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OR,

System of Universal Knowledge;

ON A METHODICAL PLAN

PROJECTED BY SAMUEL TAYLOR COLERIDGE.

SECOND EDITION, REVISED.

SCIENCE AND PRACTICE OF MEDICINE.

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HANDBOOK

OF

THE SCIENCE AND PRACTICE

OF

MEDICINE.

BY

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PREFACE.

In the compilation of this Handbook, I have attempted to give a condensed view of the Science and Practice of Medicine. It has also been my object to incorporate and connect the more recently established facts which illustrate the *Nature of Diseases* and their *Treatment*, with the time-honoured doctrines on which the Science of Medicine has been based.

While the greater portion of the volume is necessarily devoted to a consideration of the *Nature* and *Treatment* of individual diseases, a more comprehensive range of topics has been embraced, under the title of the Science of Medicine, than it has hitherto been usual to include in text-books.

The introductory sections indicate the more important elements of *General Pathology;* and those principles are shortly stated on which the more modern systems of *Nosology* have been founded since the time of Cullen.

The remainder of the volume, arranged in three divisions, treats, in the First Part, of *Systematic Medicine: Nosology, or the Classification of Diseases*, and suggests, that the classification of the Registrar-General of England should be adopted. This statistical nosology, originally proposed by Dr. William Farr, has been carefully discussed and revised at the recent meeting of the Statistical Congress

held at Vienna, and a *nomenclature* substantially the same is to be adopted in all the States of Europe. The fatal cases are to be *registered* on a uniform plan. A definite *classification*, however, is still undetermined; but I am kindly informed by Dr. Farr that a *classification* nearly the same as the English one has been adopted in Bavaria, and is quietly making its way among practical men in Germany. The Austrians, also, as represented by Dr. Hebra, approve of the separation of *Zymotic* diseases from the others.

In PART SECOND, under the head of the *Nature of Diseases, Special Pathology and Therapeutics*, I have attempted to describe the nature of each disease, considered as characteristic of its class. In so doing each disease or morbid process has been defined, not by a logical definition, but merely by stating prominently its leading characters, so that the student may *at once* distinguish the general features of the disease which he has to study, and which the physician has to treat. Having then established the position of each disease in its *Nosological* and *Pathological* relations, those principles are stated which guide its treatment, and, in some instances, definite details are given.

In PART THIRD, under the head of *Medical Geography, or the Geographical Distribution of Health and Disease*, a prominent place has been assigned to a most important Department of the Science of Medicine—a subject of study, hitherto, so far as I am aware, wholly untaught at our medical schools in this country. It was emphatically written by Cabanis and Malte Brun that climate and natural history lost much of their value from the fact that the physical conditions of the surface of the earth had not then been described in relation to these studies, a deficiency now in a great measure supplied by the labours of Humboldt, Berghaus, and Johnstone. So also it may be stated, that the NATURE OF DISEASES and their distribution on the globe, require that they should be studied in relation to the physical condition of the earth's surface, and to the variation of their *types* in the different regions of the

earth. The geographical distribution of Health and Disease in relation to Physical Geography, is a branch of the Science of Medicine rapidly and justly growing in importance, and, in one department—that of *Sanitary Science*, is beginning to yield most important fruits. To Dr. Mühry in Germany, M. Boudin in France, and Mr. Keith Johnstone in this country, the Science of Medicine is largely indebted for the elucidation of this important topic; of which I have attempted to give a sketch, illustrated by Mr. Johnstone's map, indicating some of the more useful directions which the study may take.

In my attempt to accomplish this design, I have many obligations to acknowledge. In the first instance, the work has its origin in an Article on the "Elementary Principles of Medicine," contributed to the *Encyclopædia Metropolitana* by the late Dr. Robert Williams, a distinguished physician of St. Thomas's Hospital, London. This Article contains the elements of his classic work on *Morbid Poisons*, completed about sixteen years ago—a work which "occupies the highest rank in the practical literature of this country;" and his views regarding their nature are here preserved, commencing from page 10 of this Handbook. It was originally intended by my publishers to reproduce that Article, but I deemed it necessary entirely to re-write and re-model the whole, retaining the statements of facts, and such illustrations as appeared to be of sufficient importance. While I have collected information from every other available source, the limits of this volume prevent me doing more than simply stating at the end of each paragraph the name of the author from whose writings the statements have been compiled. If I have correctly interpreted and stated the doctrines taught by the veteran labourers and original investigators in the fields of medical experience and research, the names of those of whose writings I have freely and largely availed myself, will furnish a sufficient guarantee that the matter I have attempted to communicate is at least orthodox. Much valuable material I have also to acknowledge from anonymous contributors to the pages of the *Medical*

Journals. For access to books and libraries I beg especially to express my thanks to Dr. Sieveking, Mr. Martin, Sir James Clark, Dr. Steele, and to the Library Committee of the Royal College of Surgeons. Lastly, my best thanks are due to Dr. Steele, Superintendent of Guy's Hospital. Notwithstanding the unceasing demands upon his time which the onerous duties of his office entail upon him, he has kindly revised the sheets as they passed through the press;—for their numerous imperfections, I alone must bear the responsibility.

London, 12*th October*, 1857.

CONTENTS.

INTRODUCTION.

SECTION I.

PAGE

Of Medicine as a Science and as an Art; its Objects and its Extent, ... xvii
Plan and scope of the Handbook, ... xviii
How the nature of diseases may be elucidated, ... xix
Relative Nature of the terms Life, Health, and Disease, . . . xix
Principles by which Diseases have been Distinguished and Classified, and their Nature Determined and Explained, ... xx

SECTION II.

Morbid Anatomy and Pathological Histology, ... xxiv
Nature of the Researches which have Advanced the Science of Medicine, xxv
Province of Morbid Anatomy contrasted with the Aim and Objects of Pathology, ... xxx

SECTION III.

The Elementary Constituents of Lesions in Diseased States, as shown by Morbid Anatomy and other means of Research, . . . xxxiii
Means and Instruments of Research, ... xxxiii
Forms of the Constituent Elements of Disease, ... xxxiv

SECTION IV.

Complex Morbid States, ... xxxvii
1. **Fever**—Definition and Pathology, ... xxxvii
Increased Heat, the essential symptom in Fever, . . . xxxviii
Relation of the excreta to the increased development of heat, . xl
Retention of Water in Fever, ... xlv
Causes which combine to produce the phenomena of Fever, . xlvii
General Treatment of Fever, ... xlviii
2. **Inflammation**—Definition, ... xlix
Pathology of Inflammation, ... l
Phenomena of the Inflammatory process, ... l
Theory of the Inflammatory process, ... lvi
Products, Effects, or Events of Inflammation, ... lxii
Productive Effects of Inflammation, ... lxiii

Inflammation—*continued.* PAGE
Serous Effusions, ... lxiii
Blood Effusions, ... lxiv
Inflammatory Lymph, ... lxv
Degenerate Forms of Inflammatory Lymph, ... lxviii
Development of Inflammatory Lymph, ... lxix
Formation of Pus—Suppuration, ... lxxii
Softening, or diminished Cohesion of Tissue, ... lxxv
Ulceration—Granulation, ... lxxvi
Mortification, ... lxxviii
Local and General Symptoms of Inflammation, . . . lxxix
Inflammatory Fever, ... lxxix
Typhoid Fever, ... lxxxii
Hectic Fever, ... lxxxiii

SECTION V.

Of the Modes by which Diseases Terminate Fatally; the Types of Disease and their tendency to Change; General Treatment of Complex Morbid Processes, . . lxxxv
Modes of Fatal Termination, ... lxxxvi
Types of Disease and their tendency to Change, ... lxxxix
General Treatment of Inflammation, ... xcvii
Blood-letting in the Treatment of Inflammation, ... xcviii
Medicinal Agents in the Treatment of Inflammation, . . . civ

PART I.

SYSTEMATIC MEDICINE: NOSOLOGY, OR THE CLASSIFICATION OF DISEASES.

Classification and Nomenclature of Diseases, as proposed by Dr. William Farr, ... 3

PART II.

THE NATURE OF DISEASES: SPECIAL PATHOLOGY AND THERAPEUTICS.

CLASS I.

ZYMOTIC DISEASES.

CHAPTER I.

General Remarks on the Pathology of Zymotic Diseases, . 9
Action of Poisons illustrate Zymotic Diseases, ... 10
Specific Nature of Disease-Poisons, ... 15
Conditions which modify the Action of Disease-Poisons, ... 17
Disease-Poisons are absorbed and mingled with the Blood, ... 21
Conditions which induce Zymotic Diseases, ... 23

CHAPTER II.

Description of Zymotic Diseases in their Orders.

ORDER 1. MIASMATIC DISEASES—*Miasmatici.*

PAGE

Nature of Endemic and Epidemic Influences, ... 25
On Malaria and Places known as Malarious, ... 27
Nature of the Malarious Agent and its Source, ... 29
Influence of Soil in producing Miasmata, ... 33
Causes which modify the Evolutions of Miasms, ... 35
Circumstances which influence the Infecting Distance, ... 37
General Laws of Epidemic Influence, ... 40
Small-Pox—Definition, ... 42
Pathology of Small-Pox, ... 42
Varieties and Symptoms of Small-Pox, ... 46
Varieties and Symptoms of NATURAL SMALL-POX, ... 46
Symptoms of CONFLUENT SMALL-POX, ... 49
Symptoms of the INOCULATED SMALL-POX 50
Complications of Small-Pox and special Pathological tendencies, . . 51
Symptoms, Course, and Modifications of Small-Pox after Vaccination, . 54
Prognosis and Causes of Death in Small-Pox, ... 57
Diagnosis of Small-Pox, ... 58
Treatment of Small-Pox, ... 59
Dietetic or Curative Treatment, ... 61
Prophylactic or Preventive Treatment, ... 63
Vaccination, the Operation and Tests of its Efficiency, ... 65
Chicken-Pox—*Varicella;* Definition, ... 68
Symptoms and Diagnosis of Varicella, ... 69
Miliary Eruptive Disease—*Miliaria;* Definition, ... 70
Pathology, Symptoms, and Treatment, ... 71
Of Measles—*Morbilli;* Definition, ... 71
Pathology of Measles, ... 72
Symptoms of *Morbilli Mitiores,* 74
Symptoms of *Morbilli Graviores,* 76
Diagnosis, Prognosis, and Causes of Measles, ... 77
Propagation of the Disease by Contagion and Infection, ... 78
Treatment of Measles, ... 79
Scarlet Fever—*Scarlatina;* Definition, ... 81
Pathology of Scarlet Fever, ... 82
Symptoms of Scarlet Fever, ... 86
Diagnosis and Propagation of Scarlet Fever, ... 93
Prognosis and Treatment, ... 94
Hybrid Disease of Measles and Scarlet Fever—*Rubeola* or *Rötheln;*
Definition, ... 98
Pathology and Symptoms, ... 99
Lesions seen in Fatal Cases, Diagnosis, ... 101
Table contrasting the most prominent distinguishing characters of Scarlet Fever, Rubeola, and Measles, ... 102
Treatment of the Disease, ... 104
Dengue—*Scarlatina Rheumatica;* Definition, ... 104
Pathology, Symptoms, and Treatment, ... 104
Erysipelas—Definition and Pathology, ... 105
Symptoms, ... 107
Diagnosis and Cause of the Disease, ... 110
Propagation of the Disease, ... 111
Period of Latency, Prognosis, and Treatment, ... 112

PAGE

The Plague—*Pestis;* Definition, Pathology, and History, . . . 115
Symptoms of the Plague, ... 118
Diagnosis and Causes, ... 121
Modes of Propagation, and Contagious Nature of the Plague, . . 122
Period of Latency and Prognosis, ... 127
Treatment, Dietetic and Preventive, ... 129
Typhous Fever, ... 130
General Pathology of Typhous Fevers, ... 131
Geographical Distribution of Typhous Fevers, ... 132
Peculiar and Modified Forms of the Disease, ... 133
Cutaneous Eruptions, ... 134
Thoracic Phenomena, ... 136
Abdominal Complications, ... 137
Microscopic Nature of the Lesions 139
Parts most frequently the seat of Lesions, ... 141
Causes of Typhous Fever and Modes of Propagation, ... 142
Latency of the Typhous Poison, ... 146
Prognosis and Duration of the Attack, ... 147
Typhus Fever—Definition, ... 142
Symptoms of Typhus Fever, ... 148
Secondary Lesions and Complications, ... 159
1. Convulsions and Cerebral Affections, ... 152
2. Erysipelas, ... 154
3. Secondary Pulmonary Complications, ... 154
4. Gangrene of the Pulmonary Tissue, ... 155
5. Secondary Bronchial Complications, ... 156
6. Deposit of Tubercle during and after the Fever, ... 157
7. Secondary Cardiac Lesions, ... 158
Typhoid or Enteric Fever—Definition, ... 158
Distinctive Symptoms of Typhoid Fever, ... 159
Treatment of Typhous Fever, ... 160
Relapsing Fever—Definition, ... 167
Pathology of Relapsing Fever, ... 167
Symptoms, Diagnosis, and Lesions in Relapsing Fever, . . . 168
Treatment of the Fever 171
Febricula—Definition and Pathology, ... 172
Croup—*Trachealia,* 172
Pathology and History, ... 172
Symptoms and Course, ... 177
Diagnosis, Cause, Modes of Propagation, Prognosis, and Treatment, . 179
Whooping-Cough—Definition, ... 182
Pathology and Morbid Anatomy, ... 182
Symptoms of Whooping-Cough 185
Diagnosis, Cause, and Modes of Propagation, ... 188
Prognosis and Treatment, ... 190
Influenza—Definition, ... 193
Pathology of Influenza, ... 194
Symptoms, Course, and Complications, ... 195
Causes, Modes of Propagation, and Prognosis, ... 197
Treatment of Influenza, ... 198
Dysentery—Definition, ... 199
Pathology of Dysentery, ... 199
Forms of Dysentery, Acute, Chronic, and Complex Cases, ... 201
Anatomy of the Morbid Tissues in Dysentery, ... 202
Hepatic Abscess in Dysentery, ... 209

PAGE

Dysentery—*continued.*
Types, Forms, and Symptoms of Dysentery, ... 211
Causes and Modes of Propagation of the Disease, ... 213
Effects of Diet in Causing Dysentery, ... 214
Diagnosis and Treatment of Dysentery, ... 216
Diarrhœa—Definition, ... 219
Pathology, Symptoms, and Forms of Diarrhœa, ... 220
Cholera—Definition and Pathology, ... 223
Symptoms and Various Forms of Cholera, ... 229
Origin and Modes of Propagation of Cholera, ... 233
Analysis of Opinions, ... 235
Propagation of Cholera by Human Intercourse, ... 240
Predisposing Causes of Cholera, ... 241
Susceptibility to Cholera, and the Diagnosis, ... 243
Prognosis and Treatment, ... 244
Litoral, Malarial, or Paludal Fevers, ... 247
Pathology of Paludal Fevers, ... 247
Morbid Anatomy in Paludal Fevers, ... 250
Essential Nature of Yellow Fever, ... 255
Causes and Modes of Propagation of Paludal Fevers, ... 255
Intermittent Paludal Fever, or Ague—Definition, ... 264
Symptoms, a Paroxysm of the Fever, ... 264
Treatment, ... 267
Remittent Paludal Fever—Definition, ... 270
Symptoms of the Disease, ... 270
Treatment of Remittent Fever, ... 271
Table of the Relative Mortality of the Fever, ... 275
Yellow Fever—Definition, ... 275
Symptoms of Yellow Fever, ... 276
Favourable and Unfavourable Symptoms, ... 283
Treatment of Yellow Fever, ... 284

Order 2. Enthetic Diseases—*Enthetici.*

Nature of the Enthetic Diseases, ... 289
Hydrophobia—*Rabies;* Definition, ... 290
Pathology of Hydrophobia, ... 291
Proofs that the Quantity or Virulence of the Poison Increases, . . 293
Symptoms of Hydrophobia, ... 294
Remote Causes of the Disease, ... 296
Diagnosis, Prognosis, and Treatment, ... 299
Glanders—*Equinia;* Definition, ... 301
Pathology of Glanders, ... 302
Symptoms of Glanders, ... 303
Cause of Glanders, ... 305
Period of Latency, Prognosis and Diagnosis, ... 307

Order 3. Dietic Diseases—*Dietici.*

Nature of the Dietic Diseases, ... 309
Effects of Food on the Animal Economy, ... 309
Table of Dietaries and their Nutritive Values, ... 311
Nutritive Value of Various Kinds of Food, ... 312
Nutritive Value of Salted Meats and Tea and Coffee, ... 313
Effects of Deficient Food, ... 314

PAGE

Scorbutus—*Scurvy;* Definition, ... 318
Pathology of Scurvy, ... 318
Symptoms of Scurvy, ... 321
Causes or Conditions under which Scurvy is Developed, . . 323
Treatment of Scurvy, ... 326
Purpura—*The Purples;* Definition, ... 328
Pathology of Purpura, ... 328
Symptoms, Diagnosis, and Treatment of Purpura, . . 330
Ergotismus—*Ergotism;* Definition and Pathology, . . . 332
Alcoholismus—*Alcoholism*, ... 333
Proofs of the Pernicious Effects of Alcohol, . . . 334
Delirium Tremens—Definition, ... 336
Pathology, Symptoms, and Course, ... 336
Diagnosis and Prognosis, ... 339
Treatment, ... 340

ORDER 4. PARASITIC DISEASES—*Parasitici.*

Nature of Parasitic Diseases, ... 341
Helminthoid Entozoa—*Worms*, ... 342
The Migrations of Helminthoid Parasities, ... 345
Cestoidea—*Tape-Worms*, ... 345
Structure of the Ova and Development of Tape-Worms, . . 347
Development of a Tape-Worm, ... 348
Relation between Cysticerci and Tape-Worms, . . . 351
Experimental Proofs of the Relationship, ... 352
Probable Source of the Tænia Lata, ... 357
The Cysticercus and Echinococcus, ... 358
Nematoidea—*Round Worms*, ... 359
Ascarides, ... 360
The Filaria Medinensis, or Guinea Worm, . . . 360
The Ancyclostomum Duodenale, ... 362
The Tricocephalus Dispar, ... 362
The Trichina Spiralis, ... 362
The Strongylus Gigans, ... 363
Tematodea—*Fluke-like Parasites*, ... 363
Symptoms of the Presence and Treatment of Helminthoid Parasites, 364
Prophylactic Treatment, ... 367
Epiphytes—*Vegetable Parasites*, ... 368
Trichosis Furfuracea—*Ringworm of the Scalp*, . . . 369
Definition and Pathology of the Disease, ... 369
Symptoms and Treatment, ... 370
Favus—*Scald Head;* Definition, ... 371
Pathology of the Disease, ... 371
Symptoms of Favus, ... 327
Treatment of the Disease, ... 733

CLASS II.

CONSTITUTIONAL DISEASES.

CHAPTER I.

General Remarks on the Pathology of Constitutiona Diseases, 37

CHAPTER II.

PAGE

Description of the Constitutional Diseases in their Orders, 377

ORDER 1. DIATHETIC DISEASES—*Diathetici.*

Nature of Diathetic Diseases, ... 377
Rheumatismus—*Rheumatism;* Definition, ... 377
Pathology of Rheumatism 378
Local Lesions in Rheumatism, ... 380
Cases of Rheumatism Prone to Heart Affections, . . . 383
Symptoms of Acute Rheumatism, ... 385
Diagnosis, Prognosis, and Causes of Rheumatism, . . . 389
Methods of Treatment in Rheumatism, ... 391
The Object of Blood-letting and Purgatives, . . . 393
Probable Mode of Action of Alkaline Remedies, . . . 395
Podagra—*Gout;* Definition, ... 396
Pathology of Gout, ... 396
Causes and Hereditary Transmission of Gout, . . . 398
Influence of Malt Liquors in Producing Gout, . . . 401
Symptoms of Gout, ... 401
Diagnosis of Gout, ... 405
Progress and Treatment of Gout, ... 406
Anæmia—Definition, ... 410
Pathology of Anæmia, its Nature and Effects, . . . 410
Symptoms of Anæmia, ... 411
Conditions which bring about Anæmia, ... 413
Treatment of Anæmia, ... 413
Chlorosis—*Green Sickness;* Definition, ... 413
Pathology and Symptoms of the Disease, ... 413
Causes, Diagnosis, and Treatment, ... 415
Leucocythæmia, or *White-Cell Blood,* 416
Pathology of the Disease; its Two Forms, . . . 416
Symptoms of the Disease, ... 418
Causes, Prognosis, and Treatment, ... 419
Morbus Addisonii—*Supra Renal Melasma;* Definition, . . 419
Pathology of this Affection, ... 419
Early Symptoms of "Addison's" Disease, ... 421
Morbid Appearances in this Affection, ... 423
Carcinoma—*the Cachexia Associated with Cancer,* . . . 425
Definition of the Cachexia, ... 425
Nature of the Cachexia, ... 426
Diagnostic Value of the Microscopic Examination of Cancerous Exudation, 429
Species of Cancers Described by Authors, ... 431
Stages of Hard Cancer, ... 432
Stages of Soft Cancers, ... 433
Nature of Mellanoid, Coloured, and Epithelial Cancer, . . 435
Diagnosis, Prognosis, and Treatment of the Cancerous Cachexia, . 436

ORDER 2. TUBERCULOUS DISEASES—*Phthisici.*

Nature of the "Wasting" Diseases, ... 437
Tuberculosis, or the Cachexia Associated with the Tuberculous State—
Definition, ... 439
Pathology and Nature of Tubercle, ... 439
Microscopic Constituents of Tubercle, ... 443

Tuberculosis—*continued.* PAGE
Nature of the Softening of Tubercle, ... 445
Modes of Deposition and Site of the Deposits, . . . 447
Phenomena of the Softening of Tubercle, ... 449
Nature of the Constitutional State in Tuberculosis, . . 450
Spontaneous Healing of the Lung in Phthisis, . . . 452
Symptoms of the Cachexia which Precedes and Accompanies the Deposit of Tubercle, ... 454
Dyspepsia which precedes the Tuberculous State, . . . 455
Diagnosis of a "Pretubercular Stage," 457
Modes in which Tuberculosis betrays itself, . . . 459
Causes of Tuberculosis, ... 461
Influence of Latitude and Climate on Tuberculosis, . . . 463
Hereditary Origin of Tuberculosis, ... 465
General Treatment of the Tuberculous Cachexia, . . . 467
Hygienic Treatment of Tuberculosis, ... 473
Specific Diseases—General Remarks on their Nature, . . 475

CLASS III.

LOCAL DISEASES.

ORDER 1. BRAIN DISEASES.—*Cephalici.*

Increase in the number of Cases of Diseases of the Brain, . . 478
Constitution, Chemical Composition, Absolute and Specific Weight of the Brain, ... 480
Pathological Relations of Brain and Nerve Substance, . . . 483
Necessity for Exact Diagnosis in Brain Diseases, . . . 485
Morbid Anatomical Conditions of the Nervous Structures, . . 487
Locality of Brain Diseases, ... 489
Meaning of some Words in Common Use in describing Brain Diseases, . 490
Cephalic Diesases attended with a Frebrile State, . . . 491
Meningitis—its Definition and Pathology, ... 491
Symptoms and Diagnosis of Meningitis, ... 494
Symptoms of Tuberculous Meningitis, ... 496
Treatment of Meningitis, ... 498
Cerebritis *vel* **Encephalitis**—Definition and Pathology, . . 499
Red Softening of the Brain, ... 500
Gangrene and Induration of the Brain, ... 503
Symptoms of Cerebritis, ... 505
Symptoms Diagnostic of "Softening," 507
Diagnosis, Prognosis, and Treatment of Cerebritis, . . . 509
Cephalic Diseases, Characterized by a Group of Symptoms commonly called Apoplectic. 510
Apoplexy—its Definition and Pathology, ... 511
Changes in the Blood after Extravasation, ... 513
Symptoms of Apoplexy from Congestion, ... 515
Symptoms of Apoplexy from Hæmorrhage, . . . 517
Causes of Apoplexy and Prognosis, ... 521
Treatment of Apoplexy, ... 523
Cephalic Diseases, Characterized by Exalted or Perverted Functional Activity, 525
Chorea, or St. Vitus's Dance—Definition and Symptoms, . . 525
Morbid States of the Central Ganglia in Chorea, . . . 527
Symptoms of Chorea, ... 529
Prognosis and Treatment of Chorea, . . . 531

PAGE

Hysteria—its Definition, Pathology, and Symptoms, . . 532
Dr. Reynolds's Classification for the Diagnosis of Hysteria, . . 535
Causes of Hysteria, ... 537
Catalepsy—its Definition, &c., ... 539
Epilepsy—its Definition, ... 540
Pathology and Probable Constitutional Source of Epilepsy, . 542
Symptoms of Epilepsy, ... 544
Frequency of Certain Symptoms in Epilepsy, . . . 545
Causes of Epilepsy, ... 547
Diagnosis of Epilepsy, ... 549
Means of Detecting Feigned Epilepsy, ... 550
Prognosis and Treatment in Epilepsy, ... 552
Hydrocephalus—its Definition and Pathology, . . . 555
Morbid Anatomy in Hydrocephalus, ... 556
Symptoms and Chronic Form of Hydrocephalus, . . . 558
Prognosis, Diagnosis, and Treatment of Hydrocephalus, . . 560
Insanity—its Definition, Pathology, and Morbid Anatomy, . . 564
Testimony from Morbid Anatomy as to the Cerebral Nature of Insanity, ... 567
Causes and Increasing Frequency of Insanity, . . . 569
Hereditary Origin, Symptoms, and Forms of Insanity, . . 570
Premonitary Indications of Cerebral Mischief, . . . 573
Rule to be observed in Diagnosis of Insanity, . . . 581
Prognosis and Treatment of Insanity, ... 583

Diseases of the Spinal Cord and Nerves.

Progress of Anatomical and Physiological Discoveries, elucidating the Doctrines relative to the Nature of Spinal Diseases, . . . 587
Spinal Arachnitis—its Nature and Symptoms, . . . 592
Myelitis—its Nature, Symptoms, and Treatment, . . . 595
Neuralgia—its Definition, Nature, and Symptoms, . . . 600
Causes, Diagnosis, Prognosis, and Treatment, of Neuralgia, . 603
Paralysis—its Definition and Nature, ... 604
Conditions producing Paralysis of the Nerves of Motion, . . 604
Conditions of the Muscles in Paralysis, ... 607
Lesions which give rise to Hemiplegia, ... 608
Treatment of Paralysis, ... 609
Anæsthesia—its Symptoms and Diagnosis, ... 611
Causes and Treatment of Anæsthesia, ... 612

On the Diagnosis of Diseases of the Heart and Lungs.

Physical Examination of the Chest, ... 612
Inspection, Measurement, Palpation, Auscultation, and Characters of the Respiratory Sounds, Healthy and Morbid, . . . 615
Character of the Cardiac Sounds, ... 619
Nature and Mechanism of Cardiac Murmurs, . . . 620
Characters of Murmurs in relation to Orifices, . . . 622
Percussion, ... 623
General Symptoms of Thoracic Disease, ... 624

Order 2. Heart Diseases—*Cardiaci.*

Pericarditis—its Definition, Pathology, and Morbid Anatomy, . 626
General Symptoms and Physical Signs, ... 627
Prognosis and Treatment of Pericarditis, ... 631

PAGE
Endocarditis—Pathology and Morbid Anatomy, . . 633
General and Local Symptoms of Endocarditis, . . . 635
Carditis, ... 640
Hypertrophy and Dilatation of the Heart—Forms and Diagnostic Symptoms, ... 640
Causes and Prognosis of Endocarditis, ... 642
Treatment of Endocarditis, ... 643

Order 3. Lung Diseases—*Pneumonici.*

Pleuritis—*Pleurisy;* its Definition and Nature, . . . 645
Morbid Anatomy and General Symptoms, ... 647
Physical Signs of Pleuritis, ... 649
Treatment of Pleurisy, ... 651
Bronchitis—its Definition and Nature, ... 651
Morbid Anatomy of Bronchitis, ... 652
General Symptoms and Physical Signs of Bronchitis, . . 655
Diagnosis and Treatment of Bronchitis, ... 657
Pneumonia—Nature and Forms, ... 659
Symptoms of Pneumonia, ... 661
Physical Signs of Pneumonia, ... 663
Conditions Producing Consolidation of the Lung, . . . 665
Laennec's Treatment of Pneumonia, ... 667
Phthisis—Symptoms of Phthisis, ... 669

Order 4. Bowel Diseases—*Enterici.*

Peritonitis—Definition and Nature of Peritonitis, . . . 674
Symptoms, Causes, and Diagnosis of Peritonitis, . . . 677
Ascites—Morbid Conditions Associated with it, . . . 679
Active and Passive Ascites, ... 680
Diagnosis and Prognosis in Ascites, ... 683
Stomach Diseases—their Nature and Morbid Anatomy, . . 685
Intestinal Juices and Gastric Softening, ... 687
Softening of the Stomach, ... 686
Glandular Degeneration of Proper Mucous Substance, . . 689
Forms of Congestion, ... 690
Forms of Gastric Inflammation and Condensation of Tissue, . 691
Forms and Symptoms of Gastric Ulceration, . . . 693
Abnormal Functional States, ... 694
Treatment of Stomach Diseases, ... 695
Diseases of the Lesser Intestines, ... 696
Softening of Tissue, ... 697
Glandular Lesions and Degenerations, ... 697
Congestion and Enteritis, ... 700
Treatment of Enteritis, ... 703
Diseases of the Liver—their Nature and Morbid Anatomy, . . 704
Hepatic Congestion, ... 705
Hepatic Abscess, ... 706
Symptoms of Superficial and Deep Hepatitis, . . . 707
Prognosis and Treatment of Hepatitis, ... 708
Increased Secretion and Elimination of Bile, . . . 709
Nature, Symptoms, and Prognosis in Jaundice, . . . 710

ORDER 5. *Nephritici.*

PAGE

Nephritis—Definition and Pathology of Inflammation of the Kidney, . 712
Bright's Disease—Definition and Pathology, . . . 714
Symptoms of Bright's Disease, ... 716
Diagnosis, Prognosis, and Treatment of Bright's Disease, . . 718
Diabetes Mellitus—*Melituria*, Definition, and Pathology, . . 719
Bernard's Observations on the Secretion of Sugar by the Liver, . 721
Its Formation Excited by Reflex Action, ... 723
Tests for Sugar in the Urine, ... 725
Prognosis and Treatment of Melituria, ... 725

PART III.

MEDICAL GEOGRAPHY; OR, THE GEOGRAPHICAL DISTRIBUTION OF HEALTH AND DISEASE OVER THE GLOBE.

Scope of this Department of the Science of Medicine, . . . 727
Geographical Distribution of Disease-Realms, ... 727
Sources of Information on the Subject (*note*), . . . 727
Isothermic Zones, ... 728
Realms of Disease, and Description of the Map, . . 729
1. Diseases of the Tropical Realms, ... 729
2. Diseases of the Temperate Realms, ... 730
3. Diseases of the Extreme Northern Realm, . . . 732
Acclimation, or the Influence of Climate on Man, . . . 733
Definition and Nature of Acclimation, ... 733
Persistent Pernicious Influence of Malarious Districts, . . 737
Conclusion, ... 738
Practical Bearings of the Subject, ... 739

APPENDIX, showing the Average Mortality in Different Countries and Places, 741

INDEX, ... 743

INTRODUCTION.

SECTION I.

OF MEDICINE AS A SCIENCE AND AS AN ART; ITS OBJECTS AND ITS EXTENT.

THE study of MEDICINE is prosecuted under two relations, namely, as a *Science* and as an *Art*. MEDICINE, considered as a *science*, takes cognizance of all that relates to the existence and the nature of diseases, their prevention and their treatment; considered as an *art* (in so far as Medicine has that practical value), its object is to distinguish, prevent, and to cure diseases.

Many branches of human knowledge are combined in the constitution and elucidation of the *Science;* and the practice of Medicine as an *Art* ought to be founded on principles and facts of universal, or at least of extensive applicability.

The great object and aim of the Science is to alleviate human suffering, and to lengthen out human existence, by warding off or by modifying disease "as the greatest of mortal evils," and by restoring health and even at times reason itself, "as the greatest of mortal blessings."

A consideration of the different topics which together make up the Science of Medicine, suggests a division of the subject into the following departments, namely :—(1.) PHYSIOLOGY, which embraces the study of the healthy functions of which the human body is the seat or instrument. (2.) PATHOLOGY, subdivided into *Special Pathology* and *General Pathology*, which together embrace a consideration of everything relative to the existence and nature of disease: Special Pathology being intended to comprehend the consideration of the essential nature and origin of particular diseases as they occur in man and animals, and General Pathology to include those more general facts or principles which result from the comparison of particular diseases with each other. (3.) THERAPEUTICS, which exhibits a general view of the various actions of remedies in the diseased economy or the means by which Nature may be aided in her return to health. (4.) HYGIENE, which embraces a consideration of the means of preventing disease, or in other words, of preserving health.

Physiology, General Pathology, Therapeutics, and Hygiene, are sometimes designated indifferently by the titles of the "*Institutes*," the "*Institutions*," or the "*Theory of Medicine.*"

These departments of Science are all preliminary subjects of study, and constitute a necessary and appropriate introduction to the Practice of Physic, in which Special Pathology and the treatment of special diseases are the leading topics of consideration.

Each of these departments has grown or expanded itself into a great branch of science, and any single section is sufficient of itself to occupy the lifetime of an individual in working out and studying it in detail. It is, therefore, not possible for the human mind to embrace all of them in their whole extent, and their bearings or relations to each other; and setting aside the consideration of theories and systems, it has been truly observed "that no man possesses all the pathological knowledge contained in the records of his art" (CHOMEL); and it is, therefore, far less possible to embrace in any single treatise a view of the science of Medicine in all of these departments.

For the purpose of teaching the science of Medicine in its application to practice, its elementary principles, as developed in the departments of Pathology, are the most useful guides to the student.

Although Special Pathology comes first in the order of Nature, yet, wherever the arrangements for Medical education are complete, General Pathology is taught as an introduction to, or conjointly with, the special study of diseases, just as in other sciences,—for example, in chemistry, it is found convenient to give a general view of the principles which have been established by special experiment and observation before entering upon the particular details of the science.

It is intended, however, in the introductory part of this handbook merely to guide the student to notice—(1.) How the nature of diseases have been, and are now, elucidated; (2.) The means and instruments of investigation into their nature; (3.) An account of some of the more elementary constituents of disease; (4.) An account of some complex morbid states associated with individual diseases.

In the body of the work it is intended to consider some of the details of the practice of Medicine, to furnish the student with:—

I. A nosological system by which to classify and name diseases.

II. A detailed description of some characteristic diseases in the respective classes of that nosological arrangement. Under this topic a definition and a history of the nature of each disease is given, the probable course and succession of events are described, and the grounds on which an accurate diagnosis may be made, or a prognosis expected, together with a detailed account of those rational modes of treatment which are consistent with the established principles of the *Institutes of Medicine.*

III. An account of what is known relative to the geographical distribution of diseases.

How the Nature of Diseases may be Elucidated.

The derangements to which the human body is liable may be studied under the three following aspects :—(1.) As they present themselves in individual cases, becoming thereby the subjects of CLINICAL INSTRUCTION ; (2.) As they constitute particular genera or species of disease, forming the topics of SPECIAL PATHOLOGY ; (3.) As they may be reduced to and studied in their primary elements, forming thereby the science of GENERAL PATHOLOGY.

But in whatever aspect we may view disease there is invariably presented to the student the same subjects for investigation, namely,—*First*, The morbid phenomena or symptoms by which we become aware that derangements have taken place in the economy. It is by a mental effort that either the student or the physician must convert these symptoms into signs of disease ; and hence arises the necessity of studying *Symptomatology*, or *Semeiology*. *Second*, The agents by which derangements and diseases are produced, generated, or brought about, constituting the department of *Etiology*. *Third*, The seats or localities of disease, or of derangements ; the peculiar nature, general forms and types of disease must be studied, together with varieties in their course, duration, and termination, constituting *Pathogeny*. *Fourth*, The morbid alterations discoverable in the structure of the body, before, but more especially after death, constituting *Morbid Anatomy*, must be studied in connection with the symptoms, the causes, and the course of the disease. *Lastly*, The elementary constituents of diseased products, constituting *Morbid Histology*, must be in the first instance recognized and contrasted with the analogous constituents of the healthy state.

Relative Nature of the Terms Life, Health, Disease.

The word *Disease* is used in a general and also in a specific sense ; as when it is said that a person is diseased, without stating the nature of the affection ; or that he suffers from a particular disease, such as small-pox. The attempts to give a logical definition of the term *Disease* have all been unsuccessful. The relation of the state to the condition of health, and of health to the performance of the vital functions, are of such a kind that their phenomena can merely be described in their relations to each other, but not defined.

If *life* is understood to imply that active state resulting from the concurrent exercise of the functions of the body, then there are conditions of activity and of mutual adaptability of states and

of parts, both as regards body and mind, which are necessary to the state of health.

Our notions of *the conditions of health* have thus considerable latitude. "*Health*" is merely a name we give to that state or condition in which a person exists fully able without suffering to perform all the duties of life. Many degrees of this state are therefore at first sight obvious, from the mere evidence of the possession of a feeble existence to the most robust condition of the body; and there are many degrees of feebleness and delicacy of health which we cannot call either disordered or diseased states of the frame.

So extremely indefinite is our notion of normal life, that it is only by a forced abstraction the normal can be separated from the abnormal. Hence also our idea of *disease* is very indefinite; it cannot be separated by any well defined boundary from the idea of *normal life*, and the two conditions are connected by a kind of debateable border land.

When we observe, therefore, the phenomena of the living state and the conditions of health, we can readily observe when and how *disease* is but "*a deviation from the state of health, and consisting for the most part in a change in the properties or structure of any tissue or organ which renders such tissue or organ unfit for the performance of its actions or functions according to the laws of the healthy frame.*"

It is now a received pathological doctrine that "*disease*" does not consist in any single state or special existence, but is the natural expression of a combination of phenomena, whose instruments of vital action are impaired in function or altered in structure.

All attempts, therefore, to define disease by the use of such terms as "*derangement*," "*modification*," "*alteration*," "*change*," from the pre-existent state of health, show in the first instance that very various ideas are attached to the term or to the state; and, secondly, these terms point to a nosological division into structural and functional disease rather than to a state common to all forms of disease.

A definition of any state of disease ought to include all the circumstances, whether functional or organic, which constitute the deviation from health; and for very obvious reasons such a definition can only be approximatively expressed.

Principles by which Diseases have been Distinguished and Classified, and their Nature Determined and Explained.

The associations or groups of morbid phenomena which constitute disease have been distinguished in a variety of ways, each of which has at one period or another been in common use.

Although diseases are named as if they were individual entities, yet they present so great varieties that they will not admit of that species of classification which can be made with objects of Natural History. But as in the healthy body we can observe the properties of its functions and the structure of its parts, so in disease we can observe the phenomena which constitute the morbid states. We can also often recognize the constituent elements of disease or material changes, which affect the organs and functions of the body. They become perceptible to the eye or the feelings; or by instruments or other methods of research these material changes become the subjects of pathological study in the department of morbid anatomy. But there are also many conditions of the vital phenomena which are obviously morbid, the nature of which cannot be determined during life, and when death affords an opportunity for anatomical investigation, no material change is capable of being detected by the most zealous pathologist. Chemistry, however, in such cases sometimes demonstrates that chemical changes of a quantitative or qualitative kind are connected with the morbid state.

The grounds on which diseases have been classified may be described under the following seven divisions, namely :—

I. *The nature of the ascertained causes of disease.* On this principle two classes of diseases are recognized, namely—(1.) Diseases arising from general causes; (2.) Diseases arising from specific causes.

II. *The pathological states or conditions which attend diseases.* The principle of this classification consists in determining alterations of structure or chemical composition of parts, from which names are given to the disease, *e. g.*, pleuritis, pneumonia, &c. The distinctions of Sauvages (1768) were generally derived from symptomatic and pathological characters, or external symptoms alone; Cullen following (1792), adopted similar grounds of classification.

III. *When the properties, powers, or functions of an organ or system of organs are deranged.* By this principle of classification the most prominent effects or phenomena of morbid states are considered as the disease; *e. g.*, palpitation, diarrhœa.

When disease consists in perverted powers or functions, it is then denominated a *dynamic* affection or disorder. When it depends on change of structure, it is termed an *organic* lesion or disease.

This third basis of classification is Physiological, and was adopted by Mason Good.

IV. The diseases comprehended under the two latter principles of classification are sometimes inaccurately and loosely brought together under the heads of *Structural* and *Functional* diseases. The diseases of function, for instance, being made to

embrace the *neuroses*, *hæmorrhages*, and *dropsies;* while *inflammation*, *tubercle*, *cancer*, *melanosis*, *hypertrophy*, and *atrophy*, are the subordinate classes of the diseases of structure.

The diseases of function embrace all those diseases in which the action, the secretion, or the sensation of a part is impaired, without any primary alteration of structure of the organ or tissue affected, so far as our imperfect means of research can ascertain. Thus, *mania*, *catalepsy*, *neuralgia*, are *neuroses* of the brain or other portion of the nervous system. *Colic*, *vomiting*, *diarrhœa*, and *constipation*, are *neuroses* of the alimentary canal; and so on of other parts. *Hæmorrhage*, or the effusion of blood, and *dropsies*, or an effusion of water into the shut cavities of the body, as that of the head, chest, or abdomen, are also instances of functional disease. Such are the grounds of classification adopted by the late Dr. Williams of St. Thomas's Hospital, London.

V. A basis of classification has been adopted, founded on *the pathological nature of the different morbid processes*, but the arrangement of the orders and subdivisions are determined by the anatomical arrangement of the textures and organs of the animal body, as originally developed by Bichat and others.

Such is the principle and mode of classification adopted by Dr. Craigie (1836).

VI. A ground of classification exists, having reference to *the general nature and localization of the morbid states.* It comprehends three classes,—(1.) Diseases which occupy the whole system at the same time, and in which all the functions are simultaneously deranged; these have been named general diseases, such as *fevers.* (2.) Constitutional affections, meaning thereby diseases which display themselves in local lesions in any part, or in several parts of the system, but not in all parts at the same time; *e. g.*, *rheumatism*, *gout.* (3.) Local morbid processes.

Such is the classification adopted by Dr. Wood of Pennsylvania (1847).

VII. Applying the principles of a *purely humoral pathology*, we have a classification consisting of—

a. Fevers.

b. Dyscrasiæ, *e. g.*, *tabes*, *chlorosis*, *scorbutus*, *dropsy*, *diabetes*, *pyæmia*, *tuberculosis*, *carcinoma.*

c. Constitutional diseases, induced by—(1.) Specific agents; (2.) Vegetable substances.

Such is Wunderlich's arrangement of diseases (1852).

None of these principles lead to a complete or perfect classification, because diseases are not yet sufficiently understood to permit us to see clearly their mutual relations. The tendency of modern investigations by the varied instruments and methods of research,

proves that many diseases hitherto supposed to be altogether functional, are accompanied with changes of structure, either of an anatomical, physical, or chemical kind. It is, therefore, not unreasonable to anticipate that all the so-called functional maladies will be found to depend upon some concomitant alteration of structure ; and when we are unable to detect an alteration either of the solid or fluid parts of the body, in cases where the existence of disease cannot be doubted, we must attribute our failure to the imperfection of our means and instruments of observation, or our modes of using them. In the present state of our knowledge, however, there are diseases which have baffled the attempts of the morbid anatomists to associate them with structural changes of a characteristic or constant kind. Some convulsive diseases of the nervous system are of this class.

In the present imperfect state of our knowledge, therefore, diseases cannot be philosophically classified ; and their names must yet be derived from some constant and striking feature of the morbid state, whether structural or functional. When no change of structure can be detected, the definition of the disease should include the most prominent symptoms only. Most of the diseases of the nervous system are named in this way. The following considerations generally regulate the naming of a disease :—The first alteration of the animal economy upon which all the subsequent changes depend, is generally recognized as the essential element of the disease (*pleuritis, tuberculosis*) ; and if such cannot be discovered, the first tangible link in the chain of causation is used instead (*typhous poison*) ; next to that, the most characteristic symptoms furnish the name (*palsy, diarrhœa*) ; and if death at once follow the application of a cause, that cause generally names the disease (*lightning, prussic acid, arsenic*).

It is obvious from these statements, that the names of diseases must change as our knowledge changes and becomes more precise ; and many diseases which were once named after their symptoms, are now called according to the lesion from which most of those symptoms proceed. An apt illustration of this is to be found in paralysis, which is no longer regarded as a disease *per se*, but is merely a symptom of several structural alterations of the brain and spinal marrow ; and so also *diarrhœa*, which now ought to be excluded as a disease from tables of the causes of death. For reasons given in Part I., the classification of our Registrar-General has been adopted, and with some change of place in the arrangement, as given by Dr. Farr, diseases are described in Part II. of this handbook.

SECTION II.

MORBID ANATOMY AND PATHOLOGICAL HISTOLOGY:—THE MEANS AND INSTRUMENTS BY WHICH THE NATURE OF DISEASES ARE INVESTIGATED.

MORBID, or as it is also sometimes called, PATHOLOGICAL ANATOMY, is that department of medical science which treats of the changes produced by disease in the solids and fluids of the body; while MORBID or PATHOLOGICAL HISTOLOGY treats of the origin, development, growth, and decay of the new products or new formations, which are the elementary constituents of structural or organic diseases. They stand in the same relation to the development of morbid phenomena and conditions of disease that the anatomy of healthy structures and the histology of the textures do to the natural functions and process of development, growth, and nutrition in the healthy body.

The vestiges left by the prolonged existence of a morbid state, whether in the body of man or of the lower animals, have always claimed from the physician a large share of attention; and in proportion as a knowledge of healthy anatomy and physiology has become extended and prosecuted in all its bearings, so has pathological science been extended, and morbid anatomy has gradually but steadily acquired an important and prominent position among those branches of study on which medicine rests its claims as a science.

It is a department of medical science which has gradually grown out of the accumulated experience and observation of ages. As a science, PATHOLOGICAL HISTOLOGY is of modern origin. It is but yet in process of development, but its foundations may be traced in the works of the earliest medical writers of antiquity; for all of them refer to changes which they *merely supposed* to take place in the internal organs; and they were doubtless led to the assumption by observing the connection that existed between structural lesions of the external parts and their accompanying symptoms. Hippocrates describes the deposit of tubercles in the lungs, the symptoms occasioned by them in a crude state, and those which attend their softening and discharge.

The science of MORBID ANATOMY is a record of facts. In its relation to the progress of medicine, it is a history or living record, whose pages must be ever open to receive the observations which are constantly being made by those engaged in pathological pursuits, and a record from which one may ascertain at any time the conditions under which morbid changes or new formations in the body have

taken place. The pages of this record show that at the present day the department of pathology is in a transition state; and the position of medicine, as a science, must now result from a re-arrangement of the innumerable details which the records of morbid anatomy and histology can disclose and unfold. It is necessary, therefore, and often advantageous to look back upon the past and see what has already been done, so that its venerable facts may not be lost sight of, but grouped in series with the extensively verified experiments and observations of the present day. In so doing, if we pause and contemplate the steps which have been taken to arrive at our present position, such a contemplation may stimulate the youthful student to the noblest exertions of his intellect, as he cannot fail, with extensive study, to see before him and on every side, much unlaboured but productive soil.

Such a retrospect will at the same time have the effect of placing in a prominent aspect the varied influences which morbid anatomy has had on the science of medicine, the conditions under which it has flourished, and the legitimate objects of its investigations.

The art of printing was not long invented when books on morbid anatomy began to be printed, and although the early period of the fifteenth century has left little enduring literature of any kind, but has been mainly distinguished by the number of colleges then founded, yet it is about that time that pathological anatomy in the medical school of Florence shows the earliest traces of its existence.

The increase in the facilities of study soon stirred up ardent students; and the sixteenth and seventeenth centuries produced much that will ever remain famous in the annals of medical science. Eustachius, Tulpius, Ruysch, Harvey, Malpighii, and Leuwenhoeck, are names familiar as household words to the student of medicine.

The earlier attempts of this period to form a system of pathological anatomy is characterized by abortive endeavours to explain all results upon some exclusive and general principle. A spirit of speculation marks the character of the age. The men of that period had observed but few facts, and on these facts they preferred to speculate and dogmatize, rather than prosecute the farther interpretation of nature, or record the observation of more. Accordingly, theories in abundance successively led captive the minds of the medical world, and disappearing one after the other, demonstrated the unstable nature on which the science of medicine had been placed. The leader of each sect founded his so-called school or system, all of them distinguished by a due amount of arrogance and contempt for predecessors and contemporaries, a feeling unhappily not yet quite extinct. The "*vital agency*," the "*influence of the humors*," and of the "*solid organs*," have each been con-

sidered by turns as the only orthodox belief; and each has had their school and sect respectively designated as the *Vitalists*, the *Humoralists*, and the *Solidists*. The theories of Galen, of Paracelsus, and others, have all been famous in their time, but are now unheard of, and almost unknown. The same fate awaits the false theories and absurd conceits of more recent origin, although, as in the case of Stahl, Cullen, Brown, and Broussais, they have had a wide prevalence in the schools of Europe, and made impressions on the sentiments of the profession which yet influence their motives of practice, and the reasons of their belief. Broussais*ism*, Hahnemann*ism*, and some other systems, "the fruits of a luxuriant fancy and of few facts," must all, like the others, descend the same inevitable slope to oblivion; but the vast collection of facts which the founders of such systems accumulated, are as unchangeable as nature, and will continue to recur in the daily experience of our profession, just as they appeared to the venerable fathers of medicine centuries before the Christian era. The practice of medicine on rational principles, and a knowledge of the nature of diseases, has oscillated through all these systems and theories, and morbid anatomy throughout has been marked by unmistakeable periods of *progress*, of *stationary existence*, or even of *retrogression*, according as one or other exclusive system had the ascendency, or as each principle challenged for itself a supreme importance.

The modern doctrines relative to the nature of disease and the practice of medicine may be said to be guided by the dictates of physiology, and what is known regarding the development of the human body. Ordinary dissections alone, or post mortem examinations of the body, have long since ceased to furnish us with facts before unknown; and new modes of extending observation and research, by taking advantage of every physical aid to the senses are diligently looked for by the modern anatomist, physiologist, and physician; and the means and instruments which advance the science of physiology are well able to advance our knowledge regarding the nature of disease-processes.

Organic chemistry and the microscope have opened up new fields of labour, which are being diligently cultivated; and while alterations in the ultimate tissues and organs are more especially attended to, the first beginnings of disease and the development of new formations, claim a large share of attention.

Histology, or the study of the development and arrangement of the tissues in the formation of normal and healthy organs, is characteristic of the anatomical investigations of the present day; while the histology of morbid products and chemico-physiological investigation into the nature of morbid changes is characteristic of the pursuits of the science of modern PATHOLOGICAL ANATOMY.

It is also a very significant fact, that now, in the nineteenth century, the leading doctrines of the *humoral* pathology which prevailed in the seventeenth are again revived. The experience and learning of that erudite period are now being made available for modern uses. By the improved means, instruments, and methods of research of modern times, important truths may be sifted from the errors and theories with which they are mixed up in the ancient chronicles of medical science; and when we get analogous conditions of disease with which the phenomena described by the ancients may be compared, "not a few of the apparently modern beliefs are daily found to have a time honoured reputation unappreciated before."

The chemist and the histologist now combine their researches, and work hand in hand; and we regard them as the most inquisitive anatomists of the time. They lend assistance of the most important kind in working out the foundation of our knowledge regarding the nature of diseases, the details of which can only be made more certain and perfect by taking advantage of every kind of scientific knowledge which can be brought to bear upon medical research, and more especially,—

(1.) By physical aids to the senses in the use of the stethoscope and other instruments of auscultation, as well as in the use of the microscope, aided by a careful study of the writings and labours of the men who have more particularly devoted their attention to observations aided by such means (Laennec, Louis, Walshe, Stokes, Hope, Bennett, Queckett, Vogel, Beale).

(2.) By the knowledge (gradually being made more extensive) of the textures, organs, and functions of the body, whose normal exercise constitutes a healthy existence (Longet, Muller, Sharpey, Valentin, Allen Thomson, Carpenter, Kirkes, Paget, Köl-liker).

(3.) By an intimate knowledge of the normal development of the human textures as well as those of plants and animals from the fecundated ovum (Bischoff, Costa, Allen Thomson, Huxley, Newport).

(4.) Besides these kinds of investigations the science of practical medicine is being advanced by what may appear to some as an objectionable means of research, namely, by operations (vivisections) and experiments upon the internal organs of living animals; and at some of our great schools of medicine, such investigations are now being actively prosecuted and taught; as by Bernard in Paris, Drs. G. Harley and Pavy in London.

Successful inquiries into the nature of diseases cannot be said to have commenced till the middle of the eighteenth century, when the great work of the *lifetime* of Morgagni issued from the press. In the eightieth year of his age, and not till then, did he consider

himself warranted to publish his observations, *De Sedibus et Causis Morborum* (1761); a work whose material and circumstances of publication read us the practical lesson, that the more frequently a disease occurs, the more necessary it is that its phenomena should be carefully investigated. And when we observe also the prudent reserve, the anxious and the conscientious delay exhibited by Harvey, Morgagni, and by Jenner, in the publication of their respective researches, we cannot but contrast the circumstances with those under which the exuberance of medical publications are now given to the world.

Morgagni modified and corrected many of the views entertained and promulgated by his predecessors; and the study of the nature of diseases was carried into the commencement of the present century by Cullen, William and John Hunter, Portal, and Bichat.

The knowledge of the physician regarding the nature of disease-processes may now be observed to have advanced simultaneously with that of *general anatomy;* and when the component parts of an organ and of the human body came to be distinguished, it was soon observed, also, that membranes and tissues might be individually diseased while neighbouring membranes and tissues remained untouched. Bichat's idea, therefore, of decomposing the animal body into its elementary parts, must be regarded as the foundation of modern special pathology; and while he pointed out the necessity of studying diseases with reference to the different tissues as separately and specially affected, it has been since shown in a remarkable manner how general anatomy, deduced from physical properties of parts and crude observation, may coincide with more minute investigations of a chemical and microscopical kind. The membranes and tissues composing organs roughly torn asunder by Bichat, are now themselves being daily subjected to a more inquisitive analysis of an anatomical and chemical nature, which have unravelled them into still more minute histological elements.

Although, therefore, Bichat entertained the view that each tissue had its own *diathesis*, it is to Cullen and the Hunters in this country more especially, that the application of the distinction of tissues was made to illustrate the nature of disease-processes.

Cullen's descriptions of diseases are descriptions of groups of phenomena which comprise complex morbid states.

The written labours of the Hunters form but a small part of the memorials of what they did to elucidate the nature of diseases, and it is only those who, having had an opportunity of carefully investigating their museums, preserved in London and in Glasgow, are able to form any conception of the comprehensive nature of their

labours, or can assign to them a proper place among those who have successfully advanced the science of Medicine. They hold a position at least one hundred years in advance of the age in which they lived. Bichat, Cullen, and the Hunters, in their respective countries, have thus reciprocally influenced and advanced the progress of our knowledge regarding the nature of diseases.

Although it was reserved for Bichat to complete a more perfect system of general anatomy, it must not be forgotten that Dr. Carmichael Smith, in 1790, applied his knowledge of textural anatomy to elucidate the nature of disease-processes, and that Pinel, after him, in his *Nosographie Philosophique*, made the distinction between the membranous and other animal structures the foundation of his pathology. The classic work of Baillie, his *Morbid Anatomy*, published in 1793, closed the labours of the past century.

