS IN RELATION TO MEDICAL JURISPRUDENCE AND MEDICINE.

Third American, from the Third and Revised English Edition. In one large octavo volume of 788 pages. Cloth, $5 50; leather, $6 50.

The present is based upon the two previous editions; but the complete revision rendered necessary by time has converted it into a new work." This statement from the preface contains all that it is desired to know in reference to the new edition. The works of this author are already in the library of every physician who is liable to be called upon for medico-legal testimony (and what one is not?), so that all that is required to be known about the present book is that the author has kept it abreast with the times. What makes it now, as always, especially valuable to the practitioner is its conciseness and practical character, only those poisonous substances being described which give rise to legal investigations.—*The Clinic*, Nov. 6, 1875.

TIDY (CHARLES MEYMOTT), M.B., F.C.S,

Professor of Chemistry and of Forensic Medicine and Public Health at the London Hospital, etc.

LEGAL MEDICINE. VOLUME I.

Embracing EVIDENCE, THE SIGNS OF DEATH, IDENTITY, THE CAUSES OF DEATH, THE POST-MORTEM, SEX, MONSTROSITIES, HERMAPHRODISM, EXPECTATION OF LIFE, PRESUMPTION OF DEATH AND SURVIVORSHIP, HEAT AND COLD, BURNS, LIGHTNING, EXPLOSIVES, STARVATION. Making a very handsome imperial octavo volume of 664 pages, with 2 beautifully colored plates. Cloth, $6; leather, $7. (*Just Ready.*)

We can highly recommend Dr. Tidy's book to the profession as a solid contribution to the subject of Forensic Medicine, and one which cannot fail to increase the author's reputation as a medical jurist.—*British Medical Journal*, Oct. 28, 1882.

ROBERTS (*WILLIAM*), *M.D.*,

Lecturer on Medicine in the Manchester School of Medicine, etc.

A PRACTICAL TREATISE ON URINARY AND RENAL DISEASES, including Urinary Deposits. Illustrated by numerous cases and engravings. Fourth American, from the Fourth Revised and Enlarged London Edition. In one large and handsome octavo volume. (*Preparing.*)

THOMPSON (*SIR HENRY*),

Surgeon and Professor of Clinical Surgery to University College Hospital.

LECTURES ON DISEASES OF THE URINARY ORGANS. With illustrations on wood. Second American from the Third English Edition. In one octavo volume of 203 pages, with 25 illustrations. Cloth, $2 25.

BY THE SAME AUTHOR.

ON THE PATHOLOGY AND TREATMENT OF STRICTURE OF THE URETHRA AND URINARY FISTULÆ. With plates and wood-cuts. From the Third and revised English Edition. In one very handsome octavo volume. Cloth, $3 50.

BASHAM ON RENAL DISEASES: A Clinical Guide to Their Diagnosis and Treatment. In one 12mo. vol of 304 pages, with illustrations. Cloth, $2 00.

A TREATISE ON FEVER. By ROBERT D. LYONS, K.C.C. In one octavo volume of 362 pages, Cloth, $2 25.

LECTURES ON THE STUDY OF FEVER. By A. HUDSON, M.D., M.R.I.A., Physician to the Meath Hospital. In one vol. 8vo. Cloth, $2 50.

STOKES' LECTURES ON FEVER. Edited by John William Moore, M.D., F. K. Q. C. P. In one octavo volume of 264 pages. Cloth, $2 00.

TUKE (*DANIEL HACK*), *M.D.*,

Joint author of The Manual of Psychological Medicine, &c.

ILLUSTRATIONS OF THE INFLUENCE OF THE MIND UPON THE BODY IN HEALTH AND DISEASE. Designed to illustrate the Action of the Imagination. New Edition In one handsome octavo volume (*Preparing.*)

BLANDFORD (*G. FIELDING*), *M.D., F.R.C.P.*,

Lecturer on Psychological Medicine at the School of St. George's Hospital, &c.

INSANITY AND ITS TREATMENT: Lectures on the Treatment, Medical and Legal, of Insane Patients. With a Summary of the Laws in force in the United States on the Confinement of the Insane. By ISAAC RAY, M.D. In one very handsome octavo volume of 471 pages.

LEA (*HENRY C.*).

SUPERSTITION AND FORCE: ESSAYS ON THE WAGER OF LAW, THE WAGER OF BATTLE, THE ORDEAL AND TORTURE. Third Revised and Enlarged Edition. In one handsome royal 12mo. volume of 552 pages. Cloth, $2 50. (*Lately Issued.*)

This valuable work is in reality a history of civilization as interpreted by the progress of jurisprudence. . . . In "Superstition and Force" we have a philosophic survey of the long period intervening between primitive barbarity and civilized enlightenment. There is not a chapter in the work that should not be most carefully studied, and however well versed the reader may be in the science of jurisprudence, he will find much in Mr. Lea's volume of which he was previously ignorant. The book is a valuable addition to the literature of social science.—*Westminster Review*, Jan. 1880.