If we look now to the tendency of the studies and researches of those men we have now mentioned, including Bichat, we shall find the truth gradually being more fully appreciated, that it was necessary to study alterations of structure so as to connect morbid changes with the symptoms of diseases during life, and with the operations of ascertained causes of morbid action.

Thus the progress of morbid anatomy is, in a great measure, a record of the history of Medicine ; and, we can trace the science of special morbid anatomy, giving a character to the various systems of the healing art which have prevailed from time to time.

The nature of the morbid changes were now observed to be more apparent in the progress of external diseases ; and therefore surgical experience was brought to bear upon the elucidation of internal disease-processes.

All the writers up to the time of Bichat, Laennec, and Abercrombie, were pure morbid anatomists, who did not connect the effects of disease with their causes, and who recognized the changes of disease as important in proportion to their magnitude as apparent to the senses. They are, therefore, to be regarded as pure solidists, whose researches contributed much towards a correct knowledge of the changes in the organization of the body, while at the same time the condition of the fluids of the body was neglected, as well as the relation of the texture, organs, and fluids, in their combined exercise of function. Simple functional disturbances were wholly overlooked, and the constitutional connection of local affections entirely lost sight of.

The cotemporaneous surgery of the period previous to Bichat was marked by its unwillingness to recognize anything but material facts, mechanical processes, and contrivances. The surgeons of those days desired to know nothing but anatomy and mechanics; and, accordingly, it may be recognized as the period of pure ana-

tomical and mechanical surgery, distinguished by the works of men whose every individual page bears ample testimony that the surgery of the period was founded on exact and even minute anatomical knowledge. No allusion is made, however, by them to medicine—they make no application of physiological truths, and they encourage no therapeutic tendency apart from mechanical or instrumental interference.

The purely solid as well as the purely humoral principles by which the nature of diseases have been explained may be said to have long ago died a natural death; but, as already noticed, the remembrance of what is valuable in the results of both are preserved in the modern pathology, which takes its stand upon anatomical and physiological facts, connected by simple methods of inductive observation, with the symptoms and signs of disease as seen and expounded to the student by the distinguished professors of Clinical Medicine at most of our celebrated Metropolitan schools.

In this field of instruction it seems invidious to mention here the names of men still living. For their own sakes as well as for science may they be long deprived of being thus honourably and respectfully mentioned. As teachers, they are in our own country familiar to every student. As recorders of what they observe at the bedside and after death, they are not less celebrated abroad than appreciated at home.

Tested by extensive clinical observations, the character of the present period in the history of Practical Medicine is one of *probation* as well as of *progress*, marked by a close inductive examination of past generalization and classification of facts, however remote, which illustrate the nature of diseases and their treatment.

Side by side since 1816 and 1819 the microscope and the stethoscope, under the influence of such men, have advanced our knowledge of the nature of diseases with a regular and accelerated velocity; but they have only done so as assistants and in subordination to laws and facts, whose knowledge we have acquired by a close observation of general symptoms. Such instruments have never been intended to take precedence of the close observation of general symptoms. They have never accomplished, nor can they ever accomplish, useful practical results to the exclusion of such other methods of observation as I have just noticed. We are not to confound *relative* smallness with *absolute* simplicity, and believe that because a simple organic cell is a small object, which, because we can see around it, through it, and on every side of it, the functions and conditions of its existence are less *complex* or less obscure on that account than are those of a more complex organ, or the functions and existence of a living body.

We are not to suppose that because the stethoscope enables us

to detect a mitral murmur, or a crepitation in a lung, we are justified at once in adopting one, and only one, method of treatment. It is this exclusive use of instruments to the disregard of general symptoms, and signs of disease derived from close observation and knowledge of the living functions, which leads to the repudiation of the use of such instruments by the sagacious and experienced physician, who sees the numerous errors not unfrequently committed by his younger brethren, trusting too exclusively to these instruments in the diagnosis of disease.

Like the stethoscope, the microscope has been unjustly and unnecessarily burdened with labour, and has been equally unjustly blamed and brought into unmerited discredit when it has failed to elucidate the nature or even presence of a morbid state, the existence of which could not be doubted, but which the sense of sight could not appreciate, even when presented in small quantities greatly magnified. In such instances the microscope has been applied to uses, which it is not the nature or province of the instrument to detect. The gravimeter or hydrostatic balance, the microscope, the stethoscope, the pleximeter, are merely instruments of pathological inquiry, each one adapted for the determination of particular classes of facts, and can only elucidate disease when they are brought to bear upon the physical properties of the textures, organs, and regions, the nature of which they are able to appreciate ; and it is only from their *combined and appropriate* use in connection with the general signs and symptoms, that our knowledge of the nature of diseases will be advanced.

In all the temperate regions of the world, histology, as applied to morbid products, has been cultivated, and has advanced our knowledge regarding disease ever since 1838. In warmer latitudes, our knowledge of practical medicine has been advanced by extensive observations on physical climate, medical topography, and by organic chemical analysis applied to obtain therapeutic agents from the vegetable world. These may be said to be the characteristics of the researches of our own country, Germany, France, and America, as compared with the nature of the observations prosecuted in India.

No exclusive doctrine will now stand the test of well directed pathological inquiry ; the main object of which is to connect all organic changes (lesions) and functional derangements, with their symptoms and causes, with the view of applying rational remedies and prophylactics.

The too exclusive study of pure organic pathology and morbid anatomy leads to no distinction between the signs and causes of disease ; and the obvious tendency of such exclusive study is to exaggerate the importance of the principles it may establish, to hold

out no hopes of cure, and to undervalue the power of remedies and remedial measures. To obviate this tendency, it is necessary to have recourse to inductive reasoning, so as to connect all the morbid changes seen or appreciated after death with the signs and symptoms of disease observed during life. Thus it is that links in the chain of disease-processes, which, from a one-sided or exclusive view, appear isolated and localized, are found to be connected with, it may be, a long, but intelligible series of processes developed during life throughout the metamorphosis of tissue, and going on in apparent health or obviously morbid exercise of function. The constitutional origin of many local diseases, otherwise inexplicable, then becomes apparent.

Among the more eminent exponents of this rational school of pathology, who at an early period in this country decerned and appreciated such doctrines, we find such names as Mr. Allen, Golding Bird, Sir Robert Carswell, Gregory, Hope, Hodgkin, Marshall Hall, Prout, William Stark, John Thomson, Tweedy Todd, and many others, who, although now no more, have left behind them imperishable evidence of their labours. The younger pathologists of the present day, whose name is *Legion*, follow now in the footsteps of these men, extending the fields of observation and the boundaries of the science of medicine.

By them the importance of morbid anatomy is now sufficiently appreciated, and its province distinctly defined and limited as follows, namely:—(1.) To detect the changes which have taken place during the course of diseases in the structure of tissues and organs of the body; (2.) To demonstrate the exact seat of local alterations established during the progress of disease.

The investigation and elucidation of the *nature*, *course*, and *causes* of those changes, constitute the prominent objects of the science of pathology. By the aid of morbid anatomy and clinical observation during life, pathology seeks to establish the relations of the changes which lead to the evidence of lesions, and so to connect the general progress of disease with its symptoms.

Morbid anatomy goes beyond its province when it attempts to point out the nature of the proximate cause of disease. It is only by the application of inductive reasoning that the connections of causes and morbid effects can be shown, and such constitutes the main object, and is the highest aim of the science of pathology.

The *morbid anatomist* finds a lesion or change for what ought to be the natural structure, appearance, or condition of a part. The *pathologist* seeks to connect such lesions with signs and symptoms during life, that the *practical physician* may suggest a remedy to the disease; and that the *nosologist* may give it a name, distinguishing characters, and a place in his classification of diseases.

SECTION III.

THE ELEMENTARY CONSTITUENTS OF LESIONS IN DISEASED STATES AS SHOWN BY MORBID ANATOMY AND OTHER MEANS OF RESEARCH.

WHERE the effects of disease can be rendered obvious they are found to consist for the most part of—

(1.) Morphological changes in the elementary textures of the body generally.

(2.) The presence of new formations foreign to the normal condition of an organ or system of organs.

(3.) Change in the position or form of some of the organs or parts of organs.

(4.) Deposits or changes in the elementary parts of tissues.

The object of prosecuting the anatomy of disease is, therefore, in the first instance, to institute a comparison between the known appearances or standard of health, and what may be an altered state of the parts. Such a comparison is, in the first instance, founded on an intimate knowledge of the doctrines stated at page xix.

Means and Instruments of Research.—To institute a comparison such as that indicated at page xxvii., advantage must be taken of almost every branch of human knowledge. The instruments and methods of pathological research are, therefore, very varied, but may be shortly enumerated under the following heads :—

(1.) The opening of dead bodies, to ascertain the condition of their organs and tissues in all that relates to their structural, chemical, and physical properties.

(2.) Application of various instruments, such as the microscope ; and of means to ascertain the absolute and specific weight of organs or parts, the relation, size, form, and colours of structures, and the like (QUECKETT, BENNETT, BEALE).

(3.) Application of chemical investigations to the diseased products (VOGEL, SIMON, DAY, LEBERT, GLUGE, BEALE, GARROD, CHRISTISON, PARKES).

(4.) Application of statistics to determine various points of interest in reference to the nature, course, and complications of diseases.

(5.) Means to preserve objects for further study by the microscope or any other mode of examination (TULK, HENFREY, BEALE, QUECKETT).

(6.) Experiments instituted on living animals, and, in certain cases, on man, with the view of artificially producing a morbid condition. A careful study of such experiments by the previously mentioned means affords valuable information, for the causes in action are

more under control than those which are spontaneously brought about by disease in the living body (Bernard, Harley, Pavy).

The immediate object of such investigations is to obtain information regarding the material changes in the different parts of the body which accompany or produce morbid symptoms, and to connect these changes with symptoms and signs of disease during life.

We learn how morbid products are formed at first and gradually perfected. By combining these two kinds of knowledge we learn the relative and invariable connection of the two orders of phenomena; namely, how the perverted properties, disordered actions, or altered structures give rise to perverted or impaired secretions, disordered and irregular motions; deranged, impeded, or interrupted functions; in other words, the "*order of invasion of diseased processes*" is learned from such investigations, and the effects of complications to which diseases are liable.

We learn how parts, once the seat of morbid change, return by various processes of nutrition, growth, or reproduction, to their normal condition.

The questions arising out of such investigations are or ought to be the first object of thought to the conscientious medical practitioner. It is his duty, from an attentive consideration of the signs and symptoms of disease, to form an idea as accurate as possible of the nature and extent of the morbid action or change which is going on in the tissues, organs, and fluids of the living body.

If, therefore, he does not avail himself of every means and instrument by which he can ascertain the existence of change in the dead body and its alteration from some standard of health—if he does not embrace every opportunity of making post mortem examinations—if he contents himself merely with observing signs or symptoms of disease, without witnessing the changes of structure, if any, which may give rise to them, he can have little conscious satisfaction in the study of Medicine as a science, or in the practice of the healing art. In the words of Cruveilhier, he will, during his lifetime, "see many patients, but few diseases." Such a practitioner is not to be trusted.

Various Forms of the Constituent Elements of Disease.

The histologist has now clearly ascertained the various simple organic forms which compose the textures in their normal state, and the mode in which these textures are arranged and combined, so as to form the organs and systems which carry on the healthy functions of the body. The pathologist has also made out (although with less completeness), by the methods of observation and experiment already indicated, the various simple organic forms which constitute the elements of those material changes whose phenomena

of growth, decay, and varied change are associated with the manifestations of disease. By classifying and arranging these forms we obtain more clear ideas of morbid processes, and we also ascertain that the material morbid processes follow in their development a very definite order of change, not yet in all cases determined with absolute certainty.

An anatomical investigation of morbid parts conducted with the aid of the microscope and other instruments of research shows that the solid and fluid matter of which their substance is made up, is of very various structure, sometimes combined in forms of one kind throughout, and sometimes varied by the development and combination of all the known forms of morbid growth.

An analysis of morbid structures, carried as far as scientific means at present enable us, shows that the elementary conditions in which morbid products are found may be described as follows :—

(1.) Fluid formative matter—hyaline substance.

(2.) Simple elementary forms of the nature of deposits, sometimes of a mineral or inorganic character, *e. g.*, (*a*) amorphous granules ; (*b*) crystalline structures in a granular state.

(3.) Simple, but organized products capable of growth, *e. g.*, (*a*) granules ; (*b*) compound exudation corpuscles ; (*c*) simple cells ; (*d*) fibres.

The very various appearances or states which these simple forms may assume in disease, as well as the functional states with which they are frequently associated, leads to a further enumeration and classification of morbid elementary products, as well as of more complex disease processes, as below :—

A.—Morbid Elementary Products.

I. Exudations more or less soft, semi-fluid, or fluid, and formed of—

a. Plastic or formative materials, sometimes also called *blastema*, *coagulable lymph*, *false membrane*, or *fibrine*, as seen deposited on free surfaces.

b. Aqueous matter, as seen in the permanent morbid state termed "*dropsy*."

c. Gaseous exudations, as seen in the various forms of pneumatosis.

II. Exudations more or less consolidated, and consisting of—

a. Molecular or granular material from the 800th of a line to an immeasurably small size, and consisting chiefly of the simple forms of—

(1.) Fatty molecules or granules.

(2.) Deposits of an organic kind capable of growth.

(3.) Deposits of an inorganic kind, generally calcareous salts.
(4.) Pigment granules.

b. Coagulable protein compounds, resisting the action of most re-agents, such as are seen in the elements of tubercle, scrofula, oleo-albuminous deposits.

c. Exudations of a transitional nature, organized, vascular, and capable of growth, composed of

(1.) Consolidated homogeneous structure passing to
(2.) A fibrilloid arrangement of the molecular or granular particles composing the blastema and the subsequent formation of fibres in it or from it.
(3.) Concentric arrangement of the blastema into granules, and the formation of cells and naked nuclei of cells in this way.
(4.) The formation of pyoid cells, and fibro-plastic cells passing into fusiform cells and fibres.
(5.) The formation of fluid formative matter holding pus, and other compound granular cells.

III. Exudations of a specific kind.

a. Variolus and vaccine lymph.
b. Matter of glanders.
c. Pus of syphilis.
d. Material of tubercle and scrofula.
e. Material of cancer.
f. The typhous deposit.
g. Melanotic or pigmentary deposits.

IV. Material of a complex kind.

a. Media of repair and reproduction of injured or lost parts—substance of granulations and cicatrices.
b. Hypertrophy of parts.
c. Tumors, { innocent. / malignant.
d. Concretions.

V. Parasitic formations.

B.—Complex Vital Processes whose Phenomena, more or less combined, constitute Disease.

1. *Irritation.*
2. *Congestion.*
3. *Depression* (atrophy).
4. *Fever*—the febrile state. Pyrexia.
5. *Inflammation.*
6. *Atrophy.*
7. *Degeneration.*

Such a classification as the above is merely intended to bring before the student at a glance the variety of morbid material which is concerned in the production of many of those phenomena he will see in the course of disease, the distinctions made being mainly based on structural analysis.

While it is more properly the province of the anatomist to describe the MORBID ELEMENTARY PRODUCTS, it is the COMPLEX VITAL PROCESSES WHOSE PHENOMENA, MORE OR LESS COMBINED, CONSTITUTE DISEASE, with which the physician has more immediately to deal; and two of these complex states especially require notice in this introduction; namely, *Fever* and *Inflammation.*

SECTION IV.

COMPLEX MORBID STATES.

1. PYREXIA—*Fever.*

Definition.—*A complex morbid state which accompanies many diseases as part of their phenomena, more or less constant and regular, but variously modified by the specific nature of the diseases which it accompanies. It essentially consists in elevation of temperature, which must arise from an increased tissue change, and have its immediate cause in alterations of the nervous system* (VIRCHOW, PARKES).

Pathology.—In describing the nature of fever, the following statements are principally compiled from the Gulstonian lectures of Dr. Parkes, delivered before the College of Physicians in 1855, and from a review by Dr. Jenner on the Proximate Cause of Fever, in *The British and Foreign Med.-Chirurgical Review* for 1856. Knowing how difficult it is to convey an orthodox account of the nature of fever; fully impressed with the great importance of the subject; and believing, as Dr. Jenner has expressed, "that so consistent a theory of the nature of fever, and one so largely supported by facts, has not been placed before the profession, as that developed by Dr. Parkes, I only hope I may be able to do it justice in the attempt to lay it before the student of medicine in the following form. In the eloquent language of Dr. Parkes, 'I shall have to allude to inexplicable phenomena, to vast spaces still unfilled by solid facts, to spots unknown to observation, and to regions lighted only by the dim and treacherous ray of speculation.'"

"A hot skin, a quick pulse, intense thirst, scanty and high coloured urine," are phenomena common to many diseases; and

when they are present, it is said that the patient is *feverish*, or suffers from *fever* or *pyrexia*. There are some diseases in which such symptoms constitute the prominent, and almost the only appreciable phenomena, and which run a more or less definite course, without the necessary development of any constant local lesion. Such diseases have been emphatically termed "fevers," or sometimes *specific*, *primary*, or *idiopathic fevers*. When there are diseases marked by local lesions, attended by the symptoms just stated;—such, for instance, as the local inflammations, then the *pyrexia*, *fever*, or *feverish* symptoms which attend them, are said to be *secondary* or *symptomatic;* and the physician is accustomed, when he deals with such cases, to abstract the symptoms of fever from the others proper to the special affection; in other words, he prescribes, and tries to cure the special affection, and not the *fever*, because he knows that when he has subdued the local disease the *fever* will subside.

It is to the nature of *fever*, considered in its abstract relations, that the attention of the student is at present directed, and not to any particular fever such as ague, typhus fever, or the like. It is to *fever* in general, and not to any specific disease, that the following observations apply. It is to the *pyrexial symptoms* which are common to many diseases, such as to *small-pox*, *scarlatina*, *measles*, *typhus*, *ague*, *plague*, *pneumonia*, *nephritis*, *meningitis*, and which, "like shadows to substance, are necessary to the very existence of such diseases, but yet are not, *per se*, any one of these diseases."

Galen defined fever as a preternatural heat—"*Calor præter naturam.*" Subsequently many other additional clauses were added to this definition, such as "quick pulse," "turbid urine," and the like, but still the improved definition would not meet the requirements of every case; and now it is fully recognized, that of all the clauses and phrases in the usual definitions of fever, "preternatural heat" is the only one whose accuracy is unimpeachable. When the feelings of the patient merely were judged from, the accuracy of the observation was often doubted, until De Hæn substituted the thermometer for the hand in estimating the temperature of the body, and showed that, "even in the cold stage of an ague, with the teeth chattering and the body shaking, the temperature of the blood is rapidly rising, although the pallid skin, with the supply of blood diminished by the contraction of its vessels, may really be colder than usual. In the severe initiatory shivering of pneumonia or typhus the same fact has been discovered." In short, it is now placed beyond a doubt by the observations of Gierse, Roger, Von Bærensprung, Traube Jockmann, and others, that while this preternatural heat varies in amount in different diseases in different persons, and at different times of the same day, it is this preternatural heat which is the essential symptom in fever, which proves fever to be present,

and which exists to the extent of 4°, 6°, or even 8° Fahrenheit over the natural limits of health, which averages 98° Fahrenheit, and must be judged of by the temperature of the mouth or axilla, as indicated by the thermometer. This preternatural heat is never absent in fever, and without it fever cannot be said to exist. Rigor, which is also sometimes present, is a mere peripheric phenomenon, and the apparent coldness of the skin is merely a subjective sensation produced by the state of the peripheral nerves, and not by any actual decline of temperature. "While the outer parts feel cold to the bystander, the inner parts are abnormally warm. While the outer parts freeze, the inner burn" (VIRCHOW, PARKES, JENNER).

To Dr. Parkes in this country is especially due the merit of having clearly and extensively elucidated by experiment and clinical observation that this morbid development of heat is associated in some cases with *more* abundant, in other instances with *less* abundant excretions from the body than in health, that the temperature and amount of the excretions bear some undetermined relation to each other, and that the loss of weight of the patient is due to the increase of elimination, and increased tissue change, associated with the increase of temperature.

So far as physiological facts have elucidated the normal generation of heat in the healthy body, so far has Dr. Parkes been able to elucidate the abnormal generation of heat essential to the *febrile* state. "In the healthy body," writes Dr. Parkes, "the normal temperature produced by chemical change in the body, is represented in the excretions by so much *urea, sulphuric acid, carbonic acid, excretive, volatile acids* of the skin," &c.; but in the febrile body the observations of Dr. Parkes show that a higher temperature is represented in the excretions in some cases by a larger, and in others by a smaller quantity of *urea, sulphuric acid,* and *probably carbonic acid.**

The most opposite statements have been made regarding the

* It may be useful here to state for future reference and comparison some standard numbers relative to the normal quantity of various products excreted by the urine in healthy adult men, as determined by Vogel, and to remark that in the study of special diseases the student ought frequently to make such observations, as one of the best methods for enabling him to appreciate the changes which go on in the body during disease. To aid him in prosecuting such researches, he is recommended to follow the directions given by Beale in his *Tables for the Chemical and Microscopical Examination of the Urine.*

Average quantity of urine passed in twenty-four hours, ...			52¾ to 56	ounces.
Average specific gravity, ...			1·020	
Average amount of *Urea* passed in twenty-four hours, ...			556	grains.
—	*Chlorine*	Ditto, ...	154	—
—	*Free Acid*	Ditto, ...	33	—
—	*Phosphoric Acid*	Ditto, ...	66·7	—
—	*Sulphuric Acid*	Ditto, ...	30·88	—

amounts of the excretions in fever, compared with the quantity excreted in health. At present many excellent observers hold that they are always and of necessity increased; others, no less exact, affirm that they are invariably or almost always diminished. Such discrepancy of statement is due, in the first instance, to the difficulty of collecting and measuring exactly the amount of all excretions. "Two of the excretions, the cutaneous and the pulmonary, cannot be collected and measured with anything like the accuracy necessary in such an inquiry; even in health such an inquiry is difficult, and in fever it is almost impossible." By careful and accurate observation at the bedside, however, Dr. Parkes has been able to obtain very close approximative data to found his conclusions upon, relative to the increase or diminution of the excretions. He assumes that when the respirations are not quickened (*i. e.*, about eighteen times in a minute, or about one act of respiration for every four beats of the pulse), and when the skin is not evidently sweating, the excretions by these two organs are not increased; and, on the other hand, an increased excretion by these organs may reasonably be inferred if the exercise of their function is unusually active, and if there are tolerably copious perspirations. "The other two excretions, namely, the urine and intestinal discharges, can be measured with accuracy, and the urine in particular is a valuable measure of the metamorphoses of tissue. The *urea* alone represents two-thirds of the whole quantity of *nitrogen* which passes off, the *sulphuric* acid (the sulphates of the food being accounted for), represents almost entirely the oxidation of sulphur, and the oxidized phosphorus of the body passes out in great measure, though not altogether, as urinary phosphoric acid. Therefore a careful examination of the urine, and of the intestinal discharges, with an approximative estimate of the pulmonary and cutaneous excretions, gives us sufficiently extensive and accurate materials for the question at issue.

The observations made by Dr. Parkes generally show that the products excreted are of such a kind as to be eliminated some by *the lungs*, some by *the skin*, some by *the bowels*, and some by *the kidneys;* and rarely by two or more modes of excretion—for when the discharges from the *skin* or *bowels* are profuse, those by the *kidneys* are deficient, as in the last two cases recorded in the following Table I., in which the augmented excretions are printed in italics. The facts thus so carefully observed by Dr. Parkes, confirmed by Alfred Vogel, Heller, and others, but chiefly in regard to the excretion of urea only, justify the conclusion—"*that increase of temperature may be attended with increased elimination; and therefore presumably with increased tissue change.*"

TABLE I.—*Abstract of Cases observed by Dr. Parkes in which some of the excretions are* increased *in consequence of the febrile state.*

Disease.	Average Temperature above 98°.	Condition of Pulmonic Function.	Condition of Cutaneous Function or Skin.	Condition of Intestinal Function.	Condition of Urinary Excretion.
Rheumatism.	Fah. 3°	Not noted.	*Sweating profusely.*	Discharge as usual.	Solid matter excreted *greater than in health by* 100 *grains, and due to urea and sulphuric acid.*
Rheumatism.	Fah. 3°.	Not noted.	*Sweating profusely.*	Discharge not diminished.	*Solid matters excreted greater than in health by* 200 *grains, and due to urea and sulphuric acid.*
Typhoid Fever.	Several degrees.	*Rapid.*	*Moist.*	Not increased.	*Increased by* 60 *grains.*
Erysipelas of Head and Face.		*Quick.*	*Moist.*	Unaltered.	*Considerably augmented.*
Febricula.	3°	Normal.	*Enormously augmented.*	Confined.	Solids less than normal by 91 grains.
Typhoid.	3°	Not noted.	*Sweating and Sudamina.*	*Diarrhœa profuse.*	Solids less by 73 grains.

TABLE II.—*Cases observed by Dr. Parkes in which there was* diminution *of the excretions.*

Disease.	Average Temperature above 98°	Condition of Pulmonic Function.	Condition of Cutaneous Function or Skin.	Condition of Intestinal Functions.	Condition of Urinary Excretions.
Bronchitis of both lungs.	2°·6	20 Respirations per minute.	Not increased.	Not increased.	Less by 112 grains.
Pneumonia acute sthenic.	5°	30 per minute; expectoration scanty.	Slightly moist.	Confined.	Less by 220 grains.
Typhoid Fever.	Considerable.		No sweating.	No diarrhœa.	Below normal amount.
Acute Rheumatism.	4°	Tranquil breathing.	Inconsiderable.	Bowels quiet.	Very small amount of urinary solids.

Another conclusion drawn by Dr. Parkes, the abstract given in Table II. shows to be equally legitimate, namely—"*that the products of metamorphoses as judged of by the excreta, may* be diminished in febrile cases; and these apparently discordant statements are capable of being explained in various ways." In the first place it is evident that more chemical change may go on in the body than is represented by the excreta. The metamorphosis of blood or of tissues may not be carried to the point of forming those principles which can alone pass through the eliminating organs. A vast amount of imperfectly organized compounds may be formed and retained in the system, circulating with the blood or being thrown upon certain organs." *Thus there may be increased metamorphosis with lessened elimination.* Several pathological facts point to such a conclusion.

(1.) It is in such febrile cases with diminished excreta, that, at a later period of the disease, copious discharges from one or other of the eliminating organs occur. Thus in the case of pneumonia referred to in Table II., severe spontaneous diarrhœa came on, and many other cases quoted by Dr. Parkes in which, with similar diminution of the excretions at the period of increased febrile heat, violent purging, sweating, or diuresis, with increase of urea and of sulphuric acid subsequently occurred. Such discharges occurring during the progress and towards the termination of a febrile disease have been termed *critical;* the occurrence being called a *crisis,* and the particular day on which it happens, counting from the day of seizure, has been called a *critical day.* The term *crisis* or *critical* is applied because the occurrence of such discharges is usually coincident with more or less sudden fall of temperature, and general improvement in the condition of the patient, whose convalescence dates from the critical day; when in common language his disease is said to have "*got the turn.*" In such cases, therefore, a large amount of partially metamorphosed substances are retained until they are suddenly discharged, and the system is suddenly freed from the noxious compounds, and coincident with the critical discharge is the lowered temperature.

(2.) But in another class of febrile cases retention of the products of metamorphosis is not followed by such a fortunate *critical* issue. At a later period in the history of some febrile cases, with diminished excreta, it is not uncommon for *secondary inflammatory* affections to occur, as if the blood were more contaminated; and it is sometimes observed that in a patient, whose excreting organs are acting copiously, there occurs a diminution of excretion, when a simultaneous or subsequent development of local disease becomes manifest.

The following table of cases recorded by Dr. Parkes is interesting from the exactness of the observations and the coincidence of the local lesions with suppression and retention of excreta during febrile states.

TABLE III.—*Table of cases observed by Dr. Parkes to show local lesions coincident with sudden retention of the excretions in fever.*

Disease.	Average Temperature above 98°.	Condition of Pulmonic Function.	Condition of Cutaneous Function or Skin.	Condition of Intestinal Function.	Condition of Urinary Excretion.
Rheumatic fever. Observed on the 5th, 6th, and 7th day of the disease.	2° Temperature as above, 2°	No record.	Sweating profuse. Lessened on the 8th day.	No intestinal discharge.	While 400 grains more than in health were being daily excreted, *suddenly* on the 8th day a diminution of the solids took place by 602 grains; and coincident with this diminution a local lesion became developed (*angina faucium*). Next day the excretion augmented, and the local affection subsided.
Typhoid Fever.	5° Temperature as above, 5°	No record.	Great sweating. Lessened much.	Diarrhœa profuse. Diarrhœa ceased.	While the average daily excretion for eight days was 422·348 grs., a gradual diminution continued for three days to the daily extent of 78 grains, when pleurisy came on.
Rheumatic fever.		No record.	Sweating moderately.	Unchanged.	Considerable quantity of urine passed containing an *excess* of solids; a sudden and great diminution both of the solids and fluids of the urine took place when the joints again began to suffer, and pleurodynia supervened.

Thus it is evident from these carefully recorded observations, "*that diminished excreta in fever are to be referred to retention of such excreta, and not to a want of formation; and that while the amount of excreta as capable of being measured may in fact be small, the amount of tissue change may nevertheless be great.*" Another general and practical conclusion is that the *febrile heat* cannot be measured by the amount of the excretions as a whole, nor by any ingredient of them

in particular. Under the same degree of heat and in the same disease, different patients pass very different quantities of *urea, uric acid, sulphuric acid, phosphoric acid, cutaneous* and *intestinal excretions.* The same observations may be made regarding men in health. No two persons pass exactly the same amount of excretory products.

The nature of these excretory products of the febrile state teach us, however, that it is the albuminous or nitrogenous tissues of the body which are being destroyed; for those excretory products, of the urine especially, are the representatives of the azotised structures. The amount of the excretory ingredients of the urine varies considerably from day to day in fever exactly as in health. Often there is a regular gradation of increase and decrease; the urea for instance, may, for two or three days, slightly but regularly diminish in amount, and then suddenly augment to its highest point again, slowly to fall. The same fact may be observed with the sulphuric acid; and Dr. Parkes is led to believe that both in health and in disease, a certain periodicity having a range of three or five days is connected with these gradations of increase and diminution.

The largest amount of *urea* excreted in twenty-four hours in the febrile state, is that recorded of a case of pyæmia by Alfred Vogel, namely, 1,235 grains. The largest amount observed by Dr. Parkes was in a case of typhoid fever, in which it amounted to 885 grains. The largest amount of *sulphuric acid* recorded by the same observer, when no medicine was taken, was in a case of rheumatic fever. It amounted to 52·668 grains, and under the influence of liquor potassæ in the same disease, he has known this excretion rise to 70 grains, more than twice as much as in health. The largest amount of *uric acid* excreted during a febrile disease in twenty-four hours as recorded by Drs. Parkes and Garrod, has been 17·28 grains.

"The amount of tissue destroyed in order to furnish such quantities of excreta must be enormous, and if it is recollected that little or no food is taken by the *feverish* patient, and, therefore, that no materials are supplied for the reconstruction of the textures, thus melting away three times more quickly than in health, the rapid loss in weight in fever, and the impaired nutritive condition of every organ at its close will be at once evident."

It is not yet determined where the increased destruction of the albuminous textures takes place, that is, whether it occurs in the blood or in the organs themselves. It is only known that both the albumen and the red corpuscles of blood are lessened in amount at the end of a febrile disease; and of the various tissues none appear to waste so fast as the muscles, and especially the involuntary ones (*e. g.*, the heart in typhus fever). The fat of the body is also rapidly absorbed in fevers; and Virchow asserts that the bones also become

lighter. While it is known that much of the metamorphosis of these tissues takes place in the normal way, it is also probable, as Dr. Parkes writes, that there is an unhealthy or perverted metamorphosis which leads to the appearance of compounds in the excretions either altogether foreign to the body, or foreign in respect of place and time. There is evidence of this in the peculiar smell of the perspiration, in the peculiar colouring matter of the urine, as well as in the occasional excretion by it of hippuric as well as of lactic and valerianic acids

Next to the phenomena of preternatural heat in fever, *the excessive retention of water in the febrile system* is perhaps the most remarkable and constant. Notwithstanding the large quantity of water frequently taken to quench the extreme thirst, the quantity of the urine is lessened, and is even scantiest when the skin is driest; and the "concentration of the urine appears to Dr. Parkes almost as good an index of the amount of fever as the temperature itself." The excretion of water by the skin is as a rule diminished; and it is a well known clinical fact that the skin is drier than usual in febrile affections. There is still further evidence of this retention of water in fever. For very early in the febrile state the buccal mucous membrane becomes sticky, and the amount of saliva diminishes. The decrease in the quantity of the gastric fluid during fever has also been proved by the well known experiments of Beaumont on St. Martin. The intestinal juices, like the gastric, are also probably diminished, for as Dr. Parkes observes, the stimulus of food is taken away, constipation prevails, and the fæces are dry.

This retention of water in the system cannot at present be explained, but Dr. Parkes suggests that it may possibly be due to the presence in the blood (or tissues generally) of some substance which has a powerful attraction for water.

Besides water, there is reason to believe that chloride of sodium is also retained to a certain extent in fever, or that it passes off less readily with the urine.

Much has yet to be learned of the nature of fever from investigations regarding the chemistry of the *excretions*, of the *secretions*, of the *blood*, and of the *organs*.

The Urine.—The general characters of this excretion proper to the febrile state, are deficiency of water, increase of solids if they are not retained, and especially of the *urea*, the *uric*, the *sulphuric*, the *phosphoric*, and the *hippuric acids*. The *pigments* also are increased; and the *chloride of sodium* is diminished.

The deep colour of febrile urine has usually been attributed to its concentration, but if febrile urine be diluted to the usual amount of fluid contained in healthy urine, it is still darker than normal urine. The colouring matter has been shown by Vogel to

be increased sometimes fourfold, and it appears to contain more carbon than usual. This colouring matter in febrile urine is peculiar, and does not give any of the re-actions of the bile pigment. It may, according to Dr. Parkes, be considered as a measure of the metamorphosis of the blood globules; which in some cases may thus be four times as rapid as in health.

Another important fact connected with the chemistry of the urine in fever is the augmentation of its free acidity, as measured by its neutralization with soda.

The Blood.—The most trustworthy and interesting facts connected with the chemistry of the blood in fever is—(1.) A diminution of the alkaline salts, as shown by Becquerel and Rodier in inflammation; (2.) A diminution of alkalinity of the serum, as shown by Cohen; (3.) The diminution of the albumen after the fever has lasted for some time, with a commensurate increase in the water of the serum; (4.) A diminution in the numbers of the red corpuscles of the blood; (5.) In certain specific fevers the presence of *uric acid* has been detected, for instance, in rheumatism, by Dr. Garrod.

Of the pulmonary excretion little is known. Some have found the carbonic acid augmented, others have found it diminished. Dr. Wilks, of Guy's Hospital, found that the ratio of respirations to the pulse is always increased; and that the pulse may be descending while the respiration remains high; such phenomena, he considers, indicative of a positive increase of function of the lungs.

It is important to determine when the blood becomes affected in fever. It has been, and still is, a favourite opinion to refer the *origin* of fever to primary disease of the blood; and in almost all specific diseases, such as in the *miasmatici, a fever-making cause* appears to enter the blood, at least, writes Dr. Parkes, it may be proved to enter in several cases; and a strong analogical argument can be proved of its entrance into the rest; and the fever-making cause also reproduces itself in the blood or in some organs; and it is now generally admitted that the first action of the febrile cause is on the blood.

The Nervous system seems to play so important a part in fever, that Virchow, in his definition, states that the essential phenomena *must have* their immediate cause in changes of the nervous system.

It is very difficult to substantiate this position, but the following general remarks may be made to prove the great influence of the nerves in febrile affections. Taken individually, they no doubt will impress different minds with different degrees of force, while collectively they cannot fail to furnish an argument in favour of the essential participation of the nervous system in fever.

(1.) There is the generally received physiological law that nerves regulate the metamorphosis of tissue and the production of heat, which are both altered in fevers (HELMHOLTZ, LUDWIG, BERNARD).

(2.) There are those experiments on the vagus nerve which bring about febrile phenomena, such as increased cardiac action, pulmonary congestion, anorexia, and nausea (BERNARD, PAVY).

(3.) There are those arguments derived from the various symptoms which announce, accompany, or terminate fever. (*a*) The remarkable depression, apathy, sense of exhaustion and debility which usher in the febrile state. (*b*) The shiverings, the contraction of the superficial vessels and of the skin. (*c*) The increased rapidity of the heart's action, and the relaxation of the vessels which soon follows the stage of contraction just noticed or occurs without it. (*d*) The congestion of the lungs. (*e*) The periodicity of some of the phenomena of fever, and the occurrence of death or recovery on so-called critical days. (*f*) The abnormal state of the secretions.

(4.) The fearfully rapid death which sometimes ensues in the early stage from some unknown cause, may with justice be referred to profound nervous lesions; for there is great prostration, a galloping and early-failing pulse, and an excessive rapid respiration.

(5.) The effect of certain remedies, such as quinine, upon periodical febrile phenomena.

Causes or Influences which combine to produce the complex phenomena of Fever.—They are enumerated by Dr. Parkes as follows :—

"First of all, we must place the entrance into the blood of a morbific agent, and the alteration of the blood to a certain extent, under its influence. Perhaps this occurs under the incubative period, when often there is no rise of temperature, no fever, that is, when no appreciable alteration of the general health can be discovered. The nature of the change in the blood is unknown.

"Then, secondly, when the change in the blood has reached a certain point, the nervous system, or rather that part especially connected with nutrition and organic contractility, begins to suffer changes in composition, which probably impede or destroy the normal molecular currents. When this occurs, the nervous symptoms of weakness, depression, rigors, and contraction of some parts and vessels, speedily followed by relaxation, mark the stage of invasion.

"Thirdly, and simultaneously, various parts, especially the muscles, and probably some of the organs, deprived in greater or less degree of nervous influence, begin rapidly to disintegrate, and by their disintegration produce supernatural heat.

"Fourthly, this metamorphosis is aided, in most cases, by the condition of the vagus and vasi motor nerves which cause increased action of the heart and dilatation of the vessels.

"Fifthly, the contamination of the blood, already produced by the morbid agent, is increased by the check which the normal extra-vascular currents experience, by the pouring into the blood of the rapidly disinte-

grating tissues, and by the continued action of the morbid agent, which in almost all cases appears to act more rapidly and more powerfully in blood rendered impure in any way, either as shown by Dr. Carpenter, by retention of excretions, absorption of septic substances, or, as in fever, by the too rapid metamorphosis of tissue.

"Sixthly, the various organs suffer (apart altogether from specific changes), and must, one would think, produce increased deterioration of the blood. Thus the lungs are congested in so many cases that we can scarcely suppose proper aëration to go on; the liver would seem, from Frerich's observations, to be, in some cases at any rate, in a most abnormal condition, and to produce compounds, such as leucin, unknown in health; and the spleen in many fevers, if not in all, enlarges (in persons of a certain age), and is congested, possibly even to extravasation.

"Seventhly, food being almost withdrawn, the various alkaline and neutral salts no longer pass into the system."

Treatment.—To avert the tendency to death in the febrile state, it is necessary to observe how fevers naturally terminate favourably. Four modes are enumerated by Dr. Parkes, namely:—

(1.) *By crisis*, in which the temperature falls suddenly in a few hours, and usually with some abundant excretory discharge, in which, possibly, much of the water which has been retained is poured out.

(2.) *By lysis*, in which the fall of temperature is gradual from day to day, till the normal standard is attained. The decline may thus occupy many days; *e. g.*, Dr. Parkes has known the thermometer to take seven days in falling from 102° to 98° Fah.

(3.) *By a combination of these two modes*, namely, by a sudden fall of temperature to a certain point, and then a gradual decrease to the normal heat.

(4.) Another mode has been observed by Dr. Parkes, which consists in a somewhat irregular alternation of febrile and non-febrile periods, as shown by the temperature and the issue. When *fever* terminates by any of these modes, convalescence commences, normal nutrition is renewed, and the body begins to gain in weight. The blood is poor in albumen and in red particles; and there is now a danger that the rapidity of metamorphoses of tissue will now fall below the healthy standard, as shown by the great tendency which convalescents from fever have to lose heat. The temperature falls, and the excretions diminish below their healthy amount. Great care, constant attendance, and watchfulness, is required by the fever patient when he begins to convalesce, if the fever has been long and severe. The treatment of the febrile state itself is thus generally stated by Dr. Parkes, as consisting in a combination of measures to reduce excessive heat, to insure proper excretion and elimination of the excretions, and, lastly, to act on the exhausted and semi-paralyzed nerves.

To accomplish the first indication, Dr. Currie practised to an extreme degree the application of cold water. In health, such an application tends to increase the metamorphoses of tissue, as shown by Lehmann and Sanderson; and therefore its excessive use is contra-indicated in the febrile state. Blood-letting or hæmorrhage also tends to reduce temperature. Purgatives and emetics have the same effect, but in a less degree, and the temperature soon rises after the diarrhœa ceases, when it has been induced by drugs.

To insure proper excretion, and to promote its elimination in fever, is much more difficult than to reduce temperature; which, for obvious reasons, it is not always judicious to attempt.

The system ought to be supplied with an abundance of alkaline salts, if the urinary excretions are not eliminated. *Chloride of sodium*, the *alkaline salts of soda and of potash*, tend to aid the formation of urea and its elimination. Purgatives generally also tend to insure a proper excretion, probably by removing from the blood some of the abnormal products formed in fever, and great relief sometimes follows their moderate use. Where urea is retained they promote its elimination, because it is known that urea sometimes passes off by the mucous membrane of the intestines.

The most important indication, however, in the management of the febrile state, is to find some substance which will act upon the nervous system, and which will restore the exhausted energies of the nervous centres. Food, mild stimulants, and quinine, are all more or less employed. Quinine especially may be employed with benefit. Lately, infusion of coffee as a medicine has been given by Dr. Parkes, with the beneficial effect of relieving headache. Böcker and Lehmann have shown that the use of coffee, in health, delays the metamorphoses of tissue, and excites the nervous system. The special treatment of the febrile state depends on the diseases of which it forms a part, and by which it is more or less modified, and forms a topic of consideration in the part which treats of special diseases.

2.—Inflammation.

Definition.—*A complex morbid process characterized by a series of functional actions, associated with an abnormal local condition of the nutritive changes between the blood and the minute component elements of a tissue, and not necessarily resulting in any appreciable exudation, but constantly betraying a tendency to an interstitial exudation, which, under proper regimen and proper remedies, is often abortive. When an exudation follows, it is a result of the inflammatory state, is apt to be associated with an unhealthy condition of the blood, and of blood plasma, and to assume varied forms of development, according to*—(1.) *The elemen-*

tary structure in which it occurs; (2.) *The special zymotic, constitutional, or local disease with which this complex morbid process may be associated;* and (3.) *According to the progress of the inflammation, the amount and suddenness of the effusion, the extent of tissue involved, the diminished vascularity, and the powers of absorption of the surrounding parts.*

Pathology.—As it is not possible clearly to define the limits of natural processes, it is not possible to give a correct definition of inflammation. It is a process the most important of all morbid states, and a knowledge of its phenomena, the laws which regulate its course, and the relations which its several events bear to each other have been always considered as "the keystone to medical and surgical science," and the "pivot upon which the medical philosophy of the time has revolved."

It is not wonderful, therefore, that much has been written on this subject, more especially since microscopic research has been brought to aid in the investigation. Among the many who have investigated this morbid process with success, and by whose original observations its study may be said to have begun, may be mentioned Wilson Philips, John Thomson, Gendrin, Kaltenbrunner, Gerber, and Muller; and more recently the names of Alison, Lebert, Gulliver, Addison, C. J. B. Williams, Bennett, Wharton Jones, Henle, Virchow, and Paget, are well known. From the records of these observers the following statements are compiled, and free use has been especially made of the writings of the late Dr. John Thomson, also of Bennett, Wharton Jones, and Paget.

The early experiments which illustrate the nature and phenomena of inflammation have been made chiefly on the web of the frog's foot as well as on the folds of its mesentery; and the phenomena are found to correspond in all essential points with the results of experiments performed on the more or less transparent parts of warm-blooded animals; such for example as the wings and ears of bats; the ears of rabbits; the mesenteries of these animals, and the brains of rabbits and of pigeons. As a general result of such experiments and observations, it may be stated that the chief constituents of the inflammation-process are to be found in altered conditions of the healthy nutritive changes—the phenomena of the anormal state becoming more or less obvious by the redness, swelling, heat, pain, impairment of function and exudation in the part affected.

Phenomena of the Inflammatory Process.—The process is one in which many stages of morbid action are passed through, and which reaches its acmé when the serum of the blood and the liquor sanguinis transude through the walls of the blood-vessels of the inflamed part without rupture into the surrounding texture. This is termed "exudation."

The series of complex changes through which the inflammatory

process is seen to proceed, as observed in the transparent parts of animals under the microscope, are found to occur in the following order :—1st. The capillary blood-vessels of the affected part are narrowed, and the blood flows through them with greater rapidity. 2d. The same vessels become enlarged and the current of blood is slower, although even. 3d. The flow of blood becomes irregular. 4th. All motion of the blood ultimately ceases, and the vessels appear fully distended. 5th, and lastly, The liquor sanguinis is exuded through the walls of the blood-vessels, sometimes accompanied by the extravasation of blood corpuscles, owing to rupture of the capillaries. These different phenomena are associated with the production of the more obvious symptoms, namely, redness, pain, heat, and swelling. But although these changes are here mentioned consecutively, it is not to be understood that in every instance of inflammation the changes follow each other in distinct succession. The changes are to be studied as *concurrent* rather than as a *series of events*, of which each stands in the relation of a consequent to one or more of its antecedents; so that starting from a stagnation and turgescence of blood in the vessels of a part, we must observe the various stages in the process as concurrent phenomena, which for the purposes of study are here enumerated in sequence.

An analysis of these concurrent phenomena has shown that the conditions for the healthy nutrition of the part are materially changed, the conditions being somewhat as follows :—

I. The supply of blood to the part is altered—(1.) by the changes in the blood-vessels, especially their narrowing and consequent enlargement; (2.) by the mode in which the blood moves through them.

The narrowing of the capillary vessels in the first instance may be demonstrated under the microscope, by the application of weak acetic acid to the web of the frog's foot ; and the same phenomena are presumed to occur in man for the following reasons. Sudden operations of the mind and the application of cold produce paleness of the skin, an effect which can only arise from contraction of the capillary vessels, and the diminution of the quantity of blood thereby contained in them. The subsequent enlargement of the blood-vessels is presumed to be a constant event in the inflammation of a part. It affects alike the arteries, the capillaries, and the veins of the inflamed part, and usually extends to some distance around what may be considered as the chief seat, centre, or focus of diseased action, and in some textures the enlargement and reddening is confined to the vascular parts in the vicinity. To this condition of the blood and blood-vessels is to be ascribed the usually first observable symptom of inflammation in a part, namely, the redness. But there are also many circumstances under which inflammation has existed, and yet no redness is apparent in the part itself. Thus we

often open the body of a patient that has died of phthisis and find the intestine ulcerated; but so far from being redder, it is paler than natural, and so far from being thickened, it is thinner than usual. We often find the cartilages of the joints ulcerated, and yet not a trace of a red vessel. In cases of bronchitis, with purulent expectoration, if the lungs be washed so as to remove the morbid product, the most experienced anatomist may be unable to determine whether the parts are in a state of health or disease. Take the arterial system, and how often do we find the aorta thickened and thinned, softened and indurated, ulcerated and its elasticity entirely destroyed, and yet not a red vessel to be seen; and when the patient has neither complained of the slightest sensation of pain, nor of any feeling of heat in the part during life? A large abscess also may form in the brain or areolar tissue, or pus may be effused into the cavity of the abdomen, without any appearance of redness, or evidence of having been preceded by any suffering. Although in certain parts, however, as the cornea and the articular cartilages, the ulcerated intestine or the bronchi, the arterial tissues, and the seats of abscesses, the previous existence of inflammatory action is obvious from the effects produced, and where no blood-vessels existed obvious to the eye, assisted or not by the microscope, yet it is for the most part found that enlargement of the blood-vessels of the adjacent parts, and especially of those from which the diseased part derives its nutrient supply, is a constant phenomenon. In inflammation of the cornea, for instance, the blood-vessels of the sclerotic and conjunctivæ are enlarged. In ulceration of the articular cartilages, the surrounding synovial membrane and the articular extremities of the bones are more fully pervaded with enlarged blood-vessels. The vasa vasorum of the aorta round the morbidly thickened part are also the subject of enlargement, and the channel of increased supply of blood. There is, therefore, no doubt that the conditions favourable to the existence of redness are always present to a greater or less degree, and whether the redness be always present or only slightly perceptible, the same elements of the blood and vital changes take part in the development of the inflammatory process.

The enlargement of the blood-vessels varies. It may be hardly perceptible, or it may increase their diameter to two or three times their natural size. Dr. Hunter established this stage of the inflammatory process in the ear of a rabbit by thawing it after it had been frozen, the rabbit was killed during the process and the head being injected, the two ears were removed and dried. Woodcuts representing the comparative conditions of the two ears may be seen in the first volume of Paget's *Surgical Pathology*, page 295. The blood-vessels of the inflamed ear became greatly larger than those of the healthy one, and it was found that arteries before in-

visible in the healthy state of the rabbit's ear were brought clearly into view during this stage of the inflammatory process.

The redness of an inflamed part is of various intensity and shade, according to the degree of the inflammation, its stage, and the structure of the part affected. Its shades pass from a light rose colour to a deep crimson, or even purple. It assumes the form of points where congeries of minute blood-vessels are concerned; or streaks, as where the vessels of fibrous structures are inflamed, as in tendon; or a series of minute and fine ramifications, as in synovial structures; and generally it may be stated that the form of the redness derives its character from the arrangement of the capillaries of the part. The redness is most intense towards the centre of diseased action, gradually softening down towards the circumference where the conditions of health exist. This gradual shading off serves to distinguish the redness of inflammation from the redness of extravasation. The margin of an extravasation is defined, its redness cannot be removed by pressure; while the disappearance of inflammatory redness under pressure is, to a certain extent, a measure of the activity of the circulation in the part. The brighter hues generally attend ordinary active inflammation—the darker hues of inflammatory action are generally associated with some specific cause of disease, a feeble action of the parts or a tendency to gangrene. The increased depth of colour is mainly due in the first instance to the distension of the existing vessels, and not in any measure to the formation of new ones. The redness, however, always appears more than proportionate to the enlargement of the blood-vessels; and we find that the red corpuscles are much more closely crowded in the enlarged vessels, than they naturally are in the circulation generally.

The dilated vessels of an inflamed part appear crammed with red corpuscles, which lie or move as if no fluid intervened between them. An increase of redness is also sometimes seen to depend upon extravasation of blood, or the effusion of the colouring matter of the blood corpuscles, as well into the spaces between the blood corpuscles as into the adjacent tissue through the walls of the blood-vessels. Lastly, the redness is sometimes intensified (as HUNTER first suggested, and microscopic examination subsequently proved) by the passage of the blood, unchanged, from the arteries into the veins. No new formation of blood-vessels is concerned in the redness of inflamed parts. It is only when inflammation has subsided that new vessels are formed and pass into the exudation as if for its nutrition, development, and growth, or to effect its subsequent removal, degeneration, decay, or absorption.

Peculiar changes of shape are also associated with enlargement of the blood-vessels, consisting chiefly of tortuosity of distribution

and aneurismal or varicose dilatation. The aneurismal or varicose state is seen to take place most frequently in the soft textures, as in the brain where it is a frequent condition of the inflammatory red softening (KÖLLIKER and HASSE), and in subcutaneous tissue (LEBERT). The points of what appears to be extravasated blood, are aneurismal dilatations of capillary vessels filled with the red corpuscles.

These varied conditions of the blood-vessels affect the motion of the fluid in the part, and consequently the supply of blood for the purposes of nutrition. Generally it may be stated that there is stagnation of the blood in the focus or centre of severe inflammation; and this stagnation is surrounded by a state of fullness of vessels and slow movement of the blood, while around and more distant still, there is fullness of the vessels with a rapid movement of the blood. From the discrepancy existing among observers regarding the statement as to whether the motion of the blood is slower or quicker when the vessels are contracted or dilated, there is evidence that the contraction alone of a vessel or its dilatation alone is not always sufficient to cause the current of blood to be either slow or quick. Other forces also are at work which contribute in no small degree to accelerate or slow the rate of movement in the vessels. Besides the force of the heart's action there is a mutual relation which subsists between the blood and blood-vessels and surrounding tissue which materially influences the motion of the blood. Accordingly at first with contraction of vessels the current has been described as being quickened. It also sometimes slackens, or even retrogrades for a time, and not unfrequently oscillatory movements may be noticed. But when dilatation is complete the blood flows with rapidity, and a greater quantity passes during a given time than in the unexcited state of the parts. This is known as the state of "determination of blood to a part," or "active congestion." After a time the motion of the blood becomes slower, while the volume propelled is increased, and the retardation gradually increases till the blood corpuscles no longer are propelled, floating in their liquor sanguinis, but accumulating in masses they are propelled by a jerking intermittent motion, till at last complete stagnation takes place. The blood corpuscles are now detained, while the liquor sanguinis flows onwards. To this condition the term "stasis" has been applied. In the immediate neighbourhood, and surrounding the part which is in the condition of *stasis*, the circulation of the blood goes on with increased rapidity; it may even pulsate in the arteries and oscillate in the veins, while it moves with a uniform but rapid flow through highly distended but less turgid vessels. When these conditions exist simultaneously, and the true morbid process is completely established, the vessels may burst, causing hæmorrhage or extravasation into the surrounding tissue, or the serum and liquor

sanguinis may transude through their walls without rupture into the surrounding texture.

Such is a statement of the facts ascertained regarding the early phenomena of the inflammatory process; and, they are of such a kind that, with the facilities of study which ought now to be within the reach of every student of medicine, he ought to make such experiments, or see them made by others, and thus really see the steps of the process which he requires to treat so extensively in practice, and of which he can form but a faint conception from the most lucid description.

II. The constitution of the blood is altered as regards its adaptability to nourish the part.

The nature of this alteration cannot be chemically expressed. The blood is not thus altered in the first instance throughout its whole mass, but the change is a local one confined to the seat of the inflammatory process. At one time it was believed that the blood was altered in its constitution chiefly by an increase of the fibrine and the white corpuscles;* but it is now found that the white or rudimental corpuscles of the blood cannot be separated from the fibrine by any known process, consequently the relative amount of fibrine cannot be correctly stated in relation to the blood; and, as in many inflammations these corpuscles are increased, and in many conditions, such as pregnancy and others, in which no inflammatory process exists, the blood is similarly altered, it is not known how much of change is due to fibrine or how much to the white corpuscles. The generation and accumulation of large numbers of white corpuscles in the vessels of an inflamed part is not now received as a fact. The phenomenon is true as regards some frogs, but not as regards warm-blooded animals, and it is consistent with the experienee of three most eminent pathologists who have experimentally examined this subject; namely, Mr. Wharton Jones, Dr. Hughes Bennett, and Mr. Paget, that an especial abundance of white corpuscles in the vessels of an inflamed part is neither a constant nor even a frequent occurrence; and Dr. Hughes Bennett's recent researches relative to leucocythæmia have shown that even the most extreme abundance of white corpuscles in the blood has no tendency either to produce or to aggravate inflammations.