The appearance of a new edition of Mr. Henry C. Lea's "Superstition and Force" is a sign that our highest scholarship is not without honor in its native country. Mr. Lea has met every fresh demand for his work with a careful revision of it, and the present edition is not only fuller and, if possible, more accurate than either of the preceding, but, from the thorough elaboration is more like a harmonious concert and less like a batch of studies.—*The Nation*, Aug. 1, 1878.

Many will be tempted to say that this, like the "Decline and Fall," is one of the uncriticizable books. Its facts are innumerable, its deductions simple and inevitable, and its *chevaux-de-frise* of references bristling and dense enough to make the keenest, stoutest, and best equipped assailant think twice before advancing. Nor is there anything controversial in it to provoke assault. The author is no polemic. Though he obviously feels and thinks strongly, he succeeds in attaining impartiality. Whether looked on as a picture or a mirror, a work such as this has a lasting value.—*Lippincott's Magazine*, Oct. 1878.

BY THE SAME AUTHOR.

STUDIES IN CHURCH HISTORY. THE RISE OF THE TEMPORAL POWER—BENEFIT OF CLERGY—EXCOMMUNICATION. New Edition. In one very handsome royal octavo volume of about 500 pages. (*In Press.*)

A few notices of the previous edition are appended.

The story was never told more calmly or with greater learning or wiser thought. We doubt, indeed, if any other study of this field can be compared with this for clearness, accuracy, and power.—*Chicago Examiner*, Dec. 1870.

Mr. Lea's latest work, "Studies in Church History," fully sustains the promise of the first. It deals with three subjects—the Temporal Power, Benefit of Clergy and Excommunication, the record of which has a peculiar importance for the English student, and is a chapter on Ancient Law likely to be regarded as final. We can hardly pass from our mention of such works as these—with which that on "Sacerdotal Celibacy" should be included—without noting the literary phenomenon that the head of one of the first American houses is also the writer of some of its most original books.—*London Athenæum*, Jan. 7, 1871.

INDEX TO CATALOGUE.