A remarkable phenomenon presented by the red blood corpuscles in inflammation was first accurately described by Mr. Wharton Jones.

* Andral and Gavarret showed that the proportion of fibrine in the blood was augmented in inflammations when sufficiently severe or extensive to affect the system. In health the average proportion is three parts in 1,000, and in cases of severe inflammations it has been found to rise as high as eight, nine, or ten parts in 1,000. This increase commences as soon as the inflammation is established, and ceases when the process begins to decline.

He observed, that when healthy blood is received on a glass plate or the clean surface of a polished lancet, and immediately examined, the corpuscles lie diffused in the liquor sanguinis, but in about half a minute they run together into piles or rouleaux, which arrange themselves in small meshed networks. But if a drop of blood from a patient with acute rheumatism, or with an inflammation be similarly examined, piles of red corpuscles instantly form, and are clustered into masses, leaving a network with wide interspaces.

This appearance of itself, however, is not a sure sign of inflammation. It may be observed in the blood of the chlorotic female as well as in the pregnant one; in those also in whom a plethoric condition as regards the blood exists; in those in health whose circulation has been much accelerated, as by violent exercise; and it appears to be the natural state of the blood of horses. It is a phenomenon resulting from an increased tendency to aggregation of the blood corpuscles, and gives a granular appearance to a thin layer of blood when viewed with the naked eye. When blood is drawn off in quantity, the phenomenon is associated with the formation of what is termed the "buffy coat," as the clustered blood corpuscles rapidly sinking subside to some distance below the surface before the fibrine and the white corpuscles begin to coagulate.

However indefinite and uncertain the changes may be, as observed upon a small portion of the blood, it cannot be doubted that the blood, stagnant or retarded in an inflamed part, undergoes important alterations, and by a constant succession of such changes the whole fluid may come at length to be materially altered, as indicated by the general effects and constitutional disturbance, extending throughout the nervous and the vascular system, and which may ensue in the train of an inflammation of purely local origin. It is probable that local changes ensue in the blood, similar to those we shall have to notice as taking place in the exuded products of the inflammatory process. There is no doubt, as Wharton Jones has shown, that fibrinous coagula occasionally form and even degenerate within the blood-vessels. When also the stagnation of the blood is not constant, these fibrinous coagula are carried away into the general circulation, and by their degeneration may infect the whole mass of blood, excite constitutional disturbance, producing sometimes various and wide-spreading suppuration, as when purulent infection is consequent on local injury, or when a blood clot passes upwards, and becoming lodged in the cerebral vessels, induces the state known as softening of the brain.

Theory of the Inflammatory Process.—In regard to the theory of the process, there are many points or questions deserving of attention; but it is also obvious that in a handbook such as this, any con-

sideration of speculative matters ought not to find a place. The following statement will therefore merely embrace as much as possible of those topics of special interest, which a more extended and accurate physiological knowledge of the process of inflammation has shown to be the proper objects of more extended inquiry.

In the first place, as to the primary seat of the inflammatory process, there can be little doubt from the phenomena already described, as well as from the results of dissection which show the progress and effects of the process, and from the experimental researches of Hunter, Thomson, Wilson Philips, Hughes Bennett, Wharton Jones, Paget, and other observers, that the vital morbid process known as "inflammation," is connected with the minute vessels termed the capillaries, and the most minute tissues they nourish. Questions relative to the theory of the process are therefore found to be intimately connected with the histeological and physiological relations of these vessels. During the earliest period of the process—the period of increment or of incubation, as it has been termed—it appears to be the inherent properties of the minute component tissues which first undergo a change, and combined with the reflex actions of the nervous system, seem to maintain and to confirm, or to increase the activity of the subsequent stages.

The simplest effects upon the blood-vessels are seen to follow the application of the slightest mechanical or acrid stimulus to them, and such irritant causes acting either immediately from without or through the blood, or through the instrumentality of the nerves, each component texture of the part becomes affected as soon as it is brought in contact with the irritant. A gradual contraction of the capillary vessels takes place. This power of contraction seems to be possessed by the blood-vessels of both kinds to their smallest capillary size, the contraction following at some interval after the application of the stimulus, is slowly accomplished, remains in the contracted state for a variable time, and then, gradually relaxing, they open up and gradually dilate till they acquire a size, larger than they had previous to the application of the stimulus.

The capillaries have been shown by the histologist to possess in abundance the structural elements of the non-striated contractile tissue, and in this they closely resemble the constitution of the muscular fibre of the intestine. Accordingly, the contractions they undergo (as Cullen first suggested) have been considered as analogous to spasms, while the succeeding dilatation may be of the nature of *relaxation* and ultimately of *paralysis*. This paralyzed state is shown from the fact that the same vessels now dilated will not contract upon a re-application of the same stimulus which before made them contract. If the stimulus is made with a needle upon the vessels in the transparent parts of an animal, the needle may be

repeatedly drawn over such dilated vessels and no contraction will follow, but with a stronger stimulus such as that of heat, they may be made to contract again and even close, and this state of contraction may persist for a whole day before the vessels again open up and permit the blood to flow (PAGET).

The motion of the blood in the vessels is modified by the physical state of the vascular tubes through which it has to pass, and at the same time is influenced by the action of the heart itself, and the vital processes going on between the capillary vessels and surrounding tissues which has been variously named the "capillary force," the "nutritive force," the "vital force." The action commences with determination of blood to the part, or as it has also been sometimes called "active congestion." The natural function of the part is exalted, and it may be said that a step beyond this will pass the confines of that neutral ground which exists between health and disease. With an increased circulation, the objects of that function are maintained and promoted with increased activity; and unusual transudation of the nutrient material takes place, chiefly of the serum of the blood.

The most interesting point in the whole process is perhaps that which embraces an inquiry into the cause of the "stasis," or stoppage of the blood, and the exudation of the liquor sanguinis which are the most difficult phenomena to explain consistently with physiology. The explanations of eminent pathologists and experimentalists, if not universally satisfactory, serve to present the subject in a variety of aspects to the mind, which cannot fail to be both interesting and practically instructive. Henle, Simon, Bennett, Williams, Rokitansky, and Paget, have all helped to elucidate the process by the following theories.

The theory of Henle, or as it is sometimes called the "neuropathological theory," assumes that the stimulus acting on the sensory nerves of the part, excites in them a state, which being communicated to the spinal nervous centre is reflected on the vascular nerves, occasions their paralysis and therewith the contractile coat of the blood-vessels also. Various modifications have been made upon this theory, but as the phenomena have been seen to take place in the case of absence of a spinal cord, and in division of the roots of the nerves, and in section of the lumbar and sciatic nerves, such facts are subversive of the hypothesis.

Henle considers the stasis as a necessary physical consequence of this dilatation of the blood-vessels, and this stasis, together with the relaxed and dilated state of the vessels, favours the exudation of serum, the consequence of which is, that the plasma of the blood in the part becomes inspissated by a preponderance of proteine matter over the salts. This inspissation of the plasma determines endos-

motic changes in the red corpuscles, in consequence of which they are disposed to aggregate.

Simon propounds the view that the phenomena are due, not to a reflex action, but to a direct change, effected by the living molecular structure of the part on the blood which traverses it, or on the vessels which convey that blood.

Bennett ascribes the change as due to a vital force, actively operating through the tissues which lie outside the vessels, and which is the only active agency causing the approach of the coloured particles to the capillary walls of the blood-vessels and the passage through them of exudation.

Paget supposes a mutual relation to exist between the blood, its vessels, and the parts around, which being natural, permits the most easy transit of the blood, but being disturbed, increases the hindrances to its passage.

Dr. J. C. B. Williams considers that an essential part of inflammation is the production of numerous white globules in the inflamed vessels, and that the obstruction of these vessels is mainly due to the adhesive properties of these globules.

Rokitansky is of opinion that the condition of *stasis* proceeds—1st, From the sticking together of the blood corpuscles, the heaping up and wedging of them in the capillaries, while the plasma in part flows off towards the veins ; 2d, From the inspissation of the plasma occasioned by the exudation of serum through the dilated and attenuated walls of the vessels and its saturation with fibrine and albumen ; 3d, From the heaping up of the colourless corpuscles, *i. e.*, the nucleus and cell formations together with blood globules; from their sticking together, and from the delicate hyaline, fibrinous coagula which develop themselves among them. Rokitansky considers this to be the most important moment in the inflammatory process, since on the one hand it very specially throws light upon the phenomena of stasis, and on the other hand it also comprehends the plastic processes which take place in the heaped up and stagnant blood. It separates in this way the process of inflammation from a merely simple one of exudation. The elementary formations above mentioned are not merely swept together towards the place of stasis, but they originate as new formations in the stagnant blood, which generally presents remarkable alterations.

Wharton Jones describes the progress of stasis as consisting—1st, Of the adhesion of collapsed and dark red blood corpuscles to the walls of the vessels; and 2dly, The adhesion of other blood cells to these, the first adhesion of the blood cells usually taking place at a bifurcation, and the stagnation is seen to take place first in those capillaries which are least in the direct course from the artery to the vein, depending in a great measure upon the inspissa-

tion of the plasma, on its certain and increased quantity of fibrine and albumen.

Whatever explanation may be given or accepted as to how the phenomena of inflammation in a part are brought about, our views regarding the essential nature of the process are modified according as this complex morbid state is studied rather by its effects as seen on the dead than on the living body. There are some especially eminent pathologists whose combined observations have of late done much to convey a clear notion of the essential nature of this complex process; namely, Alison, Virchow, Bennett, Simon, Goodsir, and Redfern. While Dr. Bennett regards exudation from the blood-vessels as the necessary constituent of inflammation, Alison and Virchow, on the other hand, recognize the morphological changes of the living state in inflammation as betraying merely a *tendency* in a part to such a local change as exudation amongstits structure. That *local tendency* may be so slight that hardly any difference can be appreciated between the healthy changes attendant on normal nutrition, and those changes between the blood and the minute tissues, which are of such a kind that a morbid change (inflammation), is established in the elementary components of the tissues themselves, without any appreciable exudation having taken place, either into the interstices of tissue or upon the free surfaces of membranes. To such a condition Virchow gives the name of *parenchymatous inflammation*, meaning thereby that it is a complex morbid process, established locally, between the blood and the component elements of tissue, and expressed by such abnormal relations in the morphology of local nutritive processes, as a tendency to the effusion from the blood-vessels of such plastic material as will speedily assume, in most instances, the form of decolorized coaguable lymph or pus.

Inflammation may thus exist as a local morbid process, characterized by an abnormal condition of the nutritive changes between the blood and the component parts of a texture, without any appreciable exudation; that this abnormal state betrays a tendency to an interstitial exudation, but which, under proper regimen and proper remedies, in a case of simple inflammation, seen from the first, is very often abortive, no such exudation taking place as makes itself manifest to the eye in external parts, or by any distinct disturbance of functions of internal parts (Alison).

Examples of this simple form of inflammation have been fully illustrated by Goodsir and Redfern in this country, by their demonstrations of what takes place within the large cells of cartilage. The cells become larger, the number of nuclei increases, and some, or all of them, may undergo fatty metamorphosis under the influence of this simple inflammation, as yet only manifested by this abnormal nutritive process between the blood and the cells; but in which

there is a tendency to the interstitial exudation of a hyaline material which becomes fibrous, and filamentous, and ultimately soft and gelatinous. Virchow has demonstrated similar changes in the cells of the cornea.

Thus the minute and penetrating observation of Virchow gives a more comprehensive meaning to Dr. Bennett's statement regarding exudation; but such alterations as Virchow describes in the elements of the tissues of an inflamed part have been in a great measure overlooked, except by Dr. Alison and Mr. Simon. The latter especially states that the irritation of the inflammatory process is independent of the nervous influence, *but is a direct change operated by the living molecular structure of the part on the blood which traverses it, or on the vessels which convey that blood.* Dr. Alison, also, long ago recognized the *tendency* to interstitial exudation as attending such vital changes in the constituent elements of a part, and which entitled it to be considered inflamed; and the accurate observations of Virchow, Goodsir, and Redfern, have shown that such primitive changes do take place before those more palpable phenomena occur, which constitute the exudation as described by Bennett, namely, the exudation of decolorized lymph into the interstices between the constituent elements of a texture. Both sets of phenomena alike show that *inflammation is only one of the various shades of deviation from the normal process of nutrition:—a diseased action tending to a local lesion.*—(*British and Foreign Review*, January, 1854.) That the irritation of this complex morbid process is in some measure independent of the nerves, the following interesting experiment related and performed by Mr. Simon, he submits in proof:—

"A patient had complete anæsthesia of the fifth nerve, dependent (as a post mortem examination subsequently showed) on its organic disease, the conjunctiva, as well as the integument of the face, was utterly insensible; not only was the function of the nerve destroyed, but those reflected nutritive changes of which I have already spoken had taken place, and had exhausted themselves; showing that the nerve was spoiled for participation in the acts of nutrition (whatever they may be) no less than for its more obvious uses as a medium of conscious sensation; the cornea had undergone ulceration, and had healed again. The following experiment was carefully made:—The lids being held open, a single granule of cayenne pepper was laid upon the insensible conjunctiva; in a few moments it had become the centre of a very distinct circle of increased vascularity, the redness of which slowly became more and more distinct as long as the stimulus was suffered to remain, so that, on its removal, there was a very evident circumscribed erythema on the surface of the membrane. I consider myself justified in believing that this change occurred without any intermediate nervous excitement; not only because the history of the case would lead me to consider the fifth as annihilated; not only because the experiment was totally unattended with sensation; but likewise because there was the very remarkable absence of that sympathetic phenomenon,

which the faintest remnant of nervous excitability would have produced—namely, there was not the slightest trace of lachrymation."—(*Lectures on General Pathology*, p. 76.)

Such being the essential nature of inflammation, it is easy to understand how reasonable is that doctrine which teaches "that the process of inflammation is susceptible, at all times and in all countries, of very great variety, as to extent, as to intensity, and especially as to the constitutional affection associated with it or consequent upon it.

Products, Effects, or Events of Inflammation.—When the local diseased action associated with inflammation is confined to a small space, or is carried on upon a *minute scale*, or *rapidly abates*, the inflammation is said to terminate by *resolution* as a general principle, that is, the abnormal action ceases, interstitial exudation does not take place, the tendency to further change is subdued and passes off, and leaves the part apparently as it was before. If, however, interstitial exudation has taken place, and *resolution* is to be effected, the return of the part to health may be followed, for some time, by some impairment of its structure.

After the process has thus gone a certain length, an increased local growth of cells, and of exudation into them (what Dr. Addison calls *cell-therapeutics*), are essential to its decline. Before it has attained such a length, however, *resolution* may be simply effected by a gradual return of all the parts to a natural state—a mere retracing of the steps, by which the natural actions had been departed from, sufficiently describes the process (PAGET).

The process of *resolution* has been closely watched by Mr. Paget. He has seen in those cases where exudation had taken place, that fragments of fibrine, washed from the blood in the vessels of the injured parts, were borne along and floated in distant vessels. The observations of Dr. Kirkes, also, leave no doubt that similar changes may occur in warm-blooded animals, and may be the source of great evils; may be, indeed, productive of some of those constitutional effects yet to be noticed, by carrying the materials of diseased or degenerate blood from a diseased organ to one that was previously healthy. When the disappearance of the inflammation is unusually sudden and rapid the event is technically called "*delitescence*," and if at the same time the symptoms of inflammation appear at another part not anatomically connected with the part first diseased, the event is called a "*metastasis*."

When the process does not confine itself to the simple expression of altered nutritive changes between the constituent tissues of a part and the blood; but when the tendency to exudation amongst the interstices of textures continues, and does not subside, as already explained, namely, by *resolution*, then it is that (1.) such a material is separated from the blood as undergoes those changes which have

been so well described of late by Bennett, Gluge, and Paget; and, (2.) Coincident with this exudation, and the changes which it undergoes, the tissue of the part itself sustains serious alterations; so that in all such inflammations of the vascular parts, while there is increased exudation from the blood-vessels, there is a deterioration of the surrounding elements of tissue. The texture is rendered soft and easily torn, and by such changes of cohesion the elasticity of parts (a circumstance often of very primary importance) becomes greatly altered and impaired.

These changes, therefore, Mr. Paget happily describes as consisting of—(1.) *Productive* effects, such as *effusions* or *exudations*, which are susceptible of further development, and also of *degeneration*; (2.) *Destructive* effects, *softening*, *degeneration*, *absorption*, *ulceration*, and *death* of tissue.

Productive Effects of Inflammation—Inflammatory Effusions or Exudations.—These consist of—(1.) Serum; 2. Blood; (3.) Lymph, or the so-called inflammatory exudation; and (4.) Mucus.

(1.) *Serous Effusions*, &c.—The effusion by pure serum is said to be very rare. In *serous* inflammation, even of a serous membrane, as the pleura, the fluid effused is not only greater in quantity than natural, but is also greatly altered in quality. In health the serous secretions are little more than pure aqueous vapour, with a trifling addition of saline matters; but when they result from inflammation, they contain a considerable quantity of albumen, sometimes a portion of fibrine, and at other times it appears to be the pure "*liquor sanguinis*" which is effused, entirely unchanged in its physical properties. The quantity effused varies, according to the part affected, from perhaps a portion of an ounce to a few pints, or even a few gallons.

This product of inflammation may be seen in the fluid contained in blisters raised by counter irritants, in a healthy person; also in the fluid of *peritonitis*; of *pleurisy* and *pericarditis*; such also is the fluid that fills the early vesicles of *herpes* and *eczema*, and other cutaneous eruptions. It is also seen in the fluid which surrounds an acute, deep inflammation beneath the skin. The fluid of a common *hydrocele* is another example of serous effusion. The phenomena associated with the production of such a result of inflammation may be often seen surrounding a phlegmon or boil of large size. While the centre or *core* of the boil is hard, it is surrounded by textures into which the *effusion* that has taken place is *serous*. The fluid fills the areolar tissue which immediately surrounds the inflamed parts; and when the finger is pressed firmly on this part, it displaces the fluid into the adjoining areolar spaces, which yield to receive it. When the finger is withdrawn, the fluid does not immediately return, but an impression is left in the shape of a pit.

The part which is the seat of *serous* effusion is then said to *pit on pressure*, or to be *œdematous*.

The fibrine of serous effusions remains in solution for weeks or months within the body, during life, but will coagulate readily when withdrawn. This delay of the fluid to coagulate within the body is a propitious event. So long as it is liquid, absorption may still ensue without its undergoing any ulterior change when the inflammation subsides. This subsidence is necessary, for it is known that so long as inflammation continues, absorption does not take place.

One constant characteristic in the products of inflammation is, that they contain *organizable* materials. Thus the effusion that results from mere mechanical obstruction to the flow of blood is very different from the serous effusion of an inflammation. In the former case the material effused from the blood is merely the serous part, and will not coagulate as the fluids of *anasarca* and *ascites*. Such fluids, as a rule, neither present fibrine nor do they develop corpuscles (PAGET).

The site of a serous effusion resulting from inflammation is important, as sometimes constituting the chief element of danger —a danger sometimes immediate, from the mechanism of the parts affected. A large quantity of fluid is often also poured out in a very short time. The cavity of the pleura may fill in a few hours, and the lung may be compressed by it to a half or a third of its bulk ; and if both pleural cavities become thus affected, constituting *double pleurisy*, the patient must die from suffocation, if not at once relieved by allowing free vent to the fluid. This operation is called *tapping* the chest, or, technically, "*paracentesis thoracis*." Serous effusion into the areolar sub-mucous tissue of the glottis may also produce almost immediate death from suffocation, unless the cavity of the larynx is immediately opened to admit the air to the lungs (WATSON).

(2.) *Blood Effusions.*—Such effusions chiefly occur from rupture of the new vessels formed in the lymph, which has just become vascular (ROKITANSKY). In the ordinary course of internal inflammations effusions of blood are rare, and betoken an unfavourable state of the inflammatory products, such as occur in typhous fevers, in scurvy, or in syphilis.

It is interesting to observe how little colour exists in many inflammatory exudations. This is so remarkable a property with some, that the late Dr. Robert Williams attempted a classification of inflammation into what he termed "*chromatous*" and "*achromatous*" inflammations.

Mr. Paget correctly observes, that we must not confound with hæmorrhages the cases in which the inflammatory products are

merely blood-stained, *i. e.*, have acquired a more or less deep tinge of blood, through the oozing of some of its dissolved colouring matter. The natural colour of inflammatory exudations is greyish or yellowish-white, and, even when they have become vascular, their opacity in the recent state prevents their having any uniform tint of redness visible to the naked eye. When inflammatory products present the tinge of redness, it is either because of hæmorrhage into them, or because they have imbibed the dissolved colouring matter of the blood ; and when this imbibation happens during life, or soon after death, it is important, as implying a cachetic, ill-maintained condition of the blood, in which condition the colouring matter of the corpuscles becomes unnaturally soluble.

(3.) *Inflammatory Lymph.*—This product is so named to distinguish it from the lymph in the lymphatic vessels, with which it is probably not identical (PAGET). It is a characteristic primary product of the inflammatory process, and was called originally "*lymph*," or "*coagulable lymph*;" and more recently it has been called "*exudation*," or "*inflammatory exudation.*" "It is at first," says Mr. Paget, "probably always a pellucid liquid exudation which passes through the blood-vessels"—sweats through them, as Simon hath it—"and especially through the capillaries of the inflamed part. Its most characteristic general properties are, that it is capable of spontaneously organizing itself, and that thus organized, it may proceed by development to the construction of tissues like the natural structures of the body." But the nature of the products of this development in the "*inflammatory lymph*" varies much, according to the part and the state of the constitution ; and accordingly Bennett distinguishes the products of *simple exudation* from those of *tuberculous* and *cancerous* exudations. The typical elementary forms assumed by inflammatory lymph, however, vary according to a much greater variety of circumstances. The circumstances which tend to modify the type of the inflammatory process, or impart to it a particular *tendency* in respect to the nature of the exudation, may be shortly stated as follows :—

(1.) The nature of the tissue in which the exudation takes place.

(2.) The period at which the product is examined after exudation has taken place.

(3.) The state of the blood and the nature of the *zymotic* or *constitutional* morbid state which may be associated with the inflammation.

(4.) The amount of vascularity which the affected part retains.

(5.) The amount of the local exudation and the extent of healthy tissue implicated.

(6.) The suddenness of the phenomena of exudation.

(7.) The persistence of the inflammatory state in its vicinity.

(8.) The amount of fluidity, serum, serous effusion, blood, or mucus, associated with the *inflammatory lymph.*

These are the chief circumstances which determine and modify the elementary forms which the exuded "*inflammatory lymph*" may assume during its organization, development, or degeneration. They severally, or more or less collectively, influence the different stages of its progression, by which the local lesion of the inflammatory process may ultimately terminate in *resolution*, in *permanent organic mischief*, in *death* of the parts involved, or in *death of the patient.*

There are two typical forms assumed by the "inflammatory lymph" in its organization, namely, the *fibrinous* and *corpuscular* (Vogel, Bennett, Paget, Simon, Reinhardt, Gluge, Andrew Clark, Lebert, and others).

Rokitansky describes these typical forms by the terms "*fibrinous*" and "*croupous*," and Dr. C. J. B. Williams by the names of "*plastic*" and "*aplastic.*" Examples of each variety may illustrate the application of the terms. To the *fibrinous* or *plastic* variety belong the serous effusions already referred to. The *corpuscular*, *croupous*, or *aplastic* forms of lymph are represented by those exudations or effusions in which no coagulation ever takes place, as in the early formed contents of vesicles in *vaccinia* and *herpes;* in the *fluid of blisters* raised in cachetic patients; in some instances of *pneumonia;* and in some forms of inflammation of *serous membranes.* In by far the larger number of inflammatory exudations these two typical forms are mixed in various proportions, the one or the other preponderating; and the proportions of fibrine and of corpuscles that are present in the lymph of an inflammation will go far to determine the probability of its being organized, or of its degenerating. The larger the proportion of fibrine in any specimen of inflammatory lymph (provided it be healthy fibrine), the greater is the probability of its being organized into tissue; such as that of adhesions, indurations, and the like. On the other hand, the larger the proportion of corpuscles in lymph, the greater is the probability of suppuration, or of some other degenerative process, and the more tardy is any process of development into tissue. In other words, the preponderance of fibrine in the lymph is generally characteristic of the "adhesive inflammations;" the preponderance of corpuscles, or their sole existence in the liquid, is a general feature of the "suppurative inflammation."

The hardness of inflamed parts is due to the *fibrinous* typical form of the exudation, and is exemplified in the case of a *phlegmon* or *boil* before it suppurates; as also in a lung in a state of *hepatization* when its textures are blocked up with lymph, "just as the stones of a wall are by the cement."

On the surfaces of inflamed membranes, the fibrinous lymph forms a layer of a membranous firmness or consistence, to which the name of *false* or *adventitious membrane* has been given. Thus the naturally opposed surfaces of parts are apt to adhere. This is commonly seen to be the case with such serous membranes as the *pleuræ*, the *pericardium*, the *peritoneum*, or the *edges of a wound*. The inflammation associated with this fibrinous typical organization is sometimes called "*adhesive inflammation*." Dr. John Thomson ascertained that the fibrinous typical form of "inflammatory lymph" might be effused and organized on wounds in less than *four* hours after they were inflicted.

On the surfaces of mucous membranes may generally be seen the "corpuscular" typical form of "*inflammatory lymph*." It has little tendency to cohere, but is expelled in films, gelatinous masses, shreds, patches, or delicate casts of the surface upon which it was formed. The exudation of *dysentery* is an example; so are the membranes sometimes passed from the cavity of the *uterus*, and called *dysmenorrheal membranes*. The fibrinous form of inflammatory lymph may ultimately assume the form of *fibrous* tissue, when the exudation is interstitial to such tissue. Examples of this organization are seen in the laminated and nodular thickening of the capsules of the spleen, the thickening and induration of the periosteum, or the capsule of the hip joint in chronic arthritis; and by virtue of the peculiar tendency to contraction which fibrinous products possess, the contractions of parts are to be explained which have been thus the seat of such inflammatory exudations.

There are instances also in which inflammatory lymph assumes the form of adipose tissue, elastic tissue, and epithelium (KIRKES, VIRCHOW, PAGET), and bone is a very frequent ulterior change which it assumes, especially when the exudation is interstitial to fibrous tissue; but these ulterior events only happen *after* the inflammatory process has ceased in the part. So long as the inflammatory phenomena continue, the tendency of the lymph is rather to assume the *corpuscular* than the *fibrinous* forms of organization. The tendency is to the formation of lymph corpuscles, exudation corpuscles or pus. Hence rapid organization accompanies, as a general rule, a minor degree of action; and by depressing the action of a part, we tend to prevent the threatened occurrence of suppuration.

The existence of the inflammatory state, associated with an interstitial exudation of inflammatory lymph, influences the simplest *corpuscular* forms of organization. *Lymph cells*, *cyto-blasts*, or *simple premordial* forms occur, which are represented by the corpuscles of chyle, lymph, the white corpuscles of the blood, and by those of granulation on the surface of a wound.

These simple cells become developed in the lymph while it is still fluid, transparent, and apparently homogeneous. The first discernible organic form in the lymph of herpes, for example, is that of a mass of soft, colourless, or greyish-white substance, about $\frac{1}{2500}$th or $\frac{1}{3000}$th of an inch in diameter, round, or oval, pellucid, but appearing, as if through irregularities of its surface, dimly nebulous or wrinkled. It does not look granular, nor is it formed by an aggregation of granules; nor, in its earliest state, can any cell-wall be clearly demonstrated, or any nucleus on adding water. In a few hours, however, a pellucid membrane appears to form over its surface, permeable by water, which raises up part of it like a clear vesicle, while the contained mass retreats or subsides to the lower part of the enclosure, and appears more nebulous or grumous than before. A nucleus ultimately forms, and can be distinguished in this mass (PAGET).

From these premordial cell forms in the lymph, either or both typical forms of organization may proceed. On the one hand, all the various forms of corpuscles described by authors as plastic-cells, fibro-cells, candate-cells, or fibro-plastic-cells, and some forms of filaments, are developed from these premordial cells, which can expand also in their development to granulation cells; and which are ultimately capable of assuming the *fibrinous* typical form of organization.

On the other hand, the various degenerations of these premordial cells yields the *corpuscular* typical forms which are assumed by inflammatory lymph, and which it always tends to assume, especially when the local inflammation persists, and when little fibrine is effused.

Degenerate or Developmental Forms of Inflammatory Lymph.—From the degeneration, or from the further development of the premordial lymph, corpuscles or cells, all those elementary forms proceed which are known as "*pus corpuscles*," "*granule cells*," "*compound granule masses or cells*," "*inflammatory globules*," and much of the *molecular debris-like matter* that makes inflammatory effusions turbid. The modes of degeneration are well described by Mr. Paget, from whose work on Surgical Pathology the following examples and illustrations are chiefly taken :—

(1.) The lymph may simply wither or waste, as may be noticed in the vegetations on the valves of the heart or large arteries when they become yellow, stiff, horny, elastic, and nearly transparent; or in the lymph deposited over a compressed lung, associated with empyema or hydrothorax.

(2.) The fibrine of lymph may undergo changes similar to what is known as fatty degeneration,—changes similar to those which occur in the *primordial lymph* cell, when it is transformed into pus. The two changes generally go on together. To the former change,

namely, the fatty-like degeneration of the fibrine, Mr. Paget gives the name of "*liquefactive degeneration;*" the solid fibrine of inflammatory lymph that becomes again liquid when suppuration takes place, as may be observed in a hard mass of inflamed texture when it becomes soft.

This is a degeneration which brings the exudation into a state favourable for its absorption, or to the *resolution* of an inflammation in which lymph has assumed this condition. Examples of such an absorption may be seen in *rheumatic iritis*, and the observations of Dr. Kirkes on the rarity of adhesions of the pericardium in comparison with the frequency of pericarditis may also be explained in this way.

(3.) Melanic degeneration of lymph is not unfrequent, as in peritonitis.

Concurrent with these degenerations of the lymph, are the degenerations of the *corpuscular elements;*—the lymph cells—

(1.) They may wither, as in the dried-up pus of chronic abscesses.

(2.) The fatty degeneration of lymph cells is said to be shown in their transition to the *granule cell*, known also as the *inflammatory globule* of Gluge, or the *exudation corpuscle* of Bennett. The history of the formation of these corpuscles is still doubtful.

The description of them, as originally given by Gluge, in describing the alterations of blood in inflamed parts, is as follows :—

He observes, "that the blood globules lose their tegument and their colour, their inner substance alone remains, which, however, does not remain solitary, but by means of a whitish connecting material the masses become agglomerated, and form dense, opaque, round groups, containing on an average from twenty to thirty of the smaller bodies, which, examined singly, are quite light and transparent. By means of pressure or acetic acid, the associated granules break down into the individual bodies, and we see that the opacity is merely owing to the association. The associated bodies have a diameter in the mass of from $\frac{1}{500}$th to $\frac{1}{300}$th of a millimetre; the single granules are from $\frac{1}{5000}$th to $\frac{1}{4000}$th of a millimetre. These associated bodies," says Gluge, "I have seen in the blood-vessels, so that we have not here to do with a fluid which, transuding through the coats of the blood-vessels, is changed into granules. They escape by bursting the capillaries."

That this cell or corpuscle is formed within as well as without the blood-vessels, is apparent from an examination of inflammatory lungs, exudation into many textures, and more particularly in the brain. The exuded matter may be seen to coat the blood-vessels exterior and interior to their walls; and the formation of the corpuscle of Gluge can also be traced through stages of development, as described by Vogel, Bennett, Kölliker, Hasse, and

myself: as well as through stages of degeneration from the normal state of some corpuscular elements (textural or morbid), the occurrence of which has been described by Reinhardt, Dr. Andrew Clark, Dr. Gairdner, and Mr. Paget.

The essential ingredient of which the compound granule cell is composed, appears to be oily or fatty matter; and these cells vary considerably in their appearance, according to the fineness with which this matter is divided. In some the oil-drops are large, in others they are small and quite granular. They are by no means confined to inflammatory parts. Kölliker, in examining morbid products in an animal, has seen oval blood discs included in these corpuscles, showing that the cell membrane may be in some instances a subsequent formation in their progressive development. This view of their nature would imply, that a number of the original oil or fluid granules come into contact with each other, and cohere into a glomerulus, which subsequently becomes invested with a membrane, and constitutes a cell, the contents of which gradually undergo some morphological process by which they are resolved, and ultimately pass into the circulation (Simon).

My own observations on this point, published in 1849, led me to express the same result, as to the nature of this compound corpuscular development, in the following statement:—

"(1.) The formation of clear, transparent, non-nucleated cells may be observed.

"(2.) The formation of cells with a nucleus and nucleolus are seen, differing from pus corpuscles in their large size, and in having a single nucleus. These are formed in the fluid of coagulated exuded matter, and become gradually filled by minute granules, which, when few in number, readily admit of the nucleus being seen. Subsequently, however, they conceal it; and the originally smooth cell membrane becomes rugged, the granular cell appearing as a spherical agglomeration of granules. Subsequently the cell wall appears to vanish, the enclosed granules to separate from one another, and to fall into irregular heaps."—(*Edin. Med. Journal*, No. 178, for 1849.)

My observations were chiefly made upon inflamed pulmonary tissue, and the following are the general facts connected with the appearance of these corpuscles in that tissue:—

"(1.) They are formed in greatest abundance during the first stage of the exudation (the second stage of pneumonia, according to Laennec).

"(2.) As long as the capillary circulation is going on, and before complete stagnation has taken place.

"(3.) When the redness and condensation is the greatest, the corpuscles begin to disappear, or are not seen.

"(4.) They disappear altogether as the red softening passes into grey.

"(5.) They are imperfectly formed, or not at all, in the deposits that occur during the progress of typhus fever."

Associating these observations with the descriptions of Mr. Paget, relative to the liquefaction of fibrine, with those also of Zwicky, who finds these corpuscles in the softened apex of arterial clots, with those of Simon, who states that they are often found in the fibrinous clots of veins, with their occurrence in the mammary secretion, in the softened parts of encephaloid cancer, in the vicinity of apoplectic effusions, and that generally they are extremely apt to be present where blood, or the products of exudation or secretion are undergoing absorption ; does it not appear probable, moreover, from the lucid description given by Mr. Paget (when he says, that during their formation "they present a gradual increase of shining black-edged particles, like minute oil-drops, which accumulate in the cell cavity and increase in number, and sometimes in size also, till they fill it")—that these compound granular cells, when associated with inflammatory products, fulfil a very important function, as organs or structures developed for the purpose of resolving by a vital process the liquefied, softened, and disintegrated products of inflammatory lymph ?

The observations of Reinhardt, Dr. Andrew Clark, Paget, and Gairdner, also place it beyond a doubt, that compound granular cells may also result from a fatty degeneration of the textural cells of a part ; just as calcareous or pigmental degenerations occur, and which are also common to lymph cells. While there can be no doubt, therefore, that fatty degeneration of lymph or textural elements may lead to the appearance of compound granular cells, that process can scarcely be called degeneration which is associated with development, growth, and complete absorption, by which the indurated and confused parts of an inflammation are ultimately cleared up, as are the solidified portions of a lung in pneumonia.

Degenerate products are usually persistent, but the compound granule cell is not. It seems to have an important function to perform in the removal of fluid, effete, or softened exudations, after which it disappears.

The most frequent and important degeneration of inflammatory lymph is into pus. If a phlegmon or boil be observed, when it is a firm, hard, and solid mass of texture and exudation, we may feel in a few days that the solid mass has become fluid, and that it has not increased in bulk. The solidity and hardness are due to the inflammatory lymph, the softening is due to that lymph having assumed the fluid form, partly by the liquefaction of the fibrine, and partly by the conversion of the lymph cells into pus corpuscles. So it is with the lymph cells of vesicular eruptions which become pustular. The lymph cells there also become pus cells, a change which may be accomplished in twelve hours at the most (Paget). It is doubtful, however, whether the pus cell is always a degenerate lymph

cell. There are some circumstances which point to its occasional independent development, namely, that—(1.) A preliminary lymph cell cannot always be discerned; (2.) The modification of the suppurative process, which occurs in the inflammation of mucous surfaces, where the formation of pus seems at once to take the place of the natural cell-growth, without any apparent distinction or alteration of the membranes of the mucous cells, corresponding in this instance to the most simple idea one can have of what Virchow terms *parenchymatous inflammation*, as described at page lx.

Ultimately the natural mucous secretion undergoes a change. The characteristic cells on its surface drop off in all stages of abortion. Impaired cohesion of parts, an invariable expression of the inflammatory tendency, results. The epithelial covering becomes less characteristic in its form, and gradually declines to small and simple cells, which become mingled with many premordial cells, which appear to have been hurried from the surface before they had time to undergo their legitimate development into the perfect mucous cells. From this sketch of what occurs, "it will be obvious," as Mr. Simon writes, "that the anatomical distinction between pus and mucus must be as useless as the so-called chemical tests. Infinite gradations between the two fluids destroy all practical value in such criteria. Mucus, *as a copious fluid secretion*, has no existence in health; the only natural secretion of a mucous membrane is its epithelium, which ought not to exist in quantity sufficient for any evident discharge. If the secretion be hurried, it immediately begins to assume the forms and physical characters of pus, even to the splitting of its nuclei with acetic acid." In short, the essential process of inflammation has been established in the cell itself, in the abnormal nutritive morphological relations between it and the blood in the processes of life.

Between healthy pus and healthy mucus there can thus be no confusion; but there are conditions between the two which yield neither "*praiseworthy*" pus nor healthy mucus.

Formation of Pus—Suppuration.—Pus is a peculiar fluid, specifically heavier than water, averaging generally about 1·030. Well formed, perfectly elaborated, or sufficiently degenerated pus (according to the view taken of its formation) is a smooth, viscid, yellowish or cream coloured fluid, having little or no smell, and of an alkaline re-action. Microscopically it is seen to be composed of certain essential constituents, namely, the pus cell, and often minute, clear particles, which seem to have some relation as rudiments or nuclei of the pus cells. These constituents float in a fluid or serum called the *liquor puris*. The *pus cells* are about $\frac{1}{2500}$th to $\frac{1}{3000}$th of an inch in diameter, pellucid, filled with semi-fluid albuminous contents, and sometimes containing a very few minute oil globules,

which give it a granular appearance. Their shape appears to depend upon the density of the *liquor puris*. Sometimes a distinct, circular, dark-edged nucleus may be seen in the paler corpuscles, and sometimes two, or even three particles, like a divided nucleus. The minute clear particles often seen are not more than $\frac{1}{10000}$th of an inch in size. Such are the components of *good, healthy*, or *praiseworthy* pus, the *pus laudabile* of the older authors, literally the *pus to be commended*, as showing a benign form of inflammation, indicating that the process, though a morbid one—a disease—is going on regularly, and promises a fortunate issue (WATSON). It is the *laudable pus* of surgical writers. When, however, the process deviates from the state of health—deviates from the usual and regular course of the morbid action in a healthy person, or when the inflammatory tendency may vary, and the type of the process change, then we find not only variations in the pus cells, but multiform mixtures of withered cells appear, with molecular and fatty matter, escaped and shrivelled nuclei, blood corpuscles, and fragments of granular matter like shreds of fibrine. The liquor puris becomes unduly liquid, and the pus is then said to be *watery* or *ichorous*. It may even in weak and tuberculous patients consist chiefly of a thin serum, mixed with flakes or curdled, when it is called *serous pus*. When the colouring matter of blood is mixed with it, it is called *sanious pus*. Chemical or vital changes of various kinds bring about a peculiar decomposition in pus while yet in contact with living parts, although it is probable that atmospheric air, or gases from an internal cavity may have to do with the change ; but hydro-sulphate of ammonia is frequently developed, especially in abscesses about the alimentary canal, near the tonsils or the rectum. The stench is then most offensive when the fluid is set free. Pus, also, besides possessing certain chemical properties, may possess certain specific animal properties : thus it may be impregnated with certain poisons, as that of syphilis, or of the small-pox ; it is also often, in certain constitutional states, loaded with foreign matters such as urate of soda.

The formation of pus is termed *suppuration*. It takes place under three conditions, namely :—(1.) Circumscribed ; (2.) Diffused ; and (3.) Superficial.

As examples of the circumscribed formation of pus may be mentioned an *abscess*, a *boil*, or *phlegmon*, in which the suppuration is enclosed within a cavity generally in areolar tissue, into which interstitial exudation of inflammatory lymph has extended over a certain area. It does not follow that the abscess walls are formed subsequent to the suppuration, by an adhesive inflammation. According to Mr. Paget, this is very rare. It simply happens that while the central portion of an area of inflammatory lymph has become purulent, the peripheral part has maintained its firmness

and solidity—and sometimes a "thin opaque yellowish-white layer, easily detached," separates the suppuration area from the denser part. This has been called a "*pyogenic membrane*," from the erroneous supposition that its function is to secrete the pus. The existence of such a layer, says Mr. Paget, is far from constant in abscesses, and is often a sign of imperfect organization of the abscess wall. Abscesses are sometimes formed without any of the usual accompanying signs of inflammation being present. They are generally slowly formed, and are named *cold* or *chronic* abscesses. When suppuration happens in the natural cavities of the body it is still circumscribed. It is not then, however, called an *abscess*, but a *purulent effusion*.

Diffuse Suppuration is exemplified in *phlegmonous erysipelas*, or the *purulent infiltration* of an organ. In such cases inflammatory lymph is exuded through a wide extent of areolar tissue, and from first to last the boundaries are ill defined. The exudation is distinctly and minutely interstitial; and completely and rapidly degenerates into pus, so that the tissue becomes thoroughly infiltrated as if soaked in it. The usual want of cohesion in the elements of tissue prevail from the first, and ultimately large *sloughs* or death of portions of texture may take place. In some textures of a loose kind, it is also believed that the pus may spread about or infiltrate parts by its own gravity, thereby leading to secondary destruction of parts, and the formation of what are called *sinuses*.

The incipient formation of the diffuse suppuration is probably not dissimilar to that of a phlegmonous abscess, but the inflammation is generally of a different type, and all the processes are less complete; thus, no fibrinous lymph circumscribes the limits of the abscess, nor does any membrane form to contain the pus. The process of suppuration is also less perfect, so that the abscess often contains shreds, or even large portions of mortified and loose cellular tissue. The pus is less healthy, is thinner, and less perfectly elaborated, containing a larger portion of serum, and oftentimes portions of loose lymph without a trace of fibrinous organization. The *pointing* of this form of abscess differs also from that of the phlegmonous abscess, for the pus readily passes from its original seat by infiltration of contiguous portions of healthy membrane, and, gravitating towards the most depending position, presents a soft broad surface without any indications of *pointing*.

Such collections of matter are always of greater extent than phlegmonous abscesses, for the free transmission of pus from part to part occasions a great extension of the original disease. When these diffused abscesses open, the phenomena which result depend very much on the nature of the opening, and how it has been effected. "I have," says Mr. Hunter (note, p. 395), "seen large

lumbar abscesses open of themselves, on the lower part of the loins, which have discharged a large quantity of matter, then close up, then open anew, and so go on for months, without giving rise to any disturbance : but when opened so as to give a free discharge to the matter, inflammation has immediately succeeded, fever has come on, and from the situation of the inflamed part as well as from the extent of the lesion, death in a very few days has been the consequence. The same result has also occurred from liberating collections of the diffuse suppurative process in other parts. In erysipelas, however, which so often gives rise to this form of abscess, a free opening is often necessary, to allow of the escape of the portions of loose areolar tissue they contain."

Superficial suppuration may be observed in *gonorrhœa*, *purulent ophthalmia*, and generally in *inflammation of mucous surfaces*. Such superficial suppuration is closely related to what takes place on an inflamed mucous surface. For an account of its nature and the relation of the products of suppuration to pus, see page lxxii.

There are especially three events which constantly, and some with more or less frequency, accompany or follow the expression of the complex morbid process of inflammation in a part. These are *softening*, *ulceration*, and *mortification*.

Softening, or diminished cohesion of tissue is an almost constant result. It may be due not merely to mechanical separation by infiltration of the component elements of tissue, but by a loss of the vital cohesive properties, and a change in the properties of the tissues themselves, which tends towards their liquefaction and degeneration. Examples of this may be seen in the inflammation which takes place upon mucous surfaces already referred to, also in the inflammatory red softening of the brain and spinal cord, in the lungs, where a peculiar brittleness and rottenness is imparted to their fibrous substance or skeleton texture. These are due to vital changes in the proper tissue, often independent of interstitial infiltration of exudation substance. The most remarkable example of inflammatory softening is that which occurs in bones. An acutely inflamed bone is soft and may be cut with a knife (Stanley, Paget).

But while some parts are *softened*, others are removed altogether, by the process of what has been termed *interstitial absorption*. This phenomenon is also best seen in bones which have been inflamed. Such absorption of parts gradually precedes the extension of the inflammatory process, and leads in the case of abscesses to their spontaneous evacuation, as seen in what is commonly called the "*pointing of an abscess.*" The inflammation continues and moves along in a definite direction, towards the cutaneous or mucous surfaces of the body in its vicinity ; but as the integuments are generally the more prone to inflammation, it is probable that they

thus become soft and yield sooner than the mucous surfaces do. When this absorptive process takes place in excess, the result is—

Ulceration.—This process goes on in the following way, as seen on an open surface, such as a wound or sore. Three processes go on simultaneously in order to effect ulceration, as described by Dr. Alison in his *Outlines of Pathology*. (1.) An exudation of *inflammatory lymph* forms the substance of *granulations*. (2.) From a portion of the original inflammatory lymph pus cells are formed for the protection of the delicate granulations. (3.) Absorption (interstitial as well as of the debris) takes place, and the concurrence of these three phenomena constitute ulceration. If the formation of granulations predominates, the part tends to heal.

Granulation is thus one of the modes in which a wound, or sore, or part previously acutely inflamed, heals. It is then said to do so by "second intention," and is always a reparative process. Granulation may occur with or without suppuration. The first is extremely common. The latter is occasionally seen in the healing of syphilitic maculæ and ulcers of the cornea, and Mr. Hunter conceives he once met with it in the union of a broken thigh bone.

Granulation, according to Mr. Hunter, results from an exudation of inflammatory lymph, into which old vessels extend, and new ones are formed, and a new surface results, which is "granular"—the granule, being a small conical tumor or growth, composed of a mesh of terminal loops, formed by the capillary vessels shooting into the effused lymph. The figure and colour of the granulation, says Mr. Travers, are determined by the state of the circulation ; when that is feeble and inclined to stagnate, the granulation is broad, flat, and spongy, and either pale or of a livid hue ; when, on the contrary, it is vigorous, the granulation is conical or acuminated, and of a bright red tint. The vessels prolonged into the granulation are more or less tortuous, and so numerous as to require a high magnifying power to exhibit their distinctness after successful injection. These vessels become contracted to obliteration, as the period of cicatrization approaches. Granulation may take place from a surface, or from the sides of an abscess. If from the cutaneous tissue the sore heals by a process of skinning ; the skin, according to Mr. Travers, always springing from the edges of the wound, even in cases when the new tissue first appears in the central parts. Again, if granulations spring from the walls of an abscess, their opposite surfaces for the most part unite. Granulations sometimes form most rapidly. Mr. Hunter has seen, after trephining a patient, the dura mater strongly united to the scalp in twenty-four hours. Granulations, however, have not in all cases an equal disposition to unite. Thus the granulations of fistulous abscesses are little prone to adhere, their surfaces being often as difficult to unite

as those of a mucous membrane; indeed it is often impossible to produce adhesion except by exciting a considerable inflammation. A part having healed by granulation uniformly contracts. This contractile force is so great that although the sore made by the amputation of a thigh is seldom less than seven or eight inches in diameter, yet the cicatrix left on healing is hardly more than a crown piece. It is from this cause that we always find in viscera that have been the seat of abscess, a marked depression at the point of cicatrization.

The reproductive energy of parts which heal by granulation, however, is not great. It is rare that the original tissue is perfectly reproduced. No fat, for instance, is regenerated in ulcerated adipose tissues; a muscle being divided unites by an areolar cicatrix, no muscular fibre being reproduced, and a divided cartilage unites by tough fibrous tissue, but not by a cartilaginous bond of union. The skin, when destroyed, may be reproduced as a good imitation, yet generally it is imperfect. After small-pox the rete mucosum is either slow in forming, or never forms at all, so that the cicatrix or *pit* remains whiter than natural. Neither the smooth muscular fibres, nor any of the glandular structures of the skin are formed in its scars; but its fibro-areolar and elastic tissues, its papilla, and epidermis are all well formed in them. The reparation of the mucous membrane is equally imperfect, the villi being always wanting. The reparation of a flat bone such as the cranium, is so slow that ten, twenty, and even fifty years pass away before a small trephine hole is filled up with bony matter. In like manner, a healed cavity of the lungs is always marked by a cicatrix of areolar tissue, altogether different from the original structure; neither, as far as we know, is the proper tissue of the liver, of the spleen, or of the kidney restored. A divided nerve is, in about twelve months or more, united by nervous matter; and the union is quicker and better in all tissues if air is excluded from the healing of the part.

It is a rule also of all cicatrices, that the newly formed part is harder and of greater density than the original structure. Muscle, for instance, unites by coarse, dense, areolar tissue; tendon most frequently by a harder and less pliant but not tougher tissue and sometimes by bone; and bone after a fracture is a more compact substance, and contains more phosphate of lime than before the accident; but, notwithstanding this addition, the new bond of union is not so strong, nor the living actions so energetic, as in the original structure. For when the constitution becomes enfeebled by severe disease, of a scorbutic kind especially, an old sore has been known to open, and the ends of a once broken bone to separate. It is equally a rule that a part having been once inflamed, the liability of the part to that form of inflammation is greatly increased;

and also when new membranes or tissues have formed, that these tissues are infinitely more prone to disease than the original membrane.

Mortification is the death of a part, and may be complete or incomplete. In the soft parts the former is termed *sphacelus*, and the latter *gangrene;* while in hard parts, as the bones, there is a somewhat similar distinction, namely, into *caries* and *necrosis.*

Mortification of the soft parts may be white or black in appearance, humid or dry. Mortification has a black aspect, when the blood is extravasated through the walls of the blood-vessels into the affected tissues, giving to the part a purple or dingy hue, while to the touch it is soft, inelastic, and doughy. Mortification appears white when, by the action of cold, the blood has been driven from the part, and the part subsequently freezes perfectly white.

Humid mortification occurs when the blood transudes in a fluid state, and after its exudation separates into its constituent parts, so that the serum set free dissolves in it the red globules, raises up the cuticle in bladders, and forms what are termed "*phlyctenæ:*" air is also not unfrequently contained in the *phlyctenæ*, generated by a process of commencing putrefaction, giving to the finger touching the part a sensation of crepitation.

Dry mortification is a rare disease, and is sometimes supposed to be caused by the ergot of rye or other diseased grain used as food giving rise to the disease known as *ergotism.* In the year 1716, dry mortification appears to have been to a certain extent epidemic at Orleans, fifty cases having been treated at the Hôtel Dieu of that city. Dodard has described it as beginning generally in one or both feet, with pain, redness, and a sensation of heat or burning like that produced by fire. At the end of some days the part became cold, as black as charcoal, and as dry as if it had been passed through fire. Sometimes a line of separation was formed between the dead and the living parts, and the complete separation of the limb was effected by nature alone, and in one case the thigh separated in this manner from the body at the hip joint. In other cases amputation was necessary. Mr. Solly has given an interesting case of this description, which occurred in the practice of Mr. Bayley, of Odiham. The patient was a child three years and seven months old, from whom both arms were removed, by this spontaneous process of nature, above the elbow, the left leg below the middle of the thigh, and the right foot above the ankle joint, being a remarkable instance, in modern times (*Med.-Ch. Trans.*, vol. xxii., 23), of this destructive disease. (See *Ergotism*, p. 332).

The bones, the brain, the lungs, the liver, the spleen, and the kidney, are all liable to *sphacelus* and *gangrene;* so are the different tissues, as the cellular and cutaneous tissues, the nervous and

serous tissues. The muscles, tendons, aponeuroses, and blood-vessels, are likewise all liable, but in a less degree, to these formidable affections, which are sometimes the effect of inflammation, and in some instances idiopathic.

Local and General Symptoms of Inflammation.

Redness, swelling, heat, pain, throbbing, increased sensibility, disorder of function, arrest and change of secretion, are the phenomena, which are for the most part associated with the local morbid state, or with the textures in its immediate vicinity. If the local process of inflammation, however, is carried on upon a minute scale, or in certain tissues, one or other or more of these symptoms may be absent; if, on the other hand, the local process proceeds on an extensive scale, and involves important and delicate textures of vital importance, then we have much more unequivocal expression given, not only to local symptoms, but to complex morbid processes affecting the constitution generally.

Inflammatory Fever.—Of the *constitutional symptoms* as they are termed, the most prominent are those which indicate "*inflammatory fever*, *symptomatic fever*, or *sympathetic fever*." These constitutional symptoms are of the greatest importance not only by indicating the nature of the disease, as when the inflammation is connected with an internal organ removed from sight and touch; but they are highly important as a guide to treatment. The premonitory symptoms of coldness and shivering are usually very decided, but not of long duration. They are succeeded by a stage of re-action. The pulse is then hard and swift. There is thirst and greatly increased heat of surface. The secretions and the appetite may not at first vary much from the normal state, but on the whole are diminished. Exhaustion and emaciation do not proceed rapidly. This fever is pre-eminently one of strong re-action and vascular excitement, and these characteristics may be said to constitute its *type*.

A most minute description of the disorder of the general frame by *inflammatory fever*, according to its effect on the *systems* of the body, is thus condensed from the account given by Mr. Millar:—

(1.) *The Nervous System.*—These are aching dull pains in the loins and limbs, restlessness, and much discomfort. The will and the power of exertion are diminished. Anxiety or foreboding of evil is felt and expressed upon the countenance. The head generally is hot, the face flushed, the eyes suffused, and the skin hot and dry. Special sensation is at first exalted, but afterwards the intellectual functions become more and more disturbed. Ultimately delirium is established, and coma may ensue. (2.) *The Vascular System.*

The pulse ranges from 80 to 130, or more, and the heart's action is proportionally rapid. The pulse is hard, rolling like a cord below the finger, and yielding but little to its pressure; or an irregularity of movement in the artery may exist, and thus a thrill or jar is imparted to the finger. There is increased fullness, as if the vessel were itself enlarged, and held a larger quantity of blood at each impulse; the heart is acting not only more rapidly but more powerfully than in health; and the circulation is truly accelerated. Frequency, hardness, thrilling, are seldom, if ever, absent; but fullness may be wanting, and the pulse may be small instead of full. This modification is chiefly observed during serious inflammatory action, affecting important internal organs situated in the abdominal region. Hence it is sometimes termed the *abdominal pulse;* the artery resembling a hard thrilling thread rather than a cord. This pulse always exists in connection with great nervous depression, and debilitated though rapid cardiac action; to which circumstance its smallness is probably due. In affections of the brain, on the other hand, producing coma, the pulse is commonly slow and full; the suspension of cerebral influence appearing to diminish the rapidity, without affecting the force, of the heart's action. There are idiosyncrasies also to be taken into account. The pulse may be naturally slow or rapid—50 or 90; and this must be allowed for, when previous inquiry has satisfied us that the patient is the subject of such peculiarity. (3.) *The Respiratory.* Respiration is quickened; the breath is felt to be hotter than usual; and an oppression is complained of in the chest. (4.) *The Digestive.* The tongue may be loaded, white, and moist; or the edges and central tip may be red and dry; the latter is probably the more frequent combination. (5.) *The Secerning.* The secretions and excretions in general are materially diminished. The bowels are constipated—mainly from want of mucous secretion from their lining membrane; the skin is hot and dry; the mouth is parched; the urine is scanty, high coloured, generally acid, sparingly aqueous, and holding much saline matter, with comparatively little urea, in solution. (6.) *The Nutritive.* Digestion is interrupted; so is assimilation; as the fever advances, so does emaciation; and strength is more and more prostrate.—(*Principles of Surgery*, p. 39).

The chilliness often amounting to shivering, marks the *date* of the febrile disturbance; and rigors more frequently attend the commencement of spontaneous inflammation, than of inflammation caused by external injury.

Regarding the constitutional state characteristic of inflammatory fever, some important general conclusions, especially insisted on by Dr. Alison and Dr. Watson, may be thus shortly stated:—

(1.) It is to be observed that there is no fixed relation between

the degree or intensity of internal inflammations, and the constitutional fever attending them; nor is the fever always proportioned in its degree of violence to either the size or importance of the part inflamed. In some cases, writes Dr. Alison, where we are sure that we have had inflammation going on under our inspection, to extensive effusion of pus, the pulse has been feeble, the skin cool and damp, and the patient exhausted and faint on the slightest exertion; while in others there is high and more inflammatory fever, and in some of these the organ inflamed has been so to no extent, and its function comparatively little affected, but yet the patient has become comatose nearly as in typhus, and died so. Laennec makes an observation of a similar kind (*Ed. Med. Journal*, May, 1857), and Dr. Watson observes, that the fever may be high and very strongly marked in that common complaint the *quinsy*, cynanche tonsillaris, or tonsillia, which can scarcely ever be said to imply much danger. (2.) The situation, the extent, and the degree of the local inflammation being the same, the fever commonly runs higher in young and in plethoric persons, and in those of sanguine temperament, than under opposite conditions. (3.) Inflammatory fever is modified in its expression, and especially in the characters of the pulse, by the nature of the part which is inflamed. This has been already alluded to in regard to inflammations of the abdomen, where the action of the heart is depressed, and the pulse is changed accordingly, tending to death by asthenia; and also in regard to the brain, when the mode of death tends to be by coma, the pulse being slow, laboured, and full. (4.) The type of the inflammatory fever is very much modified by constitutional circumstances such as the previous habits of the patient, and whether any zymotic disease is associated with the local inflammation. (5.) The inflammatory fever undergoes a further change of type (*a*) when suppuration takes place; (*b*) when it continues long; and (*c*) when mortification or gangrene occurs to a large extent. (6.) The febrile state follows generally the local disease; but (7.) there is also good reason to believe that the *pyrexial* condition, and the condition of *inflammation* in a part may be excited in some instances conjointly; or, at all events, their periods of commencement may correspond so closely, that it is difficult to conceive that one is the effect of the other.

When inflammation proceeds to suppuration, a severe paroxysm of shivering is often the first indication of the formation of the pus, and the character of the fever undergoes a great alteration from that just described. The degree of the fever varies greatly even in this case, for a most copious formation of pus may take place from a mucous membrane, as that of the bronchi or urethra, and yet the constitution may hardly suffer in any appreciable degree; while a

trifling amount of pus, from a serous membrane, will often be followed by fever of a fatal character.

In any case the character of the fever depends in a great measure on the constitution of the patient. If that be good, the fever is attended with a white tongue, and with little tendency to become brown, also with much heat, a full and strong pulse. On the contrary, if the patient's constitution be broken or impaired, the fever is of a low type—*asthenic*, as it is called. The event of *suppuration* is generally marked by a *rigor* of greater or less severity, while the fever hitherto has been *sthenic*. It is *the occurrence of the rigor* in the course of the inflammatory febrile state which gives it prominence and importance. It attracts the attention of the patient generally, and indicates to the physician that *pus* has been produced in the part or organ inflamed. As soon as suppuration is complete, and the abscess ripens, or pus approaches a surface to be discharged, and especially if any important organ is its seat, the fever tends to become asthenic, with a brown tongue and a rapid pulse, while the local pain in a great measure subsides. At this period the abscess must open either spontaneously or by art, otherwise the patient for the most part dies. The opening of the abscess, though attended with much pain from the contracting of the inflamed walls, is usually followed by great relief of all the constitutional symptoms; the pulse rises, the tongue cleans, the appetite returns, and a visible and immediate amendment takes place. If, however, the patient has been exhausted by his sufferings in the earlier stages of the disease, the relief afforded is but transient, the pus degenerates into a sanies, or is altogether suppressed, fever changes its type, and the patient sinks, too enfeebled to establish the reparatory process.

Typhoid Fever.—The *type* of *fever* just referred to is known by the name of *typhoid*. Its character is *asthenic* or *adynamic*. Feeble and more feeble the patient becomes, the pulse sinks, the features become pinched, shrunken, damp, and ghastly; and the skin is covered with a cold and clammy perspiration. The tongue becomes dry, black, and tremulous, sordes cover the teeth, and harden on the lips and angles of the mouth. Low muttering delirium, stupor, or coma prevail, tremors affect the voluntary muscles; and the fæces and the urine pass unnoticed. This form of fever sets in as a consequence of some untoward or unhealthy tendency of the inflammatory process, such as when mortification of the part occurs. Any cause, however, by which the system becomes extensively vitiated, will bring about this form of fever. It is not necessary that the part should die. Putrescence, or poisoning of the fluids, in the inflamed part coming in contact with textures capable of absorbing them, as in the infiltrated exudations, may induce the typhoid state. If this happens with an internal organ, the event is generally

indicated by a sudden cessation of all pain, at which the patient often appears very happy and even joyous, while to the experienced physician its sudden cessation is assuredly an evil omen (WATSON). The most important vital functions are deeply impaired by a prolonged existence of this type of fever. It tends to death by a complete sinking of the circulation, diminution and loss of animal heat; or, deepening stupor, with oppressed respiration supervenes, or the patient dies by a combination of both conditions, *asthenia and coma*. For an account of the pathology of this type of fever, the reader is referred to Part II. of this handbook under "Typhous Fever."

Hectic Fever.—If suppuration continues beyond the powers of the constitution to supply the process with material to form inflammatory lymph and pus—if the inflammation continues and becomes chronic as to time, inflammatory lymph continuing to be exuded, and pus continuing to form in profuse quantity, especially if an internal organ is its site—another type of *febrile* symptoms are apt to supervene, constituting *hectic fever*. It is not to be supposed, however, as was once believed and taught, that *hectic fever* is due in every case in which it occurs, to the continued formation of pus. There are forms of *hectic fever* which may be termed idiopathic, unconnected with suppuration anywhere, but associated with some analogous wasting of the bodily substance; for example, a prolonged secretion of milk in mothers who suckle their infants beyond the natural period. In all cases where a drain upon the system is established beyond its means, such a complex morbid condition of the body as *hectic fever* may be thus induced, and the mischief may not be revealed by any other symptoms. This type is particularly distinguished from the inflammatory and typhoid forms of fever by its remarkable intermissions, which are usually periodical; a period of remission and a period of exacerbation usually occurring once and sometimes twice in the twenty-four hours. It is also characterized by an excessive waste of the tissues of the body; and the sweating which attends the paroxysms causes great exhaustion. The assimilative and nervous functions are comparatively unimpaired, so that it is a febrile state generally of very long continuance. The mind remains perfectly clear, often vigorous and active, even when the body is debilitated; and if the intervals between the paroxysms are tolerably free from febrile excitement, the *hectic* type of fever may be protracted much beyond what at first sight might appear credible; and thus it is sometimes within our power to alleviate greatly this condition. If, however, the fever does not abate during the remissions of the excessive paroxysm, when sweating continues profuse, when suppuration or other wasting discharge is excessive, the fatal termination approaches rapidly.

The leading symptoms of this form of fever have been watched

and described minutely by many observers, non-professional as well as professional. The *fever* creeps on insidiously, and almost imperceptibly; and the physician is at first led merely to suspect that it has set in by a very slightly increased frequency of pulse, and a small degree of heat of skin, occurring generally towards evening, and subsiding before the beginning of the next day. The pulse is also subject to temporary quick excitement from slight causes, such as by exertion, emotion, or by food, as after meals. The heat is especially felt in the palms of the hands and soles of the feet. The excitement of the pulse gradually begins to be more and more easily induced throughout the day; and towards evening, the general exacerbation of the febrile state becomes regular, and is unmistakable. *Periodic* exacerbations and remission now become distinctly marked. The exacerbation or febrile paroxysm occurs almost invariably towards evening, reaches its height about midnight, and terminates by a profuse perspiration or sweating stage towards the morning. This sweating is sometimes called *colliquative*, and sometimes may be replaced or accompanied by *diarrhœa*. Occasionally a second paroxysm occurs in the morning after breakfast (Wood), or at noon, as described by Cullen; and as a midday meal was common in his day, it is probable that these slighter paroxysms may be attributed to such causes as the simple taking of food. Generally, however, in the earlier periods of this type of fever, the interval from morning till towards the afternoon and evening is free from fever; but in the advanced stage, the fever becomes nearly constant, while the evening exacerbations and the morning sweats remain characteristic to the end. The pulse of the hectic patient is scarcely ever so hard and full as the pulse of *inflammatory fever*, nor is it so soft and compressible as the pulse of the *typhoid patient*. It expresses a middle condition between the two of very variable character, both as to quickness and strength, according to the degree of exhaustion of the patient, and the amount of febrile re-action. Often during the paroxysm, or during temporary excitement from slight causes, it reaches 120 beats in the minute, the beat being performed with a jerk, as if the result of irritation upon a weakened heart (Wood).

The heat of skin during the paroxysm is often considerable, and always distressing, so that little more than the slightest covering can be endured. The respirations are quick and short. The appearance of the face is so characteristic, that the *hectic flush* of the cheek is an appearance now well known. It is limited to a spot in the centre of the cheek, its delicate bright red colour and circumscribed form contrasting strongly and often beautifully with the pale cheek, the bright and sparkling eye, with its sclerotic of pearly whiteness. The surface of the skin is harsh and dry, and towards the close of

life the region of the ankles are apt to become œdematous. The patient loses flesh rapidly, and towards the close he becomes exceedingly emaciated. It is then that *diarrhœa* is apt to supersede and to aggravate the sweating, so as completely to exhaust the remaining strength. The mind, unclouded before, now gently wanders, and the functions of life cease, generally without a struggle.

Such is an outline of *hectic fever* as described by physicians; and the non-professional pen of Mr. Charles Dickens thus beautifully portrays its more striking features in the death of Smike, for it is generally one of the closing symptoms most strongly marked in pulmonary consumption. Mr. Millar quotes the passage in a note to the chapter on hectic fever in his *Principles of Surgery* :—

"But there were times, and often too—when the sunken eye was too bright, the hollow cheek too flushed, the breath too thick and heavy in its course, the frame too feeble and exhausted, to escape their regard and notice. There is a dread disease which so prepares its victim, as it were, for death; which so refines it of its grosser aspect, and throws around familiar looks, unearthly indications of the coming change—a dread disease, in which the struggle between soul and body is so gradual, quiet, and solemn, and the result so sure, that day by day, and grain by grain, the mortal part wastes and withers away, so that the spirit grows light, and sanguine with its lightening load; and feeling immortality at hand, deems it but a new term of mortal life—a disease in which death and life are so strangely blended, that death takes the glow and hue of life, and life the gaunt and grisly form of death."

The forms of fever now noticed, as phenomena which may be associated with the inflammatory process, are usually regarded as various *types* which the febrile state may assume.

SECTION V.

ON THE MODES BY WHICH DISEASES TERMINATE FATALLY; THE TYPES OF DISEASE AND THEIR TENDENCY TO CHANGE; AND GENERAL TREATMENT OF COMPLEX MORBID PROCESSES.

In describing the nature and treatment of disease generally, and of individual diseases in particular, it is necessary to make a separate study of the various *modes by which diseases terminate fatally*; and also of the *varying types, prevailing peculiarities*, and *constitutional tendencies* which diseases at various periods assume.

Modes of Fatal Termination of Diseases.

Our knowledge on this subject is derived chiefly from three sources, namely, from the examples and illustrations afforded by the

study of—(1.) death from old age; (2.) death from fatal injuries; (3.) the powers and actions of all our best remedies. Such study leads to the important practical conclusion, that the same lesions of important organs may prove fatal in very different ways, and the fatal event may be averted by very different and very opposite remedies (ALISON). It is also to be observed, that in constitutions which are unimpaired; and, indeed, in every morbid process, there may be recognized a tendency to a spontaneous favourable termination.

Death happens either from the decay of life, as in old age; or it happens as an accident caused by some of those untoward lesions or derangements of the vital organs, which happen in the course of the various diseases and injuries to which mankind are liable.

Death by *extreme old age* may be considered in many instances as the desirable end of a long continued and dreary disease. The sufferer appears to fall asleep as he would do after severe fatigue. The long and weary journey of life is often thus brought to a close, with little apparent derangement of the ordinary mental powers; the final scene is often brief, and the phenomena of dying almost imperceptible. The senses fail, as if sleep were about to supervene; the perceptions become gradually more and more obtuse, and by degrees the aged man seems to pass into a final slumber. We scarce can tell the precise instant at which the solemn change from death to life has been completed. Sensation fails first, then voluntary motion, but the powers of involuntary muscular contraction, under the excitement of some external stimulus, may continue longer to be feebly expressed. The blood generally at first ceases to be propelled to the extremities. The pulsations of the heart then become less and less efficient to send the blood beyond a short distance; so that the feet and hands become cold as the blood leaves them, and the decline of temperature gradually advances to the central parts. Thus far the act of dying seems to be as painless as that of falling asleep; and those who have recovered after apparent death from drowning, and after sensation has been totally lost, assert that they have experienced no pain. What is called significantly the *agony of death*, may therefore be presumed to be purely automatic, and therefore unfelt. The mind, doubtless, at that solemn moment, may be absorbed with that instantaneous review of impressions made upon the brain in bygone times, and which are said to present themselves with such overwhelming power, vividness, and force, that in the words of Montaigne, "we appear to lose with little anxiety the consciousness of light and of ourselves." At such a time, the vivid impressions of a life well spent, must constitute that *euthanasia*—that happy death to be desired by all.

The untoward lesions or derangements of vital organs, which occur during the progress of disease, terminate the life of man by

various modes of dying. While it is ordained that eventually all must die, yet it is possible sometimes to avert, for a time, the tendency to death. To know by what agents this may be properly accomplished, it is necessary to know the modes in which death may approach in disease. As Dr. Watson happily observes, life rests upon a tripod, whose three vital supports are, the *heart*, the *brain*, and the *lungs*. Through the impaired functions of some one or more of these organs the tendency to death is expressed. The mode of dying may begin at the *head*, the *heart*, or the *lungs* (Bichat). But inasmuch as the functions of these organs are mutually dependent upon each other, so impairment of function in any one of them may ultimately lead to death, while the mode of dying is expressed chiefly through the functions of another. The mode of dying in disease is usually a complex one, for many parts thus mutually dependent on each other are more or less immediately involved. Therefore it is of the greatest practical importance to observe, how and when, the different functions begin to languish, and how they may be best sustained in their exertions to maintain life.

When a person loses blood to such an extent that he faints, as from a wound, or by hæmorrhage occurring in disease, and if the flow of blood is not arrested, the state of *faint* or *syncope* continues, is not recovered from, and the heart's action ceases ; not because it is unable to contract, but because its natural stimulus, the blood, is withdrawn from it, or does not arrive in sufficient quantity to be of use.

This is called death by *anæmia*. In such cases, if blood can be timeously supplied to the heart (as by the operation of transfusion from a healthy person into the patient who is losing blood), the suspended function of the heart may be restored, and a supply of blood, sufficient to maintain life for a time, may be thus obtained.

The symptoms of approaching death by this mode of dying are, paleness of the countenance and lips, cold sweats, dimness of vision, dilated pupils, vertigo, a slow, weak, irregular pulse, and speedy insensibility. If the hæmorrhage has been sudden, in large quantity, as from the uterus, in "flooding," there may be nausea, or even vomiting, restlessness, tossing of the limbs, irregular sighing breathing (anxietas), delirium, and one or two convulsions before death ensues.

But another mode of death may be more immediately connected with the heart itself, and be independent of the supply of blood. In other words, the stimulus from blood may be sufficient, but the contractile power of the organ may fail.

Such a mode of death is by *asthenia*. Many poisons act in this way, and many diseases which are due to morbid poisons in the blood tend to prove fatal by this mode of dying. Cases of extensive mortification of parts, of acute inflammation of the peritoneum, and of malignant cholera, die in this way.

The symptoms consist in the pulse becoming feeble and frequent, and ultimately failing altogether to be perceived. The muscular debility becomes extreme, but the senses remain perfect, often painfully acute, and the intellect clear to the last.

Persons whose death is by *anæmia* or by *asthenia* are often spoken of as having died in a faint, or by *syncope;* and there is still a mode of dying intermediate between the two, the type of which is seen in *death by starvation.*

Death may also be produced by the suspension of the functions of respiration, as when access of air to the lungs is prevented by a direct obstruction, either to the air passage, in choking, or to the action of the chest, so as to prevent its expansion; or when the actions of the muscles of respiration cease, in consequence of disease or injury to the brain producing insensibility.

The first of these modes by which the respiratory functions are suspended, is that known as *suffocation*, technically expressed by the term *apnœa*, or privation of breath. Examples of this mode of dying may be referred to by cases of *drowning*, *smothering*, *choking*, *strangulation*, *throttling*, and closure of the *rima glottidis* by foreign bodies. In Dr. Allen Thomson's anatomical museum at Glasgow, there is a larynx preserved in which a piece of coal is wedged between the rima glottidis. A collier thus died by *apnœa* or *suffocation* produced by the piece of coal dropping into the larynx while he lay on his back in the mine, excavating the coal from the roof of the coal pit. Forcible pressure upon the chest, as sometimes happens in crowds during a continued crush of people, or occurs to workmen who have been buried by falls of earth and rubbish; in short, whatever causes an immovable condition of the lung case beyond a period of three minutes, will thus produce a fatal result. Tetanus, and the influence of strychnine, prove fatal in this way. Morbid states, produced by disease, and which terminate fatally by *apnœa*, are *œdema* of the glottis; disease of the spinal cord above the origin of the respiratory nerves (phrenic, intercostals and spinal accessory); effusion of serum into the pleural cavities; sudden infiltration of the lungs by inflammatory exudation, or collapse of the lung in bronchitis.

The symptoms of approaching dissolution by this mode of dying are, strong but ineffectual efforts to contract the respiratory muscles and struggling efforts to respire, amounting to agony, of short duration, followed by vertigo, loss of consciousness, and convulsions; at last all effort ceases, twitchings or tremors of the limbs alone remain, the muscles relax, and the sphincters yield. The heart and the pulse, however, still continue after all other signs of life are past. On this last circumstance rests our hope of resuscitating persons so suffocated, if artificial respiration be timeously resorted to, and perse-

vered in. This prolonged action of the heart circulates blood, which is dark, venous, and not arterialized, and accordingly, the face, at first flushed, becomes turgid, and then assumes a livid and purple hue; the veins of the head and neck swell, the eyeballs protrude from their sockets. At length the heart ceases to beat, and life is extinct (WATSON).

Death by coma occurs when there is a loss of consciousness first, with the appearance of profound sleep, from which the patient may be partially roused. The symptoms of approaching death by this mode of dying consist in a gradual blunting of sensibility to outward impressions, slowness of respiration, the inspiratory effort being often delayed, and then performed with a sudden noise and jerking inspiratory effort, technically known as *stertorous* breathing. All voluntary attention to the act of breathing is lost, but the influence of a reflex stimulus to its performance continues. At length this function fails also. The chest ceases to expand, the blood is no longer aërated, and thenceforward precisely the same changes occur as in death by apnœa.

Such are the several modes by which death tends to approach; and "*to obviate the tendency to death*" is a doctrine which was often and strenuously inculcated by Cullen. After him, no less earnestly has it been impressed on many by my respected teacher, Professor Alison, whose interesting Lectures on *fevers* and *inflammation* furnished numerous illustrations. To his *Outlines of Pathology and Practice of Medicine*, and to the first volume of Dr. Watson's *Lectures on the Principles and Practice of Physic*, the student is referred who would seek further information. From these sources the preceding observations have been compiled, relative to the modes by which death may approach.

"Many are the ways that lead
To his grim cave, all dismal; yet to sense
More terrible at the entrance than within."

Types of Disease and their tendency to change.

In describing, appreciating, or ascertaining the type of a disease, our attention must be directed to a variety of phenomena and conditions; and the type of the disease only becomes characteristic and distinctive when some one or other of those conditions becomes predominant, or manifests itself more decidedly than others. The hereditary or natural constitution of the individual may be regarded as an important element in determining the type of the disease. Town life, as compared with country life, also exercises an influence; and there are good grounds for believing that the town life and artificial habits of the present period are more prejudicial to the strength of the constitution than those which prevailed when large

towns were but rural villages, the inhabitants more simple in their mode of life and less artificial in their habits.

The occupation of the individual also in many instances exercises an influence over the complex processes of disease. The social habits of the age are very much different from what they were wont to be. Society is now disposed "to exercise a rigid temperance in all that concerns life. The human constitution cannot now bear with impunity and safety a great amount of stimuli and mental work. This was not the case in those halcyon days, when men were recognized as being two, three, four, or five bottle men. This change may be attributed to the social habits of the age; but, to some extent, may not those altered and temperate habits arise from a consciousness of our inability to live above par, as men were accustomed to do thirty or forty years back?" (WINSLOW).

Further, there cannot be a doubt that some diseases have altogether disappeared, while others have been so much modified that their resemblance to the original form or type can with difficulty be recognized; others have arisen, more or less new, in some instances resulting from a hybrid combination of various pathological phenomena. While this is undoubtedly the case, there is abundant evidence to prove that we now have a more healthful enjoyment of our life on the whole, although the constitution may not be so strong than even in those so-called halcyon days; and that the duration of man's life of late years has been, on the whole, prolonged. While it is the lot of "all men once to die," that final change is now much more frequently extended, than was wont, to those limits which Omnipotence has set to human existence—to that period when, in the words of the inspired Psalmist, it is recorded that "the days of our years are threescore years and ten; and if by reason of strength they be fourscore years, yet is their strength labour and sorrow."

It has been observed by a popular writer that there never were any specifics discovered against the *plague*, the *sweating sickness*, or the *leprosy*, and yet these diseases, as far as regards this country, are now amongst the things that were, and are almost unknown. They have disappeared, not before any marvels of medicine, or any perfection of chemical sciences, but before the gradual amelioration of our condition through sanitary improvements.

Dr. Pollitzer, of the Children's Hospital at Vienna, is of opinion, that while the duration of mortality at early ages is diminishing in all civilized countries under the various influences of extended hospital accommodation, care of the sick, vaccination, and general sanitary regulations, there is no corresponding increase in the strength and vigour of the human race. On the contrary, the boundaries between health and disease are thus becoming less and less

marked. There are now to be observed numerous conditions which are undoubted deviations from the healthy standard, which it is impossible to delineate or accurately to define, because they make their appearance during a state of "*relative health.*" The physician is not always even able to name the disease; and while the patient maintains he is not feeling in health and not looking in health, but wasting away, his food doing him no good, he has no alternative but to call himself ill. Such is the insidious mode in which many of those truly CONSTITUTIONAL diseases, now common, make their appearance, and which may be regarded as constituting a peculiar characteristic in the pathology of our times. These diseases are known by the various names of *anæmia, spanæmia, leucocythæmia, chlorosis,* to which we must now add that form of disease lately described by Dr. Addison, all the pathological features of which show that it undoubtedly belongs to the class referred to.

The poorness of the blood, peculiar to this class of diseases, furnishes the soil in which the feebleness and deterioration of our race is most unmistakably evident. The nervous system is, moreover, extensively involved in the diseases of the age, and thus feebleness and debility constitute their dominant character. This physical deterioration is apparently a "*sad memorial of modern civilization.*" In this respect the observations of Dr. Pollitzer coincide with those of Dr. Forbes Winslow. "A constant stretch of the mental powers, a restless excitement of the passions, a perpetual struggle for advancement, the fresh wants of every day (science, and the arts themselves, being subservient even to the luxury and demoralization of the times), the destruction of all moral harmony and peace, are evils which undoubtedly prevail, and which re-act especially upon the younger generation." The sins of the fathers are now undoubtedly being visited upon the children in these days, and are likely to continue to be so. The demands made upon the youth of eighteen or twenty of the present day, would formerly have been considered a sufficient tax for the strength of a man of upwards of five-and-twenty. Many of the features, also, which characterize the pathology of our age, have had their source in the treatment of infancy and childhood; and much of the deterioration of the race at large dates its origin from childhood. Thus, after seventeen years' observation in children's disorders, Dr. Pollitzer writes that *anæmia* and *chlorosis* occur alone, or associated with *rickets, hypertrophy* of the *lymphatic glands*, and of the *spleen* and *liver*, to an incredible extent even from the first month of life. In the Children's Hospital from 70 to 80 per cent. were thus affected. Wherever the nutrition of the child has been imperfectly effected, the constitutional diseases associated with poverty of the blood become widely diffused. The stomach and intestinal tract first suffer, con-

stituting the prevailing morbid condition of childhood—materially influencing the mortality at an early age, and if the age of childhood is survived, affecting the future health of youth and manhood."—(*Med.-Ch. Rev.*, Report on Medicine, p. 261, July, 1857.)

The types of disease are also evidently modified by complication with other diseases, now more widely spread. Virchow relates a case of typhoid fever, combined with striking symptoms of cholera, occurring at Würzburg, where no cholera has ever yet been seen. There are also good grounds for believing that as we approach certain well marked geographical regions of the earth where characteristic types of disease prevail, the confines of these disease-realms are found to mingle their types of disease together, so that the diseases of one region merge into and participate in many of the characters peculiar to the other.

The synocha described by Cullen is now rarely if ever seen. Typhoid fever, as described by Dr. Christison in Edinburgh, and by Dr. Jenner in London, has scarcely existed in our country more than fifty years, but it is now more and more frequently observed.

Cholera has extended its ravages over the earth, and is now a disease endemic to our land; and, consistent with the prevailing medical constitution, the system under its influence, especially in the early cases of an epidemic, becomes rapidly depressed to the speedy extinction of life. The furunculoid epidemic which prevailed about two years ago, was one of a novel variety, and must be associated with a similar kind of medical constitution. The *black death* of the fourteenth century seems to have revived in India, and is described by the name of the *Indian Pali plague;* and it may be that the formidable disease which laid waste our country in the thirteenth century may have arisen in these districts, and proceeded thence to our land, passing apparently in the same way that cholera has done (Dr. Allen Webb).

Our modern treatises on medicine justly and properly deal, largely and minutely, with the descriptions of individual diseases, as far as their nature can be discerned; and the languages of all civilized nations have very clearly described them. Now only are we beginning to profit by an extended inquiry into the diseases of nations; and to find that as man wanders from his native home, the type of the diseases to which he is liable also changes. In this field of science an unmeasurable and still unexplored country extends on every side. The more minutely also that individual diseases can be described, the more useful will such descriptions be for comparison in future ages; and it will be seen on comparing the descriptions of diseases, in times past, with accurate descriptions of the same diseases now, how at various periods, and under various circumstances, the expression of certain sets of symptoms becomes sometimes

strongly developed, while at other times the same classes of symptoms were mild and subdued.

It will be seen how in epidemics, diseases have been characterized by the malignant expression of phenomena, almost scarcely perceptible before. The small-pox now-a-days is not the malignant small-pox of the time of Sydenham. And although it may be said that such an example does not illustrate a change in the type of a disease, because the change has been effected by artificial means, yet it must appear evident, that in effecting this *favourable change*, natural results have only been imitated; and who can tell what modifying influences of a similar kind are going on although the science of medicine can as yet take no cognizance of such. We know that certain diseases confer immunity on the individual from future attacks; and may it not be that immunity to individuals from some diseases is conferred by agents and processes of which we as yet know nothing; and that ultimately the types of complex morbid states may still come to be very much changed from what they are now? They certainly appear to be very much changed, according to the best authorities, from what they were forty or fifty years ago. "Many of the symptoms, and particularly the constitutional fever usually attending internal inflammations, and resulting from cold, or from other causes independent of the application of morbific poisons, are liable to variation in like manner, although not so decidedly nor so rapidly as the epidemic diseases, in the course of time, and from causes not yet known. They have in fact undergone very considerable change since the early part of the present century; and it is on this account that inflammations of the lungs in particular are treated with equal success at present, with a much smaller loss of blood than they used to demand" (Alison).

Such changes in the types of disease were formerly observed and much insisted upon by Sydenham, especially in the progress and recurrence of continued fevers; and it is now a fact well recognized, that not only does the prevalent mode of fatal termination during epidemic diseases vary, but so also do the types, peculiarities, and morbid constitutional tendencies vary in these diseases. It is chiefly with regard to the *local*, *sporadic*, or *intrinsic diseases*, and especially inflammations, such as the *cephalic*, the *pulmonic*, or the *enteric*, that any doubt exists as to whether or not they vary in their type, or constitutional tendency. Distinct statements as to this fact, however, have now been made by many accurate observers, whose experience is of the utmost value to science. Dr. Alison and Dr. Bennett both agree as to the fact, "that of late years, and apparently also in different parts of the world, *inflammation*, the most important of all forms of *local diseases*, seldom shows itself with such general symptoms as demand or would justify, in the

opinion of the practitioners treating them, or indeed could bear the large bleedings which were formerly regarded as the appropriate remedy, and which accordingly are now seldom practised." There are not only also fewer examples of violent inflammation of the lungs to be met with, but the *usual* (highly inflammatory) type of fever attending such inflammation then, as occurring in the present day, has materially changed. This change which has taken place in the *type* of the usual phenomena symptomatic of inflammation, cannot be explained merely by the circumstance that a previously enfeebled or diseased state of the system has brought it about in the individual. The inflammations of internal parts, such as pneumonia, now *occur often without such febrile re-action*, and neither demanding nor bearing full bleedings, as described by Cullen and other authors. It is consistent, moreover, with the extensive experience of Drs. Alison, Christison, Watson, and many other physicians now living, of the greatest eminence and long experience, that the inflammations now very seldom occur with such severe symptoms of inflammatory fever as have been described at page lxxix, and which were the rule in the times of Cullen and of Gregory. The constitutional symptoms now attending such inflammations partake more of the type of *typhoid fever* (as described at page lxxxii), and independent of any epidemic influence or poison like that of the *typhous poison* having acted on the body.

The general character of the constitutional symptoms for many years past, accompanying pneumonia, for instance, in this country, have been of the following kind :—An enfeebled circulation ; softness of the pulse, and easiness of depression by depletion, or even by taking the erect posture ; tremors and feebleness of voluntary muscular motion, approaching to subsultus ; indifference to surrounding objects, approaching to typhoid delirium stupor ; sickness and vomiting in some cases, with dryness and feebleness of tongue and lips in others ; complete anorexia or depraved appetite ; in all, the symptoms tend to assume those of *typhoid* fever rather than of *inflammatory fever*. Nevertheless, in the treatment of such cases, blood taken early is distinctly beneficial ; and although it may show the *buffy coat*, this has neither the thickness nor the tenacity of the *fine buffy* coat, seen and described in former days ; faintness also supervenes on the loss of a quantity, small in comparison of what was formerly well borne, and there is no such encouragement to a repetition of the bleeding, from the pulse speedily regaining its strength, or from the local symptoms abating and quickly recurring, as was formerly noticed by Cullen, Gregory, Christison, Alison, and other veterans in the practice of medicine. The mode of fatal termination is also different. The tendency to death is now most usually either by *coma* or by *asthenia*, as in typhus. The tendency

to gangrene has also become much more frequent in various inflammations of internal parts, and particularly in the lungs, within the last forty years, than it was in the time of Cullen and of Gregory. Such is the matured records of experience, as stated by Dr. Alison in a series of papers published in *The Edinburgh Medical Journal* in 1855, 1856, and 1857 ; than whom the opinion of no one is more entitled to respect and consideration.

Dr. Handfield Jones, physician to St. Mary's Hospital, London, observes, "that instances of impaired action of the heart, sometimes amounting to serious danger, are now met with at the present time, with an absence of all conditions which require or justify venesection. This is associated with other symptoms of depressed nervous power, which appear to be most reasonably attributed to some kind of epidemic influence much resembling that of malarious diseases.

The type of disease which reigns at present, and which seems to have prevailed more or less since the appearance of pestilential cholera amongst us, is also decidedly unsuited to the beneficial action of mercury. There is now little of sthenic inflammation ; bleeding and tartar emetic are but sparingly needed, while quinine, strychnine, and other tonics, with opium, and cod-liver oil, are continually in requisition in our efforts to raise and maintain failing power (*Medical Journal*, March, 1857, quoted by Dr. Alison). According to the experience of obstetric practice, the observations of Mr. Sidey of Edinburgh are to the same effect. He also observed that the epidemic of influenza in this country thirty years ago, was of a most decidedly inflammatory character. We now know also that cases of influenza generally assume the *asthenic* type, and demand a different treatment ; and many diseases of an inflammatory nature, which were quite common years ago, are now comparatively rare, *e. g.*, *croup* and *iritis*. Moreover, he observes that it is consistent with the experience of the veterinarians, that the change in the type of disease has been observed among the lower animals to the same extent as in man.

Dr. Forbes Winslow writes, with regard to nervous diseases, that cases of disease of the brain and nervous system are now also not only of more frequent occurrence, but that a certain unfavourable type of cerebral disorder develops itself in the present age at a much earlier period than formerly. Softening of the brain, for instance, now often manifests itself at the early age of thirty and thirty-five. The brain in the present day is overworked, its psychical functions are unduly exercised, strained, and taxed in the great effort required in the severe struggle and battle of life to obtain intellectual supremacy, professional emolument, and status (*Journal of Psychological Medicine*, July, 1857.)

Sir James Clark made the observation more than twenty years

ago, that he believed as a rule that the constitutions of the past three generations had deteriorated progressively from father to son (*Treatise on Pulmonary Consumption*, p. 11).

Whatever, therefore, the explanation may be, writes Dr. Alison, it certainly is a matter of fact, that the *constitutional affections* going along with the same extent of inflammation and its local effects, are extremely various in different persons, previously alike in good health, or even in the same person at different times; and that we are not entitled to deny that what happens in this way in different individual cases, may not happen also in nations and in seasons. As we are still very imperfectly informed as to the mode in which any local inflammation excites constitutional fever, I cannot see, he writes, that we have any reason to doubt that the constitutional re-action consequent on the excitement of a certain degree of inflammation of the lungs may vary, equally as that which is consequent on the introduction of a certain quantity of the poison exciting *typhus fever*, *measles*, *scarlatina*, or *cholera;* in all of which the previous muscular strength goes for nothing in determining the degree or danger of depression or debility which may ensue.

Dr. Christison has also recently communicated to the Medico-Chirurgical Society of Edinburgh, his experience relative to the changes which have taken place in the constitution of fevers and inflammations in Edinburgh during the last forty years. His experience, as well as that of many of the older physicians of Edinburgh, shows that a transition had and did every now and then take place from an *inflammatory form* of fever to one of an *asthenic type;* that it was necessary also on the outburst of any epidemic to watch carefully the early cases, to observe the mode in which the fatal cases terminate, and to observe generally the *constitutional tendency* or type of individual cases, in order to form an accurate judgment of the general character of the epidemic about to prevail. It will be seen also, on referring to the most approved and recent works on the diseases of India, that the descriptions of inflammations as well as fevers now seen there, when compared with the statements of Dr. Johnson, Mr. Twining, and others, twenty-five or thirty years ago, may be held to indicate that there has been a change in the usual form of *re-action* in inflammatory diseases in that climate as well as here. Such conclusions may be inferred from the experience of Dr. Morehead recorded in his *Clinical Researches on the Diseases of India*, (vol. ii., pp. 71, 72, and 359, quoted by Dr. Alison); and the experience of Mr. Martin, expressed in his recent classic work on Climate, bears out the same observation (MARTIN, p. 143).

It appears therefore fully shown, that the *human body* is capable, from causes unknown to us, of undergoing various alterations as

regards what has been termed its "*Medical Constitution.*" *Fevers* are known to change their types; *Epidemics* to assume new tendencies; and *inflammations* and *local lesions* to affect in no constant manner the constitution of individuals at the same period or at different times and in different countries. In the eloquent language of Dr. Watson, this topic may be concluded ;—"for my own part," he writes, "I am firmly persuaded, by my own observation, and by the records of medicine, that there are waves of time through which the *sthenic* and the *asthenic* characters of disease prevail in succession, and that we are at present living in one of its adynamic phases" (*Edin. Monthly Journal*, June, 1857).

Treatment of the Complex Morbid Processes.

The general treatment of the febrile state having been already indicated at page xlviii, it is here only necessary to consider that of inflammation.

It is necessary clearly to understand and to bear in mind that it is not the *lesion* which may attend the inflammatory process as a result, which is to be attended to in the first instance ; but it is *the diseased action tending to the lesion* which it is the object of the physician to overcome, to subdue, and turn aside ; and that the occurrence of any lesion is, if possible, to be prevented. It is to the *strictly vital* action which tends to organic lesion that remedies must be applied, in order to avert that tendency to local lesion, which may be expressed by symptoms of a constitutional kind, already referred to.

The treatment which will subdue this tendency is technically called "*antiphlogistic treatment.*" Its mode of action depends upon the regulation and adoption of every agent, plan, or circumstance most favourable to the subsidence of the disease, and which will favour the influence of remedies, and oppose the advance and persistence of the inflammatory tendency. The treatment embraces —(1.) antiphlogistic regimen ; (2.) antiphlogistic remedies.

The *regimen* consists in—(1.) a sparing allowance of non-nutritious diet ; the administration of bland, simple, and cooling drinks, given often and in small quantities. (2.) Absolute rest of body and mind. (3.) Residence in a well ventilated apartment, maintained at a temperature of about 62°.

The *remedies* comprehend *blood-letting*, *purgatives*, *emetics*, *mercury*, *opium*, *antimony*, *diuretics*, and *saline* drugs.

The most important and the most efficient of these remedies is undoubtedly *blood-letting;* while it must at the same time be remembered that it is not every case of inflammation that requires or warrants the abstraction of blood in the present existing *medical*

constitution. It is a spoliative remedy, powerful for good and for evil. In the treatment of inflammation, it has been well observed by Dr. Watson, that "each case requires its special study, speaks its proper language, furnishes its peculiar indications, and reads its own lessons." The carefully recorded facts of well conducted though empirical observation, for hundreds of years, have attested the immediate sanative influence of blood-letting in incipient inflammation; and the most eminent physicians of by-gone modern times have recorded in unmistakable language how potent is this remedy for good, and the reasons for their belief.

Our forefathers well knew when the body suffered from an inflammation in the "*inward parts;*" and in saying this, we give them credit for far less scientific knowledge than they really possessed. Against such inflammations, whether in the *head*, the *chest*, or the *abdomen*, they learned by "*watching* and not by *counting*" the sanative efficacy of early venesection; and they obtained most trustworthy evidence and experience of its power to control inflammation. Following up such doctrines, will be found those veteran physicians who hold the foremost rank in the science of medicine of the present day in this country—Alison and Christison of Edinburgh, and Watson of London. In the words of the latter, the doctrine generally taught and universally acted upon with reference to blood-letting in inflammations is, "*so to bleed as to secure the advantages of the remedy, and to avoid its disadvantages.*"

The standard examples of what blood-letting can do soon become apparent to every surgeon's apprentice, if he does not himself swoon the first time he sees the blood flow from the patient whom his master and teacher may wish to relieve. He sees the apoplectic sufferer roused to consciousness, while the blood yet flows from the vein; and he will soon observe also that the *stounding pains* of the head in cephalic inflammations are immediately relieved, that the impatience of light and sound, the frequent sharp intermittent pulse, with vomiting or nausea on assuming the erect posture, the tendency to squint,—in short, all the urgent symptoms of incipient encephalitis, at once, or one by one, disappear as the blood continues to flow. He will frequently also notice in *thoracic* inflammation that the pain, the dyspnœa, the tightness of the chest, all disappear. Dr. Alison, as regards pleurisy, and Dr. Watson, as regards inflammation of the bowels, bear personal testimony to the good effects of blood-letting. They experienced its sanative influence in their own persons, and the practice undoubtedly saved their valuable lives from these respective diseases. Testimony from such personal experience has also been borne by the late Dr. Gregory of Edinburgh, and before him by the celebrated Dr. Radcliffe; and so also is the testimony of many who, having experienced the benefit

of the remedy once, imagine that when again attacked with inflammation they may be again relieved by its use. Accordingly they anxiously desire the remedy, when seized by an apparently similar attack. Of any one of these illustrious examples from personal experience, it might be said, as Dr. Gregory said of Dr. Radcliffe, that "he was at least no fool; and we may depend upon it he would not have allowed a hundred ounces of blood to be taken from him in one day without good reason for it" (*Edin. Med. Jour.*, March, 1857).

"Although much has been done," writes Dr. Alison, "particularly by the French pathologists, to enable us to judge of the texture within the chest which is the subject of inflammation, and although this is a matter of real importance, because we know that the history of the changes to be expected from inflammation in the bronchiæ, substance of the lungs and pleura, is materially different, and of course the diagnosis of these gives us a great advantage in studying the progress of any individual case,—yet as to the specific questions of blood-letting or not, the quantity, or the repetition of the blood-letting, our predecessors were very nearly as well informed as we are. It is an important practical error," he also continues, "to fix the attention, particularly of students of the profession, too much on those characters of disease which are drawn from changes of structure already effected, and to trust too exclusively to these as the diagnostics of different diseases; because, in many instances, these characters are not clearly perceptible until the latest and least remediable stage of diseases. The very object of the most important practice, moreover, in many cases, is to prevent the occurrence of the changes on which these lesions depend. After these lesions are once established, the cases are very often hopeless, or admit only of palliative treatment. In those diseases in which most can be done by art, our practice must always be guided in part by conjecture, because, if we wait for certainty, we very often wait until the time for successful practice is past; and therefore, although an accurate knowledge of the whole history of each disease is essential to its proper treatment, yet, in a practical view, the most important part of its history is *the assemblage and succession of symptoms*, by which its nature at least, if not its precise seat, may often be known, *before any decided lesion of structure has occurred.* Accordingly, when this department of pathology is too exclusively cultivated, the attention of students is often found to be fixed on the lesions to be expected after death, more than on the power and application of remedies, either to control the diseased actions, or relieve the symptoms, during life."

The immediate effects of loss of blood as a remedy in inflammation are—(1.) A sedative result on the heart's action, by diminishing the quantity and altering the quality of the blood, the withdrawal of a considerable amount of stimulus from the central organ, and the depressing effect of sudden loss of blood, the excitability of the nervous system being thus reduced. (2.) The loss of blood generally has a derivative influence upon the blood in the part about to

become the seat of effusion. This has been seen to occur in experiments upon the transparent parts of animals. (3.) Blood-letting facilitates the action of other remedies. (4.) While the effect of blood-letting is well known by the observations of Louis and Alison not always to check the extension of the sphere of inflammation, *yet it essentially modifies* its character (*a*) sometimes by limitation of its sphere to a certain extent, (*b*) by diminishing the quantity of blood from which the effusion or exudation is to proceed, (*c*) rendering the exuding lymph more liable to re-absorption.

Of late the medical profession has proclaimed with no uncertain sound, especially from the metropolis of Scotland, as to the good effects of blood-letting in the treatment of inflammation. It is well known that no remedy demands a more careful study of its application or a more delicate adjustment of its powers; and therefore some general rules may be here stated as a guide in the use of the lancet.

(1.) The utility of blood-letting varies with the variations in the type of disease. A change in the type of inflammatory diseases (*i. e.*, in their usual symptoms, local and general, in their tendencies to certain local and general results rather than others, or a change in their mode of tending to a fatal termination) demands a new study and fresh adjustment of the remedy in each particular case.

(2.) There is no truth, perhaps, in medicine more conclusively determined than that we ought not to bleed, or if we do so, we must bleed sparingly, when the inflammation depends on or is associated with the action of a morbid poison. In epidemics, therefore, of every kind we should not hastily have recourse to the lancet, but should remember that the disease probably depends on a poison, has a course to run, and is not amenable to the mere abstraction of blood.

(3.) It is necessary to observe carefully and to watch the *combination* and *succession* of the *constitutional* and *local* symptoms from the commencement of the febrile attack, and so to judge as to the propriety of blood-letting.

(4.) In order to obtain the good effects of the remedy by a full bleeding, it must be done *prior* to *effusion;* seeing that it is *the diseased action which tends towards the lesion*—namely, effusion—which the physician desires to control by this remedy.

(5.) When the symptoms of *inflammatory fever* are little complicated and seen early, in persons previously healthy, the more violent they are, the more intense the constitutional re-action, and the more decided the change on the function of the part affected, the more confidently we may depend on the effect of full blood-letting in relieving them.

(6.) When the symptoms of inflammatory fever have been uncertain and insidious in the beginning or modified by previously existing constitutional disease, or complicated with organic local

disease, they generally prove intractable to blood-letting even when seen within the first few days.

(7.) Generally, it may be stated, that when the fever is inflammatory, when we may be sure that over a part of the inflamed organ there is congestion, stagnation of blood, distension of vessels, commencing extravasation, and change of the constitution of the blood—but these last changes, still partial and only so far advanced, the power of blood-letting then used to control the disease, has been universally believed.

(8.) The nature of the membrane or organ affected must always be considered in estimating the propriety of bleeding. If a serous membrane, for instance, be actually inflamed, the patient, for the most part, bears bleeding well, and is usually greatly relieved by it. Erysipelas spreading, tending to vesicate, and accompanied with acute inflammatory fever, also bears bleeding well. If, on the contrary, asthenic symptoms are present, and an epidemic prevails, the advantages of the remedy may be doubted. With respect to organs, it is found that inflammation of the brain is less influenced by bleeding than inflammation of the liver; and inflammation of the liver than inflammation of the lungs. The symptoms, which demand a full blood-letting in pneumonia, are also those which indicate the greatest danger — namely, violent pyrexia, usually beginning suddenly, with full, strong, hard, and quick pulse—urgent *dyspnœa*, even *orthopnœa*—swelling and flushing of the face, frequency and violence of cough, with scanty or truly pneumonic expectoration, aggravating the pain which extends through the chest—when such symptoms are seen within *three* days of their commencement, especially in those of robust and full habit in the prime of life, blood-letting is the remedy to be used, everything else is *trifling*, and it is *not safe* to dispense with it. The nearer a case answers this description, the more sure we may be that the effect of blood-letting will be satisfactory, and its repetition, if the symptoms shall recur, will be well borne (Alison). But the type of inflammation of the lungs and other parts prevailing in our time is rarely of this nature; and it is often not less dangerous because the symptoms partake of an *asthenic* type; yet such inflammations get well without such large bleedings as used to be demanded, the loss of a very small quantity of blood making a sufficient impression on the progress of the diseased action tending to the lesion as checks it efficiently.

(9.) It is found in practice, also, that this most powerful of therapeutic agents, in the cure of inflammation, requires the greatest caution in its repetition, for there is a line beyond which bleeding becomes destructive, instead of remedial. Two indications are of great use in determining as to the propriety of a second blood-letting, namely—

(10.) *As to how the first bleeding is borne*—a test first suggested by the late Dr. Marshall Hall. If much blood flow before any tendency to syncope manifests itself, venesection is then considered to be well borne; if, on the contrary, the patient soon faints after a vein is opened, the judicious practitioner desists from further depletion.

(11.) The urgent symptoms, being relieved for the moment, may again return, after a more or less long interval, and thus demand a repetition of the remedy, to be now judged of by the re-action of the system generally, as indicated by the state of the local symptoms, their urgency for relief, the character of the pulse, and the appearance of the blood first drawn.

(12.) The re-action may be of such a kind that a *sthenic* state of *inflammatory fever* still continues, or returns after temporary subsidence. The inflammatory process having been interrupted, so far modified but not arrested, the remission proves transient, and the re-accession may be more fierce than the onset. A repetition of blood-letting is demanded so soon as such re-action has declared itself. On the contrary, the re-action may be *asthenic* or of nervous character, the pulse being rapid, soft, and jerking, the breathing oppressed, headache and tinnitus aurium present, with general nervous excitement; bleeding, under such circumstances, is *not to be repeated*. A full opiate will allay the nervous excitement.

(13.) The next consideration is, what indications for bleeding are to be drawn from the state of the blood? The blood offers certain therapeutic indications, either for bleeding or not bleeding, when the symptoms would otherwise demand or forbid this operation. The firmness of the coagulum, for example, has been considered, at all times, as a mark of the tonic state of the system, and as a warranty for repeating the bleeding when the part is as yet unrelieved, and the re-action continues of the sthenic type.

The thickness, and especially the firmness of the *buffy* coat, if lifted on a pin, was one of the leading characteristics of the existence of acute inflammation, amongst others already noticed, and much founded upon by Dr. Gregory, as guiding his practice in the treatment of inflammation. On the contrary, a looseness of texture of the clot is a sure sign of great debility, so that unless other circumstances strongly indicate the necessity of bleeding, it ought not to be repeated.

(14.) The proportion of the serum to the clot, and also its occasionally altered characters, are arguments also for or against bleeding. When the quantity of serum is unusually large, unless the clot be very firm, bleeding ought not to be repeated. Also when the properties of the serum are so altered that it coagulates and forms one mass with the clot, bleeding is constantly prejudicial; and, lastly,

it has been observed, that when the serum, which has little or no affinity for the red globules in health, readily dissolves them, it is an unerring sign that further bleeding should be avoided. In some of the febrile diseases the fibrine never augments, remains often in normal quantity, and is also often diminished. In the acute inflammatory forms, on the contrary, there is a constant augmentation of this principle ; as observed by Andral, the fibrine being in excess, compared with the red globules, and instead of being 3, as in health, oscillates between 4 and 10. It is this excess of fibrine which gives firmness to the clot, and is the cause of its being buffed and cupped. The immediate effect of bleeding, according to the same high authority, is to reduce the red globules, but not so with the fibrine ; for a reduction of fibrine does not take place till after a certain time. Such is the state of the blood in the sthenic inflammatory states. There are many reasons, however, for not esteeming the buffed and cupped state of the blood denoting an excess of fibrine as a sufficient warranty for bleeding ; for these conditions are often present in erysipelas, phthisis, or the early stages of typhous fevers ; and in either case the loss of a moderate quantity of blood might hurry the patient to his tomb. Again, in acute rheumatism the blood is not only buffed and cupped, but contains a maximum quantity of fibrine ; yet the best practitioners seldom think it necessary to take blood, considering that mode of treatment as neither affording present relief, nor shortening the course of the disease. The fact, then, of the blood being buffed and cupped does not, in all cases, warrant venesection. It is also well known that the sthenic or buffed characters of the blood are often greatly modified by the manner in which the blood is drawn ; thus, if an individual be bled in both arms, and the blood allowed to flow with different velocities, that is, in a full stream from one and slowly from the other, the blood drawn is identically the same, yet a thick buff will be wanting in the latter, and be present in the former. Also, if the apertures be of different sizes, the same differences will result ; the blood from the larger orifice will be buffed, while no such effect is seen in the blood drawn from the smaller one. Again, the form of the vessel which receives the blood, as to whether it be flat or conical, and also its temperature, or whether the blood be received into one that is cold or warm, will also affect the phenomena of its coagulation.

There are many circumstances, therefore, which prevent the blood from being an unerring guide for bleeding in cases of inflammation ; but *the assemblage and succession of symptoms* must decide as to the propriety of blood-letting in doubtful cases.

(15.) An improvement in the character of the secretion or excretion from the inflamed part contra-indicates its repetition ; for

instance, in pneumonia, if the *character* of the expectoration, from being scanty, tenacious, and tinged with blood, becomes copious and free, much may be expected from this natural process.

(16.) It is an object to effect the sanative result with as little expenditure of blood as possible; but the amount to be taken can only be judged of by the effects produced. The patient should be bled, if possible, in the upright position, and a full stream of blood allowed to flow from a sufficiently large orifice in a vein. To accomplish this fully, it may sometimes be necessary to open a vein in each arm, so that the flow may be from both at the same time.

Blood-letting may be employed either generally or locally. General bleeding is best adapted to subdue acute inflammation, because it makes a more decided and rapid impression upon the system. Local blood-letting, by leeching, scarification, or cupping, is more useful in chronic inflammation; but often it is advantageous to combine the two methods of taking blood.

The next most important class of depleting agents in the treatment of inflammation consists of *purgatives*. (1.) They free the stomach and intestines from accumulated food and fæces, or other irritating and acrid matters. (2.) They subdue the inflammatory tendency by the discharge of a large quantity of serous fluid from a large extent of mucous membrane. Their use is especially indicated in cephalic inflammations and hepatic congestions; but they are less efficient in subduing *thoracic* inflammation; and in the enteric inflammations they ought not to be pushed beyond merely unloading the alimentary canal.

The influence of mercury varies with its mode of administration and the constitution of the patient. It is followed in large doses by an increased flow of watery evacuations from the bowels, an increased discharge of bile, and an increased flow of saliva. If, however, the use of the remedy is continued, especially in small and repeated doses, combined with opium, so that it is not passed off by the bowels, this mineral induces *salivation*, that is, saliva flows profusely, the gums become tender, red, swollen, and ulcerated on the margins in contact with the teeth. The patient gets rapidly thin during its use, and the red corpuscles of the blood are rapidly destroyed. Its sanative power consists in controlling or preventing the coagulation of lymph; and for this purpose it is used as an auxiliary to blood-letting. In the present prevailing type of inflammations, or in typhoid states, it is less useful than in the *sthenic* forms of inflammatory action.

The administration and sanative influence of other remedies used in the treatment of inflammations, such as *antimony, opium, colchicum, digitalis*, will be sufficiently illustrated in describing the nature and treatment of individual diseases.

PART I.

SYSTEMATIC MEDICINE: NOSOLOGY, OR THE CLASSIFICATION OF DISEASES.

Nosology is that branch of the Science of Medicine, the objects of which are (1,) to distribute or arrange diseases into classes, orders, genera, or species; (2,) to distinguish each disease by an appropriate name. These two divisions of Nosology are respectively known as the *Classification* and *Nomenclature* of diseases.

Present State of Nosology.—So great is the importance of this branch of Medical Science, that a Statistical Congress of the Great Powers of Europe was convened by the Government of the Emperor of the French, and met in Paris on the 10th of September, 1855, for the purpose, amongst other business, of devising and adopting an uniform system of nomenclature for recording Diseases and the Causes of Death from them. A nomenclature of the Causes of Death was agreed upon, essentially the same as that used in England and Geneva. Subsequent arrangements were made, at a second Congress held at Brussels, to hold a third Congress at Vienna, when it is expected that a system of Nosology will be adopted which shall be similarly uniform, and applicable to the requirements of all countries; at least, till the advance of science shall demand a revision and further modification of the system adopted. As science advances so must Nosology; and notwithstanding the differences of doctrine which prevail in the Science of Medicine, there is now an agreement all over Europe in the designation of diseases. But yet, there are also many nice questions which arise, relative to the nature of diseases, on which it is in vain to expect physicians and statists to agree unanimously; and therefore no perfect system of naming the diseases of mankind can ever hope to be realized.