	PAGE
American Journal of the Medical Sciences	3
American System of Gynæcology	23
Allen's Anatomy	7
*Ashhurst's Surgery	25
Ashton on the Rectum and Anus	29
Ashwell on Diseases of Women	23
Attfield's Chemistry	9
Barlow's Practice of Medicine	14
Barnes' Midwifery	24
*Barnes on Diseases of Women	22
Bartholow on Electricity	18
Basham on Renal Diseases	31
Bellamy's Surgical Anatomy	6
Blandford on Insanity	31
Bloxam's Chemistry	10
Bowman's Practical Chemistry	9
*Bristowe's Practice	14
Browne on Ophthalmoscope	28
Browne on the Throat	19
*Bryant's Practice of Surgery	28
*Bumstead on Venereal	20
*Burnett on the Ear	30
*Carpenter's Human Physiology	8
Carpenter on the Use and Abuse of Alcohol	8
Carter on the Eye	29
Century of American Medicine	5
Chadwick on Diseases of Women	23
Chambers on Diet and Regimen	15
Churchill on Puerperal Fever	23
Classen's Chemistry	9
Cleland's Dissector	6
Clowes' Chemistry	10
Coleman's Dental Surgery	26
Condie on Diseases of Children	23
Cooper's Lectures on Surgery	29
*Cornil and Ranvier's Pathological Histology	13
Cornil on Syphilis	20
Cullerier's Atlas of Venereal Diseases	20
*Dalton's Human Physiology	8
Davis' Clinical Lectures	15
Druitt's Modern Surgery	27
Duncan on Diseases of Women	23
*Dunglison's Medical Dictionary	4
Edis on Diseases of Women	22
Ellis' Demonstrations in Anatomy	7
*Emmet's Gynæcology	23
*Erichsen's System of Surgery	28
Esmarch's Early Aid in Injuries and Accidents	29
Farquharson's Therapeutics	11
Fenwick's Diagnosis	14
Finlayson's Clinical Diagnosis	16
Flint on Auscultation and Percussion	19
Flint on the Heart	19
Flint on Phthisis	19
Flint on Respiratory Organs	19
*Flint's Clinical Medicine	15
Flint's Essays	15
*Flint's Practice of Medicine	15
Foster's Physiology	8
*Fothergill's Handbook of Treatment	14
Fownes' Elementary Chemistry	10
Fox on Diseases of the Skin	19
Fuller on the Lungs, &c.	16
Galloway's Analysis	9
Gibson's Surgery	29
Gluge's Pathological Histology, by Leidy	14
*Gray's Anatomy	6
Greene's Medical Chemistry	9
Green's Pathology and Morbid Anatomy	13
Griffith's Universal Formulary	11
Gross on Foreign Bodies in Air-Passages	26
Gross on Impotence and Sterility	20
Gross on Urinary Organs	26
*Gross' System of Surgery	26
Gusserow on Uterine Tumors	23
Gynecological Transactions	22
Habershon on the Abdomen	14
*Hamilton on Fractures and Dislocations	25
Hamilton on Nervous Diseases	18
Hartshorne's Anatomy and Physiology	6
Hartshorne's Conspectus of the Medical Sciences	5
Hartshorne's Essentials of Medicine	16
Heath's Practical Anatomy	5
Hermann's Experimental Pharmacology	10
Hillier's Handbook of Skin Diseases	19
Hill on Venereal Diseases	20
Hoblyn's Medical Dictionary	4
Hodge's Obstetrics	21
Hodge on Women	22
Hoffmann and Power's Chemical Analysis	10
Holden's Landmarks	6
Holland's Medical Notes and Reflections	14
*Holmes' Surgery	28
*Holmes' System of Surgery	27
Horner's Anatomy and Histology	6
Hudson on Fever	31
Hyde on the Diseases of the Skin	19
Jones (C. Handfield) on Nervous Disorders	18
Keating on Infants	21
King's Manual of Obstetrics	24
La Roche on Pneumonia, Malaria, &c.	14
La Roche on Yellow Fever	14
Laurence and Moon's Ophthalmic Surgery	29
Lawson on the Eye	29
Lea's Studies in Church History	31
Lea's Superstition and Force	31
Lee on Syphilis	20
Lehmann's Chemical Physiology	9
*Leishman's Midwifery	24
Ludlow's Manual of Examinations	5
Lyons on Fever	31
Maisch's Materia Medica	13
Medical News	1
Meigs on Puerperal Fever	23
Miller's Practice of Surgery	29
Miller's Principles of Surgery	29
Mitchell's Nervous Diseases of Women	18
Montgomery on Pregnancy	23
Morris on Skin Diseases	19
Neill and Smith's Compendium of Med Science	5
Nettleship on Diseases of the Eye	29
*Parrish's Practical Pharmacy	11
Parry on Extra-Uterine Pregnancy	23
Parvin's Midwifery	24
Pavy on Digestion	14
Pirrie's System of Surgery	29
*Playfair's Midwifery	24
Playfair on Nerve Prostration and Hysteria	24
Politzer on the Ear	30
Ramsbotham on Parturition	21
Remsen's Principles of Chemistry	9
*Reynolds' System of Medicine	17
Richardson's Preventive Medicine	16
Roberts' Principles and Practice of Surgery	25
Roberts on Urinary Diseases	31
Rodwell's Dictionary of Science	4
Sargent's Minor Surgery	29
Schafer's Histology	13
Seiler on the Throat	19
Sharpey and Quain's Anatomy	5
Skey's Operative Surgery	29
Slade on Diphtheria	16
Smith (Edward) on Consumption	16
Smith (Eust.) on Wasting Diseases in Children	21
Smith (H. H.) and Horner's Anatomical Atlas	6
*Smith (J. L.) on Children	21
*Stillé & Maisch's Dispensatory	12
*Stillé's Therapeutics	11
Stimson on Fractures	25
Stimson's Operative Surgery	25
Stokes on Fever	31
Sturges' Clinical Medicine	15
Tanner on Pregnancy	23
Tanner's Manual of Clinical Medicine	5
*Taylor's Medical Jurisprudence	30
Taylor's Prin. and Prac. of Med. Jurisprudence	30
Taylor on Poisons	30
*Thomas on Diseases of Women	22
Thompson on Stricture	31
Thompson on Urinary Organs	31
Tidy's Legal Medicine	30
Todd on Acute Diseases	15
Tuke on the Influence of the Mind	31
Walshe on the Heart	16
Watson's Practice of Physic	16
*Wells on the Eye	29
West on Diseases of Children	21
West on Diseases of Women	21
West on Nervous Disorders of Children	21
Williams on Consumption	16
Wilson's Handbook of Cutaneous Medicine	19
Wilson's Human Anatomy	7
Winckel on Childbed	21
Wöhler's Organic Chemistry	9
Woodbury's Practice	16

Books marked * are also bound in half Russia.

Date Due

Demco 293-5

RJ
881

Accession no.
1733
Author
Smith, J.L.
Treatise on diseases
of infancy ...
Call no. 5th ed.