Classification of Diseases.—By classifying diseases and recording the Causes of Death, the most valuable information is obtained relative to the health of the people, or of the unwholesomeness and pestilential agencies which surround them. "We can take this or that disease, and measure not only its destructiveness, but its favourite times of visitation; we can identify its haunts and classify its victims." We are able to trace diseases also as they perceptibly

get weaker and weaker, as some have done of late. We know from the valuable returns of the Registrar-General, prepared by Dr. Farr, that Scarlatina is decreasing, and that it has been growing less and less destructive since 1851: that the Whooping-Cough has also ceased, in some measure, from its ravages; and that Measles alone, out of these severe diseases, has exhibited any tendency to increase. The advantages therefore of adopting some system of classifying diseases, which can be put to such useful practical purposes, must be obvious to every one. Many systems of Nosology have been adopted from time to time, and valuable general principles have been deduced from some. It is not, however, within the limits of this work to give examples of the Nosologies in repute at various periods, or which have been propounded by eminent medical writers. It will be sufficient here to refer the reader to the systems of Linnæus (1763), Vogel (1764), Sauvage (1768), Macbride (1772), Sagar (1776), and Cullen (1792), of ancient date; and to those of Cooper, Copeland, Mason Good, Craigie, Bright, Addison, Watson, and Wood of Pennsylvania in more recent years. The antiquated system of Cullen cannot now be applied to any useful purpose; and therefore it is necessary to adopt some system which shall meet the requirements of science, which will illustrate by its use the practical questions of the day relative to diseases, and bearing on the preservation of the public health; and which will show those causes that are injurious and fatal to the life of man, and so contribute to remove the evils which tend to shorten human life in town and country, and impair the strength of our Armies and our Fleets.

As classification is only a method of generalization, there are, of course, several classifications of disease which may be used with advantage for special purposes. The physician, the pathologist, the jurist, the hospital statist, may each legitimately classify diseases from his own point of view, and for his own purposes, in the way that he thinks the best adapted to facilitate his inquiries, and to yield him general results. The medical practitioner may found his main divisions of diseases on their treatment, as medical or surgical; the pathologist, on the nature of the morbid action or product; the anatomist or the physiologist, on the tissues and organs involved; the medical jurist, on the suddenness or slowness of the death; the hospital statist, on the kind of diseases which are treated in its wards; and all of these points of view may give useful and interesting results (Farr). But that is not enough, and accordingly the most distinguished physicians now living are giving their assistance to obtain a nomenclature and classification of diseases which can be used in every country. Our eminent statist, Dr. Farr, has completed a system of Nosology which will be submitted

to the members of the approaching Congress for their consideration. That system is given in the following pages, because it is eminently scientific and practically useful. It is a nomenclature which can be used by every country, and its practical bearings tend to elucidate the great questions connected with public health, the improvement and preservation of which is the duty of every medical man.

In the succeeding part of this volume individual diseases will be grouped under the following divisions, and treated of accordingly.

TABULAR VIEW OF THE CLASSES AND ORDERS OF DISEASE IN THE PROPOSED NOSOLOGY OF DR. FARR.

CLASS I.—Zymotic Diseases. *Zymotici* (ζύμη, leaven).—Diseases that are either epidemic, endemic, or contagious; induced by some specific body, or by the want of food, or by its bad quality. In this class there are four orders of diseases, namely:—

ORDER 1. MIASMATIC DISEASES—*Miasmatici* (μίασμα, stain, defilement).

ORDER 2. ENTHETIC DISEASES—*Enthetici* (ἔνθετος, put in, implanted).

ORDER 3. DIETIC DISEASES—*Dietici* (δίαιτα, way of life, diet).

ORDER 4. PARASITIC DISEASES—*Parasitici* (παράσιτος, parasite).

CLASS II.—Constitutional Diseases. *Cahetici* (κακεξία, bad habit of body), sporadic diseases; affecting several organs in which new morbid products are often deposited, sometimes hereditary.

ORDER 1. DIATHETIC DISEASES—*Diathetici* (διάθεσις, condition, diathesis).

ORDER 2. TUBERCULAR DISEASES—*Phthisici* (φθίσις, wasting away).

CLASS III.—Local Diseases. *Monorganici* (μόνος, alone, without others; ὄργανον, organ), sporadic diseases in which the functions of particular organs or systems are disturbed or obliterated, with or without inflammation; sometimes hereditary.

ORDER 1. BRAIN DISEASES—*Cephalici* (κεφαλή, head).

ORDER 2. HEART DISEASES—*Cardiaci* (καρδία, heart).

ORDER 3. LUNG DISEASES—*Pneumonici* (πνεύμων, lung).

ORDER 4. BOWEL DISEASES—*Enterici* (ἔντερον, intestine).

ORDER 5. KIDNEY DISEASES—*Nephritici* (νεφρός, kidney).

ORDER 6. GENNETIC DISEASES—*Aidoici* (αἰδοῖα, pudenda).

ORDER 7. BONE AND MUSCLE DISEASES—*Myostici* (μῦς, muscle; ὀζέον, bone).

ORDER 8. SKIN DISEASES—*Chrotici* (χρώς, skin).

CLASS IV.—Developmental Diseases. *Metamorphici* (μεταμόρφωσις, change of form), special diseases, the incidental result of the formative, reproductive, and nutritive processes.

ORDER 1. DEVELOPMENTAL DISEASES OF CHILDREN—*Paidici* (παιδία, youth).

ORDER 2. DEVELOPMENTAL DISEASES OF WOMEN—*Gyniaci* (γυνή, woman).

ORDER 3. DEVELOPMENTAL DISEASES OF OLD PEOPLE—*Geratici* (γῆρας, old age).

ORDER 4. DISEASES OF NUTRITION—*Atrophici* (ἀτροφία, atrophy).

TABULAR VIEW OF THE CLASSES, ORDERS, AND NOMENCLATURE OF DISEASES.

CLASS I.—Zymotic Diseases. *Zymotici.*

ORDER 1. MIASMATIC DISEASES—*Miasmatici.*

ENGLISH NAMES.	LATIN NAMES.
Small-Pox,	*Variola.*
Varioloid	*Varioloides.*
Chicken-Pox,	*Varicella.*
Miliaria,	*Miliaria.*
Measles,	*Morbilli.*
Scarlatina,	*Scarlatina.*
Hybrid of Measles, and Scarlet fever,	*Rubeola.*
Dengue,	*Scarlatina Rheumatica.*
Quinsy,	*Tonsilia.*
Diphtheria,	*Diphtheria.*
Mumps,	*Parotia.*
Croup,	*Trachealia.*
Whooping-Cough,	*Pertussis.*
Typhoid Fever,	*Febris Typhoides.*
Relapsing Fever,	*Febris Recurrens.*
Typhus Fever,	*Typhus.*
Erysipelas,	*Erysipelas.*
Erythema,	*Erythema.*
Hospital Gangrene,	*Gangræna Nosocomialis.*
Pyemia,	*Pyemia.*
Metria,	*Febris Puerperarum.*
The Plague,	*Pestis.*
Carbuncle,	*Anthrax.*
Boil,	*Furunculus.*
Influenza,	*Influenza.*
Dysentery,	*Dysenteria.*
Diarrhœa,	*Diarrhœa.*
Cholera,	*Cholera.*
Yellow Fever,	*Typhus Icterodes.*
Remittent Fever, Crimean Fever,	*Febris Remittens.*
Hong-Kong Fever, &c., &c,	*Febris Tropicorum.*
Ague,	*Febris Intermittens.*
Rheumatism,	*Rheumatismus Acutus* vel *Febris Rheumatica.*

ORDER 2. ENTHETIC DISEASES—*Enthetici.*

Syphilis (Primary),	*Syphilis (Primarius).*
Syphilis (Secondary),	*Syphilis (Secondarius).*
Gonorrhœa,	*Gonorrhœa.*
Leprosy, (Including Greek Elephantiasis, or the Leprosy of Moses).	*Lepra.*
Yaws,	*Frambœsia.*
Pellagra,	*Pellagra.*
Radesyge,	*Radesyge.*
Purulent Ophthalmia,	*Ophthalmia Purulenta.*
Glanders,	*Equinia.*
Hydrophobia,	*Rabies.*
Necusia,	*Necusia.*
Malignant Pustule,	*Pustula Maligna.*

Order 3. Dietic Diseases—*Dietici.*

English Names.	Latin Names.
Famine Fever,	*Febris à fame.*
Scurvy,	*Scorbutus.*
Purpura,	*Purpura.*
Rickets,	*Rachitis.*
Bronchocele,	*Bronchocele.*
Cretinism,	*Cretinismus.*
Alcoholism, including Intemperance, Delirium Tremens, and Catacausis,	*Alcoholismus.*

Order 4. Parasitic Diseases—*Parasitici.*

Thrush,	*Aphtha.*
Porrigo,	*Porrigo.*
Scabies,	*Scabies.*
Phthiriasis,	*Morbus Pedicularis.*
Worms,	*Vermes.*
(*a*) Hydatids,	*Acephalocystis, echinococcus hominis.*
(*b*) Tape Worm,	*Tænia Solium.*
(*c*) Strongilus Gigas,	*Strongilus Gigas.*
(*d*) Round Worm,	*Ascaris Lumbricoides.*
(*e*) Thread Worm,	*Ascaris Vermicularis.*
(*f*) Guinea Worm,	*Dracunculus.*

CLASS II.—Constitutional Diseases. *Cachetici.*

Order 1. Diathetic Diseases—*Diathetici.*

Gout,	*Podagra.*
Anæmia,	*Anæmia.*
Dropsy,	*Hydrops.*
Cancer,	*Carcinoma.*
(*a*) „ Soft,	*encephaloides.*
(*b*) „ Colloid,	*alveolare.*
(*c*) „ Osteoid,	*osteoides.*
(*d*) „ Scirrhus,	*scirrhoma.*
(*e*) Cancer, Epithelial and Sweep's,	*Carcinoma Epitheliomata.*
Melanosis,	*Melanosis.*
Lupus,	*Lupus.*
Canker,	*Noma.*
Mortification,	*Gangrena.*
Dry Gangrene,	*Gangrena Senilis.*

Order 2. Tubercular Diseases—*Phthisici.*

Scrofula,	*Scrofula.*
Tuberculosis, mesenteric,	*Tuberculosis Mesenterica.*
Tubercular peritonitis,	*Peritonitis tuberculosa.*
Phthisis,	*Phthisis.*
Hydrocephalus,	*Hydrocephalus.*
Hydrocephalus (with tubercular deposit),	*Meningia tuberculosa.*

CLASS III.—Local Diseases. *Monorganici.*

Order 1. Brain Diseases—*Cephalici.*

Meningitis,	*Meningitis.*
Encephalitis,	*Encephalitis.*
Cephalitis,	*Cephalitis.*
Myelitis,	*Myelitis.*
Apoplexy,	*Apoplexia.*
Paralysis,	*Paralysis.*
Shaking palsy,	*Paralysis agitans.*
Chorea,	*Chorea.*
Delirium Tremens,	*Delirium tremens.*
Mania,	*Mania.*
Monomania,	*Monomania.*
Dementia,	*Dementia.*
Epilepsy,	*Epilepsia.*
Hysteria,	*Hysteria.*
Tetanus,	*Tetanus.*
Convulsions,	*Convulsio.*
Laryngismus,	*Laryngismus.*
Neuralgia,	*Neuralgia.*
Tic Douloureux,	*Neuralgia.*
Neuroma,	*Neuroma.*

Order 2. Heart Diseases—*Cardiaci.*

English Names.	Latin Names.
Carditis,	*Carditis.*
Pericarditis,	*Pericarditis.*
Endocarditis,	*Endocarditis.*
Disease of Heart Valves,	*Morbus Cordis Valvularm.*
Heart Hypertrophy,	*Hypertrophia cordis.*
„ Atrophy,	*Atrophia cordis.*
„ Fatty Degeneration,	*Cordis degeneratio.*
Aneurism of the Heart,	*Aneurisma cordis.*
Aneurism of the Aorta, &c.	
Angina Pectoris,	*Angina Pectoris.*
Fainting	*Syncope.*
Arteritis,	*Arteritis.*
Atheroma,	*Atheroma.*
Phlebitis,	*Phlebitis.*
Varicose Veins,	*Varix.*

Order 3. Lung Diseases—*Pneumonici.*

Hæmoptysis,	*Hæmoptysis.*
Laryngitis,	*Laryngitis.*
(Œdema of the Glottis),	*Œdema glottidis.*
Laryngismus Stridulus,	*Laryngismus stridulus.*
Bronchitis,	*Bronchitis.*
Pleurisy,	*Pleuritis.*
Hydrothorax,	*Hydrothorax.*
Empyema,	*Empyema.*
Pneumothorax,	*Pneumothorax.*
Congestion of Lungs,	*Apoplexia Pulmonalis*
Pneumonia,	*Pneumonia.*
Pleuri-Pneumonitis,	*Pleuri-Pneumonitis.*
Asthma,	*Asthma.*
Emphysema of Lungs,	*Emphysema.*
Grinders' Asthma,	*Asthma.*
Miners' Asthma, Colliers' Phthisis, Spurious Melanosis,	*Asthma Metallicorum.*

Order 4. Bowel Diseases—*Enterici.*

Glossitis,	*Glossitis.*
Stomatitis,	*Stomatitis.*
Pharyngitis,	*Pharyngitis.*
Œsophagitis,	*Œsophagitis.*
Gastritis,	*Gastritis.*
Enteritis,	*Enteritis.*
Peritonitis,	*Peritonitis.*
Ileus,	*Ileus.*
(Constipation),	*(Constipatio).*
Intussusception,	*Intussusceptio.*
Dyspepsia,	*Dyspepsia.*
Pyrosis,	*Pyrosis.*
Gastralgia,	*Gastralgia.*
Hæmatemisis,	*Hæmatemesis.*
Melæna,	*Melæna.*
Supra renal Melasma,	*Morbus Addisonii.*
Pancreatic disease,	*Morbus Pancreatici.*
Splenitis,	*Splenitis.*
Hepatitis,	*Hepatitis.*
Jaundice,	*Icterus.*
Gallstones,	*Chololithus.*
Cirrhosis,	*Cirrhosis.*
Ascites,	*Ascites.*

Order 5. Kidney Diseases—*Nephritici.*

Nephritis,	*Nephritis.*
Ischuria,	*Ischuria.*
Diuresis,	*Diuresis.*
Nephria, (Bright's Disease). Albuminuria.	*Nephria.*
Diabetes,	*Diabetes.*
Stone, Gravel,	*Calculus vesicæ* vel *renalis.*
Hæmaturia,	*Hæmaturia.*
Cystitis,	*Cystitis.*

Order 6. Gennetic Diseases—*Gennetici.*

Varicocele,	*Varicocele.*
Orchitis,	*Orchitis.*
Hydrocele,	*Hydrocele.*
Hysteritis,	*Hysteritis.*
(Uterine tumour),	*(Tumor Uteri).*
Ovarian dropsy,	*Hydrops Ovarii.*
(Ovarian tumour),	*(Tumor Ovarii).*

Order 7. Bone and Muscle Diseases—*Myostici.*

English Names.	Latin Names.
Synovitis,	*Synovitis.*
Ostitis,	*Ostitis.*
Exostosis,	*Exostosis.*
Brittle bones,	*Fragilitas ossium.*
Soft bones,	*Mollities ossium.*
Curvature of spine,	*Curvatura Spinæ.*
Caries,	*Caries.*
Necrosis,	*Necrosis.*
Muscular atrophy, or degeneration,	*Atrophia* vel *degeneratio musculorum.*

Order 8. Skin Diseases—*Chrotici.*

Roseola,	*Roseola.*
Urticaria,	*Urticaria.*
Eczema,	*Eczema.*
Herpes,	*Herpes.*
Pemphigus,	*Pemphigus.*
Rupia,	*Rupia.*
Ecthyma,	*Ecthyma.*
Impetigo,	*Impetigo.*
Acne,	*Acne.*
Mentagra,	*Mentagra.*
Lichen,	*Lichen.*
Prurigo,	*Prurigo.*
Psoriasis,	*Psoriasis.*
Pityriasis,	*Pityriasis.*
Ichthyosis,	*Ichthyosis.*
Phlegmon,	*Phlegmon.*
Whitlow,	*Whitlow.*

CLASS IV.—Developmental Diseases. *Metamorphici.*

Order 1. Developmental Diseases of Children—*Paidiaci.*

Stillborn,	*Natus Mortuus.*
Premature Birth,	*Prematurus Natus.*
Atelectasis,	*Atelectasis Pulmonum.*
Malformations,	*Vitia Conformationis.*
Cyanosis,	*Cyanosis.*
Spina bifida,	*Spina Bifida.*
Imperforate Anus,	*Anus imperforatus.*
Idiocy,	*Fatuitas.*
Congenital Deaf-Dumbness,	*Mutitas.*
Teething,	*Dentitio.*

Order 2. Developmental Diseases of Women, chiefly in the Reproductive Age—*Gyniaci.*

English Names.	Latin Names.
Chlorosis,	*Chlorosis.*
Childbirth, Miscarriage, Abortion,	*Partus, Abortus.*

(Including death from "pelvis deformed, rupture of uterus, extra-uterine fœtation, flooding, puerperal mania, puerperal convulsions, syncope, hysteritis, breast abscess.")
See also "Metria," Class I. 1.

Paramenia, ... *Paramenia.*

(Including "amenorrhœa, leucorrhœa.")

Climacteria (turn of life), ... *Climacteria.*

Order 3. Developmental Diseases of Old People—*Gyratici.*

Old Age, ... *Senectus.*

Order 4. Diseases of Nutrition—*Atrophici.*

Atrophy, Debility (includes premature old age), ... *Atrophia, Asthenia.*

The preceding classification of diseases into four groups is not given as a perfect system, but as a convenient grouping of diseases.

By its use the student will be able to preserve uniformity in the recording of his cases;—it furnishes him with a table of reference to aid him in naming diseases, and a system to guide him in acquiring a knowledge of his profession. It will not be necessary to describe all the diseases mentioned under the various classes —some of them are more properly treated of in systematic works on surgery. Those diseases, however, will be described at length which mostly influence the health of the community, or which contribute to increase and maintain the causes of death.

PART II.

THE NATURE OF DISEASES; SPECIAL PATHOLOGY AND THERAPEUTICS.

It is the object of this part to treat of diseases in groups or classes, which possess certain characters or types in common; describing first the common properties or characters peculiar to the respective classes mentioned in the previous part on systematic medicine; and describing, second, the several orders into which these classes of diseases may be subdivided; and third, describing in detail the several diseases individually, their *general nature*, *symptoms*, *course*, and *complications; causes*, *diagnosis*, *prognosis*, and *treatment*.

CLASS I.

Zymotic Diseases.

CHAPTER I.

GENERAL REMARKS ON THE PATHOLOGY OF ZYMOTIC DISEASES.

This class comprises diseases which have been observed to be *epidemic*, *endemic*, and *contagious;* and includes *fevers*, *small-pox*, *plague*, *influenza*, *cholera*, and such other diseases as possess the peculiar character in common of suddenly attacking great numbers of people, at intervals, in unfavourable sanitary conditions. In the language of Dr. Farr, the diseases of this class distinguish one country from another,—one year from another; they have formed epochs in chronology; and, as Niebuhr has shown, have influenced not only the fall of cities, such as Athens and Florence, but of empires; they decimate armies, disable fleets; they take the lives of criminals that justice has not condemned; they redouble the dangers of crowded hospitals; they infest the habitations of the poor, and strike the artizan in his strength down from comfort into helpless poverty; they carry away the infant from the mother's breast, and the old man at the end of life; but, their direst eruptions are ex-

cessively fatal to men in the prime and vigour of age. They are emphatically the *morbi populares.*

The name *Zymotic*, first suggested by Dr. William Farr to designate the class, is not to be understood as implying the hypothesis that these diseases are fermentations, which the derivation of the term would lead one to believe. It has become extensively used of late as applied to the diseases, whose characters as a class are already indicated, and for which some convenient term is required. The class then to which the term ZYMOTIC has been applied, is intended to comprehend all the principal diseases which have prevailed as *epidemics*, or *endemics;* and all those which are *communicable either by human contact, or by animals in a state of disease;* as well as the diseases that result from the *scarcity and the deterioration of the necessary kinds of food*, or from *parasitic animals.* The diseases of this class are thus conveniently arranged into four orders or groups, of which *fever*, *syphilis*, *scurvy*, *worms*, are the common names typical of the respective groups.

In the greater number of the diseases of this class the blood is more or less changed, and by some is presumed to be the primary seat of diseases which result from specific poisons, of organic origin, either derived from without, or generated within the body. These specific poisons tend to produce in the blood an excess of those decomposing organic compounds, which physiology teaches us are always present in the circulating current.

Physiological Modes in which Poisons act Illustrate by Analogy the Zymotic Diseases.—If the reader will now consider the following statements as to the modes in which poisons act physiologically, he will be prepared to appreciate the effects of those conditions which, like poisons, induce diseases of the class termed Zymotic. The actions of poisons are subject to certain general laws,—the most important of which are, *first*, that they have all certain definite and specific actions; *second*, that they all lie latent in the system a certain but varying period of time before those actions are set up; and *third*, that the phenomena resulting from their action vary in some degree, according to the dose, and to the receptivity of the patient. These laws are common to all poisons, but there are also many others which are peculiar to individual poisons or classes of poisons, and it may be necessary to notice a few of them.

The *first* law, or that of the definite and specific actions of poisons, cannot be doubted; for if it be supposed that agents acting on the human body do not produce their effects according to certain definite laws, we can neither determine the seat or course of any disease, nor direct nor judge of the operation of remedies. No physician, for instance, has seen castor oil produce tetanus, or colchicum intoxicate the brain, or opium inflame the spleen; he perfectly well

knows that the first of these substances acts on the intestines, the second on the ligaments, and the third on the nervous system generally. The action of poisons, therefore, is not accidental, but determined by certain definite laws.

The action of poisons, though definite, is variously limited. Some poisons, for instance, act on one membrane, or on one organ, or on one system of organs; while other poisons extend their action over two or more membranes, or organs, or system of organs, or even over the whole animal frame. We have examples in aloes and jalap, of substances that act upon one membrane only, namely, the mucous membrane of the alimentary canal. In digitalis we have an instance of a medicine that principally acts on one organ, namely, the heart, greatly reducing or even stopping its action; while strychnine is an example of a medicine acting on one system of organs, namely, the parts supplied by the spinal cord, producing powerful and sometimes fatal tetanic action of every voluntary muscle in the body.

It is seldom, however, that the action of poisons is limited to one membrane, or organ, or system of organs. The greater number of these noxious agents more usually act on two or more membranes, or organs, or systems of organs. Elaterium, for instance, acts on the mucous membrane of the intestinal canal and on the kidneys. Tobacco nauseates the stomach, intoxicates the brain, and affects the action of the heart. Antimony has an equally extensive range; it induces cutaneous perspiration, acts cathartically and emetically, and in large doses appears to cause gangrene of the lungs. Alcohol and opium are examples of substances acting still more generally, affecting not only the action or secretion of every organ or tissue of the body, but even in some instances altering their structure. Thus, alcohol in its most limited action has been shown to cause structural disease of the liver, of the stomach, and of the coats of the arteries, while opium tends to produce apoplexy and structural disorganization of the brain and its membranes. From the circumstance of these two substances acting not only generally but locally on a given number of tissues, they resemble in their effects those of many morbid poisons, as that of typhous fever, of scarlet fever, or of the small-pox.

The *second* important law of poisons is, that they lie latent in the system for a period of time which varies in different individuals, before they set up their specific actions. Rhubarb, for instance, produces no immediate result, but lies dormant in the system six or eight hours before its action is sensible on the bowels; opium, in the usual dose, is generally thirty minutes before it subdues the brain to its influence. The convulsions from strychnine do not follow till twenty minutes after its exhibition, and perhaps every substance, except hydrocyanic acid, has a greater or less sensible period of latency.

When a medicine, however, acts on more parts than one, a considerable space of time may elapse after it has affected one organ before it affects another : thus digitalis frequently occasions emesis before it acts on the heart, and the action of mercury on the bowels is frequently sensible for many weeks before the gums and salivary glands are affected. The doctrine of the latency of poisons is indeed so generally admitted, that the actual period has been a point on which the condemnation or acquittal of a prisoner tried for murder has turned in our courts of justice, when certain poisons have been supposed to have been given.

The *third* great law of poisons is, that their effects are modified by the dose, the temperament, and the existing state of the constitution, mentally and bodily, of the recipient. The effect of dose in modifying the pathological phenomena of disease may be exemplified in the actions of oxalic acid and of arsenic. The specific action of oxalic acid is to inflame the mucous membrane of the stomach ; but to insure this effect the dose must be limited so that this poison may lie in the system many hours. On the contrary, if the dose be excessive and rapidly absorbed, the poison so disorders all the functions of the three great nervous centres that life is destroyed in a few minutes. Arsenic, likewise, is a poison which inflames and ulcerates the mucous membrane of the alimentary canal, but it requires some hours to set up its specific actions; for when the dose is large, it, in like manner, destroys by general irritation, and before traces of morbid change of structure can be appreciated after death. It follows, from this law, that the larger the dose or the greater the intensity of the poison, the more rapid its action and the less the probability of finding any trace of specific lesion induced by it.

In studying the effects of dose on the constitution, we find some poisons are absorbed and are *cumulative*, while others are not absorbed into the system, or else are so rapidly removed that no cumulative effect is produced. Thus, in persons predisposed to the effects of digitalis, a dose so small as to produce no sensible effect whatever, will, if frequently repeated, at last destroy the heart's action. In cases, likewise, in which it is desirable to produce vomiting at the least expense to the constitution, the means employed are *cumulative*, namely, a repetition of small doses of ipecacuanha. This cumulative property of poisons, however, is by no means universal. There is no instance of jalap or of castor oil proving cumulative, and if a frequent repetition of either of them produces an increased effect, it is perhaps, in consequence of the nervous papillæ with which they are brought in contact being more easily irritated by each application, and hence they induce a more violent result. That the habitual ingestion of decomposing matter in the

water used as drink, is capable of inducing conditions favourable to the development of Zymotic diseases, admits of no doubt. Cogent instances of this are to be found recorded in the bitter experience of epidemics of cholera.

Temperament is also a circumstance which greatly influences the action of poisons. There are a few persons altogether insensible to the action of mercury, so that no quantity will affect their gums, or increase the secretion of the salivary glands. There are others, in like manner, the action of whose heart no quantity of digitalis will control. On the contrary, there are some constitutions so morbidly susceptible of these remedies, that it is scarcely possible to exhibit even a fractional dose without giving rise to their specific effects.

Besides natural temperament, *habit*, which may be termed an artificial temperament, has a powerful influence in reconciling us to particular classes of poisons, and of making them even sources of enjoyment. Thus tobacco, alcohol, opium, are all substances which are productive, in the first instance, to many persons of great discomfort, but by frequent repetition they cease to have any unpleasant effects, and their stimulus at length becomes a necessary indulgence. Still there are many poisons to which no repetition can habituate us, as arsenic, corrosive sublimate, or the preparations of copper. On the contrary, each repetition only the more debilitates the constitution, and renders it more susceptible of the action of the poison.

A peculiar existing state of the constitution has also a powerful influence on the action of poisons; and it would seem proved, with some exceptions, that these agents act with an intensity proportioned to the debilitated state of the patient. There is indeed no duty more imperative on the physician than that of adjusting the dose to the strength of the patient, and nothing is more common than to forbear administering a medicine because the patient's strength will not admit of it. As a general principle, therefore, medicines or poisons may be said to act with a power proportionate to the debility of the patient.

Still there are states of disease which render the constitution of the patient, though greatly debilitated, insusceptible to the action of even powerful remedies. Thus, in typhus fever, the patient will often bear a considerable quantity of vinous stimuli without being affected by it. In tetanus, or hydrophobia, no quantity of opium will tranquillize the symptoms or procure sleep. Fallopius mentions a singular instance of the constitution being armed against the action of a poison. He states, that in his day a criminal was given up to himself and other anatomists, to be put to death in any manner they might think proper. To this man, therefore, they exhibited

two drachms of opium, but, labouring under a quartan ague, and the fit just coming on, the "opium was hindered of its effect." The man, therefore, having survived this dose, begged that he might take a similar quantity, earnestly entreating, if he escaped, he might be pardoned. The same dose was exhibited, but it was in the interval of the attacks, and the man now died.

The experiments of Majendie may be referred to as affording many curious proofs of the state of the constitution in accelerating or retarding the actions of poisons. He has shown that if a poison be introduced into the system of such potency as usually will destroy life in two minutes, on bleeding the animal the same result will follow in half a minute, or in one-fourth of the time; and this experiment has often been repeated. Majendie has also brought to light the curious fact, that if, after having poisoned the animal, and even after the poison has begun to act, we inject an aqueous fluid into its veins in such quantity as to cause an artificial plethora, as long as this artificial plethora can be maintained, the action of the poison is superseded. No sooner, however, does the plethora cease, from the general effusion of fluid into every cavity of the body, than the poison acts in the usual time, and with even perhaps more than its accustomed severity.

Mr. Hunter thought that no two poisons could *co-exist* in the same system together, or that, co-existing, they could not set up their specific actions at the same time. This hypothesis, however, is unquestionably erroneous; for we constantly see opium and digitalis, jalap and mercury, as well as many other combinations of medicines, producing their respective effects in the same system, and at the same time, by accelerating or retarding each other's actions. There is no truth better established in medicine, than that a combination of salts and senna produces a much more efficient and pleasant action than the exhibition of either remedy separately; and opium is an agent possessing a modifying or controlling power over every organ or tissue, without which it would be impossible, on many occasions, to reconcile the system to the introduction of many necessary and essential remedies. Poisons, therefore, are capable of co-existing together, and of so influencing the system that they reciprocally accelerate or retard each other's actions.

The general laws observable in the actions of medicinal substances are for the most part precisely similar to those which govern morbid poisons, or only differ in a few minor points; for these latter poisons have their specific actions and their periods of latency, while their phenomena equally vary according to the dose, the state of the constitution, the predisposition of the patient, or the receptivity of his blood to respond to the influence of the poison.

Specific Action of Poisons which Produce Zymotic Diseases.—The specific actions of poisons which produce the Zymotici, are distinctly proved by the fact, that we are enabled to determine, within certain limits, the course, symptoms, and pathological phenomena which result from the presence of any given morbid poison. No man, for instance, can confound the phenomena of *small-pox* with those of *intermittent fever*, or those of *intermittent fever* with *syphilis*, or those of *syphilis* with *cholera;* each of these poisons has its separate and peculiar laws, and consequently its actions are definite and specific.

The actions of morbid poisons also, like those of medicinal substances, are variously limited, some affecting only one membrane or organ, or system of organs, while others involve two or more membranes or organs, or systems of organs. Thus, *tinea* is an example of a poison acting on one tissue of the body, and even then partially. In some parts of the world, for instance, in Switzerland, a poison exists whose action is limited entirely to the thyroid gland. The contagion of *whooping-cough* and the virus of *hydrophobia* affect all the organs supplied by the eighth pair, or pneumogastric system. Instances of morbid poisons acting on two membranes or organs, or system of organs, are still more common, and form the great body of this class of disease. The poison of *measles*, for instance, acts no less on the mucous membrane of the eyes, nose, fauces, and perhaps on the mucous membranes generally, than on the skin. That of *scarlatina* acts not only on the mucous membrane of the fauces, and on the skin, but also on the serous membranes of the joints and of the abdomen. The *paludal poison* has a still more extensive range, hardly any organ or tissue of the body being exempt from its destructive ravages.

Morbid poisons also, like other poisons, have their period of latency; and, generally speaking, a much longer time elapses before their specific actions come into operation than takes place with medicinal substances. The virus of the *natural small-pox* lies dormant from sixteen to twenty days before it produces any constitutional disturbance; and a still further period elapses, of three or four days, before the specific eruption appears on the skin. The poison of *scarlatina* lies latent from seven to ten days after exposure to the contagion; that of the *measles* from ten to fourteen; while the poison of *paludal fever* has been known to lie dormant for a twelvemonth, and that of *hydrophobia* for a still longer time. These are examples of periods of latency far beyond anything that has been observed in the action of medicinal substances; and *syphilis* in its tertiary action, is still more remarkable.

When morbid poisons act on more tissues or organs than one

their actions are sometimes simultaneous, but more commonly they are consecutive, and frequently long intervals of time elapse between each successive attack. Thus, the poison of *typhous* may attack the lungs, the membranes of the brain, and the mucous membrane of the alimentary canal, and all these may be attacked contemporaneously; but it is more common that their attacks take place consecutively, or first on the alimentary canal, then on the brain, and lastly on the lungs, several days elapsing between each successive attack. In *syphilis* the poison acts on the part to which it is first applied—as the skin, throat, bones, and ligaments; and cases have been met with in which the throat, the skin, and the bones have been affected at the same time with the primary sore. It is more common, however, for them to occur *seriatim* and at very remote periods from the primary affection, so that many years frequently elapse before the poison has exhausted itself. In scarlatina also, the peritoneum is not affected till many days after the eruption of the skin and the ulceration of the throat have altogether disappeared.

It occasionally happens that morbid poisons which usually act on a plurality of membranes, exhaust themselves on one or more without affecting the whole series. In the disease termed *scarlatina simplex* the poison sometimes exhausts itself entirely on the skin without affecting either the mucous or serous membranes of the body. The *rubeola sine catarrho* is a similar example of the poison exhausting itself on the same tissue, the skin. In *intermittent fever*, when the dose of the poison is limited, and the disease properly treated, it is seldom that any organ or tissue is involved; yet, left to run its course, scarcely any organ or tissue would escape destruction.

Sometimes, when the morbid poison acts on many membranes, the usual order of attack is inverted. It is the general law of *syphilis*, that the bones are the last that suffer in the order of the secondary symptoms, but sometimes they are the first to be affected. In *scarlet fever* the affection of the skin may precede that of the throat, or the reverse may take place; and, in *fevers*, the affection of the head may precede that of the intestines, though the latter is the most common.

It has been seen that the period of latency of medicinal substances being passed, and their actions set up, their effects vary in a considerable degree, according to the dose, temperament, or present state of the constitution of the patient. With respect to the dose of a morbid poison, we rarely possess any direct measure of its strength. The *paludal poison*, however, of tropical climates, to which *malarious fevers* are due, unquestionably greatly exceeds in intensity that of more temperate climates, and its effects are pro-

portionally marked. Thus, in the West Indies, we have the *yellow fever*, with hardly a trace of organic disease after death; while, in Holland, we have a fever of less severity, but followed by enlarged livers or spleens, or else by dropsy; while, in this country, the same fever is comparatively mild, and, if properly treated, for the most part terminates without any visceral affection. With respect to the influence of temperament in modifying disease, *small-pox* offers very striking instances; for different persons inoculated or poisoned from the same source have suffered in every varying degree from this formidable malady,—from the horn, the distinct, the confluent, and the bloody small-pox; while, in the worst cases, children have died in the primary fever, and before the specific action on the skin had been induced. It may, therefore, be laid down as a general law, that the more intense the dose of the morbid poison the more severe the form of disease; and also that fewer traces of organic alteration will be found after death, than when the poison, or the disorder it produces, has been of a milder character. Thus, enlarged livers, disorganized spleens, and dropsy, marked every case that died of the Walcheren fever; while in the West Indian and African fevers, though resulting from the same poison, scarcely a trace of disease was to be found.

The existing state of the constitution also influences the event. Thus, persons of a good constitution, but ignorant of their danger, are often seen to pass through a mild form of typhous fever, while the nurses and others contaminated by the same poison, but more alive to their critical state, have sunk without a struggle. A presentiment of death is a very unfavourable circumstance in the progress of *remittent* fever, especially in tropical climates. A soldier will say, "You have been very kind to me, sir, but this time I shall not get over it." There may be no appearance of absolute or immediate danger at the time—yet the man generally dies (Martin). As a general principle, therefore, it may be stated, that morbid poisons act with an intensity proportioned to the enfeebled or depressed state of the constitution; but this law is not universal. Want of a sufficient amount of food, is most powerful among the conditions which bring about Zymotic diseases, and most constant in operation. It is a popular belief that the lowering of all the vital forces by deficiency of food, constitutes the particular condition which renders a starved population so peculiarly open to the invasion of Zymotic diseases; but it is also a curious phenomenon of starvation that a state of general putrescence supervenes during life as if the want of material for the generation of new tissue were an obstacle to the deportation of that which has become effete (Carpenter). The hardy mountaineer is a surer victim, whether he visits the low countries of the tropics or the marshes of a more temperate climate,

than the feebler native of those countries. The immunity the latter enjoys is probably owing to his habit of living in the noxious atmosphere; for let him remove to a more healthy climate, and then return to those regions of pestilence, and he will be found as susceptible of the poison as the hardier stranger.

Another law of morbid poisons is, that two may *co-exist* in the same system; thus, scald-head and fever, small-pox and cow-pox, have often been seen at the same time in the same person. In this case the respective diseases sometimes appear simultaneously, and each runs its course unaffected by the presence of the other; but the more usual law of febrile poisons perhaps is, that when two co-exist, the one lies latent while the other runs its course, or they interrupt each other's progress, the active one becoming latent while the latent one becomes active, and occasionally they modify each other's actions. A case of intermittent fever may suddenly subside, and the small-pox appear in its stead. The small-pox having run its course, and the patient being recovered from that disorder, the intermittent fever may return. A child, having been exposed to the infection of the small-pox, was vaccinated; in a few days, however, the small-pox appeared, and ran a very mild and modified course. When the small-pox had entirely subsided, some action was seen in the punctured part of the vaccinated arm, and the cow-pox vesicle formed, but not till three or four weeks after the time it usually appears, and then exceedingly small.

Peculiarities in the action of Poisons which induce Zymotic Diseases.—The principal points in which the effects of poisons which induce Zymotic diseases, agree with those of poisons generally, having been stated; it will now be necessary to state those circumstances in which they principally differ. Many medicinal poisons have the property of accumulating in the system, and acting with an intensity proportioned, not to the last dose, but to the aggregate of the whole quantity that has been administered. Thus the last few minims of digitalis may stop the action of the heart, or the last few grains of mercury salivate the patient, or the last minute dose of strychnine become fatal. There is, however, no well authenticated fact which can be arranged under this law in the whole circle of morbid poisons. The actual quantity according to the experiments of Dr. Fordyce, is perhaps extremely small; for that physician, in hopes of mitigating the small-pox, inoculated with virus greatly diluted. The disease was not always produced, but when produced, it assumed every form, character, and degree of severity, according to the temperament or constitution of the patient.

The puerperal female is not only highly susceptible of poisons of the Zymotic kind, but is proved to favour their further develop-

ment; and various forms of puerperal fever are also generated by *materies morbi* of a kind other than that which might be considered peculiar to it. It is a well-known fact, unhappily not of rare occurrence, that a medical practitioner or a nurse goes from a case of puerperal fever to attend on other cases of labour, and the chances are that these will be attacked with the disease. Further, the practitioner or nurse may go to cases of labour from attendance on a case of scarlatina, typhus, erysipelas, or small-pox, and his parturient patients become the victims of puerperal fever. Their system is peculiarly receptive of the Zymotic poisons.

In the Vienna Lying-in Hospital it is recorded that a mortality of 400 to 500 in an average of 3,000 deliveries per annum appeared traceable to the introduction of cadaveric matters, through the uncleanliness of the attending students; these matters being especially potent, when derived from the bodies of those who have died from the adynamic forms of Zymotic disease. Students of practical midwifery should bear in mind this fact. They ought not to attend cases of labour, while they are also engaged with practical anatomy in the dissecting room.

Another peculiar law of morbid poisons, and one wholly unknown in medicinal substances, is the faculty which the human body possesses of generating to an immense extent a poison of the same nature as that by which the disease was originally produced. A quantity of small-pox matter not so big as a pin's head will produce many thousand pustules, each containing fifty times as much pestilent matter as was originally inserted; and moreover, the blood and all the secretions of the body are supposed to be also equally infected with the matter of the pustules. The miasmata secreted by one child labouring under whooping-cough, are sufficient to infect a whole city.

There is still perhaps a more remarkable law of morbid poisons, which is, that many of them possess the extraordinary property of exhausting the constitution of all susceptibility to a second action of the same poison. This is the case with scarlatina, measles, the small-pox, the whooping-cough, and indeed with a considerable number of others. Still it would seem that a temporary protective influence is imparted by most morbid poisons, for it is certain that few persons suffer a second attack of the same epidemic disease; and, consequently, it follows that the previous action of the poison must for a time impair the susceptibility of the constitution to its attacks. This beneficent law is of great importance in social life; it enables those that have recovered to attend on those that are sick, and allows a mother fearlessly to nurse her child in a dangerous and contagious distemper she has herself passed through, if such an inducement is necessary to strengthen the moral courage of a mother.

It only remains to mention one other law, which is but little shared by poisons of the vegetable or mineral kingdoms. It is well known that the actions of vegetable or mineral poisons are not influenced by the climate in which they are administered. Climate, however, has the property of greatly modifying the intensity of morbid poisons. The severe forms of typhous so common in the north latitudes are hardly known in more southern latitudes, and the cholera has been infinitely more fatal in Europe and in America than in the country which gave it origin; but besides influencing the intensity of the disease, climate or season, or both, greatly modify the specific nature of morbid poisons. In one season, for instance, typhous fever will attack only the glandular structure of the intestinal canal; in another only the mucous tissue of the same part, the glands or follicles being healthy; while, in another season, no disease whatever of the intestinal canal can be traced. Again, in one paludal district the liver will be inflamed and the spleen healthy, and in another the liver will be unaffected but the spleen disorganized. In both cases the generic character of the disease remains the same, but its specific character varies. It will have been seen, that this variety of pathological phenomena is also caused by peculiarity of idiosyncrasy, and that nothing can be more different than the distinct, the confluent, and the horn small-pox from each other; and yet all these different varieties may exist in different persons inoculated with the same poison. The character of the vaccine pustule is equally various; so that that which insures exemption from the small-pox has not yet been determined; neither have pathologists determined the primary forms of syphilitic ulcers. It is important, therefore, to remember, in the study of morbid poisons, that absolute uniformity of pathological phenomena is not to be expected in different persons and in different seasons. There is a limit, however, within which their variations oscillate, and within which nature has bounded her deviations.

The laws of poisons are more important than their *modus operandi;* and this part of the subject has been deeply investigated by modern physiologists, and deserves some consideration. The great and striking alterations which often take place in the blood, led from a very remote period to the doctrine of humoralism, or, that a morbid state of the fluids was the great and primary cause of disease. On the contrary, when anatomy began to be cultivated, and nerves traced into every organ and tissue, it was supposed that disordered actions of these prime agents of motion, and of the great phenomena of animal life, were the great causes of disease; the morbid state of the fluids being secondary. Fontana determined to prove this latter theory, and found, to his surprise, on laying bare the sciatic nerve in a great number of rabbits, that neither the

venom of the viper, nor the poison of the ticunas, nor hydrocyanic acid, when applied to it, produced the phenomena of poisoning, and that no other consequence resulted beyond what would have been produced by a similar mechanical injury.

Fontana having shown that the phenomena of poisoning do not result from the application of the deleterious agent to the trunk of the nerve or to the *solids*, determined to ascertain whether they followed after absorption, and consequently contamination of the *fluids*. He therefore injected the venom of the viper, hydrocyanic acid, and other poisonous substances directly into the veins of different animals; and he found that although the nerves of a part may be steeped in these poisons with impunity, yet no sooner did the substance enter the veins than the animal, after uttering a few horrible shrieks, struggled and almost instantly died, and thus demonstrated a morbid state of the fluids, as well as the existence of a tissue of extreme sensibility, with which the poison being brought into contact, accounted for the death of the animal. Fontana pursued this subject one step farther, and showed if poisons acted by absorption, that this absorption was in many instances extremely rapid. He submitted a number of pigeons to be bitten in the leg by the viper, and chopped the wounded limb off at different intervals after the introduction of the venom, and found, as the result of an extensive series of experiments on several dozens of pigeons, that none recovered when the poisoned leg was removed at a later period than twenty-five seconds, though the phenomena of poisoning did not occur till several minutes later.

The experiments of Fontana had shown, supposing a poison to be introduced into the veins, that all the phenomena of poisoning were accounted for; but still it might be said that to prove the fact of absorption something was wanting in strict demonstration; and for the further prosecution of this subject we are indebted to Segalas, who showed, if the arteries and veins of the mesentery of a dog be tied, that a quick acting poison would lie in harmless contact with the corresponding portion of the intestine for many hours; but no sooner were these ligatures removed than poisoning took place in a few minutes. Majendie even has carried this proof, of the veins absorbing, still farther, for he amputated the leg of a dog, having first introduced a portion of quill into the femoral artery and vein, in such a manner, that on dividing these vessels, the leg hung connected with the trunk solely by means of the quill, all continuity by means of the solids being cut off. The poison was now introduced into the paw, and in four minutes the animal was under its influence.

By these experiments, it is apprehended that Fontana, Segalas, and Majendie have completely demonstrated the absorption of

poisons by the veins, and consequently of their circulating with the blood; and that no doubt may remain on the subject, modern chemistry has demonstrated the actual presence of many medicinal substances either in the blood itself, or else in the secretions from it. Thus after a treatment by soda, large quantities of uncombined alkali have been found in the serum. Alcohol has been obtained by distillation from the blood; while iodine, rhubarb, the nitrate of potash, and a large number of other substances taken into the stomach have been found in the urine. It follows, then, that poisons are absorbed and mingled with the blood, and are conveyed directly to the parts on which they act, passing with impunity over others for which they have no affinity.

The fact of morbid poisons in like manner being absorbed, and mingling with the blood, has been shown by many continental writers; but perhaps the experiment made by Professor Coleman is the most satisfactory. "I have produced the disease (the glanders) by first removing the healthy blood from an ass, until the animal was nearly exhausted, and then transfusing from a glandered horse blood from the carotid artery into the jugular vein. The glanders in the ass was rapid in its progress, violent in degree, and from this animal I afterwards produced both glanders and farcy." Both scarlatina and measles have also been produced by inoculation from the blood of patients labouring under those diseases.

The circumstance of the presence of a poison in the blood is supposed by Andral to produce, besides its toxicological states, certain alterations in its physical condition. Thus he conceives a specific cause has a tendency to destroy or reduce the quantity of fibrine in the blood, which he has found in some instances to be only one part in a thousand. Hence he adds, whatever may be the nature of the pyrexia, the blood, whether it be taken from a vein or collected from the heart and arteries after death, always exhibits the following characters—namely, that the serum and clot are incompletely separated the one from the other, so that the clot is consequently large, and often appears to fill almost entirely the bleeding-basin. Its edges also are never raised, and its consistence is inconsiderable, so that it is easily torn, broken down, and reduced to a state of diffluence; in this state it becomes grumous, and discolours the serum. It is also remarkable for the absence of all buff, which is rarely met with in typhus, in measles, in scarlatina, or in small-pox, unless there has been some inflammatory complication; and even when it does exist, as in confluent small-pox, with large collections of pus, the buff is soft and gelatinous, and, by expression of the serum, is easily reduced to a thin pellicle. This defect of fibrine he conceives to be the cause of the great tendency to hæmorrhage, and to that stasis or congestion so

remarkable in typhous, scarlatina, and other diseases dependent on morbid poisons.

The facts and arguments which have been adduced, have, it is apprehended, distinctly proved that morbid poisons act in all instances not capriciously, but according to certain definite and specific laws, modified by the influence of climate, temperament, or the magnitude of the dose; also, that they mingle with the blood, with which they continue in latent combination a certain but varying period of time; and likewise that many of them are capable of co-existing together in the same system. Two other remarkable laws result from the study of morbid poisons,—or, that these singular agents are not acted upon by medicinal substances as long as they continue latent: and again, that when they act on more tissues than one, the remedy which is an antidote to the action on one is often absolutely powerless when it affects another tissue; so that many different remedies are frequently necessary to combat the varying phenomena of the same disease. A knowledge of these laws is necessary for understanding this class of diseases, and it is hoped that by their application many of the difficulties which have hitherto obscured the doctrines of fever, of syphilis, of hydrophobia, and of many other diseases incident to this class of morbid poisons, may be removed, and that this portion of medical science may be placed on a surer foundation, if not on a permanent basis.

Conditions favourable to the Development of Zymotic Diseases.—The following observations are condensed from an interesting paper by Dr. Carpenter on the "Predisposing Causes of Epidemics:"—he shows that the conditions which bring about the diseases of the Zymotic class, are referable to three categories. (1.) Conditions which tend to introduce into the system decomposing matter that has been generated in some external source. (2.) Conditions which occasion an increased production of decomposing matter in the system itself. (3.) Conditions which obstruct the elimination of the decomposing matter normally or excessively generated within the system, or abnormally introduced into it from without.

Of these in their order. (1.) The decomposing matters generated in external sources, may be enumerated as putrescent food, water contaminated by sewerage or other decomposing matter, and air charged with miasmatic emanations. These constitute poisons of a specific kind. (2.) Poisons of a specific kind are also developed by the degeneration of the tissues within the body, such as are formed in the puerperal state, after severe injuries, and as a consequence of excessive muscular exertion. (3.) Poisons are also engendered by an insufficient supply of air, a high external temperature, and the ingestion of alcoholic drinks. Each and all of these causes produce one and the same condition of the blood,

namely, surcharging it with decomposing organic compounds. By any of these conditions a certain receptivity or disposition of the blood is produced, which makes it liable to undergo the morbid changes peculiarly characteristic of this class of Zymotic diseases.

The practical questions immediately involved in this exposition of the nature of Zymotic diseases, is contained in the following statement, namely, that it is possible to extinguish the greater number of epidemic diseases, however intense or abundant may be the atmospheric or other agencies which constitute their potential causes, by preserving the blood of every individual in that state which shall prevent these poisons from finding the conditions of their development within the body. This end is to be attained on the one hand by preventing every unusual production of fermentible matter in or out of the body; and on the other hand by promoting its removal when it is inevitably generated (as in the puerperal state), through the respiratory process which ought to be favoured as much as possible, not merely by a free supply of pure air, but by the reduction of that air to the lowest temperature at which the condition of the patient will allow it to be safely inhaled.

Deaths from Zymotic Diseases.—The average annual rate of mortality in Great Britain for the past seventeen years, is represented by 2·245; *i. e.*, nearly 22 per 1,000, or 1 in 45 of the population. This statement is given, as a fact by which the student may compare the numerical statements which are made in estimating the fatal nature of individual diseases, or of diseases considered in classes.

With regard to diseases of the Zymotic class, it may be stated generally, that from 21 to 26 per cent. of the total number of deaths which take place in Great Britain during a year, are due to diseases of this class. Generally speaking, also, they may be arranged in the order of their greatest fatality, as follows:—namely, cholera, typhus and other forms of continued fever, scarlatina, whooping-cough, measles, croup, small-pox, dysentery, erysipelas. The other diseases of this class are less fatal; and it has been observed, that of late years, small-pox and influenza are less fatal than they used to be.

Under the class of Zymotic diseases the following orders are to be distinguished and described—namely,

Order 1. Miasmatic Diseases—*Miasmatici.*
Order 2. Enthetic Diseases—*Enthetici.*
Order 3. Dietic Diseases—*Dietici.*
Order 4. Parasitic Diseases—*Parasitici.*

CHAPTER II.

DESCRIPTION OF THE ZYMOTIC DISEASES IN THEIR ORDERS.

Order 1. Miasmatic Diseases—*Miasmatici.*

The diseases to be described under this order are diffusible through the air or water, and are attended by fevers of various forms. The matter by which they are communicated is derived from the human body, or the bodies of animals (as in small-pox), or from the earth (as in ague); small-pox and ague are therefore given as types of the diseases to be considered under this head.

There are some peculiar and characteristic features of the Miasmatic order of diseases which require special notice as introductory to a description of the individual diseases:—*First; they may suddenly spring up in a locality—under unfavourable sanitary conditions. Second; they may rapidly spread at irregular intervals so as to incapacitate or destroy great numbers of people.* These two marked and striking features are technically described as being due respectively to *Endemic* and *Epidemic influences.* Of these in their order—and first of

ENDEMIC INFLUENCES.

They result from those conditions peculiar to a locality, and from which various miasmatic diseases may suddenly arise. Such diseases are then said to be *endemic.* These endemic influences, for the most part, are exerted by the geological properties of a district, and are traceable to the constitution and state of the soil, water, and air; to elevation above the level of the sea, vicinity of sea, rivers, or stagnant water, woods, and vegetation; variations of temperature, prevalent winds; in connection with avocations, modes of life, quality of food and quantity, as modified by moral agencies, such as indolence or activity; privation and comforts, filth or cleanliness of people; together with their habits of life and employments, ignorance or mental culture; and, lastly, their social, moral, religious, and political conditions. It may be shortly stated in illustration, that endemic influences are mainly due to the following three sources, namely, 1st, miasmatic or paludal poisons; 2d, animal malaria poisons; and 3d, mixed poisons from both of these sources. It may be also stated (without meaning to assert that the statement is scientifically accurate, but is merely given for the sake of illustration), that certain definite diseases may be ascribed to these specific poisons, as follows. To the first, namely, miasmatic paludal poisons, are due yellow fevers and intermittent fevers of all

kinds, cholera, plague, and diseases of a similar type. To the second, namely, the animal malaria poisons, are ascribed typhus, and the epidemic typhoid fevers, dysentery, and the like. To the third, or mixed poisons, are due erysipelas, metria, furunculoid diseases, such as boils, carbuncles, and others. Of these in their order; and first, of the

Malarious or Paludal Poisons.—The diseases usually attributed to this endemic source, and which were formerly so destructive, have almost disappeared from this country, with one exception, namely, cholera. The reason of this may fairly be ascribed to the improved drainage both of the towns and of the agricultural districts. The fact may be proved, did space permit; and the practical inference leads one to hope for still more immunity from diseases arising from this source, if the "proper authorities" direct further efforts in this direction.

The facts collected by medical writers from Hippocrates downwards, show that every country is unhealthy in proportion to the quantity of marsh, or of undrained alluvial soil that it contains; the inhabitants of such districts dying often in the ratio of 1 in 20, instead of 1 in 38, the average mortality in healthy countries. The connection of a given class of disease with marshy districts is distinctly established.

Places known as Malarious.—Ancient Rome was once the seat of so many fatal epidemics, that the Romans erected a temple to the goddess Febris. These arose from the great masses of water poured down from the Palatine, Aventine, and Tarpæian hills becoming stagnant in the plains below, and converting them into swamps and marshes. The elder Tarquin ordered them to be drained, and led their waters by means of sewers to the Tiber. These subterraneous conduits ramified in every direction under the city, and were of such considerable height and breadth, that Pliny terms them "operum omnium dictu maximum suffossis montibus atque urbe pensili subterque navigata;" and this system of drainage, which was continued as late as the Cæsars, rendered Rome proportionably healthy, and the seat of a larger population than has since perhaps been collected within the walls of any city. On the invasion of the Goths, however, the public buildings were destroyed, the embankments of the Tiber broken down, the aqueducts laid in ruins, the sewers obstructed and filled up, and the whole country being now again overflowed, Rome once more became the seat of an almost annual paludal fever, as in the times of her earliest foundation.

The insalubrity of the Pontine Marshes, past or present, is notorious. Three hundred years, however, before the Christian era, Appius Claudius drained them by making canals, building bridges, and by constructing that magnificent road, portions of which

still remain, and still bear his name. On the invasion of Italy by Theodoric, Cæcilius Decius gave a free course to the waters in the neighbourhood of Rome, and the re-establishment of these immense marshes was one of the many disasters which resulted from the attacks of the Goths on Italy. Their present state is such, that the Tuscan portion of the Maremme, and indeed the whole of that district, may be said in summer to be absolutely depopulated; not a single house retaining an inhabitant, except the guard-houses, with a few soldiers and custom-house officers; and these are relieved twice or thrice during the summer with the Maremme fever almost invariably upon them.

Many districts in the East and West Indies, in Pennsylvania, and Continental Europe, are known to be active in the evolution of *malarious influences*. Such places are generally the deltas, marshy banks, and embouchures of rivers, in the plains extending from the bases of mountain ranges, partially inundated and irrigated lands, or such as are traversed by percolating streams or canals in wooded districts termed *jungles* (MARTIN). The sea-bound, especially where there is jungle or salt marsh. In the Bengal district, the stations of Calcutta, Chinsurah, and Berhampore, are highly malarious (COLONEL TULLOCH). The woods and marshes of the Sunderbunds—covering a superficies of more than 20,000 miles, and extending 180 miles S. and E. of Calcutta, composed of marshy land, covered with forest and underwood, together with the numerous embouchures of the Ganges, are well known unhealthy districts. The partially dried up marshes and beds of rivers have too often been fatal to our armies when imprudently, if not wantonly and ignorantly, encamped in their vicinity. In 1810 the plains of Spain, along the course of the Guadiano, with its "lines of detached pools," and its ravines, always "half-dried," could tell of a fever-stricken army. The pages of history will also remind us how our British soldiers perished on the low dry-looking sandy plains of Walcheren and of Rosendaal in 1794 and 1809–10. Our last war with Russia during the campaign in Bulgaria, and especially at Varna in 1854, furnishes a no less melancholy record of the sufferings of British troops, and the persistent pernicious influence of the residence there.

In China we know of the miasmatic nature of the deltas of the Blue and the Yellow Rivers. In Africa we know also of the Zais, the Orange, and the Zambesa as unhealthy rivers. In America, the Amazon, the Orinoco, and the Rio-del Norte are similarly deleterious. In England we have the fens of Norfolk and Lincolnshire still a source of disease; in short, there is hardly a country which has not its marshy lands, so that abundance of work exists for chief commissioners of sewers, to direct for good, where such "heads" of "*bodies*" exist; and the extent of disease proceeding from this source

has been shown in many places of Italy, Sicily, and Greece to be so great as to occasion more than two-thirds of the average mortality.

Removal and Neutralization of Malaria.—Of towns that have been drained and remain healthy there are many examples in ancient and modern history. Hippocrates tells us that the city of Abydos had been several times depopulated by fever; but the adjoining marshes having been drained, it became healthy. London, in the time of Sydenham, was infested with epidemic intermittent fever and dysentery, the mortality from the former alone averaging, in a comparatively small population, from one to two thousand persons annually. In the present day, owing to the formation of sewers and a general system of drainage, a case of ague contracted in London is hardly known. Many other towns, both of this country and of France, as Portsmouth, Rochefort, and Bordeaux, from being the constant seat of paludal fevers, have been from the same causes rendered in like manner perfectly healthy.

Dr. Wood of Pennsylvania relates an interesting fact regarding the neutralization of miasmatic effluvia. He tells us they are in some way rendered innocuous by the air of large cities. This fact is notorious in relation to the city of Rome; and it is abundantly confirmed in the larger towns of the United States, in the neighbourhood of which these diseases have prevailed.

Nature of the Noxious Agent.—The intimate connection, therefore, between marshy districts and certain diseases is thus established by a great amount of direct or indirect evidence; the next proposition is, what is the nature of the noxious agent, and what circumstances are necessary to its formation or extrication?

It seems certain that the deleterious agent is neither heat nor moisture, nor any known gas extricated from the marsh. It cannot be heat, for many of the hottest parts of the West Indies are free from fever. It cannot be moisture, for no persons enjoy better health than the crews of a clean ship at sea, even when cruising in tropical climates, as long as they have no communication with the land. While carbonic acid, azote, oxygen, or carburetted hydrogen, the gases collected by stirring the bottom of marshes, have all been inspired without producing any disease similar to paludal fever, it seems consequently to follow almost as a necessary consequence, that the remote cause must be a *miasm*, *poison*, or *malaria*, whose presence is solely detected by its action on the human body, and two hypotheses have been imagined to account for its origin; the one, that it is a product of vegetable decomposition; the other, that it is an exhalation from the earth, favoured by the conditions of the marsh.

The general evidence in favour of vegetable decomposition being the remote cause is, that all countries are for the most part free

from paludal diseases while the crops are growing, and only become unhealthy after the harvest, when large quantities of vegetable matters are left on the ground at the time the rain begins to fall. It may be said that, except rice, we neither reap nor sow in marshes. This is unquestionably true ; but it will be seen hereafter that marshes are in general healthy till the summer's sun, or other cause, has diminished their waters, and bared a greater or less portion of their bed. The part thus exposed almost always contains a large portion of vegetable matters, which, running into rapid decomposition, generates the poison which gives origin to this class of disease ; and it is during the periods of the year when the drying process is in greatest activity, that unhealthiness prevails with greatest severity in the East Indies, namely, the commencement and termination of the rainy season.

The particular evidence of vegetable decomposition being the source of this poison is as follows :—Lancisi, for example, gives the history of an epidemic which for several summers infested, and almost depopulated, the ancient town of Urbs Vetus, situated on an elevated and salubrious part of Etruria, and which was traced to the circumstance of the peasants steeping their flax in some stagnant water in the neighbourhood of the town. This practice was therefore prohibited in 1705, and the epidemic ceased to appear. The apprehension of the steeping of flax being productive of paludal fever, is not limited to Italy, for the ancient as well as the new "coutumes" of almost all the provinces of France have proscribed the steeping of flax, "la rouissage," even in running waters, from the fear of infection. In the Netherlands also the same belief has prevailed ; for, in July, 1627, the King of Spain passed an ordinance, prohibiting the steeping of flax in the streams and canals of Flanders.

The experience of the indigo-planter is to the same effect. In India, after the colouring matter has been extracted from the indigo plant, it was formerly the custom to throw the detritus into large heaps or masses in the immediate neighbourhood of the works, and which, at the end of three or four years, becomes manure of an excellent quality. It was found, however, that these heaps, wetted from time to time by the heavy rains, and afterwards heated by the rays of a burning sun, rapidly decomposed, and at length emitted miasmata, which produced all the effects of those extricated from the marsh ; for the workmen who lived near, and more especially those to leeward of these masses, were found to be very commonly attacked by fever, chiefly of the remittent type, and similar to those which prevail in the paludal districts of that country. This consequence is now so well established that the most intelligent indigo-planters no longer allow these heaps to be formed either near the works, or in the immediate neighbourhood of the cottages of their workmen.

Ships also afford additional evidence of the truth of the hypothesis of vegetable decomposition being the remote cause. The Priamus frigate underwent some repairs at Plymouth previous to a voyage to the West Indies, but the chips and shavings, instead of being removed, were allowed to remain, and to mix with the bilge-water under the limber-boards. On the voyage the foul state of the hold was indicated by the moist offensive smells, and at Antigua a fever broke out, which daily destroyed increasing numbers. The true cause was not yet suspected, and a voyage was undertaken with a view of mitigating the calamity, but without success. The ship at length returned to Antigua, and the state of the hold was examined, and of the effect produced by this proceeding, Mr. Hartle, one of the medical officers present, gives the following account :—When the limber-boards were removed the effluvium surpassed everything he had before experienced. A boatswain looking into the hold, fainted, and afterwards passed through a formidable attack of fever. Every individual also present likewise suffered from fever, and Mr. Hartle himself suffered from a slight indisposition. Although the frigate had only been six months from England, four large mud-boats of filth were removed from her. The fifth lay nine inches thick in the hold. Even the negroes employed in removing this mass were obliged to go on deck occasionally, so insufferable was the stench, and three of them had the characteristic disease. The after magazine, immediately under the gun-room, was found in the worst state, and this accounted, in the opinion of Mr. Hartle, for every officer's servant, and every servant of the gun-room mess, having suffered. Several cases occurred after the removal of the crew in consequence, as it was discovered, of the men having gone on board clandestinely. The ship having been cleansed and thoroughly purified, the general health of the crew was restored, and on their returning on board continued good. All intertropical regions, where the nature of the locality admits only of a rice cultivation, are well known to be unhealthy.

These facts render it highly probable that the noxious agent must be a product of vegetable decomposition, changed from a fixed to an aëriform state, and evolved in the lower regions of the atmosphere. But it must be admitted no analysis of the air has yet disclosed any immediate principle to which the unhealthy influence of miasms may be ascribed. The atmospheric air collected at the embouchure of the Valtelline, a country where it is impossible to sleep without being attacked with fever, gives, on analysis, the same constituent parts and proportions of gases as that collected at the summit of the Alps, or in the narrowest streets in London. Moscati has condensed the exhalations of the marsh as they arose, by means of glass globes filled with ice, but these experiments have not led

to any discovery, nor have they in the least degree elucidated the subject. Dr. R. D. Thomson has analyzed the air in infected places, and has found, with regard to cholera especially, that there is no evidence of the existence of any organic body in the atmosphere which chemistry can detect.

If we consider the paludal poison to be a product of vegetable decomposition, it follows that heat and moisture, quantity of vegetable matter and nature of the soil, though not the essential agents, must have a sensible influence on its formation, must vary its intensity or quantity, and also must limit paludal diseases to particular localities, seasons, and latitudes. A certain temperature, for example, is evidently necessary to its extrication; for should the heat be excessive, the vegetable substance, rapidly parting with its juices, is dried up before decomposition commences.

It is certain also that a given quantity of moisture is as necessary to vegetable decomposition as a given temperature, and that the extrication of the paludal poison will be most abundant from that soil which contains no more moisture than is necessary for that process; for an excess in quantity, by dividing and separating the particles, and by preventing the access of atmospheric air, will either retard or altogether put a stop to putrescency. This law is most important, as it explains the reason why in some countries frequent and heavy rains will render marsh fevers prevalent, by saturating the whole of the open country, while privation of rain will in others produce exactly the same effect in other instances, merely by diminishing the superfluous quantity of water. Thus, in the West Indies, an uncommonly rainy season seldom fails, in the perfectly dry and well cleared island of Barbadoes, to induce for a time general sickness; while at Trinidad, whose central portions are described as a sea of swamp, and where it rains nine months in the year, an excess of moisture is a preservation from sickness; for should at any time rains fall only eight months in the year instead of nine, the swamps become dry and bared to the sun, and remittent fevers of the worst kind are sure to make their appearance. The same result follows on the subsiding of the waters of rivers that have overflowed their banks, as those of the Nile, the Rhone, the Danube, the Tigris, the Ganges, and many others.

It is evident from these data that the swamp, on its approach to dryness, is the harbinger of disease and death, while an excess of rain has a preservative power. On the contrary, on the rich and dry plains, and even on the hills of tropical countries, rain is the cause not only of vegetable decomposition, but also of disease; while absence of rain tends to preserve health.

In estimating, however, the dryness of a country, its superficial appearance is often deceitful. In the years 1748 and 1794 the

summers were dry, and our troops took up the encampments of Rosendaal and Ousterhout in South Holland. The soil in both places is a level plain of sand with a perfectly dry surface, and where no other vegetation existed or could exist but a few stunted heath-plants; yet in both years fever became epidemic among the troops in each place. On digging for water the cause was discovered, for the soil was found to be saturated with water to within a few inches of the surface. It is probable, therefore, that this country was originally formed of vegetable and other detritus, brought down by the Rhine and the Waal, and afterwards covered with sand thrown up by the sea, and which, heated by the summer's sun, became the powerful cause of the extrication of marsh miasmata. From the exceeding malignity of the salt marshes, it has been supposed that a mixture of salt and fresh water rendered a marsh more pernicious than either of them alone, on account of its destroying certain animals and vegetables that can exist only in the one or the other medium. It has been found, however, that, on coasts where these marshes have been kept up to one uniform level by means of flood-gates, the surrounding country is healthy; it has therefore been inferred that the sickness produced was a consequence of the perpetual alteration of the level of the waters of the marsh, and not owing to the admixture of sea and spring water.

It is probably owing to a great excess of temperature that rocky countries, as Gibraltar and the Ionian Islands, are so often and so severely attacked with fever. It is on the summits of these rocks that springs arise. The slightest frost produces fissures, into which mould and vegetable matters insinuate themselves, while the bare rock becomes heated to an intense degree. Humboldt, on ascending the Orinoco, found this station at the great fall depopulated by fever, which the natives attributed to the bare rocks of the rapids. He determined the heat of these rocks to be 118·4°, while the thermometer of the air immediately around was only 78·8°. Again, the rock of Gibraltar is known to be percolated with water, so that we can hardly conceive a more pestilential focus of disease, when the chemical causes necessary to the formation of miasm are combined. The existence of paludal fever in dry and rocky districts, therefore, although it may appear extraordinary and unexpected, is not necessarily an exception to the general law of paludal diseases being generated by miasmata, the result of vegetable decomposition. In many hot climates the most deadly sites for encampments have been the dried up beds of rivers, or their immediate vicinities (Martin).

These facts seem, therefore, unquestionably to prove that heat and moisture, though not the primary cause of paludal disease, are conditions essentially connected with the extrication of the

noxious miasmata, and consequently are a strong additional argument in favour of the hypothesis of vegetable decomposition generating the remote cause which produces some miasmatic diseases. It is certain, however, even when the conditions of heat, moisture, and vegetable matter most abound, that paludal diseases do not always assume their severest forms : thus Jamaica is more unhealthy than Demerara, Demerara than Barbadoes ; and taking the West Indies generally, that country is more unhealthy than that of the East Indies. There must be other circumstances, therefore, affecting the problem in question ; and there seems reason to believe that differences of geological formation, by favouring or otherwise influencing vegetable putrefaction, may variously affect the health of countries similarly situated in other respects.

It is perfectly well known that different soils radiate heat with very different degrees of intensity, and consequently are, under the same circumstances, of very different temperatures, having very different powers of attracting moisture ; and possibly also they may have other and more direct chemical affinities for generating or attracting the paludal miasm. Nothing, for instance, is better determined in husbandry than that the carbonate of lime, mixed with the ordinary matters of a compost, greatly forwards the processes of putrefaction, so that the mass thus prepared is fit in a much shorter time for the purposes of manure. The causes which occasion this rapid decomposition have been investigated by Sir Humhprey Davy, and he has ascertained that lands situated in calcareous districts, like the West Indies, where the surface is a species of marl a few inches deep, lying above limestone earth, are extremely hot, and attract moisture largely. No springs, it is well known, arise on chalky hills, the water being unable to penetrate so impervious a soil ; yet it is of common observation that the ponds on those hills are always full. The different powers of absorption of water by different soils is often well seen in this country ; for the sandstone and limestone hills of Derbyshire and of North Wales, for example, may be easily distinguished from each other at a considerable distance by their different tints of verdure ; the grass on the sandstone hills being usually brown and burnt up, while that on the limestone is flourishing and green. Now if the difference in the absorbing powers of different soils in this country is so striking when the atmosphere contains only 1-75th part of its weight of vapour, how much greater results must arise from this difference of soil between the tropics, where the atmosphere contains three times that quantity, or 1-21st part of its own weight of vapour. It appears, therefore, there are some soils peculiarly favourable to the decomposition of vegetable matters, and consequently to the more abundant extrication of marsh miasmata ; and it is remarkable that

those countries most celebrated for paludal fevers have been found similar in their geological formation to each other, and to those artificial conditions which most favour rapid vegetable decomposition.

The geological nature of the soil is of the greatest importance as influencing the physical climate of a country for good or evil. The deleterious influence of ferruginous soils has been well established by Dr. James Johnson by analysis of soil from the unhealthy regions of the west coast of Africa, from Hong-Kong, from Aracan. M. Boudin, Surgeon-General to the Military Hospital at Versailles, speaking of the great importance of the nature of the soil in relation to public health, remarks a connection between the geological nature of the soil and certain pathological conditions of man. Thus the occurrence of goitre and cretinism in the Alps and Pyrenees caused the existence of the same forms of disease to be predicated and foreseen a long time in the Himalayas and Cordilleras, and experience has verified the induction. Under a dissimilar geological constitution we see the forms of disease differ entirely at the mouth of the Po from those of the Arno, so we can predict a similar difference between the eastern and western coasts of America, and affirm safely the rarity of miasmatic fevers at the granitic embouchures of the Simpson, the Columbia, the Oregon, and the St. Francis (Martin).

It seems probable also that the volcanic matters which enter so largely into the structure of the West India islands add to the intensity of the miasm, and thus cause the severest forms of paludal disease. It is perhaps to this cause that the severe paludal fevers which occasionally appear in the rocky and volcanic countries of Europe, as Gibraltar, the Campagna di Roma, many parts of Spain, and the Ionian Islands, are partly owing.

Of the matters evolved in volcanic eruptions, it seems probable that sulphur is the agent which, by its affinity, adds to the intensity of the miasm; for that substance appears to exist in a remarkable degree on the western coast of Africa, a spot fatal beyond all others to European settlers. An experience of between thirty and forty years, for example, has shown that the copper sheathing of a ship will be as much or more injured in a nine months' cruise off that coast as from a similar service of three or four years in any other quarter. This circumstance induced the Lords of the Admiralty to send to Mr. Daniel, for analysis, a quantity of sea water drawn between the 15° and 16° of latitude off that coast; and that celebrated chemist has shown that it contains a considerable quantity of sulphuretted hydrogen, arising either from a soil having a volcanic origin, or else from the decomposition of the sulphates contained in sea water by the carbonaceous matters arising from the decomposi-

tion of the immense quantities of vegetable matters which grow down even to the water's edge in that country. If sulphuretted hydrogen should hereafter be determined to be an element increasing the virulence of the disease, it will be an interesting question whether it acts merely as a depressant, or whether, by combining with the poison, it augments its intensity.

It is highly improbable that we shall ever arrive at such an exact knowledge of the causes which effect the extrication of marsh miasmata, so as to enable us to predicate all the facts connected with paludal diseases; for the variations of atmospheric temperature, the changes in the quantity and nature of the electric fluid, the quantity of water, the nature of the soil, the amount and character of the vegetable matters, form a problem extremely complicated, and one whose smallest variation as to quantity or time may occasion marked differences in the result. As a general rule, however, it may be stated, that in no climate do paludal fevers prevail to an equal degree all the year round. In the winter much of the vegetable matter has already undergone decomposition, while the dryness of the season, and the diminished temperature, are little favourable to further putrefaction. When the spring, however, arrives, and the rain falls, and the heat of the sun increases, the earth again opens its bosom, and a miasm of mitigated intensity is again developed. In summer the products of vegetable decomposition are used up, in affording nourishment to the growing crops; and this season, like the winter, is in general healthy. But in the autumn, and after the harvest has been gathered, when the ground is covered with vegetable debris, when the rain falls in torrents, and when the solar heat has acquired its greatest intensity, all the conditions of the greatest quantity of vegetable matter, of moisture, and of highest temperature are united; so that the season which realizes the hopes of the husbandman, is also the period of pestilence and of his greatest danger. There are two other facts also which are too prominent to be mistaken: the one is, that the miasmata vary greatly in intensity in different countries, and also in different parts of the same country. Again, the diseases they produce, though annually *endemic* in given districts, yet become, in certain years, and from the action of causes not yet determined, *epidemic*.

In the same countries, also, it is determined, that difference of altitude is equivalent to difference of latitude; and, as a general law, it may be stated that in the Antilles, on the continent of America from Boston to Rio Janeiro, and also on the continents of Asia and Africa, while in the low country severe remittent or yellow fever prevails, still in the higher country, though immediately contiguous, the type is changed to intermittents and mild remittents. The interesting fact stated by Humboldt, that the

vomito prieto never appears on the table lands of Mexico, is strictly in accordance with the observations made in every other equatorial part of the world at a similar elevation above the level of the sea.

The symptoms of intermittent, remittent, and yellow fever differing in many respects from each other, it may be doubted whether these diseases arise from the same cause, differing only in intensity. The circumstance, however, of intermittents passing into remittents, and remittents into yellow fever, and conversely of remitting and yellow fever often terminating in intermittent—facts observed not only in the East and West Indies, but on the continents of America and of Africa—demonstrate an unity of cause as firmly as the best established facts in medicine.

The law that paludal diseases, like many diseases produced by morbid poisons, are annually endemic, and only occasionally epidemic, is unquestionable. A few years ago intermittent fever was epidemic in particular districts in this country, but of late years the cases of ague have been comparatively rare. In Demerara it is observed that yellow fever is epidemic about every seventh year. At Gibraltar, although sporadic cases of paludal fever occur annually, still yellow fever is only occasionally epidemic, but so irregularly, that it assumed that character in 1804, then in 1810, again in 1813 and in 1814, and from that period the garrison suffered no similar visitation till 1828. The physical causes on which this greater virulence and greater spread of the disease depends are not determined. In temperate climates it has been observed that paludal fevers have been most epidemic when a hot summer has succeeded a wet spring. In the West Indies, however, they often appear without any warning and without any sensible change in the thermometer, the quantity of rain, or in the height of the barometer. They follow no given cause, but, like influenza or cholera, appear to be altogether the result of inscrutable influences.

Having thus stated the general laws which relate to the extrication of marsh miasmata, it is now necessary to ascertain those limits within which the poison issuing from its source may infect the human body.

Infecting Distance of Miasmata.—As a general law, the danger of infection is in proportion to the proximity to the marsh. But there are many disturbing causes, which produce remarkable exceptions to this law, and render the solution of the problem one of extreme difficulty. These disturbing causes are the extent of surface which generates the miasmata, their intensity, the direction of the wind, its force, the season of the year, the time of the day, and the attracting influence of the surface over which they pass. These data are so multifarious that it is impossible to do more than assign

the most general facts, in illustration both as to the altitudinal as well as to the lateral range.

The Altitudinal Range.—The Monte Mario, which adjoins Rome, is, according to Breyslack, about 165 yards perpendicular height above the Pontine Marshes, and is extremely unhealthy. Tivoli, which is about 230 yards above the level of the same marshes, is infinitely more salubrious; while at Serre, 340 yards perpendicular height, the inhabitants enjoy an entire exemption from the paludal diseases which prevail below. In Italy, it is estimated that an altitude of 1,400 to 1,600 feet is necessary to assure an exemption from paludal disease; but in the West Indies, where the poison is of so much greater intensity than in Italy, it is estimated that an elevation of 2,000 to 2,500 feet is necessary to give a similar immunity.

In towns partially freed from marsh miasmata by extensive drainage, the difference of a few feet perpendicular height makes an almost inconceivable difference in the liability of persons to paludal disease. The barracks of Spanish Town, the capital of Jamaica, for instance, consist of two storeys, or of a ground floor and of a first floor; but it being found that two men were taken ill on the ground floor for one on the first floor, it was at length ordered that the ground floor should be no longer occupied. Dr. Cullen remarked a similar result at Portobello, Dr. Ferguson in St. Domingo, and Sir Gilbert Blane in the expedition to Walcheren. This law is so well understood in the West Indies, that in Demerara, and in many other parts, the houses are built on dwarf columns, after the manner of our corn stacks, in order that a stratum of air may be interposed between the house and the ground. In Rome, and in other towns of Italy it is also so well known that the lower rooms of the houses are abandoned, the family occupying the upper rooms, as affording a greater protection from the paludal poison.

The Lateral or Horizontal spread of marsh miasmata is a problem still more difficult than that of the altitudinal range. The least complicated cases are those when water alone intervenes between the marsh and the recipient. In the year 1746-47, while our troops lay in Zealand, the sickness was so great among four battalions quartered there that some of those corps had hardly 100 men fit for duty, or less than a seventh part of a battalion. In one corps, the Royals, only four men escaped. At the time, however, of this remarkable prevalence of fever on shore, Commodore Mitchell's squadron lay at anchor between South Beveland and the island of Walcheren, and the fever raged at both places; but, nevertheless, in the midst of all the sickness that reigned around, the seamen were neither affected with fever nor flux, but continued to enjoy perfect health. These observations of Sir John Pringle were fully confirmed by those of Sir Gilbert Blane, during the last disastrous

expedition to Walcheren : "I had," says this physician, "the opportunity of observing the extent to which this noxious exhalation extended, which was found to be less than was generally known. Not only the crews of the ships in the road of Flushing were entirely free from this epidemic, but also the crew of the guard-ship, which was stationed in the narrow channel between this island and Beveland. The width of this channel is about 6,000 feet : yet, though some of the ships lay nearer to one shore than the other, there was no instance of any of the men or officers being taken ill with the same disorder as that with which the troops on shore were affected." It appears, therefore, that in Europe the horizontal spread of marsh miasmata over fresh water is less than 3,000 feet. With respect to the spread of the miasmata over salt water, Sir Gilbert Blane is also of opinion, that in tropical climates ships at a distance of 3,000 feet from a swampy shore—a distance to which the miasmata did not extend in Zealand—and even farther, were affected with the noxious exhalations. Dr. John Hunter considered a few miles to be a necessary interval for a ship lying to leeward of a swamp, in order to insure a complete exemption from the disease. When, however, the swamp or other source of the poison is of small extent, a much less space is sufficient to assure an exemption. In the epidemic on the coast of Spain, the fisherman living with his family on board his boat has been rarely attacked, though lying at anchor close in shore. Also, during the late epidemics at Gibraltar, it was not unusual for the richer inhabitants to hire a Moorish vessel, and to live on board in the bay ; and there was scarcely an instance of those persons having been affected, though keeping up a free communication during the day, either directly or indirectly, with the town. The explanation of the exemption of ships riding in rivers or shallow waters may be that the water in these situations is often much hotter than the land, or the atmospheric air, and consequently the vapour the latter contains is not condensed or deposited. In harbour, also, if the water be shallow, the same thing must take place ; while in deeper water the temperature of the water is sometimes lower than that of the land, and consequently the poison is often precipitated, and at considerable distances from the swamp.

The extent to which the marsh miasmata may spread from its source over land in a horizontal direction, is a much more complicated question, on account of the different affinity which either the poison, or the vapour which it holds in solution, has for the many substances over which it passes ; for different soils act as so many attracting or repelling causes, tending to limit or extend the spread of the poison. The effect of trees in intercepting the paludal poison is remarkable, and appears to have been known to the ancients, who are supposed to have surrounded their temples

with groves on account of their protecting influence. Pope Benedict XIV. ordered a wood to be cut down which separated Villatri from the Pontine Marshes, and, in consequence, for many following years there raged throughout the whole country, and in places never before attacked, a most severe and fatal fever. The same effects were produced from a similar circumstance, in the environs of Campo Santo. On the contrary, even in the West Indies, it is quite wonderful how near the marsh the planter, provided he is protected by trees, will venture to place his habitation. It is probable the immunity arises from the trees partly condensing the vapour of the marsh, and partly, perhaps, by their giving an upward direction to the current.

Different soils also act as attracting or repelling causes which affect the transmission of the paludal poison. The spot, for instance, on which the new National Dock and Arsenal are built was a marsh of about 700 acres, and on either side of it are the villages of Greenhithe and of Northfleet. The peculiarity in this case is, that the inhabitants of these villages rarely suffer from intermittent fever, whilst those on the hills beyond were greatly afflicted with that disease. Dr. Maton mentions a similar fact in the neighbourhood of Weymouth, and the same circumstance is observed also in the neighbourhood of Little Hampton, and the marshy districts in Sussex.

The different force by which the paludal poison is attracted by different surfaces has often been observed in the West Indies. Fort Hildane, at Porto Maria, Jamaica, occupies the extreme point of a promontory which projects considerably from the mainland, and divides the bay into two basin-like recesses. This promontory, which is 150 feet above the level of the sea, and 200 feet across, is so nearly perpendicular, and so nearly alike in all its faces, that it has the appearance of an artificial structure raised for the defence of the harbour. It is formed of pure carbonate of lime, and looking at it merely as a dry mass of chalk, washed on three sides by the sea, we should imagine it to be one of the healthiest situations in the West Indies; yet, strange to say, the inhabitants at its base, and living on the banks of a sluggish river, covered with mangrove, are healthy, while the troops quartered on the rock were so rapidly destroyed by fever that for some years past it has not been garrisoned. In attempting to assign the law which may explain these varying and often apparently opposite phenomena, there is no hypothesis so satisfactory as that which supposes the diffusion of the paludal poison to follow the same laws as those which govern the vapour or dew, by which it is held either in a state of solution or suspension, and which, it is well known, is variously attracted and repelled by various soils, and the vegetable productions which cover them.

Lastly, let us notice in a few words the endemic influence of the

Animal Malaria Poisons.—Animal effluvia arise from the decomposition of the exhalations, excrements, or excretions of individuals (whether of mankind or of the brute creation), of filthy habits, or crowded in confined spaces. Such poisons appear to be more limited in their cause than the paludal poisons just noticed. We know little about them except that they are developed in situations where numbers are crowded together, as in prisons, hospitals, besieged towns, camps, ships, and such like places. Winter is known to be favourable to their development and deleterious influences. They are sedative or depressing in their actions, and while they lower the energies of the nervous system, they tend also to corrupt or poison the blood. We have given *typhous fevers* and *dysentery* as types of the diseases produced by their influence.

EPIDEMIC INFLUENCE.

The second peculiar and characteristic feature peculiar to the miasmatic order of Zymotic diseases, is, that they sometimes spread rapidly, so as to incapacitate and destroy great numbers of the people. The disease is then said to be *epidemic* (επι, upon; and δημος, the people). No subject has afforded greater scope for speculation, than the origin, cause, and progress of epidemics. It is in vain to speculate upon the subject; and, in the words of Dr. Wood, of Pennsylvania, "all we can say, with certainty, regarding epidemics, is, that there must be some distempered condition of the circumstances around us—some secret power that is operating injuriously upon our system—and to this we give the name of *epidemic influence* or *constitution*."

The most recent speculation, regards the discovery of a peculiar atmospheric condition, ascribed to a principle called *ozone*, or *osmazone* (ὀζων, stink, or ὀσμη, smell), of which, as yet, we know nothing definite; although many subtle instruments and apparatus are in use to detect and measure the amount of this principle in the air.

A careful study of the effects of the *epidemic influence* appears to warrant the enunciation of certain laws which seem to regulate its operations. These laws are thus condensed from the statements of Dr. Wood, above noticed.

Laws of Epidemic Influence.—(1.) This influence frequently gives rise to diseases, apparently independent of any other known cause, as in the case of influenza and cholera. It makes itself manifest also by appearing to give increased energy to causes which produce particular diseases: so that small-pox, scarlatina, typhus, and the like, sometimes rage with great violence as epidemics. It also appears to predispose to new and anomalous forms of disease, as witnessed in the furunculoid epidemic, which recently prevailed

both in Europe and America, from 1849 till 1852. (2.) Sometimes the *epidemic influence* manifests itself by a certain type or direction, which existing diseases appear to take. Thus at one period diseases take a low, or what is called a *typhoid* type, so that depletion is not tolerated; at another time, an *inflammatory* tendency predominates, and antiphlogistic treatment is required. At one period also, there is a tendency in disease to complicate its course by a disposition to affect particular organs. At one time head affections predominate; at another time, affections of the chest, or of the alimentary canal, complicate the course of a prevailing disease. Consequently the same disease may demand very different, and even opposite modes of management. (3.) During epidemics other diseases are apt to assume more or less of the prevailing epidemic features. Thus, when cholera prevails, looseness of the bowels often complicates the course of other affections. When influenza prevails, catarrhal complications increase the danger of other diseases. Ill health of any kind, therefore, favours the action of the epidemic influence. (4.) Some change in the character of prevailing diseases of a constant and recurring kind often indicates the approach of an epidemic and the prevalence of the epidemic influence. (5.) The first effects of the *epidemic influence* are usually the most violent and marked, and the cases of the epidemic disease become mild as the *epidemic influence* passes away. (6.) *The epidemic influence* sometimes disappears entirely after a short prevalence: sometimes continues with irregular intermissions for two, three, four, or even six years, or longer—influenza and cholera are examples. (7.) An epidemic tendency, after continuing for several years, may give place to one of a different kind, which, in its turn, may again give place to the first. *Miasmatic fevers*, *yellow fever*, and *typhus*, illustrate this in America. The eruptive affections seem to run in somewhat similar cycles. After the introduction of vaccination, the *small-pox* seemed for many years to be almost entirely subdued; but more recently again the disease has seldom been entirely absent from among us, alternating as an epidemic now and then with *measles*, *scarlet fever*, and *typhus*. We look forward to the time, when vaccination, enforced by law, will predominate, and in time completely eradicate the disease. (8.) The lower animals are also subject to epidemic influences; and seasons of unusual fatality among them have coincided with those in which the human race have suffered.

A successful study of these two peculiar and characteristic features of miasmatic diseases, namely, the *endemic and epidemic influences*, is of the utmost importance to the student. He will learn how much and successfully mortality may be diminished by well directed hygienic measures: such as cultivation and improvement of soil, extension of commerce, improvements in diet, and the social cir-

cumstances of the lower classes—especially in regard to cleanliness, ventilation, and domestic management of improved dwellings and efficient sewerage; care in the separation and treatment of the sick when in numbers, and the use of strict measures of a prophylactic kind suited to the circumstances of the case. Next to large towns, the health of the Army is of the greatest importance, especially when we consider the high rate of mortality in that service. In the military age (which is the age between twenty to forty), the mortality of the general population in England is less than one per cent. per annum. The mortality of the British army is much above this; and chiefly from sickness of the Zymotic class of diseases. From 1808 to 1814, the mortality of the whole British army was at the rate of 7·16 per cent.; and it is much greater than this during campaigns, when more than 22 per cent. are constantly on the sick list. The causes of this high rate of mortality requires investigation (Dr. Farr).

We shall now proceed to consider the zymotic diseases in detail, commencing with small-pox.

Small-Pox.

Definition.—*Small-pox is the product, and is productive of a morbid poison; which after a period develops a remittent fever followed by an eruption on the skin, and sometimes on the mucous surfaces, with other concomitant and occasionally succeeding affections. The eruption on the skin passes through the stages of pimple, vesicle, pustule, scab; and leaves marks or cicatrices on the site of exudation. The disease runs a definite course, and exhausts the susceptibility of the constitution to another attack.*

Pathology.—The theory regarding the development of small-pox is, that a poison is absorbed and infects the blood, and after a given period of latency, gives rise to "primary fever," which lasts from two to four days, till the eruption appears, when it for the most part *remits*. The secondary, or specific action of this poison, makes itself obvious by an exudation in the form of an eruption on the skin, and also sometimes on the mucous membrane of the eyes, nose, the mouth, and of the fauces and great intestine. The eruption runs a given course, namely, of *pimple*, vesicle, and pustule, and when fully out, or at its height, the febrile phenomena, which had remitted, return, and give rise to what is termed the *secondary fever*. The occasionally succeeding affections are inflammation of the various tissues of the lungs, affections of the urinary organs, and lastly of the cellular tissue of the body generally, which often becomes the seat of an endless number of abscesses.

The phenomenon of fever preceding the secondary or specific actions of the poison, or the appearance of the eruption, has scarcely an exception, and indeed in some instances it has been of so severe a character as to have destroyed the patient on the first onset. The remission or subsidence of the fever is also constant in mild cases, but in the severer forms of the confluent small-pox it sometimes runs on, and is constant. The recurrence of the "secondary fever," and the exacerbation of the fever in severe cases at the time of the maturation of the pock, is also constant. The cause of this secondary attack has long been a difficulty in the history of small-pox, some attributing it to a remittent nature in the fever, while others consider it to result from the maturation of the pustules, and to be a *suppurative* fever. Modern pathologists are inclined to regard this secondary fever as *symptomatic*, and dependent upon the local affection.

Another constant phenomenon in the development of small-pox, is that the secondary actions of the poison occasion a peculiar eruption, has only a few rare exceptions, and constitutes a variety of small-pox sometimes noticed as the "*variolæ sine eruptione.*" With this exception the eruption is uniformly present; but the affection of the mucous membranes is often wanting in mild cases, though rarely absent in severe ones. The poison also is apt to produce many tertiary actions, as inflammation of the lungs, of the urinary organs, of the eye, and of the cellular tissue. Generally it may be mentioned that the state and appearance of the eruption depends in a great measure upon the type and character of the fever, while the type and character of the fever may be modified by the organic functions and condition of the blood.

The development of small-pox is traceable through certain stages, namely,—1st, The stage or period of incubation; 2d, The febrile stage, or period of primary fever; 3d, The exudative stage, or period during which the eruption appears and becomes fully developed; 4th, The suppurative stage, or period of secondary fever.

As the eruption, or formation of the small-pox pustule is undoubtedly a marked characteristic of the disease, it requires particular description. It has itself certain definite stages in its development. It runs a given course of about eleven days, and in its progress undergoes many mutations. It is at first a pimple, then a vesicle, then a pustule, and lastly it forms the scab or crust. These various changes form so many stadia of unequal duration. The first, or stage of pimple, lasts from twenty-four to forty-eight hours; the second, or vesicular stage, four days; the pustular stage three days; while the last stage, or that of scabbing, lasts three days more, making the whole duration of the *normal* pustule ten or

eleven days. There are varieties, however, of this disease, in which the formation of the pustule is irregular; as in the *confluent* and *horn* small-pox. In the latter the two last stages are singularly shortened, or else absent altogether.

When the small-pox pustules are distinct, they consist, on the first appearance of the eruption, of a number of small red pimples, about the size of a pin's head, more or less numerous, but separate and distinct from one another, and scarcely salient. On the second or third day the second stage, in the development of the pustule, commences; and a small vesicle, which gradually enlarges, bound down and depressed in the centre, or *umbilicated*, forms on the apex of each pimple, and contains a clear whey-coloured fluid. This stage lasts about four days, when the pustule maturates. This process is so gradual, that Dr. Watson says, if you examine the pustule closely about the fifth or sixth day you may see, at least in many, two colours, viz., a central whitish disc of lymph, set in, or surrounded by, a circle of yellowish puriform matter. "In truth, there is in the centre a vesicle, which is distinct from the pus, so that you may puncture the vesicular portion, and empty its contents without letting out any of the pus, or you may puncture the part containing the pus and let that out without evacuating the contents of the vesicle." While this change also is going on, a damask red areola forms around each pustule; and as the vesicle fills, the whole face swells, and often to so great a degree, that the eyelids are closed. When the maturation is complete the "*bride*," which bound down the centre of the vesicle, ruptures, and the pustule now becomes spheroidal or *acuminated*. About the eighth day of the eruption a dark spot is seen on the top of each pustule, and at that spot the cuticle ruptures, and allows a matter to exude, which concretes into a scab or crust; and during this process the pustule shrivels and dries up. This crust is detached between the eleventh and fourteenth days, leaving the cutis beneath of a dark reddish-brown, a discoloration which lasts many days or weeks. On the face, however, the pustule often penetrates or burrows, so as to cause ulceration of the rete mucosum, and to leave a permanent cicatrix in the form of a depression or "pit." The cicatrix formed on filling up of these ulcers, though at first of a reddish-brown, ultimately becomes of a dead white colour.

The small-pox eruption does not appear over the whole body at once, but appears in three successive crops. The first crop covers the face, neck, and upper extremities, the second the trunk, while the third appears on the lower extremities. There is usually an interval of several hours between each crop; and by how much the later the pustules are in appearing on the trunk and lower extremities than on the face and neck, by so much the later they are

in maturating and in disappearing from those parts. When the eruption on the face is declining, that upon the extremities has scarcely yet arrived at its height, so that the hands and feet are then considerably swollen. This is to be regarded as a favourable sign, so far as it indicates a certain vigour of constitution.

The number of pustules is very various, sometimes not exceeding five or six over the whole body, more commonly from one to three hundred, and occasionally amounting to several thousands. It has been calculated, if ten thousand pustules be counted on the body, that two thousand at least will be found on the face, and accordingly, the number of pustules on the face being in proportion, those on the other parts of the body is a fair estimate of the extent of the disease, and of the danger of the patient.

The pustule is subject to many irregularities, both as to its form and course; which give rise to two very marked varieties of the disease, or to the *confluent* and to the *horn* small-pox. The *confluent small-pox* differs from the *distinct small-pox* in the pimples being small, less prominent, and so numerous that even on the first appearance of the eruption there is hardly any distinct separation between them. The vesicles which form on their apices appear earlier, and their diameters increase more irregularly than in the distinct forms, and often they run one into the other. The pustules, likewise, which are confluent, either remain flat and do not rise, or else, the cellular tissue rupturing, they form large bullæ or bladders (variolæ corymbosæ), and are not encircled with the usual red areola round their base; neither do their fluid contents always acquire the yellow colour and thick purulent consistency of the milder disease. Their crusts, moreover, are soft, and do not fall off till many days after the usual period, or not till the eighteenth or twentieth day, or even later; and when the desiccation is completed and the crust detached, a deep scar or pit, sometimes an extensive seam, shows the destructive ulceration that has taken place beneath them.

The *horn small-pox* is a variety of the pustule, and is by much the mildest form of the disease. The pustule in this variety passes through the stages of pimple and of vesicle, but on the fifth or sixth day of the eruption, instead of maturating, the pustule shrivels, desiccates, and crusts, and the disease terminates three or more days earlier than in the usual course; and without the occurrence of any secondary fever. This is the form of the disease which so usually follows after vaccination.

Many other varieties have been described by the older authors, which are seldom if ever now seen, for instance, *black small-pox* (Sydenham); a *blood small-pox* (Mead); a *siliquous small-pox* (Friend), in which the pustule resembles a small hollow bladder, but contains no fluid. These varieties of the pustule were probably

occasioned by improper treatment, or by some rare idiosyncrasy, and are consequently not mentioned by modern writers. There is one variety, however, which is not uncommon, which is the *crystalline* or *pearl pock* (*variolæ crystallinæ*), in which the vesicle continues transparent, seldom maturates, and has a tendency to become confluent. Every variety of the eruption, also, when the disease is severe, may be intermixed with petechiæ. Such are the chief features of the disease, so far as the development of the eruption is concerned; the sequel will complete the pathology.

Varieties and Symptoms of Small-Pox.—The species of small-pox to be described are:—1, *The Natural Small-Pox;* 2, *The Inoculated Small-Pox;* 3, *The Small-Pox after Vaccination, or Varioloid.* Of these in their order; and,

1. *Of the Natural Small-Pox.*

There are three varieties of this species, namely,—first, the small-pox without eruption (*variolæ sine eruptione*); second, the distinct small-pox (*variolæ discretæ*); and third, the confluent small-pox (*variolæ confluentes*).

Symptoms of the Small-Pox without Eruption.—Sydenham and Frank have observed in every variolous epidemic, that some few persons who have not previously had the small-pox, or, according to Frank, have neither had the small-pox nor been vaccinated, are seized during the time the small-pox is raging, with all the symptoms of primary variolous fever, and which having subsided, they have afterwards been found insusceptible of the disease. Sydenham states that he has seen fatal cases of this kind attended with purple spots and bloody urine; and hence the "variolæ sine eruptione" of authors; which when it occurs in the present day, is more usually regarded as a modification of small-pox, probably depending on the influence of vaccination.

Symptoms of the Distinct Small-Pox.—The symptoms of *variolæ discretæ*, or of distinct small-pox, may be divided into *four stages.* The *first stage* comprises the period of incubation or of latency. The variolous poison having infected the blood, lies in latent combination with that fluid a period of time which varies according as the poison has been introduced by the mucous or cutaneous tissues. In the former case, or in natural small-pox, for example, the more usual time of latency is from ten to sixteen days; while in the inoculated small-pox the period of latency is only from seven to nine days. The extremes, taking both forms of the disease, being from five to twenty-three days. The *second stage* comprises the primary fever, which commences with the disease and terminates with the appearance of the eruption. The *third stage* commences with the

eruption and terminates with the appearance of the secondary fever. The *fourth stage* commences with the secondary fever, and includes all the subsequent phenomena.

In the adult, the symptoms of the second stage are not to be distinguished from those of the first stage of typhus, or other febrile affections; but in children there is a greater tendency to vomiting, and the brain also is more oppressed with drowsiness, stupor, or coma, followed occasionally by convulsions. The ordinary duration of this fever is four days, and it may be sudden in its attack, or be preceded by some days' illness, in which case the most prominent and characteristic symptoms in the adult are severe muscular pains simulating rheumatism, especially in the small of the back, and the frequent occurrence of obstinate vomiting.

On the fourth day inclusive from the first attack of the primary fever, sometimes sooner, and but seldom later, the eruption appears, and the third stage commences. The phenomena of the third stage are as a calm succeeding to a storm; for, on the appearance of the eruption, the fever remits, the heat abates, the affection of the head subsides, the vomiting ceases, and the pulse returns to its natural standard, and consequently the febrile phenomena have altogether disappeared.

The number of pustules varies, according to the severity of the case, from about twenty to some thousands. They appear first in minute bright red specks on the face, neck, and upper extremities, then on the trunk, and lastly on the lower extremities, and run their course in a succession of crops. They undergo the various mutations of pimple, vesicle, and of pustule already described. About the eighth day of the disease, however, or when the eruption is fully out over the whole body, and the pustules on the face begin to maturate, the whole face, head, and neck swell, particularly the eyelids, which often close and blind the patient; the swollen parts also throb and are painful when touched. The intumescence of these parts lasts three days, during which the spaces between the pustules inflame, and are of a deep red or damask-rose colour; and the closer this resemblance is seen to be, the milder will be the subsequent affections.

It is during this period of intumescence that the fever which had remitted, returns, and the *fourth stage*, or that of secondary fever, commences. This attack, in cases of ordinary intensity, is marked by a considerable increase of heat, by a frequent pulse, and by slight delirium, from which the patient is easily aroused. If, however, the disease be of greater intensity, hæmaturia, hæmoptysis, or a hard dry cough are added. In favourable cases, the swelling of the face, the redness of the intervening spaces, and also this secondary fever, having lasted from the eighth to the eleventh day, subside,

and the pustule, now fully ripe, bursts and discharges a thin yellow matter, which, concreting into a crust, falls off on the fourteenth or fifteenth day, and the disease terminates.

A very mild variety of distinct small-pox was wont to be named the "*horn-pox.*" In this variety the primary fever is little more than a febricula; the pustules do not exceed half a dozen to two or three hundred, and having passed through the stages of pimple and of vesicle, they on the eighth day, or about the usual time of maturation, shrivel, desiccate, and crust. The secondary fever also, often so fatal, does not recur, so that the convalescence usually commences on the eighth day, and the disease is terminated on the eleventh.

It was once supposed that in such cases the pus of the pustules was absorbed, but it appears that pus does not form, the fluid always remaining serous. In cases of any degree of severity, even in the *distinct small-pox*, the poison acts not only on the skin but also on the buccal and ocular membrane, and produces an exudation on those parts. This additional affection, however, does not appear to aggravate the fever, or to occasion other inconvenience than what arises from the local disease. The buccal eruption is usually preceded and accompanied by soreness of the throat and difficulty of swallowing, and sometimes salivation; but these symptoms do not exceed those of a common sore throat. The exudation upon the mucous membrane is generally resolved without the formation of ulcers, or anything that can be considered a scab or cicatrix. The exudations, which form within the eyelids, are not attended with much pain, and it is only when the swelling has subsided that the mischief which sometimes takes place is discovered.

A peculiar faint and sickly odour emanates from the small-pox patient during the period of maturation of the pustules. When, however, the disease assumes an unfavourable character, and threatens a fatal termination, the face, which ought to have been intumescent on the eighth day, remains without increase of size, and the spaces which ought to have inflamed are pale and white. The pustules also, says Sydenham, look red and continue elevated, even after death, and the sweat, which flowed freely up to this day, suddenly ceases. At this critical period the secondary fever, instead of its usual sthenic character, may assume one of two forms, or that of the second stage of typhus, with brown tongue, frequent pulse, and delirium, or else the patient may be overwhelmed with the depressing influence of the poison, and sink almost without experiencing a re-action, the pulse being hardly increased in frequency, the heat of the body natural, and the intellect unimpaired. But the patient suffers from an indescribable restlessness, an inexplicable anxiety, some cough, with sickness, a frequent desire to pass urine, and with these symptoms he dies, after a short struggle.

Symptoms of the Confluent Small-Pox.—The confluent small-pox is described by Sydenham as beginning with symptoms similar to those of the distinct small-pox, but more violent; the second stage, or primary fever, being attended with more sickness and vomiting, with greater heat, with more severe muscular pain, with more considerable delirium, and in children often, on the evening before the eruption, by convulsions. This fever is not only more intense than in the distinct kind, but is also of shorter duration; the eruption appearing more generally on the third day, or even earlier; and the sooner the pustules appear, so much the more confluent is the disease that follows likely to be. The eruption is often preceded also by an extensive erythematous or erysipelatous inflammation, and the pimples come out irregularly, or in small clusters, like the measles, and are less eminent than in the distinct small-pox.

When the third, or eruptive stage, is formed, the primary fever remits, but not so completely as in the distinct kind, for the pulse often continues frequent (110 to 120 in a minute), the tongue is white, and even the delirium may recur in the evening. This eruption also has some remarkable characters, for the pustules, especially those of the face, do not rise, they are more irregular and flatter in their forms, and from their greater number and contiguity run into each other, or are confluent, sometimes forming bullæ as large as a hen's egg, and sometimes scarcely a portion of healthy skin is visible.

Another symptom also, sometimes seen in the distinct, never fails to accompany the second stage of confluent small-pox, namely, *salivation*. The salivary discharge begins either with the eruption or within a day or two after, and is then thin and copious, resembling the ptyalism of mercury. About the eighth day, however, it becomes viscid, and is expectorated with difficulty; while in bad cases it either ceases for a day or two and then returns, or else it disappears altogether. Children are not so liable to this salivation as the adult, but in them a vicarious diarrhœa often appears, but not constantly, neither does it occur so early in the disease. It is frequently profuse, unless checked, and often proceeds till the disease terminates. Not unfrequently the larynx and trachea are implicated, even to the larger divisions of the bronchia, attended with cough, hoarseness, painful expectoration, and sometimes complete extinction of the voice. These are most dangerous symptoms.

It has been stated, that on the appearance of the eruption and the commencement of the third stage, although the fever is mitigated, it does not altogether subside, but that the affection of the head, the frequency of the pulse, and greater heat of the surface, often continue. With these ominous symptoms still present, on

the eighth day of the eruption, or the eleventh day of the fever, the fourth stage, or secondary fever, commences, bringing with it new sources of anxiety to the physician and of danger to the patient.

"The confluent small-pox," says Sydenham, "does not in the least endanger life in the first days of the illness, unless there happens a flux of blood from the urinary passages, or from the lungs. Yet, on the decline of the disease, or on the eleventh, fourteenth, seventeenth, or twenty-first days the patient is often brought to such a state that whether he will live or die is equally uncertain. He is first endangered on the eleventh day by a high fever, attended with great restlessness and other symptoms, which ordinarily prove destructive, unless prevented by medicine. But should the patient outlive this day, the fourteenth and seventeenth are to be apprehended, for a very vehement fit of restlessness comes on every day towards evening, and there is the greatest difficulty in saving him."

The fatal symptoms of the fourth stage are, the absence of the usual redness in the intermediate spaces, the non-intumescence of the face, the suppressed salivation, cough, with hæmoptosis, or hæmaturia, and great restlessness. Sometimes other symptoms are added to these, as a brown tongue, delirium, petechiæ, or a black spot in the centre of each pock, scarcely so big as a pin's head, or else a disposition to gangrene in the large vesicles; and when these symptoms are present few persons survive this terrible crisis. In some cases, however, the event is favourable, and the patient is restored, but the struggle is sharp, and the convalescence long; and in its progress an endless series of abscesses may form, or inflammation of a joint may take place and produce lameness; ulceration of the cornea, blindness, otitis, or deafness may also ensue; while the deeply-scarred face is a lasting record of the severity of the disease, and of the great danger the patient has survived.

2. *Of the Inoculated Small-Pox.*

Symptoms.—The phenomena which result from the introduction of the variolous poison by means of the cutis differ in many respects from those that occur in the natural small-pox; and they are as follows:—On the day after the operation is performed, little alteration is discovered in the punctured part. On the second day, however, if the part be viewed with a lens, and the operation has succeeded, there generally appears an orange-coloured stain around the incision, while on the fourth or fifth day the part is hard, slightly inflamed, and itches, and a vesicle containing serum is formed on it. About the sixth day some pains and stiffness are felt in the axilla, symptoms which foretell the near approach of the fever and the favourable progress of the disease. On the seventh day the vesicle

becomes more developed, and the red areola forms round its base.

The operation having now been performed seven, eight, or nine days (the usual period of latency of the poison,) and the vesicle having existed four days, the ordinary symptoms of primary fever appear. This fever lasts three or four days, when the general eruption follows, now called the secondary eruption, the pustules coming out, as usual, in three successive crops, on the face, trunk, and lower extremities. On the day of the general eruption the primary pustule, says Dr. Gregory, is distended with matter, and proceeds on its course so that it has scabbed when the secondary eruption is only about to maturate.

The most remarkable phenomena, however, of the inoculated small-pox are the singular mildness of the fever and the diminished number of the pustules of the secondary eruption. The mildness of the fever is thus instanced by the late Dr. Watson, of the London Foundling Hospital:—"Of the seventy-four persons whose histories I have related, though inoculated with variolous matter in different states, although prepared in so different a manner, and a great number not otherwise prepared than by an abstinence from animal food, not one of them were disordered enough during the whole progress to occasion the least anxiety for the event; not one of them had, from the pustules being upon the eye or near them, their eyes closed a single day; none continued in bed an hour longer than they would have done in their best health."

The number of pustules is subject to great varieties, but, with very few exceptions, it is much less than in the natural small-pox. In some cases not more than two or three appear, occasionally only the primary pustule is seen; but more generally the number varies from ten to two hundred, the mean being thirty or forty. Such is the general course of the inoculated small-pox. In a few instances, however, the disease that follows this operation is extremely severe, and in a still smaller number it is confluent; and in either case the patient is perhaps destroyed. Many theories have been invented to explain the singular mildness of the inoculated small-pox, but none of them are satisfactory.

Complications of Small-Pox and special Pathological Tendencies.—Small-pox having been chiefly studied previous to any sound knowledge of morbid anatomy, or of the laws of morbid poisons, the occasional subsequent affections of the disease are still but imperfectly known. About the eighth day in the distinct, and the eleventh day in the confluent small-pox, a secondary fever is established, and at the same time a new series of phenomena present themselves in a few severe cases,—as affections of the lungs, of the urinary organs, or of the cellular tissue of the body generally.

These are the *tertiary affections,* the eruptions and the fever being the *secondary effects.*

The most frequent affection of the lungs is hæmoptysis, but occasionally inflammation of those organs takes place. The mucous membrane, for instance, of the trachea is found often covered with a thick semi-purulent muciform matter, peculiar to small-pox, irregular or honey-combed at its free surface, and which being removed, the subjacent tissue is found diffusely inflamed. The substance of the lungs also is occasionally found inflamed in every degree, even to purulent infiltration. The pleura also, according to Dr. Gregory, is peculiarly disposed to inflammation, which comes on about the eleventh or twelfth day, for the most part very suddenly, proceeds rapidly to empyema, sometimes destroying the patient in thirty-six hours. The inflammation of the pleura does not merely run into suppuration, but takes every other form to which it is, at any time, liable.

The tertiary action of the variolous poison on the urinary organs and on the uterus is seen in the frequent occurrence of hæmaturia, and in the occasional formation of abscess of the kidney; while its action on the uterus is manifest from menorrhagia in the unimpregnated state, and also of frequent miscarriage when the patient is parturient.

The cellular tissue of the body generally is also acted upon by this poison. In some cases examined a few hours after death, the bodies can with difficulty be laid on the table, the skin being detached by the pressure necessary to raise them; the serous coat of the intestines also separates from the mucous and muscular coats with the greatest facility for many feet, and apparently might be entirely peeled off. In some cases, also, the finger can be thrust through the walls of the heart with ease, as if the muscles of that organ had become unnaturally soft, and broken down. This affection of the cellular tissue generally is also seen in the great tendency to the formation of abscesses on the subsidence of the eruption; for twenty, thirty, and even more small abscesses will sometimes form on a limb or other part of the body in most formidable succession, and which, on being opened, are found to contain sanious, or, only in a few instances, laudable pus.

The different lesions that have been mentioned are not the only miseries from which the patient may suffer; for these are often followed by sequelæ even more formidable than the preceding phenomena, as blindness, deafness, or lameness. With respect to blindness, it is generally supposed that pustules form on the conjunctiva or cornea, the inflammation then extending to the deeper-seated parts, and thus destroying the eye. Mr. Marson, formerly a surgeon to the Small-Pox Hospital, says that, according to his experience,

"The eye seems to possess a complete immunity from the small-pox eruption, and that although it sometimes extends to the inner margins of the eyelids, the particular local affection that causes the destruction of the organ of vision in variola begins generally on the eleventh or twelfth day, or later, from the first appearance of the eruption, and when the pustules in every other part of the body are subsiding. It comes on after the secondary fever has commenced, with redness and slight pain in the part affected, and very soon an ulcer is formed, having its seat almost invariably at the margin of the cornea. This continues to spread with more or less rapidity, and the ulceration passes through the different layers of the cornea, until the aqueous humour escapes, or till the iris protrudes. In the worst cases there is usually hypopion, and when the matter is discharged the crystalline lens and vitreous humour escape. In some instances the ulceration proceeds very rapidly; I have, more than once, seen the entire cornea swept away within forty-eight hours from the apparent commencement of the ulceration; and, what is singular, now and then the mischief goes on without the least pain to the patient, or his being aware that anything is amiss with his eyes." Further, he calculates that in 1,000 cases 26 had ophthalmia, or about 1 in 39; and of these 11 lost an eye each, or 1 in about 100.

The inflammation of the buccal membrane may extend to the Eustachian tube, causing suppuration of the ear, and sometimes permanent deafness. It may spread also to the glottis; and the patient has been known to die suffocated by effusion into the cellular tissue around it, causing occlusion of the aperture. Sometimes it has terminated in ulceration, with the loss of a portion of the nose, or in caries of the jaw-bone, or in enlargement of the glands of the neck.

It has been much disputed whether the eruption forms on any other of the mucous membranes, and, as a general principle, it does not; but Martinet found, in a man that died on the eighth day, the rectum covered with variolous pustules. Rostan has seen the alimentary canal garnished with pustules similar to those of the mouth, from the œsophagus to the rectum. Sir Gilbert Blane also met with pustules on the mucous membrane of the intestines in two cases that died in the West Indies: and Rayer has given a plate representing pustules on the mucous membrane of the trachea. Dr. Mead's experience has made him state that, "I myself have seen subjects in which the lungs, brain, liver, and intestines were thickly beset with pustules." Dr. Pitzholdt, in the morbid anatomy of small-pox, says he has seen the peritoneum covering the liver and the spleen, presenting appearances which he felt justified in regarding as the product of the small-pox.

The pustules which form on the mucous membranes, however, have not been very distinctly studied either as to their course or phenomena. Rayer terms them *rudimentary* pustules.

A case recorded by Dr. George Patterson, of Edinburgh, was examined by one of the most learned and discriminating pathologists of the day, Dr. W. T. Gardiner. He observed pustules on the mucous membrane of the colon, and pronounced them to be identical with the pustules on the skin.—(*Edinburgh Monthly Journal*, 1849, p. 549.) Still it appears to be doubtful whether such eruption on the mucous membrane of the intestine is not the same as we have in cholera cases, extending (as I have frequently seen it do in cases I have examined in the hospitals at Scutari, in 1855) throughout the whole intestinal tract, and which was nothing more than mucous glands filled with exudation not of a purulent kind; but having all the external appearance of pustules.

Such are the pathological phenomena which occasionally complicate small-pox. Death, however, not unfrequently anticipates their action, and destroys the patient during the primary fever, and before any of them are set up.

3. *Of the Small-Pox after Vaccination—Varioloid, or Modified Small-Pox.*

Symptoms, Course, and Modifications.—It has been already noticed that during the epidemic prevalence of small-pox, even before vaccination was known, cases of small-pox occurred in a very modified form: such as the occurrence of variolous fever without the eruption (*variolæ sine variolis vel eruptione*), or the occurrence of small-pox in which the eruption continued vesicular (*the crystalline pock*), and, lastly, the occurrence of small-pox in which the vesicles dried up instead of becoming mature pustules, and known as stone-pock, horn-pock, wart-pock (*variola verrucosa vel cornea*). Modern pathology now regards these varieties as the result of the modifying influence of vaccination: and they may now be all described and classed under the common name *varioloid*. Comparative mildness of symptoms and course is their great characteristic. There appears to be every variety in the nature of the modification, of which the principal are—

1. A fever of three days, without eruption, affecting people during variolous epidemics.

2. A high and severe fever followed by a very mild eruption, sometimes only a single pock; the slight proportion which the amount of eruption bears to the severity of the preceding fever is perhaps the most marked characteristic of varioloid.

3. The occasional appearance of a scarlet efflorescence like that of scarlatina or roseola preceding the appearance of the proper pimples, which are in a very scanty crop.

4. In some rare instances the eruption is confluent, but does not advance beyond the development of a pimple or vesicle, and begins to dry on the fourth or fifth day of the eruption, forming a small hard tubercule which soon disappears.

5. Sometimes the eruption is at once pimple, vesicle, and pustule, at one time in the same case.

6. Sometimes the eruption runs its regular course, but stops sooner, sometimes on the sixth or seventh day instead of the eighth or ninth. In general, it may be stated, that the severity and fully developed state of the disease is in proportion to the length of time which had elapsed from vaccination (COPELAND).

7. The varioloid eruption wants the peculiar odour of natural small-pox, and secondary fever is very rare.

8. Other eruptive affections—such as measles, scarlatina, purpura, materially modify the course and symptoms of small-pox.

Exhaustion of Susceptibility.—The small-pox has the property in common with measles and scarlet fever, of exhausting, on the first attack, the susceptibility of the constitution to the future actions of the poison. This law, however, is not without some exceptions, and in the late epidemic at Marseilles, Bosquet considered that one person in one hundred was attacked a second time with small-pox. In some few instances even a second attack has no protective influence. Dr. Roupel says he met with an instance in which small-pox occurred three times in the same person. The lady of a Mr. Guinnett had it five times. Dr. Maton speaks of a lady who had it seven times; while Dr. Baron mentions a surgeon of the South Gloucestershire militia, who was so susceptible that he took the small-pox every time he attended a patient labouring under that disease.

Co-existence with other Morbid States.—The variolous poison is capable of *co-existing* with many other poisons, and also of influencing their actions, and of being reciprocally influenced by them. Dessessarz has seen variolæ co-exist with scarlatina and with whooping-cough; Cruikshanks with measles; Frank with psora; and Dimsdale with syphilis. A patient was admitted into St. Thomas's Hospital with tertian ague, writes Dr. Williams; the ague subsided and the small-pox appeared. The small-pox having run its course, the ague immediately returned. Ring mentions a case of triple disease co-existing, or of small-pox, measles, and whooping-cough, and that they all ran their course together.

Cause.—The same obscurity hangs over the cause of small-pox as over those of many other diseases of the zymotic class, such as of

measles and of scarlatina. While, however, the causes of these two latter diseases seem still active, there is every probability that of small-pox has subsided, and that this disease has now no other source than human contagion. There are some grounds for believing, however, that small-pox, in common with some other distempers, originated in the lower animals, and extended from them to the human species by infection or contagion. Sheep, we know, are liable to a distemper of the nature of small-pox, and there is every reason to infer that the disease is perpetuated by its own miasm, effluvium, or virus, which spreads it about by the media of substances, technically called "*fomites*," and which are capable of receiving, preserving, and carrying the germs of the disease. By such means the disease has been propagated since its first appearance in the sixth century. The poisonous material of small-pox is given out from the mucous and cutaneous surfaces of a patient, especially from the lungs and skin, from the exhalations, the secretions, the excretions, the matters in the vesicles and pustules, and the scabs. These all contain the noxious germs of the disease, which may attach themselves to bed-clothes, body-clothes, and especially to woollen, cotton, and felted articles. Such stuffs retain the specific poison for a very long, but undetermined, period: just as the hat, cap, and coat, worn in a dissecting room retains the peculiar effluvia of the place for a very long period.

It is not yet determined at what period this poison is first generated by the patient's person, whether during the primary fever, or not till after the eruption has appeared; but it is probably secreted during the primary fever. Generally it may be stated, that the poison is most powerful when it is most manifest to the sense of smell; that the dried crusts of the pustules or scabs possess a contagious quality, and retain it for a very long time; and it is unsafe for a susceptible person to be in the same room, or in the same house, with a patient labouring under the disease. It has also been caught by passing a child ill of small-pox in the street: so that, "to expose a person in the public highway, infected with this contagion, is considered a common nuisance, and indictable as such." The dead body of a variolated person is equally infectious, and students who have been near it when brought into the dissecting-room, have in consequence fallen ill of the disease. The *infecting distance*, therefore, must be many yards around the patient's person: indeed, with every precaution, there is great difficulty in preventing it spreading from ward to ward in large hospitals during prevalence of the disease.

The fact of the contagious nature of small-pox has been fully demonstrated by the once general practice of inoculation; and the poison by this operation has been proved to exist in the serum,

in the pus, and in the crusts of the small-pox pustule. There is no law more singular and unexpected, in the whole range of morbid poisons, than that the introduction of the variolous poison, by means of the cutaneous tissue, should produce an infinitely milder disease than when the same poison is absorbed by a mucous tissue.

The causes which predispose to small-pox or increase the susceptibility of infection are—(1.) A very early age. (2.) Not having had the disease before. (3.) Not having been vaccinated, such are called "unprotected persons." (4.) Peculiarity of constitution, *e. g.*, the Negro and dark races. (5.) Fear of infection. (6.) Epidemic influence.

It is gratifying to know that of recent years the prevalence and mortality of small-pox is greatly less than was wont to be. Dr. Farr tells us that, for the three years previous to 1855, out of every 1,000 deaths from all causes only 7·607 were from small-pox.

Prognosis and Causes of Death.—The prognosis of the natural small-pox is always most grave. The danger may be measured, to a certain degree, by—(1.) The quantity and confluence of the eruption. (2.) The state of the circulating fluids. (3.) The presence and nature of the complications, especially those of the respiratory organs and nervous centres. (4.) Age, and habit of body of the patient. (5.) Nature of the epidemic constitution which may prevail.

Natural small-pox in unprotected persons is generally very fatal. The deaths average one in three. The fully formed confluent small-pox is always very dangerous. About one in ten die of distinct natural small-pox; and one to three per cent. only of small-pox after inoculation or after vaccination. The calculation of the proportionate number of deaths, however, appears to have greatly varied in different years.

There are certain signs regarded as unfavourable, for example: excessive lumbar pains continuing; the persistence of vomiting after the appearance of the eruption; the occurrence of delirium, convulsions, or coma in adults during the primary fever; great confluence and simultaneous appearance of the eruption over the whole body. Such unfavourable signs are not necessarily fatal; but unfavourable signs which appear during secondary fever, forebode, with greater probability, a fatal end. These are: the absence of the usual redness in the intermediate spaces; the distribution of petechiæ in the interstices; the development of a black spot hardly so large as a pin's head in the centre of each pustule; a livid, or purple colour of the pustule; a disposition to gangrene in the larger vesicles; imperfect development of the pustules, or their sudden subsidence, without remission of symptoms; sudden suppression of salivation; sudden suppression of urine: hæmatura cough with hæmoptoë; absence of swelling in the hands and feet

when the eruption is copious; tendency to the formation of abscesses after desquamation has commenced; congestive pneumonia, or bronchitis, with livid lips, face, or extremities, with hoarseness or complete aphonia. Recovery may take place, even although the first mentioned of these unfavourable signs exist; but convalescence is likely to be retarded by ulcerations of the cornea, asthenic ophthalmia, purulent deposits in the joints, ulceration of cartilages, otitis, abscesses and suppuration in the areolar tissue under the skin.

The development of scrofula and phthisis is apt to follow the disease, even though no unfavourable symptoms occur. In pregnant women the disease is always dangerous, often fatal, and almost always produces abortion.

The most common causes of death are due to combinations of the unfavourable signs already noticed; and according to Dr. Gregory's observations at the Small-Pox Hospital in 1828-29, the greatest number die on the eighth day, and next to that the eleventh day is the most fatal period. In private practice, Dr. Wood, of Pennsylvania, considers the period between the twelfth and eighteenth day as the most dangerous to life. The greatest mortality from small-pox is in the early periods of life, fer example, before the fifth year. Dr. Farr estimates that, out of every 100 deaths from small-pox, 75 are below that age.

Diagnosis.—It is not possible to distinguish the primary fever of small-pox from that incident to many other diseases attended with eruptions, or from the first stage of continued fever. In the adult, however, the muscular pains are more severe; and if vomiting occur, which cannot be ascribed to any obvious cause, and persist till a papular eruption appears on the third or fourth day, with a remission of the febrile symptoms, little doubt can exist as to the variolous nature of the disease.

The diseases with which it may be confounded are *petechial eruptions*, *measles*, and *chicken-pox*, and the *secondary pustular eruptions of syphilis*.

The nature of the fever, the character of the eruption, and the absence of any tendency to suppuration are sufficient to distinguish *petechiæ* from variolous eruption.

Small-pox is to be distinguished from *measles* by the symptoms, as well as by the form and successive changes of the eruption. Crescentic patches, terminating in desquamation on the fourth day, characterize *measles*, as compared with small-pox, the eruption of which, even although it may be at first in efflorescent patches, never fails to become vesicular and pustular, proceeding to suppuration or blackening on the eighth day; a process which never fails to be attended by secondary fever.

It is more difficult to diagnose between varioloid, and varicella or chicken-pox. The chief difference consists in the eruption of chicken-pox presenting a vesicular character, which it retains; and it does not proceed to suppuration, but completes its course in five or six days, with a mild and short symptomatic fever.

The combination of mercury, scrofula, and syphilis, often gives rise to cutaneous eruptions attended with fever, which may, in the first instance, be mistaken for small-pox. The eruption, however, is more tedious in its development, irregular in its course, and is persistent. It must, therefore, be distinguished by the history of the case, the long duration of the eruption, and the deep red or copper colour it generally presents.

Treatment.—Since the first accounts by the Arabian physicians of the ravages of small-pox in Mecca, the history of this disease may be arranged in three great eras, each of which are characterized by remarkable epochs, and the epoch of a fourth may be said to be now becoming apparent. The first of these eras is marked by an improvement in the treatment of small-pox. In few diseases has medical opinion undergone a more obviously beneficial change. To Sydenham is due the merit of this revolution in medical practice. The second era is marked by the discovery of the singular and beneficial phenomenon, that the virulence of the poison of *small-pox* is greatly mitigated by introducing or ingrafting the disease into the system, through the cutaneous tissue, thereby causing the transference of the disease from one person to another, by inoculation. To Lady Mary Wortley Montague is due the merit of having introduced the practice of inoculation into this country; a deed which must be considered as one of great heroism, when measured by the knowledge possessed by physicians in those days. The third great era is marked by the remarkable discovery which has rendered the name of Jenner immortal,—namely, the modifying and protecting influence of vaccination. He found that a certain disease in the cow, known as the *cow-pox*, could be transferred to the human subject, by inoculation; and that, having been so transferred, it modified to a considerable extent at least, if it did not altogether prevent the occurrence of small-pox in its natural state in the human subject.

A fourth era may be said to have now commenced almost imperceptibly. It may be described as a period of transition, marked in this country by doubt and scepticism as to the efficacy of vaccination, tending to propagate an erroneous popular belief; and consequently, the ineffective adoption of means which science has proved to be sanative in the highest degree. In other countries on the contrary, and especially in Central Europe, this period is marked by implicit faith in the virtues of vaccination, and the successful legal enforcement of this sanative measure.

An account of the treatment of small-pox resolves itself, therefore, into the consideration of two topics, namely :—(1.) The usual therapeutic or curative treatment of the disease. (2.) The means of protecting individuals from the *small-pox* ; or, of modifying the influence of the malady by inoculation or by vaccination. Of these in their order.

Therapeutic or Curative Treatment of Small-Pox.

The main object, in the first instance, is to prevent, if possible, a copious eruption ; for the severity and danger of the disorder may be measured, in some degree, by this. The vulgar belief, that "better out than in" does not apply in the case of small-pox. Another object is to reserve the strength of the patient. The attentions of an experienced nurse are demanded. A third indication is to watch for and deal vigorously with intercurrent inflammatory action which is apt to be set up. The disease is not under the influence of any specific. It must run its course. But, it is the business of the physician to assuage the untoward symptoms which may arise, by all the most approved methods of treatment, in accordance with the science of medicine of the present day.

Dietetic and General Treatment.—In the first instance, the course to be pursued is, for the physician to act on the defensive, and simply protect his patient from certain injurious influences to which he may be exposed,—such as heating drinks to force out the eruption, which are apt to be given by ignorant and officious friends. Throughout the whole course of the disease, the diet should be strictly limited to slops, sago, arrow-root, and ripe fruits.

The chamber in which the patient lies should be cool, and freely ventilated. The bed-clothes should be light ; the body linen daily changed : and, when the disease is long, the patient's back should be often examined to prevent sloughing. The scalp likewise should be examined, and, if full of pustules, the hair should be cut off to prevent its matting. If the disease be diagnosed early, however, it is proper to shave the scalp, because the irritation which attends the suppuration of the pustules is thereby diminished, and cold may be more efficiently applied to the head, if necessary. In the early stage of the primary fever, in severe cases more especially, it is necessary to have the bowels well opened in the first instance, and to keep them regular by saline medicine. A cathartic pill, composed of the following ingredients, will be found to be efficient in most cases, especially if aided by a seidlitz powder, given six or eight hours after the pill :—

Two grains of calomel, one grain of the compound extract of colocynth, one grain of gamboge, and one grain and a-half of scammony, made up with a little aromatic oil.

The bowels are to be daily attended to afterwards, and castor oil or rhubarb, or magnesia, &c., may sometimes be required. Saline diaphoretics, in the form of James's powder ; or the "aqua acetatis ammonia," to which a grain or two grains of tartar emetic has been added, so as to have $\frac{1}{8}$ or $\frac{1}{16}$ of a grain in every table spoonful of the mixture, becomes an efficient and cooling diaphoretic. Spirit of nitric ether or the nitrate of potass may be added if required.

The surface of the body over the hands, face, and feet may be sponged several times a-day with tepid water; but caution is necessary to prevent exposure to cold. With regard to the occurrence of convulsions in children, it is *not* found that opiates, as recommended by Sydenham and Cullen, are expedient. When the children are robust, or previously in good health, local bleedings by means of one or two leeches to the temples, are more beneficial. Delirium, violent screaming, intolerance of light or sound, heat of head, all of which indicate a tendency to meningeal congestion, still more clearly warrant the application of leeches.

With regard to the propriety of bleeding (general) in adults, it is now well ascertained that it will neither eradicate the fever nor diminish the amount of the eruption. Bleeding is only warrantable if the pulse be full and strong, combined with evidence of inflammatory congestion in any important organ, as in the head, the chest, or the abdomen. Local is, on the whole, to be preferred to general blood-letting, and must only be adopted if danger threatens some important organ.

When delirium, with restlessness, wakefulness, and a frequent pulse is continuous, an opiate is indicated ; and, combined with tartar emetic, is most advantageously given. A draught composed of—

Thirty drops of the solution of muriate of morphia, with half a grain of tartar emetic, will be found beneficial in such conditions.

Cooling drinks of lemon juice, tamarinds, neutral effervescing powders, are always agreeable to the patient ; who ought also, for the sake of coolness, to be very lightly clothed. After the eruption has fully appeared, this is all which in ordinary cases requires to be done, and if, towards the tenth or eleventh day, there is much restlessness or sleeplessness, an opiate should be given.

When the febrile symptoms do not abate, as they ought, in the regular course of the disease, cathartics may be daily required to keep the bowels open. The most approved are the saline infusion of senna or the black draught, the compound powder of jalap combined with calomel, and some aromatic powder such as ginger. In this disease the bed-clothes ought frequently to be changed, and abundance of cool fresh air supplied to the apartment.

When the state of the skin *alone* seems to keep up the febrile irritation, an antimonial opiate may allay irritation and procure sleep, after which a cathartic may be given with advantage in the morning.

In the complications which sometimes ensue, such as *inflammation of the throat* and *base of the tongue*, opiates are found to be injurious. The general treatment must be by cathartics or purgative clysters if swallowing is difficult. In the other inflammations, however, opiates are of the greatest service, provided the symptoms be not of cerebral oppression; and local blood-letting is always to be preferred to general. In bronchitis nauseating doses of antimony every hour, sometimes procure relief; and if relief does not follow in the course of thirty to thirty-six hours, doses of calomel and opium ought to be given every second hour till three dozes have been taken, each consisting of *two grains of calomel* and *half a grain of opium*. If the symptoms are not then relieved, this remedy need not be carried farther.

In the advanced stage of the secondary fever, the strength of the system requires maintenance and support; because the abundant suppuration and extensive cutaneous irritation combine to exhaust the strength, as shown by the weakened pulse, the dark and dry tongue, blueness, paleness, or coldness of the extremities. Tonics, stimulants, and nutritious diet, are now called for. Quinine, mineral acids, malt liquors, especially the light bitter ales, wine, and even brandy, may be demanded. The diet should now consist of milk, animal broths, eggs raw or well boiled, according to the discretion of the physician.

To prevent the face from being seamed, scarred, or "pitted" by the suppuration of the pustules has taxed the ingenuity of physiologists and physicians. It has been stated that the influence of the atmospheric air is essential to the development of the pustules; and accordingly, anything which would effectually exclude this influence would prevent the occurrence of a scar. But it is evident that the chance of scars can only be diminished by those means which are calculated to allay the general violence of the disease. When the eruption is severe, it is almost impossible to prevent the formation of "pits," because the depression results from the expulsion of a slough; and the more mild the suppurative inflammation can be rendered, so in proportion will the chance of "pitting" be diminished.

The local means adopted to prevent "pitting" may be shortly stated as follows:—

1. To open each individual pustule after suppuration has commenced.
2. To cauterize the pustules with nitrate of silver.
3. To employ both methods, that is, to open each of the pustules when it becomes vesicular, and introduce a strong solution of nitrate of silver

into the cavity of the vesicle. At the end of a week scales fall off, and no pit is left. Or, lastly, to paint the face with a solution in the strength of one drachm to the ounce of water.

4. The application of a mercurial plaster with the view of producing resolution of the papulæ. The preparation in use for this purpose at the Children's Hospital in Paris consists of

25 parts of mercurial ointment.
10 parts of yellow wax.
6 parts of black pitch.

5. Sulphur ointment applied several times a-day.

6. Calamine mixed with olive oil to form a coherent crust (BENNETT).

7. Tincture of iodine, painted over with a brush.

8. Saturated solution of gutta percha in chloroform (DRS. GRAVES and WALLACE).

9. To smear the face over with common olive oil.

All of these applications are for the most part applied to the face, the hands, and the arms, only.

The severity and the mortality of small-pox has led many to think of means by which the disease might be completely extirpated. This leads us to consider

The Prophylactic or Preventive Treatment of Small-Pox.

Fifty years ago it was generally taught, among English physicians, that small-pox attacked the same individual only once in the course of life, and that its double occurrence in the same person was either very rare or next to impossible. The observations of Drs. Willan, John Thomson, Mr. Cross, Dr. Barnes, Dr. Craigie, and others since the time of these eminent physicians, lead to the following general conclusions:—

1. Small-pox, though in general attacking the same individual only once during the course of life, may, however, affect him a second, and even a third time.

2. This happens much more commonly when the first attack has been one of mild distinct small-pox, than when it has been severe; and if the first attack have been one of confluent small-pox, it is rare for the same individual to have a second attack.

3. It is established by numerous observations, that an attack of any one of the varieties which have been named spurious small-pox or chicken-pox, by no means secures the same individual from an attack of confluent small-pox at a subsequent period.

4. Small-pox produced by inoculation does not necessarily secure the individual against an attack of small-pox induced in the natural way.

5. Every previous attack, however, of small-pox, whether natural or inoculated, exercises some modification on that which succeeds. This modification may be various in degree, from very slight and almost imperceptible, to very conspicuous and remarkable. In this modification, the symptoms of eruptive fever may be mild and of short duration; and the

eruption may consist of vesicles or hard pustules, which disappear without suppuration.

6. The most powerful modifying agent of small-pox is cow-pock, or the disease produced by the application of vaccine lymph to the exposed skin, the previous application of which, in a large portion of cases, not only renders the individual less likely to be affected by the variolous effluvia, but if he is affected, changes very much the characters of the disease which it produces. Though the fever which precedes the eruption in cases of this class be similar in form and equal in degree to that by which the inoculated small-pox is attended, the eruption is either papuliform or tuberculated, without much surrounding inflammation. A similar eruption is produced when vaccine and variolous matter are inoculated at the same time in the same individual; or when a person who is exposed to the variolous contagion has been inoculated with vaccine lymph early enough to mitigate, but not wholly supersede, the eruption of small-pox. In such circumstances, the vaccine lymph and variolous matter restrain and counteract the operation of each other on the system and on the skin. To these eruptions of modified small-pox the general name of *varioloid* eruptions has been applied.

7. Cow-pock destroys the susceptibility to inoculated small-pox almost entirely; but the susceptibility to the natural disease, or that by inhalation, it does not entirely extinguish. This susceptibility, however, it diminishes in a much greater degree and much more effectually than inoculated small-pox does.

8. The susceptibility to second attacks of small-pox, and attacks of small-pox after vaccination, is principally favoured by the existence of an epidemic constitution of the atmosphere, and by the circumstance of early life, or the age below ten years. If no epidemical constitution takes place, the occurrence of second attacks of the disease may not be observed for a long series of years. But if, on the other hand, the atmosphere possess or acquire an epidemic or variolous constitution, then neither the circumstance of a previous attack of small-pox, nor vaccination, can insure many of those under ten years of age, and not a few between that and thirty from attacks of small-pox.

The preventive management of small-pox consists (1.) in the artificial production of the disease by *inoculation*, or *artificial variolation;* (2.) in the modifying and protective influence of *vaccination*. Inoculation consists in the application of small-pox matter to the surface of the corium, exposed by a puncture or scratch, the effect of which is to produce a local inflammation similar to small-pox, attended with an eruption, which is generally in a milder form than small-pox in its natural state, acquired under ordinary circumstances, through the medium of atmospheric infection acting on the mucous surfaces.

The course of the disease so induced has been already noticed.

For obvious reasons this operation has been rendered illegal in this country; and the practice of vaccination has been attempted to be enforced by law. What remains to be said about inoculation will be considered under the topic of vaccination.

Vaccination.

It is now fifty-eight years ago since Jenner first promulgated his discovery to the world, and modestly said "he would continue to prosecute his inquiry, encouraged by the hope of its becoming beneficial to mankind." In 1841, the Vaccination Act was passed, which rightly made the practice of inoculation unlawful. In 1853, another act was passed, with the view of rendering the practice of vaccination compulsory,—an act which is known as Lord Lyttleton's Vaccination Act. During the interval between the first and second reading of this bill, "the Small-Pox and Vaccination Committee of the Epidemiological Society completed a report on the prevalence and mortality of small-pox, and of the means taken to guard against it through vaccination." The conclusions they arrive at, are deduced from the largest and most accurate mass of statistical evidence which has ever been brought to bear upon the question. A most weighty consideration, which enhances the value of the conclusions arrived at in this report, is, that the written opinions of nearly two thousand medical men in this kingdom, as well as from Bombay, Bengal, the Mauritius, the West Indies, and various other places, concur to confirm the belief in the protecting and modifying influence of vaccination in small-pox. A most valuable pamphlet, by Dr. Seaton, has since been published, which demonstrates the truth in a still more forcible manner. It is now well known, that Lord Lyttleton's act has proved but a half measure, which has fallen far short of accomplishing all that it required.

The conclusions now arrived at regarding vaccination may be summed up in the following statements:—

1. That vaccination is a safe and efficient protection, and confers an immunity upon those who mingle with small-pox cases.

2. That there is no important difference between the protecting power of variola and vaccinia during childhood, under circumstances of ordinary exposure; with regard to severe exposure, there are not facts to determine one way or the other.

3. There are not facts to determine the comparative protective power of variola and vaccination in adults under ordinary exposure; but there are abundant proofs of the enormous amount of protection afforded by vaccination.

4. Adults severely exposed, relying on what is ordinarily termed vaccination, will probably take small-pox, though of a modified kind, in a greater ratio than those having previously had small-pox by inoculation; but,

5. If vaccination has been thorough and efficient, it is extremely probable that the liability to small-pox, under severe exposure, is not greater than after inoculation.

6. Those statements are entirely without foundation which speak of small-pox after inoculation as a risk hardly exceeding a possibility, and never to be taken into account; while small-pox after vaccination is represented as a thing of daily and constant occurrence.

7. The representation that the protection afforded by vaccination gradually wears out, till at length it leaves the system as liable to attack as though protection had never been imparted, is not only unproved, but is opposed to important facts, and in all probability will turn out to be unfounded.

8. There is, however, a great proclivity to small-pox, whether natural or after vaccination, between the ages of fifteen and twenty-five.

9. The mortality from small-pox has decreased since vaccination, as the following statistical facts will show :—

During the ten years preceding vaccination, the mortality was in the ratio of 96 per 1,000 deaths; since vaccination, it has been in the ratio of 32 per 1,000; or the results may be thus stated in the manner given by Dr. Seaton :—

Before vaccination was adopted.	Population.	Average annual loss from small-pox.
Ten years ending 1800, ...	261,233	1780
Four years ending 1841, ...	1,948,369	1659
After vaccination was adopted.		
Fourteen years ending 1855, ...	2,373,799	821

10. Where vaccination is most efficiently carried out by legislative enactments, the mortality from small-pox is the least. The proportionate mortality from small-pox in England and Wales is considerably more than double what it is in any country where vaccination is efficiently compelled to be done.

11. One obviously beneficial result of vaccination has not yet been so fully illustrated as it might be; which is, that the epidemic influence of small-pox has greatly decreased; for example :—During ninety-one years previous to inoculation, there had been 65 distinct and well-marked annual epidemics, which is a ratio of 71·4 epidemics in a hundred years. During sixty-three years, in which inoculation was practised, and that to a great extent, there were 53 distinct and well-marked epidemics, which is a ratio of 84 epidemics in a hundred years.

During the last fifty years, since vaccination has been practised, and inoculation been declared illegal, there have been 12 epidemics of small-pox, which is a ratio of 24 epidemics in a hundred years.

Thus it is apparent, that while the epidemic influence has been diminished by vaccination, it is, at the same time, made manifest

how great an influence the practice of inoculation had in spreading the disease.

The Operation of Vaccination is performed by making an oblique puncture through the epidermis, generally over the insertion of the deltoid muscle, so that the papillary surface of the true skin may be reached without drawing blood. A portion of the contents (the lymph) of a vaccine vesicle is to be introduced into the puncture on the point of a lancet or needle; or scratches may be made on the skin with a lancet or needles so loaded. The vaccine virus thus brought in contact with the derma is imbibed into the system, and the success of the operation is indicated by certain local and constitutional effects. On the third or fourth day, if the operation has been successful, a slight degree of elevation and hardness of the skin, at the seat of puncture, with slight redness is obvious; on the fifth, sixth, seventh, and eighth days a *vesicle* forms, which presents an umbilicated form, and attains perfection upon the eighth day. On this day, or on the ninth, the vesicle is surrounded by an inflamed areola, and is frequently the seat of eruption of a crop of small transparent vesicles; on the ninth, tenth, and eleventh days the vesicle becomes a pustule, the lymph becoming purulent, the umbilicated form is lost, the areola enlarges and constitutional fever is established, when the axillary glands sometimes swell and an erythematous flush may spread in patches all over the body. On the twelfth, thirteenth, and fourteenth days the pustule dries up, and on the succeeding three days the scab separates and falls off. The operation should be performed between the third and seventh month of infancy.

The following standard is given by Erasmus Wilson as a guide to judge of the probable success of the operation; and the nearer the following conditions are fulfilled the influence of the operation will be the more complete. (1.) That the lymph employed be pure. (2.) That it has been procured from the vaccine vesicle, between the eighth and ninth day of its course. (3.) That the vesicle which the operation produces shall pass regularly through the stages described above. (4.) That one vesicle be permitted to run its course unbroken and uninjured till its scab falls off in the natural course. (5.) That the cicatrix left be well marked, permanent, and perhaps also studded with numerous small pits (foveolated).

Vaccination Tests.—To ascertain the efficacy of the operation it has been proposed (1.) to inoculate with small-pox after vaccination; (2.) to re-vaccinate; or, (3.) to re-vaccinate a few days after the first vaccination (Dr. Bryce). In this latter case, if the first operation has been successful, the second pock hurries through its stages, and soon reaches an equal development with the first, arriving at its acmé at the same time, drying up and losing the scab at the same time as the pustule from the first operation.

Chicken-Pox—*Varicella.*

Definition.—*The disease consists of a specific eruption, attended with fever, which runs a definite course in eight or ten days.*

Pathology.—This disease derives an importance which it does not of itself possess, in consequence of its resemblance to small-pox, with which, in the modified form, it is considered by some to be identical. It is for the most part peculiar to childhood and early adult age; but its epidemic influence is very inconsiderable, and its extension easily under control. That it is contagious has been proved by inoculation. The theory of the disease, therefore, is that a poison is absorbed and infects the blood, and after a given period of latency, gives rise to primary fever, which lasts from twenty-four to seventy-two hours, when the eruption appears and runs a course of eight or ten days. The fever is much mitigated on the appearance of the eruption, and entirely subsides with it.

That fever precedes the eruption is a phenomenon observed so generally that no exception is to be found in any writer, excepting Heberden. The febrile affection is of a mild character, and though for a few hours it may seem severe, yet, perhaps, it never passes into a brown-tongue stage. The eruption has three stages,—that of pimple, of vesicle, and of incrustation; and after the fever has lasted from twenty-four to seventy-two hours, a number of red papulæ appear, which become vesicular, and perhaps in a few points pustular, on the first day. On the second day, the vesicles are *umbilicated*, and filled with a whitish or straw-coloured lymph. On the third and fourth days, they attain their greatest magnitude, when the central bride ruptures, and they become *acuminated*, and shortly afterwards they burst and shrivel, except those which contain purulent matter, and have much inflammation around their base. The fifth day they begin to crust, and in four or five days more the crust falls off, leaving for a time red spots on the skin, generally without, but sometimes with, a "pit" or depression. The "pit" is permanent, and the cicatrix generally whiter than the original tissue, and the patient consequently is marked or scarred.

The eruption is not at first universal over the body, but usually consists of a series of crops, which succeed each other at intervals of twenty-four hours, and die away in the order of their occurrence. The first crop usually appears on the breast and back, and afterwards on the face and extremities. The number of crops may be limited to two or three, while in other cases a new succession will appear, every twenty-four hours, for ten or twelve days.

Symptoms.—Of the varicella there are three kinds, the varicella lenticularis, the varicella conoides, and the varicella globata. The symptoms of these varieties are similar to each other; their only

differences consisting in the size and form of the vesicle, that of the varicella globata being the largest.

The fever which precedes this eruption is often as severe as that which precedes mild small-pox or the measles, but it generally, though not constantly, remits on the appearance of the eruption, and does not return as it ripens.

The globate chicken-pox is also known as the swine-pox, or vulgarly "the hives." The eruption consists of large vesicles, not quite circular in form, but often a little larger than the pustules of small-pox, surrounded with a red margin, and containing a transparent fluid, which, on the second day of the eruption, resembles milk whey. On the third day they subside, shrivel, and present a yellow tint. Before the conclusion of the fourth day, they are converted into thin blackish scabs, which dry, and fall off in four or five days more.

Diagnosis. — Dr. John Thomson, who carefully studied this disease during the epidemics of 1815 to 1821, concluded that it was impossible to distinguish chicken-pox from modified small-pox; and as their identity is still a matter of opinion, the following statements (CRAIGIE) embrace the most important pathognomonic characters derived from the respective phenomena of both diseases:—

1. Chicken-pox emit a peculiar odour different from that of small-pox, and less decidedly partaking of the variolous fœtor.
2. Chicken-pox appear indiscriminately and almost equally all over the person, beginning first on the trunk in general, and then appearing on the face and scalp; while small-pox appear first on the face and neck, and are more numerous in the face than in any other part.
3. Chicken-pox eruption is generally completed in the space of twenty-four hours, or solitary vesicles come out irregularly afterwards in different points; but in small-pox the eruption begins in the evening of the third, or morning of the fourth day, and proceeds regularly for the ensuing three days, until it is completely established.
4. While variolous pustules are on the first and second day of the eruption small, hard, globular, red, and painful, and communicate to the finger a sensation similar to that which would be excited by the presence of small round seeds under the cuticle;—in chicken-pox, every vesicle almost has on the first day a hard red margin, but communicates to the finger a sensation like that from a rounded seed flattened by pressure.
5. On the second or third day of the eruption of chicken-pox, the individual bodies are vesicles containing serous fluid, and giving them a whitish aspect.
6. These vesicles are surrounded by little or no inflammatory redness, and do not naturally, and independent of external violence, proceed to suppuration.
7. Chicken-pox may be confidently distinguished from small-pox on the third and fourth days, by the state of the vesicles, some of which being left entire are shrivelled and wrinkled, while others, whose ruptured tops

have been closed by incrustation of their fluid, are marked by radiating furrows. None present depressions on the *apices;* and as they do not suppurate, they incrust and disappear sooner than variolous pustules.

8. The marks left by chicken-pox, when they do leave marks, present a peculiar conformation, being round or elliptical, and less frequently irregular than those of small-pox, and in general smooth and shining. Lastly, it is said by Luders, that while small-pox is formed in the *cutis vera* or corion, the chicken-pox eruption is formed in the tissue situate between the corion and cuticle.—(CRAIGIE, vol. i., p. 614.)

Treatment.—It consists simply in abstinence from animal food, having recourse to a milk diet, and careful attention to the bowels.

MILIARY ERUPTIVE DISEASE—*Miliaria.*

Definition.—*An eruption of innumerable minute pimples, occurring in successive crops with white summits upon the skin of the trunk and extremities, preceded and accompanied with fever, anxietas, oppression of respiration, copious sweats of a rank, sour, fetid odour peculiar to itself. The base of the pimples and the skin around are red and irritable.*

Pathology.—The specific nature of this disease, authors are not agreed upon at the present day. All physicians are not disposed to admit that in miliaria a peculiar disease exists, with a characteristic eruption and definite course, such as the variolous pustules and course of small-pox exhibit. Certain it is, however, that a peculiar epidemic disease prevailed in different parts of Europe at different periods in the world's history, the nature of which is described in the definition; and although in this country it seems to have disappeared, yet there can be no doubt that a specific disease of this description prevails, epidemically, in many parts of continental Europe and Asia. The disease of these epidemics has been described under the various names of "sweating sickness," "miliary fever," "sudatoria," "miliaria," and the like. Rayer has given the most accurate account of the disease; and I have had an opportunity of witnessing a great number of cases of it, amongst the Turks in their military hospitals at Scutari, during the recent war against Russia. The temperature and physical climate of that place, combined with the relaxed habits of the Turks, appear to be favourable to the development of such a disease. The best accounts of it are those of Borsieri and Rayer.

Symptoms.—The fever which precedes the eruption is ushered in by chills, intense and general, shivering, anxietas, oppression of the chest, restlessness, a sense of great feebleness and imminent fainting, with pains in the head, loins, and limbs. In a few hours nausea, flushing, and profuse sweat supervene, but without any

diminution of the dyspnœa, the anxietas or pectoral oppression, but rather with an aggravation, in the form of short irregular panting and sighing breathing, as if proceeding from a sense of weight under the sternum with a feeling of internal heat, wandering pains, and sometimes cramps of the hands and calves of the legs. The pulse is generally rapid, small, and feeble, in a few cases hard, often variable, irregular, or intermittent at every ninth, twelfth, or sixteenth beat. The tongue is coated with a white, foul or yellow fur, indicative of a sluggish condition of the alimentary canal; and the bowels are constipated throughout the disease. The sweat which accompanies this febrile state is profuse, and emits a peculiar smell of a rank sour fetid odour. From the fifth or sixth day, up to the twenty-first, an itching sensation is felt in the mammary and epigastric regions, and inner surface of the arms, and the skin of those parts is found to be diffusely red, rough, and irregular, with numerous elevations not larger than pin-heads. In a short time the summits of these become pearly-white, the cuticle being elevated by a slight opaque sero-albuminous fluid,—crop after crop breaks out and continues from three to seven days, followed by a corresponding desquamation of the cuticle. This eruption is generally confined to the neck, breast, mammary and epigastric regions, and the inner surface of the loins and legs. In severe cases miliary vesicles appear at the junctions of the skin and mucous membranes, and there they are apt to become aphthous.

A deranged state of the gastro-enteric mucous membrane, indicated by nausea and vomiting of bilious matter, acid eructations, flatulence, and diarrhœa, frequently complicate the disease. Two forms have been described, namely,—a mild and malignant. The malignant is rendered so, chiefly by the occurrence of violent inflammation in some of the internal organs, especially of the stomach, lungs, kidneys, brain; and the danger of the disease is chiefly due to these complications. Such malignant forms have been known to prove fatal in two or three days, but more frequently in from seven to twenty-one. The treatment of the disease appears to consist in cooling drinks, purgatives, and antiphlogistics, as prescribed by the Italian medical officers, who commonly attend on the sick in Turkey.

Of Measles—*Morbilli.*

Definition.—*The eruption of a crimson rash, consisting of slightly elevated minute dots disposed in irregular circular forms, or crescents, preceded by catarrhal symptoms for about four days, and accompanied with inflammatory fever. It affects the system only once; and sometimes prevails as an epidemic.*

Pathology.—That a poison is absorbed and infects the blood there

can be no doubt, and after a given period of latency acts on the great nervous centres, producing a continued fever, which does not remit on the appearance of the eruption, but runs on throughout the whole disease. The fever thus established at the end of three, more generally of four, and in some few instances of five days, is followed by a certain secondary or specific inflammation of the skin and of the mucous membranes of the eyes, nose, mouth, fauces, and bronchia in addition to the fever. In a few cases the poison has certain tertiary actions, and produces inflammation of the substance of the lungs, or of the pleura. As the primary fever lasts from three to five days, and the eruption from six to seven days, the whole duration of the disease is from nine to twelve days. Whenever the tertiary actions occur, the disease is so much more prolonged.

The law that fever precedes the specific actions of the poison has scarcely a recorded exception; and consequently, though the pyrexia may greatly vary in intensity, it is uniformly present. The fever which precedes the local lesions, is termed the primary fever. It does not always thus happen, however, that the functions of the mucous membrane are disordered, as well as the cutaneous surface. There are cases in which no catarrhal symptoms exist, and such cases are described as "morbilli sine catarrho." Such cases occur during epidemics of the disease, and are but few in number.

Since the affection of the skin is uniformly present, while that of the mucous membranes is sometimes absent, the cutaneous eruption is necessarily the great characteristic of the disease; but the morbillous eruption being evanescent after death, we can only imperfectly trace its pathology. It first appears as a circular dot, similar to a flea-bite, slightly prominent, and sensible to the touch. Its colour is of a deep raspberry hue, and in rare instances, as in the *morbilli nigri*, is livid or black. In severe cases, also, especially if the patient be of tender age, the eruption assumes a papular form, and when at its height, occasionally a vesicular form; the latter being most common on the arms, the neck, or the breast. The colour of the eruption is evanescent on pressure, but returns on the finger being removed.

The patches of the eruption are extremely numerous, so that they leave little of the healthy skin intervening between them; and they not unfrequently become confluent, forming large maculæ, sometimes of a semi-lunar form. The principal seats of the eruption are the face and back, while the parts least affected are the pudendal and popliteal regions. The inflammation of the cutaneous texture extends in some degree to the subjacent cellular tissue, for the face is tumid and swollen, but not so as to close the eyelids.

The eruption does not at once cover the whole body, but consists of three crops, each of which follows the other at an interval of

twenty-four hours,—the duration of each crop being from three to four days. The course of the measles then, in its most simple uncomplicated form is, that on the third or fourth day of the primary fever, the first crop appears on the face, neck, and upper extremities; on the following day, the second crop covers the trunk; and on the third day, the third crop appears on the lower extremities, so that the whole body is covered with the eruption, which is then at its height. On the following day (the fourth of the eruption), it begins to decline from the face, neck, and upper extremities; on the following day, it fades from the trunk; and on the sixth or seventh day, it is evanescent over the whole body. The eruption terminates by resolution, followed by a furfuraceous desquamation of the cuticle of the body generally.

The inflammation of the mucous membrane, of the eyes, and nasal fossæ, generally commences either with or before the primary fever, and consequently precedes the eruption by some days. This inflammation is perhaps, for a few hours, confined to fixed spots, and is marked by itching at the mucous orifices, then it becomes diffuse, and quickly changes to the serous; for a profuse watery discharge from the eyes and nostrils shortly follows, technically termed "coryza." This affection usually continues till the decline of the eruption, and in some cases to a later period.

The mucous membrane of the mouth and fauces also inflames, but the inflammation differs from that of the eyes and nose, in not being accompanied by any discharge. In other respects it is exactly similar to the cutaneous eruption, for a number of exanthems, more or less confluent, are seen upon the palate, uvula, tonsils, and velum pendulum palati, and they, equally, terminate by resolution. They appear also at the same time with the eruption on the face, neck, and upper extremities, but do not decline till the eruption fades from the body generally.

The bronchial and tracheal mucous membranes are usually attacked, either before or at the same time with the buccal membrane, but whether the inflammation, of which they are the seat, is marked by the same characteristic eruption is not determined, for few patients die at this early period of the disease. The cough and expectoration, however, which accompany it are constant, and the latter shows that it partakes of the same serous character as that of the nasal and ocular membrane. Again, towards the close of the disease, or even as late as the third or fourth day after the eruption has disappeared, the poison not unfrequently affects the substance of the lungs or pleura, and thus constitutes the most dangerous complication of measles. When the substance of the lungs is affected, a serous exudation pervades that tissue, and the quantity of fluid effused is frequently so considerable as to stream from the lung as soon as its tissue is divided. In

severe forms of the disease, either the red or grey hepatization of the lung may supervene, but these results are rare. The pleura does not at all times escape the morbid action; and the diffuse, the serous, the adhesive, and even the purulent inflammation may invade that tissue, and either destroy the patient or retard his convalescence. Diarrhœa also is often an accompaniment, which renders it probable that the mucous membrane of the intestines may be a surface, on which any exudation, peculiar to the disease, may take place.

Symptoms.—The symptoms of measles result from the fever, and the consecutive local lesions. The varieties of the disease, however, are extremely few, for no instance is known of a morbillous fever without the secondary or specific actions following; but the poison is supposed, sometimes, to limit its action to one membrane, as the cutis, and to exhaust itself on that tissue; and hence, the "*morbilli sine catarrho.*" The varying intensity also of the disease enables us to divide measles into two grades, or into the "*morbilli mitiores,*" and into the "*morbilli graviores.*" The arrangement, therefore, of the forms of this disease will be as follows:—(1.) *Morbilli mitiores.*—(2.) *Morbilli graviores.*—The primary fever may make its attack suddenly, or be preceded for a few days with symptoms of a common cold, and in general, the latter is the case; but in no instance is the primary fever (which is afterwards prolonged, and accompanies the eruption), at any time, of great intensity; for, although many fall from the severity of the local lesions, yet no instance is known, of the patient being overwhelmed or destroyed, by the general depressing action of the poison, as in typhus fever or scarlatina. The depressing powers of the poison, however, are considerable, and are always sufficient to confine the patient to his bed for a few days, and to leave him, for a short time after the disease has subsided, weak and debilitated. The type of the fever of measles consequently greatly differs from that of typhus or of scarlatina, and the formidable brown tongue, so grave a symptom in the latter, is hardly known in the former, or only seen in a few fatal cases.

Morbilli Mitiores.

The essential characters of this affection are, that the poison produces primary fever, and a specific inflammation of the skin and mucous membranes,—the fever not subsiding till the eruption dies away.

The symptoms of the measles may be divided into three stages; the first embraces the primary fever, or the period before the eruption, and may last from three to five days; while the second stage embraces the period of the eruption, and lasts from six to seven days. These two stages very commonly comprise the whole disease,

whose usual course is from nine to twelve days. The third stage includes any inflammatory action which may be caused by the tertiary action of the poison, and therefore only occasionally exists.

The early symptoms of the primary fever are seldom severe, and greatly resemble those of an ordinary but severe catarrh. They are shivering, alternated with heat, frequent pulse, headache, derangement of the bowels, sometimes accompanied by nausea and vomiting; and these affections are so considerable that the patient usually takes to bed. At the end of a few hours the fever becomes continued, and the specific action of the poison commences by the mucous membrane of the eyes and nose inflaming, so that the light is painful; the senses of smell and taste are lost, followed by a copious discharge of serum from the nose and eyes.

The buccal and bronchial membranes may become affected at the same time, and the patient is then troubled with a frequent cough, which has this peculiarity, that it occurs in paroxysms. The cough does not remit till about the seventh day, and is often accompanied by hoarseness, by a sense of constriction across the chest, by diarrhœa, and sometimes by ischuria. The duration of this first stage is three, four, or five, or even six days.

The second stage commences with the appearance of the eruption, whose course and character has been described. On the appearance of the eruption the fever is often aggravated, but the distressing nausea and vomiting seldom last beyond the fourth day. The fever, therefore, together with the coryza, sneezing, coughing, hoarseness, and diarrhœa, continue with unabated severity till the eruption has reached its height, and is fully out over the whole body, which is on the third or fourth day after its first appearance. From this period, in favourable cases, all the symptoms begin to decline; and on the eruption disappearing the cuticle desquamates, and the disease terminates on the ninth, tenth, or eleventh day from its commencement.

In a few cases, however, on the subsiding of the eruption, or about the ninth, tenth, or eleventh day of the disease, and in some instances earlier, the pectoral symptoms do not subside as they ought to do, but the tertiary actions of the poison are set up, and inflammation of the substance of the lungs or of the pleura takes place, prolonging the duration of the disorder, and endangering the life of the patient. The inflammation of the bronchial membrane is denoted by the expectoration either of a thick viscid mucus or of pus, and which may or may not be streaked with blood, while the mucous or sonorous rattle will point out the peculiar seat and extent of the mischief. If the substance of the lungs be inflamed, the breathing is more difficult, the cough more troublesome, and the countenance livid; but the loud mucous rattle which accompanies it seldom

allows us to hear crepitation, or to determine the absence of respiration in any given portion of the lung. If the pleura be inflamed, we have, in addition to the cough, severe pain in the side, and an impossibility of filling the chest with air, except in a very limited degree ; and this is often accompanied by dulness on percussion, by bronchophony or ægophony, assuring us that fluid is effused into the cavity of the chest.

Morbilli Graviores.

The characteristic of this severe form of measles is the exanthemata becoming suddenly black, or of a dark purple with a mixture of yellow. The early writers on measles describe this form of the disease as being much more common in their time, than we find it to be in the present day. Sydenham considers this appearance as extremely formidable, and that persons so seized are irrecoverably lost, unless they are immediately relieved by bleeding and a cooler regimen. Willan says he has seen this discoloration, but thinks more lightly of it.

The eruption is sometimes greatly delayed from causes not quite manifest. Excessive purging is thought to have this effect, or anything which greatly debilitates the system, hereditary or acquired unhealthiness of constitution, or the peculiarly malignant nature of the disease. The occurrence of the eruption is therefore to be looked for with anxious care, as the appearance of it, even though late, is in itself a favourable indication.

If the eruption also suddenly disappears, or "goes in," it is no less an unfavourable omen, and is apt to be followed by dangerous results, diarrhœa, dyspnœa, coma, convulsions, all which unfavourable signs may again disappear, on the reappearance of the eruption.

Diagnosis.—The diseases with which measles may be confounded are scarlet fever and some forms of syphilitic eruptions. The diagnostic symptoms between measles and scarlet fever are numerous; for, there are many differences, both in their general laws and particular symptoms, by which they may readily be distinguished. Thus, the periods of the latency of the poisons are different, that of scarlet fever being from two to ten days, while that of measles is from ten to sixteen days. The exanthema in scarlet fever seldom appears later than the second day of the primary fever ; in the measles it is delayed till the fourth day. In scarlatina, the patches of the exanthema are large, and the surface they cover ample ; but in measles they are not larger than flea-bites, and when most confluent, the clusters are small. The colour is also different, being of a bright red in scarlet fever, while in measles it partakes more of a raspberry hue. The affections of the mucous membranes are also different in the two diseases. In scarlatina, the tonsils are almost

constantly greatly enlarged and ulcerated, while in measles they are little or not at all affected. In scarlatina the eyes are free from coryza, while in measles this is the most prominent symptom. The tertiary actions of the poison are also different, being, in scarlatina, inflammatory affections of the joints, and dropsy; while in measles they are inflammations of the lungs or pleura; and lastly, in measles the fever usually subsides on the disappearance of the eruption; but in scarlatina the fever often continues many days or weeks after the eruption has run its course, or till the sore throat has healed.

Prognosis.—The mortality from measles greatly varies in different years. During each of the last four years, the proportion of deaths from measles in every 1,000 deaths from other causes has been in 1851, 24·107; 1852, 14·599; 1853, 11·818; 1854, 21·463. Percival says, that out of 3,807 cases of measles, 91 died, or 1 in 40. Watson says, that in one year, at the London Foundling Hospital, 1 in 10 died; and in another 1 in 3. In the same establishment also in 1794, out of 28 cases, none died; in 1793, out of 69 cases 6 died; in 1800, out of 66, 4 died; and the aggregate of these data will give us an average of 1 death in 15: so that the prognosis in every case of measles is favourable. The prognosis, however, is more favourable in the country than in large metropolitan towns; for it appears by the Registrar-General's reports that the proportion per cent. of the population that died of measles in London is much greater than in England and Wales.

The chief danger arises from bronchial and pulmonary inflammation, and the danger of this is greater after the disease has begun to decline, than during its progress. Croup also sometimes supervenes and cuts off young patients. Measles, in any of the malignant forms described, is highly dangerous; and the danger is greater in the old than in the young; in cold than in warm weather.

Causes.—The measles appeared at the same time and in the same country with scarlet fever, and have subsequently followed nearly the same course. They now prevail all over the world, are little influenced by season, are constantly sporadic, and occasionally epidemic. Their poisons, it would appear, must consequently have a similar origin, and it can scarcely be doubted that there is one specific cause.

Measles, though incidental to every period of life, are most frequently contracted in childhood, when it is difficult to trace the effects of accidental circumstances, so that our knowledge of the predisposing causes are most imperfect. Both sexes, however, appear to be equally liable to this affection. With respect to the influence of season, it is generally supposed that measles break out in the beginning of winter, increase till the vernal equinox, and then die away towards the summer solstice. The deaths, however,

from this disease, registered in England and Wales, show that the influence of season is exceedingly trifling.

Propagation of the Disease by Contagion and Infection.—It is admitted by all authors that a patient labouring under measles generates a poison which is both infectious and contagious.

This disease, like scarlatina, is greatly infectious; and in like manner no susceptible person can remain in the same room, or even in the same house, without hazard of taking the disease. In the year 1824 it was imported into Malta by some children belonging to the 95th regiment, and spread extensively in that island, so that many natives died. This circumstance was the more remarkable, as the measles had not been seen in the island for many years. The *infecting distance* of this poison, it will be plain from what has been stated, must be considerable; indeed it is impossible to isolate it in our public schools, or other large establishments, where it sometimes appears.

The contagious nature of measles has often been proved; but some difference of opinion exists as to the possibility of communicating the disease by inoculation. Healthy children have been inoculated, either by blood drawn from the arm of a patient suffering from measles, or else with serum taken from the vesicles which are occasionally found intermixed with the eruption,—an experiment which appears to have been first made by Dr. Home, with a view of producing a mild disease, but as no such result has been obtained, the practice has been abandoned. Many trials of this kind have also failed to produce the disease at all, yet on the whole the successes are numerous and varied.

This disease is also propagated by fomites. The strictest demonstration of this fact is, that the disease has been communicated by direct application of substances impregnated with the virus, in the attempts to inoculate for the measles; it is also proved by the clothes and boxes of children sent home from schools, where the disease has raged, communicating the disease; and also by the same circumstance resulting when susceptible children have lain in the same beds, or in the same room, shortly after it has been occupied by patients suffering from the disease. Cold weather appears favourable to the production of the disease. No age is exempt, from the fœtus in the womb, to the second childhood of old age; but it is much more frequent in children than in adults, and there are few who have not an attack of measles at some period of life.

The morbillous poison having once produced its specific effects, as a general principle, leaves the patient exempt from all liability to a second attack. This law may be considered as proved both by Willan and Rosenstein—the former affirming that, after an attention of more than twenty years to eruptive complaints, he had not

net with an individual who had twice had "febrile rubeola;" while he latter states, that in a practice of forty-four years, he had met vith no instance of a second infection. There are, however, occa- ional exceptions to this law; one variety of this disease, namely, he rubeola sine catarrho, is supposed to afford no protection against n attack of the rubeola vulgaris. There are many exceptions also o the non-susceptibility of persons who have passed through the ubeola vulgaris, for Burserius, Robedieu, Home, Baillie, Rayer, nd Holland, have all seen instances of a second attack of the neasles in the same individual.

The period of latency of this poison is determined to vary from en to sixteen days. It seems also determined that the contagion f measles is generated, as soon as the primary fever is established, nd before the eruption appears.

Treatment.—The measles differ from scarlet fever, not only in he fever being much less depressing, but in running a shorter or nore definite course, and in having no tendency to terminate in ulcerations or mortification of the skin. The constitution during neasles is little impaired by the short continuance of the disease, nd consequently admits of a more strictly antiphlogistic treatment.

As no antidote is known to the poison of the measles, the disease vill run its course, whatever treatment we adopt. The rule, there- ore, is to interfere as little as possible as long as the disease is safe, nd merely to moderate symptoms when they threaten danger; and o subdue them, if possible, when danger really appears.

The *morbilli sine catarrho* is usually of such a mild form as to equire no other treatment than a milk diet, and the customary ttention to the bowels, and the prevention of exposure to cold and vet. Measles will not bear exposure of the surface of the body to old, so well as either scarlatina or small-pox, on account of the reat tendency to bronchial and pulmonary inflammation. Children nust be watched night and day to prevent them lying uncovered. n the *morbilli mitiores* the cough, the frequent vomiting, and the eavy catarrhal symptoms which so generally attend the primary ever, render medical attendance necessary from the first moment of he attack. The treatment of these symptoms, however, and also f the eruptive stage, as long as the patient continues free from ny serious inflammatory affection of the lungs, need not necessarily e active, it being sufficient to alleviate the cough, allay the vomiting, nd check the catarrh by some of the large class of saline laxatives, ntseed tea, mucilaginous mixtures, to which antimonial wine may e added, if necessary, as a diaphoretic, and to subdue high vascular ction. In making our selection from these, we must be princi- ally guided by the state of the bowels, and the condition of the tomach. If the bowels be constipated, the milder purging salts,

as the sulphate of magnesia, are to be preferred. On the contrary, if the patient be purged, and the vomiting distressing, a neutral mixture or effervescing draught will be found most beneficial. There are many persons in whom the cough and catarrh are the most urgent symptoms, and in such cases, if the stomach be quiet, the liquor ammoniæ acetatis, in half ounce doses combined with camphor mixture, from its more powerful action on the skin, is an excellent substitute. Another remedy equally or perhaps still more useful, is ipecacuanha, of which from one to two grains may be given every four or six hours. Some practitioners prefer antimony to ipecacuanha, but antimony appears, at least in large doses, to act in some instances perniciously on the lungs.

The treatment which has been specified is, in most cases, all that is necessary throughout the whole course of the disease; and the greatly extended experience of Willan has hardly enabled him to enlarge it. He thinks, however, that an emetic given on the second or third evening, *somewhat* alleviates the violence of the catarrhal symptoms, and contributes to prevent the diarrhœa which usually succeeds the measles. An emetic is especially useful if the disease be threatened with croup as a complication. During the eruption, he adds, "I have not observed any considerable effect from antimonials or other diaphoretics." Bathing the feet every evening seems a more beneficial application. Emulsions and mucilages afford but a feeble palliation of the cough and difficulty of breathing. With respect to opiates, they are not generally advisable; in the early stages especially, according to Willan, opium produces an increase of heat and restlessness without conciliating sleep.

The catarrhal symptoms are frequently accompanied, even in the very earliest days of the disease, with much bronchial inflammation, and sometimes with pneumonia; or these affections may occur at any later period after the decline of the eruption, or from the tenth to the twelth day of the attack. This great tendency to pneumonia has caused the question to be agitated, whether bleeding ought not to be adopted as part of the treatment of this disease in all cases, either as a means of cure or as a precautionary measure, or whether it should be reserved until the pneumonic symptoms are present. Experience has shown that bleeding may be practised with impunity in the very first onset of the disease, or at any subsequent stage. Willan, however, is of opinion that it is very rarely necessary to bleed before the subsidence of the eruption; for, if we wait that event, we "usually find the pulse become moderate, and the uneasy, laborious respiration terminate in twenty-four hours. This oppressed breathing is common to other eruptive fevers; and if it were universally to be considered as an indication for bleeding, the practice would often be more fatal than the disease." If, however, pneu-

monia or pleurisy be at all threatened, blood should be freely but not extravagantly taken; for it should be remembered that although some children bear the loss of blood well, yet that others are long in recovering from it even when the quantity drawn is small. In children, then, below ten years of age, it is more prudent to take blood frequently and in small quantities, than in a large quantity at once. We should likewise be content with moderating the symptoms; for, as the inflammation depends on a morbid poison, it has a course to run, and does not admit of a sudden cure. The bleeding should also be more moderate during the eruption than after it; for we have a right to look for a diminution of all the symptoms when it disappears. Blisters, ipecacuanha, and mercury, are amongst the best adjuvantia to bleeding in severe cases.

During the whole course of the disease, it is necessary to enjoin an abstinence from all animal food, and to limit the patient to a low diet and to slops. The chamber should be of a moderate temperature, not subject to any sudden change from heat to cold, and the strictest cleanliness should be observed. In large establishments separation is necessary, to prevent spreading of the disease if possible. Should the eruption disappear or be retarded, and untoward symptoms appear, such symptoms must be carefully studied, as prompt measures may be demanded, with the object of bringing the eruption "out," and subduing internal irritation or inflammation. A most efficient help is the hot or vapour bath. Warm drinks may also be given; and if there are no bronchial symptoms, or evidence of cerebral oppression, a dose of compound powder of ipecacuanha will be of service, apportioned to the age of the patient.

When convulsions occur in children, hot foot baths sometimes give relief, as well as sinapisms to the limbs; after which, if they do not subside, blood must be taken by leeches from the temples, and it is in all cases necessary to determine the most probable source of the irritation, giving rise to the convulsions, *i. e.*, whether they depend upon dentition, or upon intestinal irritation or cerebral disorder. Diarrhœa should not be checked suddenly.

Scarlet Fever—*Scarlatina.*

Definition.—*An infectious and contagious febrile disease, on the second day of which, or sometimes later, a scarlet efflorescence generally appears on the fauces and pharynx, and on the face and neck, which spreads over the whole body, and commonly terminates in desquamation from the fifth to the seventh day; the fever is accompanied with affection of the kidneys, often with severe disease of the throat, or of some internal organ, sometimes followed by dropsy, and occurring only once during life.*

Pathology.—After a definite period of latency, the peculiar poison of scarlet fever induces a disorder of the blood, which is, in the first instance, made manifest by a febrile state and *a disturbed condition of the great nervous centres.* This fever, termed the primary fever, having lasted for one, two, or three days, does not subside, but the secondary actions of the poison are set up as a peculiar eruption, preceded, followed, or accompanied by a sore throat. The eruption runs a given course of six to eight days, but the duration of the affection of the throat is more indefinite, and varies from eight to twenty, or more days. The fever continues during the eruption, and as long as the sore throat exists; but this being terminated, it subsides, and the disease is ended. In a few instances, however, tertiary actions succeed, as dropsy or inflammation of the joints, diseases quite as formidable as any which had preceded them. As in ordinary fever, the poison of scarlet fever acts on the brain and its membranes, often causing the usual forms of inflammation of those parts, modified in their course and effects by the nature of the specific febrile disease.

That fever precedes the specific actions of the skin, is so general a rule, that it has few exceptions, and the pyrexia has been occasionally so severe as to destroy the patient, before the more specific actions of the poison have been set up. Again, the law that the great specific action of the poison is on the skin, causing the eruption or exanthema, has likewise only a very few exceptions. Of this eruption there are several forms, such as smooth, papulose, phlyctænoid, or vesicular. These are all evanescent after death.

In the smooth eruption the surface of the inflamed skin presents no inequality either to the sight or touch. The scarlatina papulose is when the papillæ of the skin are enlarged, and the appearance is that of roughness, or "goose-skinned." The third form is, when the eruption is accompanied by a number of vesicles filled with serum, which ultimately shrivel up and desquamate.

Whatever the ultimate form of the eruption may be, its first appearance is that of innumerable small bright red puncta or maculæ, separated by interstices of healthy skin. These puncta or maculæ quickly become confluent, so that in a few hours the redness becomes general over the parts attacked. The colour, in ordinary cases, is in the first instance a bright red, like that of a boiled lobster, but on the decline of the disease it becomes deeper, and more resembles that of beetroot, while in severe cases it is livid, and intermixed with petechiæ. But whatever tint the eruption may assume, it has this peculiarity, that it disappears on pressure, and again returns from the periphery to the centre on that pressure being removed. The colour is also always brighter and more vivid in the flexure of the joints, and about the hips and loins, than over the rest of the body. The

termination of this inflammation is generally by desquamation, and the desquamation generally begins with the decline of the eruption; and is usually completed by the end of the second week, unless it is longer delayed by successive crops of eruption, and consequent succession of exfoliations. A few days after the commencement of the desquamation, albumen may be detected in the urine in small quantity, which continues to be given off for several days, along with a considerable amount of epithelium from the uriniferous tubules (Dr. J. W. Begbie). Occasionally the squamæ are so large, as to preserve entire the whole epidermis of the palms of the hands and of the soles of the feet—frequently, it is furfuraceous or scaly. Frank has even seen them come away with the hair, nails, and even verucæ attached. In a few instances, however, the termination is by ulceration and sloughing of large portions of the integument.

Whatever be the colour or description of the eruption, it does not attack all parts of the body simultaneously, but appears partially or in a succession of crops, the order of which may be stated as follows:—On the first day it spreads universally over the face, neck, and upper extremities; on the following day over the trunk, but is less general on the back than on the abdomen; and, lastly, on the third day, it has extended itself over the lower extremities. The duration of each crop is about three days, when it disappears, and in the order of attack, falling from the head and upper extremities on the fourth day; from the trunk on the fifth day; and from the lower extremities from the sixth to the eighth day. The order of attack, however, which has been mentioned is not constant, for in some few instances the eruption appears first on the trunk and lower extremities, and only on the second day very faintly on the face and upper extremities. The disease attains its height, usually, from the fifth to the ninth day, when, in favourable cases, all the symptoms begin to decline. The fever does not subside on the appearance of the rash, as is the case with small-pox, but continues, with various degrees of violence, throughout its progress. The pulse is often 120 to 130 in a minute, and sometimes beats with considerable force. The skin frequently indicates a thermometric temperature of 105°, 106°, or even 112° Fahrenheit, and is dry, with a sensation of burning heat.

The poison as frequently falls on the mucous membranes of the eyes and nasal fossæ, as on the skin, and excites a similar eruption over those parts; at first consisting of a similar distinct punctated or dotted appearance, which changes in a few hours to one of diffuse redness. The inflammation of the ocular membrane, however, has this peculiarity, that it does not distress the sight, for the eye bears light without inconvenience, and in no case is it combined with coryza. Neither is sneezing a consequence of the affection of the nasal

membrane; and only in a few severe cases is there any discharge from the nostril. As the eruption attacking these parts generally appears with the first crop of the exanthemata of the skin, so does it generally die away with it. This inflammation usually terminates by resolution; but in a few instances the alæ of the nose ulcerate, and sometimes mortify.

The lingual and buccal mucous membranes are also often the seat of a similar exanthema, presenting nearly the same appearance as in other parts. The papillæ of the tongue, however, are singularly elongated and enlarged, and stand up salient and erect, and of a deep scarlet colour, above the thick white mucus which coats the lingual membrane, and hence the term "strawberry tongue." This affection lasts longer than the former, and usually terminates by resolution, although, in a few instances, the buccal membrane ulcerates and mortifies.

The sore throat, or inflammation of the faucial membrane, though not so constant an affection as that of the skin, yet, when it does exist, is often of much longer duration, and a much more grave disease, may either precede all the other symptoms, or else occur at any period of the fever. This inflammation, at first punctated, then diffuse, usually runs into ulceration, and the character of the ulcer is so completely in unison with the state of the constitution as to enable us, according as it is slight or severe, to divide scarlatina into two great varieties, or into "*scarlatina mitior*," and into "*scarlatina gravior*." The first, or sthenic form, is marked by a greatly enlarged or swollen state of the tonsils, which are of a vivid or bright red colour; and, when ulceration takes place, the ulcers are seldom deep, or the sloughs slow to come away, but usually separate about the fifth or sixth day, so that in mild cases the sore throat is healed about the eighth or tenth day, or in more severe ones about the fifteenth or twentieth. In malignant cases, or in scarlatina gravior, the tonsils are much less tumified and enlarged, but much more loaded with blood, and of a deeper, and sometimes of a livid colour. The ulcers also are deep and formidable, and the sloughs are thrown off later in the disease. They are likewise slow to heal, or not till the end of three weeks, or in severe cases not till four or even six weeks have elapsed, during which period the fever continues, and the patient remains in considerable danger.

The inflammation of the throat may extend to all the neighbouring parts, and an abscess may form in the pharynx, or pus issue from the ears; the tympanum has been eroded, and in a few instances the inflammation has extended to the larynx, and the patient has died of croup. Besides these disorders, the glands of the neck often enlarge and occasionally suppurate, and, singular to say, sometimes not till after the sore throat has healed, and some-

times when there has been no previous affection of the throat, as if these parts were the seat of a specific action of the poison.

The inflammation of the cutis, as also of the buccal mucous membrane, is usually accompanied by some inflammation of the sub-cellular tissue. This affection takes place as soon as the rash appears, and causes the hands to swell, so that the patient is unable to bend his fingers, and his face also becomes tumefied and painful. The serum effused, however, is, in mild cases, absorbed, and the disease terminates without any unpleasant consequences. In severe cases, however, it has a tendency to terminate in ulceration or in mortification. In children the toes of one foot have been known to slough off; and in some the integuments of the leg have mortified from the knee to the foot; while in others, mortification commenced in the upper lip, and spread till one-half the cheek was eaten away. Some have been known to die of mortification of the rectum, and others of a similar affection of the pudenda.

Such are the primary and secondary affections of scarlatina; but this poison has also some tertiary actions, as on the cellular tissue, causing dropsy, and on the synovial membranes of the joints.

The dropsy which sometimes occurs after scarlet fever must be considered as a tertiary action of the poison. This usually commences between the fifteenth and twenty-third day of the disease, and almost uniformly not till after all the other symptoms have subsided. The patient is liable to it during desquamation, and for a considerable time afterwards. It begins with anasarca of the face, afterwards attacking the hands and feet. In some instances the anasarca is universal, the whole cellular tissue filling so rapidly as sometimes to destroy the patient in a few hours; the cavities of the chest and abdomen frequently filling at the same time. According to the observation of Dr. Wood and many others, it has occurred more frequently after mild than severe cases. Its forms are, therefore, *anasarca*, *ascites*, *hydrothorax*, *hydropericardium*, and even *hydrocephalus*; and in whatever form, heaviness approaching to stupor is a common attendant; and, during its progress, œdema of the glottis must be watched for and relieved. The dropsy is generally accompanied with scanty and albuminous urine; and although the presence of albumen, without diminished secretion, is almost a regular phenomenon in the course of the disease, as shown by Dr. James W. Begbie (*Ed. Med. Journal*, January, 1849, and October, 1852), yet if the urine become highly albuminous and diminished in quantity, the dropsical complications may be apprehended.

Intercurrent inflammations of the synovial membranes have been described by Withering, Sennertus, Heberden, and others. This disease may attack the wrist, ankle, or knee-joints, and usually terminates by effusion of serum; and in some cases the cavities of

the joints contain pus. This inflammation seldom occurs till after the eruption has subsided, and is generally a tertiary phenomenon in the course of this specific disease.

Such are the morbid phenomena which have been observed in the ordinary course of scarlatina, and with sufficient constancy to be attributed to the specific action of a poison; but these appearances are only to be found when the disease is of moderate intensity and the patient survives some days. In severe and rapid cases the patient dies, not from any organic lesion, but from the intensity of the shock, in the first instance, on the nervous system—for Bretoneau, Tweedie, and Sims all speak of having examined the bodies of persons who have fallen early in the disease, in which there was scarcely any appreciable lesion; coma, or other violent cerebral affection carrying off the patient.

Symptoms of the Disease in its various Modified Forms.—Although several varieties of scarlatina are described by authors, it is not to be supposed that they are equally distinctly defined in nature. Yet, it not unfrequently happens, that the characters of each variety are tolerably well marked: and the following may be distinguished, namely—(1.) "*Scarlatina simplex*" vel "*sine angina;*" (2.) "*Scarlatina anginosa;*" (3.) "*Scarlatina maligna;*" and (4.) "*Scarlatina latens.*"

Scarlet fever, of whatever description, essentially consists of fever and certain local inflammations; but, among the more striking phenomena of this disease, is the sudden and remarkable depression of the mental and physical powers of the body which the poison produces,—a depression so great, as, sometimes, to cause the death of the patient in a few hours, without any re-action, or any very sensible local lesion of the throat or other part being discoverable after death. On the contrary, there are a few instances in which the re-action is so great as to destroy the patient in an equally short time, and with a similar absence of all pathological phenomena, the affection of the skin being suppressed, the sore throat wanting, and the patient dies as from an overwhelming poison.

The symptoms of scarlet fever under ordinary circumstances may be divided into three stages. The first stage occupies the period from the commencement of the disease till the appearance of the eruption, and is technically termed the "*primary fever.*" The second stage, that from the appearance of the eruption till its entire subsidence; while the third stage is reckoned from the disappearance of the eruption till the termination of the disease. The duration of the first stage is one, two, or three days; that of the second from six to eight days; while the third stage may either not exist, or vary from a few hours to two or three weeks, making the whole

duration of the fever to vary from eight to thirty or more days. These stages are not, as in typhus, usually marked by changes of the tongue; for, except in the more severe forms of the disease, it continues coated with a white mucus throughout the whole course of the disease. In "*scarlatina anginosa* or *maligna*," however, it becomes brown or black in the second or at the commencement of the third stage.

The primary fever may be sudden in its attack, or the patient may complain for some days of slight indisposition. Its symptoms, whatever be the variety, are those of the first stage of typhus,—as headache, pains in the back and loins, loss of appetite, sickness, and white tongue. Still there are symptoms which distinguish it from ordinary continued typhus fever, for the pulse, instead of being full and strong, is small and weak, and rapid, and the heat of the skin more ardent, and these phenomena continue through the whole course of the disease. The fever varies, however, greatly in intensity, or from a mere febricula to the severest forms of the typhoid type.

1. *Scarlatina Simplex.*

This form is known also by the various names of *S. mitis* and *S. sine angina*. It is the simplest form of scarlet fever, and is limited to the fever and eruption, without any affection of the throat.

The symptoms of this variety are extremely mild, so that the patient is frequently not confined to his bed. The primary fever, except that the pulse is rapid, is little more than a mere febricula, and is not aggravated on the appearance of the eruption. The eruption appears at the end of twenty-four or forty-eight hours, and the crops follow each other according to the usual order of succession, appearing first on the face and neck and upper extremities; on the following day on the trunk; and on the third day on the lower extremities, when the disease has reached its acmé. On the fourth day the rash begins to decline, and fades from the face, neck, and upper extremities; on the fifth day it disappears from the trunk; and on the sixth or seventh day it is evanescent over the whole body. The colour of the rash is always more florid during the night than in the day, and on its declining desquamation takes place. With the disappearance of the rash the fever of this variety ceases, and the disease terminates; but it often leaves the patient in a state of considerable debility for several days, and may be followed by albuminuria.

2. *Scarlatina Anginosa.*

In this form of the disease also, the specific action of the poison is limited to one tissue,—that of the throat, the eruption on the skin being altogether wanting, or appearing at a later period than usual, generally by one day; and, as a general rule, is less copious and less diffused than in the other forms.

There is seldom a season in which scarlatina has been in any degree epidemic, that cases have not occurred in which patients, not having previously had the scarlet fever, are seized with severe fever and sore throat, unaccompanied by any eruption, and who, on subsequent exposure to the contagion of scarlatina, have been found insusceptible of the action of the poison; and hence it is inferred that the disease they have passed through must have been a variety of scarlet fever, or scarlatina sine eruptione, making itself manifest by a peculiar sore throat.

This disease, therefore, essentially consists in fever and sore throat. It has been stated, that the state of the throat was constantly in unison with the state of the constitution, and consequently this form of disease, according to its severity, assumes all the symptoms which accompany scarlatina simplex or the more severe forms, with the exception of the absence of the eruption. It seems unnecessary, therefore, to give a separate detailed account of this variety.

In its milder form, the essential character is, that the secondary or specific actions of this poison fall on two tissues; on the skin, and on the mucous membrane of the eyes, nose, mouth, and fauces. This form is liable also to the tertiary actions of the poison, but in what proportions have not as yet been determined.

The fever which precedes the eruption in this mild form of scarlatina lasts from twenty-four to seventy-two hours. The symptoms, however, are more violent than in the preceding species: for nausea or vomiting, great restlessness, headache, and some delirium frequently occur as early as the second day. The heat of the skin also is more considerable, and often raises the thermometer as high as 105°, while the pulse is quick, feeble, and fluttering, and shows the extreme debility the poison has occasioned. The primary fever having lasted its period, the specific actions of the poison are set up, and the eruption runs the course which has been described in scarlatina simplex, but its colour is more intense, its duration more variable, and its attack more partial.

The *angina*, so marked a symptom in this affection, may precede the primary fever, may commence with the eruption, or may occur at some later day in the disease. It has many grades, and in this form of scarlatina they are all sthenic. Thus, in slight cases the

throat has merely the sensation of roughness, with some pain in deglutition; at a higher degree the tonsils are enlarged and ulcerated; while, in cases of still greater severity, they are swollen to a degree almost to occlude the fauces. In this latter case the act of deglutition is not merely painful, but in many instances impossible, and is impeded by a thick viscid mucus, which frequently requires the effort of vomiting to remove. The irritation of the fauces is sometimes propagated to the larynx, and the patient's voice is hoarse or inaudible, and perhaps he may ultimately die from this new affection. The parotid and submaxillary glands also often enlarge, sometimes previously to the sore throat, more commonly about the fifth day, and again after the sore throat has healed.

The degree of fever is usually proportioned to the severity of the angina, and is accompanied by headache and sometimes by delirium. It does not abate on the appearance of the eruption, but continues till the throat is healed. If the sloughs come away early, or on the fourth or fifth day, the throat heals, and the fever perhaps subsides within a day or two after the eruption. It sometimes happens, however, that the sloughs do not separate till the fourteenth or fifteenth day; and in this case the fever runs on with equal violence after the disappearance of the eruption, and the whole disease is sometimes prolonged for three weeks or a month. In this case the tongue may become brown or dry, but it seldom continues so for more than a few hours.

In the more severe forms of the scarlatina anginosa (and which have been described by some authors as the "*scarlatina gravior*"), the specific actions of the poison are the same as in scarlatina mitior, but the symptoms, both local and general, are more severe, and the tertiary affections more frequent, and, consequently, the disease is more grave and the danger more formidable.

The more remarkable symptom which distinguishes this form of the disease is the state of the tonsils. In the milder form, previously noticed, it has been stated that the tonsils are either slightly affected or greatly enlarged, of a bright red, and the ulcers comparatively superficial; but, in this severer form, the tonsil though less swollen is more gorged with blood, more livid in colour, while the ulcers are foul, deep, and burrowing; the secretions of the mouth also are more copious, and generally impregnated with the offensive sordes of the sloughs; while deglutition, if less difficult, is perhaps infinitely more painful, and the mouth often so tender that the slightest touch excoriates it. The ulcers likewise are slow to granulate, and only heal after a fearful struggle; and in the worst cases they spread in every direction, and the parts vesicate and mortify previous to the death of the patient.

The eruption also offers some peculiarities, being often later, by some hours, in coming out, its colour darker and more livid, its duration more uncertain, and its distribution more irregular and capricious than in the milder form. The primary fever likewise is usually longer, the delirium earlier, and the depression more complete than in the milder forms, and, towards the close of the disease, the tongue becomes brown, and the symptoms closely resemble those of the last stage of typhus fever.

Such are the more marked characters of the severer form of scarlatina; but it often happens that the progress of this disease is silent, slow, insidious, scarcely marked by any prominent symptom, till the degree in which the constitution is subdued by this formidable poison is shown by the inflamed nasal membrane discharging its fetid ichor, causing mortification of the alæ of the nose, or mortification of the lip or cheek; or, it seizes on some remote part, as the toe, the leg, or the whole of a lower extremity, and which, for the most part, terminates the life of the patient, thus passing into the next form of the malady, namely,—

3. *Scarlatina Maligna.*

This form is that known also as the "malignant sore throat," or "putrid sore throat" of some authors; and is the name now generally applied to certain cases of extreme severity, into which some of the forms already described may pass, as if by insensible gradations. In others, the violence of the attack is so sudden, that the patient is at once struck down by the force or virulence of the poison, the type of the attack being at once adynamic, typhoid, and malignant. The extreme severity of the constitutional symptoms is marked by the smallness, feebleness, and irregularity of the pulse; the oppressed, short, and quick respiration; the appearance of early raving, stupor, and sometimes coma, alternating with fretfulness and violence, dulness and suffusion of the eyes, flushing of the cheeks, and dark brown furred tongue. The rash appears late, and is of uncertain duration, and soon assumes a dark or livid colour, or disappears in a few hours, and reappearing again after several days, if life is so far prolonged. Aphthous elevations in the throat, surrounded by a livid base also become dark, and bursting they expose a surface of an excoriated dark gangrenous appearance. The passages of the fauces are always clogged up with much viscid mucus or phlegm, which produces a rattling noise in breathing, and increases the pain and difficulty of swallowing. The discharges are remarkably acrid which issue from the nostrils and posterior nasal passages, causing soreness, excoriations, and even blisters on the surfaces over which they flow. To this source the diarrhœa may

be ascribed, which is sometimes severe at this period and generally adds greatly to the sufferings of the patient.

The severity of the symptoms may produce death on the second, third, or fourth day of the disease. Death frequently results from the gangrene occurring in the course of the œsophagus or alimentary canal. In other instances in which the early symptoms were not remarkably severe, the aphthous state of the throat has all at once assumed a sloughing aspect, and has carried off the patient at the close of the first week. When the disease is continued beyond this time, death is foretold by the rapid, small, and weak pulse; by the rapid, languid, and oppressed respiration; frequent fluid acrid discharges issue from the bowels, and blood may be discharged from the nostrils, mouth, throat, bowels, or even from the kidneys; petechial spots appear on the skin, and the patient is at last destroyed with local manifestations of the morbid state in several different parts and organs (CRAIGIE).

4. *Scarlatina Latens.*

The marked prevalence of late of anasarca in children has led to the discovery that such children have had previous attacks of scarlet fever, in such a mild form that it has escaped detection. In such cases, the constitutional affection of scarlatina has been produced, with the development of the two principal or characteristic features of the poison, namely,—the eruption and sore throat. On the kidneys alone, the poison makes itself felt, and the dropsy which ensues is more severe, complicated, and fatal than that which follows the regular forms of the disease (COPELAND).

Sequelæ of Scarlatina.—Under this head it is proposed to notice what may be called the "tertiary actions of the poison." The effects produced in this way, are often called by the people the "*dregs*" of the fever.

The principal source of some of these sequelæ is found to be, for the most part, the primary obstruction to which the functions of the kidneys are so liable.

Amongst the most important of these sequelæ, are the effects produced by an extension of the original affection of the throat towards the internal ear, by the Eustachian tube. When this takes place, it not unfrequently happens that the small bones of the ear are completely destroyed, the tympanic cavity becomes inflamed, ulceration of the membrane takes place, and perforation follows.

This morbid state is most difficult to remedy; a chronic discharge from the ear is established, which is of a most offensive

kind, and which may continue till the whole of the internal ear is involved in the destructive and inflammatory processes, till the delicate and soft tissues in the cochlea and semicircular canals are destroyed, and the petrous portion of the bone itself dies, till the mastoid process with its capacious osseous areolæ become the seat of an obstinate carious process; or even till the brain itself or the membranes are involved in the unhealthy inflammatory process. Such a combination of effects occasion great and protracted sufferings, and sometimes in the end, a fatal result.

A similar inflammation may destroy the tissues in the back part of the pharynx, extending towards the base of the cranium and upper cervical vertebræ.

A frequent form, in which the tertiary actions of the poison of scarlatina are manifested, consists in inflammation of the joints, and dropsy; and it is singular that these diseases are more often set up after mild than after the more severe forms of this fever. In a few cases, then, about the time of the disappearance of the rash, the joints of the wrist or fingers, of the knees or other articulations become swollen and inflamed, and present all the phenomena of an attack of acute rheumatism. This affection keeps up the fever, and prolongs the whole duration of the disease for many days beyond the usual period.

Again, in a given number of cases, not exceeding three per cent. in general, but in different seasons, or under different treatment, sometimes amounting to twenty per cent., the tertiary action of the poison produces dropsy. This disease usually occurs about the twenty-second or twenty-third day, or about the time when the patient is convalescent, and more often after a mild than after a severe disease. This affection more commonly begins with œdema of the face, then the hands and feet swell, and, in a few cases, the trunk and lower extremities become enormously distended, and the patient presents a frightful appearance. When the cellular tissue is thus slightly or more generally distended with fluid, effusion may take place into the cavities of the head, chest, or abdomen. When the brain is threatened, the effusion is commonly preceded by the usual hydrocephalic headache, by convulsions, and sometimes by blindness. Effusion into the cavity of the chest or of the abdomen causes the usual symptoms of hydrothorax and of ascites, which have been described, and need not be repeated. In the former instance, however, the water is sometimes poured out so rapidly as to destroy the patient in a few minutes or in a few hours.

The first appearance of the œdema, whatever form of dropsy may follow, is usually preceded or accompanied by an accelerated

pulse, by the urine being scanty, commonly turbid, and passed with pain; the quantity, however, is shortly increased; and if examined when passed copiously, it is found to be of low specific gravity, or from 1·011 to 1·017, and to contain albumen.

Diagnosis.—The only diseases with which scarlatina can be confounded are the acute forms of roseola and measles. Roseola, though usually accompanied by fever and sore throat, is distinguished from scarlatina by the eruption being confined generally to the chest. The diagnosis between measles and scarlatina will be better understood after the next disease we have to notice has been described, namely, the hybrid form sometimes assumed by a concurrence of the two diseases.

Cause.—The original source of the poison is distinctly traceable to Arabia; and the disease has now spread over the whole world. It prevails at all seasons of the year, is always sporadic, and often epidemic.

Scarlet fever has been found to spread more extensively, and with greater fatality, among the poorer than among the wealthier classes of society. It is twice as fatal in towns as in the country. Its prevalence also appears to be influenced by season—at least, if we suppose the deaths to be proportioned to the numbers attacked. Both sexes are attacked in nearly equal proportions. All ages are probably liable to the action of this poison; but it is most common to childhood, the feebleness of this early period of life facilitating, perhaps, the reception of the poison; as the older children grow, the less liable are they to be attacked.

Propagation of the Disease.—This disease being once produced, the infected person of the patient generates a poison which is both contagious and infectious,—*infectious* because no susceptible person can remain in the same room, and hardly in the same house, without contracting it. The *infecting distance* is consequently much greater than in typhus. Indeed, it is necessary to break up every academic establishment in which it prevails; it being hardly possible to isolate children in the same house or school, however large, so as to prevent it spreading. It is likewise *contagious;* for children have been inoculated with the serum found in the vesicles which sometimes accompany the rash, and have taken the disease; but the inoculated disease not having proved milder than the natural, the practice has been abandoned. Another proof of the contagious nature of scarlatina is, that it has often been propagated by *fomites*, as by the clothes and boxes of boys returning from school. Susceptible persons also sleeping in a room lately occupied by patients labouring under scarlatina, and before the furniture has been

washed and the bedding and walls well ventilated, have often taken the disease.

Dr. Willan says, that out of 2,000 cases that he attended, he witnessed no instance of a *second attack*. Still, there are some exceptions to the statement, that an attack of scarlatina gives an immunity from a second attack: Dr. Binns has seen instances of scarlet fever occurring twice in the same person, while Sir Gilbert Blane met with an instance of its occurring thrice in a young lady, without the least suspicion of ambiguity or possibility of mistake in diagnosis.

Scarlet fever has often co-existed with the vaccine disease and with erysipelas, and this poison is consequently capable of co-existing in the system, not only with those that have been mentioned, but probably with all other morbid poisons.

The poison of scarlatina is absorbed by the mucous membranes; and absorption is also evident from the fact of inoculation by the skin. Children have been born labouring under this disease.

The period of latency varies from a few hours to ten days. In one case inoculated by Rostan, the disease appeared on the seventh day. The disease is probably contagious and infectious as soon as the primary fever has formed, and perhaps continues so till the sore throat has perfectly healed, supposing that affection to continue after the eruption has died away.

Prognosis.—The mortality from scarlet fever varies greatly according to the season, and also, perhaps, according to the *treatment*. In some years the proportion of deaths is not greater than three per cent.; but Sir Gilbert Blane says his practice gave one in four; but he probably was consulted only in the worst cases, for in the same year it appears, from the reports of other practitioners, the deaths varied from one in six to about one in thirty, according, perhaps, to their different modes of treatment.

There is perhaps no disease in which the progress is so capricious: for it is found to vary with the several forms, types, complications, epidemic constitution, and with the treatment in a most remarkable degree.

Treatment.—Scarlet fever being evidently accompanied by many highly inflammatory symptoms, the practice of bleeding was adopted on the first breaking out of the disease, in all countries, and according to Willan, with the most disastrous results. This mode of treatment was adopted by Morton; and he speaks of witnessing 300 deaths from scarlatina in a week. It prevailed also down to the times of Huxham, who abandoned it and introduced a treatment by bark. In this manner, an entirely opposite system of treatment

has been introduced, and the records of medicine enable us to state the results of these opposite modes :—Of cases treated at the Foundling Hospital by bleeding in 1786, and of cases treated at the London Fever Hospital in 1829, in the same manner, it seems proved, that one in six has died after bleeding, while only one in twenty-two has died after a milder, if not a directly opposite, mode of treatment ; and the conclusion which inevitably follows is, that the chances of recovery are diminished by the practice of bleeding, nearly in the ratio of four to one as compared with the chances of recovery, supposing the patient not to have been bled. It remains now to give some general directions for the treatment, and to point out the circumstances in which bleeding, purgatives, wine, and tonics, may be most advantageously employed.

It should be laid down as a maxim, that in scarlatina, medical advice ought always to be had recourse to ; for the worst cases we meet with, as those in which mortification of the nose, cheek, or limbs sometimes take place, are those in which the disease has, from its apparently mild character, been left to itself.

In the mildest form of the disease, it is often sufficient to confine the patient to the house ; to enjoin strictly a milk diet ; to regulate the bowels ; and, above all things, to avoid the *nimia diligentia medicorum*. If anything more be done, a small quantity of wine and water, proportioned to the age of the patient, is the best. The disease thus treated is uniformly mild, and when the rash declines the fever subsides, and the disease is at an end.

A gentle emetic at the outset is believed, by physicians of great experience, to have a happy effect in modifying the future course of the disease. Let it be ipecacuanha with tartar emetic.

The treatment of the milder forms of the fever, or when the tonsils are considerably enlarged, is first to tranquillize the stomach and allay its perverted action when vomiting exists, either by small doses of the sulphate of magnesia or by the effervescing draught,—medicines which, according to the state of the bowels, may be exhibited every four or every six hours. As soon as this object is effected, and it is ascertained that the tonsils are greatly enlarged and swollen, the practice (supposing the patient to be an adult) is to relieve them by a local bleeding, and twelve to fifteen leeches should be applied to the throat, and allowed to draw freely, and this bleeding may be further encouraged by the application of a poultice. The trifling loss of blood thus sustained does not impair the general strength of the patient, while it greatly reduces the swelling of the tonsils, and prevents their becoming permanently enlarged. Another advantage is also gained by the application of leeches to the throat,—namely, that they relieve the affection of

the head; for we constantly, in diseases depending on morbid poisons, often relieve the head by relieving the part specifically acted upon.

The tonsils having been relieved, the fever may now be permitted to run its course little influenced by medicine, and the patient only refreshed by the occasional exhibition of the saline draught, so grateful to his parched mouth and feverish state. For in these cases, if we stimulate the patient, we only bring back the tumefaction of the tonsils; while, on the contrary, if we take more blood, we hazard producing the more serious accidents incident to scarlatina. The medicines, therefore, that have been mentioned should be persevered in till the disappearance of the eruption, and till the healthy granulations of the throat, and the decline of the fever, give the certain evidence of a state of convalescence. At this point, perhaps, some mild tonic medicine is desirable, and prepares the patient, once more, for the fullest enjoyment of health. This is the most successful treatment of scarlatina in its milder forms.

The severe forms are characterized by the less swollen state of the tonsils, and by their being more livid and gorged with blood; by the ulcers being deeper and more spreading; and by the slough being fouler than in the milder varieties. As there is a greater tendency of parts to run into mortification, the necessity of adopting a more stimulating plan of treatment, and one more calculated to support the powers of the constitution, is manifest, and experience has shown this view of the case to be correct. The administration of wine should therefore be the basis of the treatment. The quantity of wine for an adult is from four to six ounces in twenty-four hours, and for the child about half that quantity. The wine may be either port or sherry, and should be drunk in small quantity, mixed with two-thirds water; or it may be given with sago, arrow-root, or other slop. The earlier the wine is given in the disease the better, and when delirium does or does not exist, or whether the tongue is moist and white, or brown and dry, and it should be continued till the patient is decidedly convalescent, and even for some time after. While pursuing this plan, it is necessary that the patient's bowels should be attended to. This treatment by wine is often extremely successful: and, as it is in general pleasant to the patient, whether a child or an adult, it is seldom refused.

It is proper, before adopting any special continuous mode of treatment, to follow the emetic first given by a dose of calomel, as a purgative, and this especially to children, to be followed in six or seven hours by a dose of castor oil, or magnesia; and the bowels are ever afterwards to be kept open by remedies suited to the state of the patient and nature of the disease. The following are the

principal indications which must guide the treatment :—If there is much excitement of the system, depleting cathartics are to be given; if nausea and vomiting prevail, a seidlitz powder is of service. If the discharges from the rectum are acrid and acid, with acidity of the stomach, magnesia is preferable; if there is abdominal pain give castor oil with opium (Wood).

The treatment of the tertiary affections of the poison is very various. Thus the affection of the larynx is one of the most important; and it is singular, that although this affection would seem to be of an inflammatory character, yet bleeding is not successful in combating it; on the contrary, the most beneficial mode of treatment appears to be, that of moderately supporting the powers of the patient by wine and mild tonics.

Again, when the synovial membranes inflame, and the joints become enlarged and swollen, all stimuli should be withdrawn; but bleeding, in this instance, appears unnecessary; a moderate action, however, of the bowels should be kept up by means of the sulphate of magnesia, with camphor mixture; and, if pain be severe, some sedative should be added, as the tincture of hyoscyamus in a dose of fifteen minims.

The more formidable affection in scarlatina is dropsy; and from the great tendency to effusion into the head and chest, an active treatment is necessary. We should have imagined, that in dropsy, a symptom in most cases of great debility, and following a disease whose characteristic is great depression, bleeding would have been dangerous and improper; but experience has shown that bleeding by leeches is often of service, especially if œdema appears in the face and is accompanied by headache, some blood should be taken, from two to four ounces in the child, and from four to eight ounces in the adult. The rest of the treatment consists in purging the patient. The choice of the purgative must rest with the practitioner; but the bitartrate of potash in drachm doses three times a-day is among the most useful; digitalis also is much recommended, but it does not appear to possess any specific virtue. When the danger is passed, five to ten grains of the tartrate or citrate of iron may be added to each dose of the salt. Solutions of chlorine and chlorate of potassa have also been greatly recommended in the treatment of scarlatina. Dr. Watson recommends a solution of the latter salt, in the proportion of a drachm to the pint as a drink, of which, from a pint to a pint and a-half may be used daily.

Blisters have been much recommended as a means of relieving the throat, but their value is not yet determined. Some writers speak of mortification and death following their application, while others consider them as powerful auxiliaries. As a general principle, they are unnecessary, and are better omitted; since the

irritation they occasion may predispose the cervical glands to the tertiary action of the poison.

Gargles are unnecessary for children, for they cannot gargle; but they are of the greatest service, when the patient can be taught to use them. In slight affections it is sufficient to employ infusion of lintseed in water, acidulated with nitro-muriatic acid, weak solutions of alum, nitre, or common salt. When membranous diphtheritic patches are observed on the fauces, and the colour of the mucous membrane is of a dark red, capsicum infusion, or powdered red pepper is an excellent application (WOOD), and in children who cannot gargle, it may be applied with a hair pencil. Solutions of zinc or nitrate of silver are also of service.

Dietetic and Preventive Treatment.—The diet of the patient should be slops, light nutritious broths, and jellies. Fumigation will not, it should be remembered, destroy the miasmata in the sick room; and consequently, the doctrines of cleanliness, of ventilation, and of separation, are as imperative in this disease as in typhus. We cannot disinfect the walls of the chamber, nor the clothes of the patient, except by washing them, or exposing them to a dry heat exceeding the boiling temperature. In general, then, the chamber where the sick patient has lain should be white-washed and well scoured after the disease has subsided, before any person susceptible of the poison be allowed to sleep in it. It is important to guard against cold during convalescence.

Different prophylactic medicines have been recommended; amongst which belladonna has the greatest number of advocates, but its value as such has still to be determined, as the weight of testimony is against its possessing any prophylactic virtues. (WOOD.)

HYBRID OF MEASLES AND SCARLET FEVER—*Rubeola* or *Rötheln.*

Definition.—*A specific eruptive disease, preceded by, and accompanied with fever, watery discharges from the eyes and nose, sneezing, and sore throat. The eruption appears on the third or fourth day, and consists of crimson stigmata, rapidly running together into patches of an irregular shape, with obtuse angles, and of sizes varying from a threepenny to a crown piece, according to the severity of the case. The eruption continues from six to ten days, and terminates in desquamation by furfuraceous scales.*

Pathology.—Those diseases now fully considered in the previous pages,—namely, small-pox, measles, and scarlet fever, have been by some nosologists termed exanthematous diseases, in consequence of their principal phenomena being a very marked eruption.

The Arabians first described them, and considered them merely

as varieties of one and the same disorder. Many essential differences, however, were soon observed to distinguish the small-pox; but the points of resemblance between measles and scarlet fever were so many, that it was not until fatal accidents had occurred from the great error of confounding them, that their differential characters were remarked, and their separate identity established. The measles and scarlet fever were especially confounded under the common name of *morbilli;* and even as late as the middle of the eighteenth century, writers of the highest repute supported the identity of measles and scarlet fever (the morbilli confluentes of Sir William Watson). All authors before Sauvages (1768) had used the term *morbilli* (the term now in use) to designate measles; but he adopted a new name, and called measles by the designation of "rubeola," an innovation which has caused much confusion, being adopted by some (such as by Willan and Bateman) and rejected by others. Hildebrand, following the old nomenclature, calls measles *morbilli*, and scarlet fever *scarlatina;* and terms the present disease *rubeola*, as has been done by Dr. Copeland. The German authors call it *rötheln*, and by this name it was first described by a most distinguished and learned Scotch physician, Dr. Robert Paterson, of Leith, in 1840; and he is the only physician in this country who has given an original description of the disease in the English language, from many cases of it which occurred in his practice.

A difference of opinion prevailed amongst authors, as to whether or not this disease is of a distinct and specific form. Those who have most recently described it (Hildebrand, Paterson, and Copeland) consider it to be a disease possessing characters common to both measles and scarlet fever, as well as characters peculiarly its own. In truth it seems to be a hybrid disease developed from combined poisons of the two fevers, measles and scarlet fever. The following description of the disease is condensed from Dr. Paterson's account :—

Symptoms.—The febrile stage of the disease varies like all the diseases already noticed, not only in the severity of the symptoms, but also in the length of the attack when compared with scarlet fever. It usually commences with rigors, not severe, but continuous. More or less cough soon makes its appearance, of the same clanging nature which is observed in the febrile stage of true measles, and is very shortly accompanied with itchiness, redness, and weakness of the eyes: lachrymation, frequent sneezing, and watery discharge from the nose. In persons more advanced in life, severe frontal headache is complained of, together with rheumatic pains, more especially in the muscles of the back and chest: nausea, and sometimes vomiting, together with constant drowsiness. The skin is hot and dry, with the pulse above the natural standard.

A greater or less number of these symptoms is always noticed, but, in addition, sore throat is a most constant one. This, in some cases, is extremely slight, amounting only to a roughness of speech, and trifling difficulty in swallowing; but in others it goes on to severe inflammation of the *tonsils*, *velum pendulum palati*, and surrounding parts. This last inflammatory affection is, however, more severe during the eruptive stage. The sore throat is one of the most characteristic features of the disease, occurring in the slightest and most gentle cases.

The odour given forth by patients under this disease is described by Dr. Heim, of Berlin, as similar to, but stronger than that which scarlatina patients have, and has been likened to the smell of a place where fish is kept.

When the febrile state now described has continued for three or four days, the appearance of an eruption is sudden and general. It breaks out all at once over the whole body: consisting of bright and thickly set stigmata, which appear on the trunk, but are more sparingly dispersed over the face and extremities. It assumes different aspects and degrees of confluence according to the severity of the case. Its first appearance resembles measles, but the stigmata rapidly run together, and soon assume an irregular shape, with obtuse blunt angles. These irregular patches are of an intense red colour towards the centre, being gradually shaded off towards the margins, which approach in colour that of the surrounding skin. The size of the patches in ordinary cases seldom exceeds a sixpenny piece; but, in the severe forms of the disease, they run still further together, and are to be seen of the size of a crown piece. In such cases, which are usually of a malignant nature, the whole body may be covered over with patches, varying from the size of a sixpenny piece to a crown piece, thickly set together, and of an intensely dark colour towards their centres. The eruptive patches are felt to be distinctly elevated above the skin, some more than others, and always greatest in the centre of the patch.

During the continuance of the eruption, the general symptoms already described are usually aggravated, and not unfrequently new symptoms are superadded. The sore throat becomes much worse. The hoarseness becomes so great as frequently to cause entire loss of voice, and generally more or less external tumefaction of the throat takes place. In severe cases this is great, and is accompanied with much redness and swelling of the throat internally. There is a total inability to swallow even the slightest portion of fluid, which generally regurgitates by the nose. A large secretion of mucus of a vitiated nature takes place, the cough is constant, and is rendered doubly severe by the state of the throat. The pulse is very frequent; the skin hot and dry; and there is

great restlessness, expressed by children tossing the head frequently from side to side, accompanied with frequent starting; and they are sometimes seized with convulsions. It is in this stage, in the worst forms of the disease, that death generally occurs, and that by coma. It may, however, take place either by suffocation from the large quantity of vitiated mucus, or by convulsions and subsequent coma.

Vomiting is an occasional symptom during this stage, and like convulsions is sometimes seen in mild cases of the disease in children.

The eruption in mild cases, in general, continues distinct for from four to five days, during which time the other symptoms are going on favourably, becoming gradually milder as the period of the decline of the eruption draws near. In severe cases, however, the rash keeps its bright colour and distinct form for a much longer period, *e. g.*, six, eight, or ten days.

The termination of the eruptive stage is, in some instances, marked by what is termed a distinct crisis,—such as the occurrence of copious sweating, deposits from the urine, diarrhœa, and epistaxis. Most commonly, however, there is no such crisis, but the eruption gradually fades and the disease subsides.

As this happens, the desquamation by furfuraceous scales gradually ensues. This event is indicated by the appearance of scales towards the centre of the patches of eruption, to the margins of which they gradually extend, and soon spread over the whole body. The scales are small, and not unlike those of measles. On the hands and feet the scales are larger, but never reach the size of those of scarlet fever.

Lesions seen in Fatal Cases.—The accounts of these are few in number. They vary according to the period of the disease at which death occurs. Death most frequently happens during the eruptive stage, from coma, or from the affection of the throat and lungs. No morbid appearances of a uniform nature can be observed, and connected with the mode of death by coma; but when death happens from pulmonary oppression, the lungs are found much congested, the mucous membrane of the bronchia injected, with a copious mucous secretion. The throat presents very similar appearances to those which are seen in scarlatina, great tumefaction and dark coloration of the membrane lining the throat, dark aphthous spots, and large quantities of vitiated viscid mucus.

Diagnosis.—The accompanying febrile symptoms at once distinguish the disease from roseola, as also do the peculiar characters of the eruption. The only other affections with which it may be confounded are measles and scarlet fever. The following table, modified by Dr. Paterson from the description of Dr. Heim of Berlin, points out the diagnostic marks more clearly by contrast than can otherwise be done, and shows that rubeola, rötheln, or

the mixed disease, has every right to be considered as a distinct affection :—

TABLE SHOWING THE MOST PROMINENT DISTINGUISHING CHARACTERS OF SCARLET FEVER, RUBEOLA, AND MEASLES.

SCARLET FEVER.	RUBEOLA OR RÖTHELN.	MEASLES.
Symptoms of First Stage, or Premonitory Fever.		
Rigors; nausea; sometimes vomiting, thirst, and heat of skin; together with sore throat, hoarseness, and delirium in the anginose variety.	Shiverings; nausea; rarely vomiting; itching; redness and pain of the eyes, with increased flow of tears; sneezing, and watery discharge from nose; cough, sore throat, and hoarseness.	Rigors; nausea, and sometimes vomiting; frequent starting during sleep; itching; redness; pain of eyes; watery discharge from eyes and nose; sneezing; harsh cough.
Duration of Premonitory Fever.		
Premonitory fever is of short duration. The eruption most generally making its appearance on the second day.	The eruption generally breaks out on third or fourth day, so that the premonitory fever is prolonged over that time.	Eruption makes its appearance towards the close of the third, or beginning of fourth day.
Appearance of Exanthematous Eruption.		
It first appears in innumerable red dots or points, being at first of a pale red colour, soon acquiring a deeper tint, and at last giving the affected portion of skin a uniform red appearance.	The rash appears in minute dots, and rapidly assumes the appearance of irregular - shaped patches with obtuse angles, varying in size from that of a threepenny to much larger than a crown piece. The red rash is gradually shaded off with the surrounding skin.	The rash appears in minute red points, like fleabites; several of them soon coalesce, and form rounded masses, irregular - shaped crescents, or semicircular patches.
Roughness or Elevation of the Affected Skin.		
There is a perceptible roughness in the skin affected with scarlatina. It is in general most evident on the breast and extremities, and seems to consist of the enlarged papillæ of the skin.	In this disease, more especially in the severer forms of it, the patches of eruption are distinctly and considerably elevated, and more especially towards the centre of the patch.	The elevation of the patches of eruption in measles is slight, though in general distinct in the worse cases. they are certainly not at all elevated as a rule.
Part of Body First Affected.		
The efflorescence is first perceptible on the face, neck, and chest, gradually passing downwards, and becoming diffused over the whole body.	The efflorescence first appears on the trunk of the body, the whole of which it at once occupies. It is always more sparingly seen on the extremities, but seems to break out there at the same time as it does on the trunk.	The efflorescence first appears on the forehead and among the roots of the hair, and spreads slowly and successively over the neck, chest, trunk, and extremities.

Scarlet Fever.	Rubeola or Rötheln.	Measles.
	Duration of the Eruption.	
The eruption remains resent three days; begins) disappear on the fourth ay; and is almost entirely one by the termination of ıe fifth day.	In the rötheln, the duration of the eruption seems to depend upon the severity of the disease: in mild cases remaining out four or five days, and in bad cases, six or ten days.	In this disease, it remains out three days.

Symptoms accompanying the Eruption.

The symptoms which accompany the eruption in all the three are quite the same as ıose of the premonitory fever. It is proper here, however, to remark, that it is only ı the anginose and malignant varieties of scarlatina that we have sore throat, there eing little or none in the simple scarlatina, while in the mildest kind of rötheln this is lways a prominent and troublesome symptom.

Desquamation.

The cuticle in this disase is thrown off in patches f considerable size, the argest being from the hands ınd feet.	The desquamation of rötheln consists of minute portions of cuticle like scales of fine bran. The desquamation always begins towards the centre of the eruptive patch, and gradually extends to the circumference.	The desquamation of measles consists of minute portions of cuticle, like scales of fine bran.

Sequelæ.

Anasarca is the most comıon sequela of scarlet fever. t is extremely common, and ıost frequently occurs after he mildest cases; swelling ınd suppuration of the cerical glands is also comnon.	"I have noticed one case of dropsy after a mild, though well-marked attack of this disease; swelling and suppuration of the cervical glands also frequently takes place" (Dr. Paterson).	Affections of the lungs and pleura; tedious distressing cough; chronic bronchitis; pneumonia; tubercles; gangrenous inflammation of cheeks, gums, lips, genital organs, &c.; dropsy occasionally occurs, but very rarely; diarrhœa is very common after some epidemics.

Prognosis.—It requires to be as guarded as in scarlatina. It must be borne in mind that, like scarlatina, rubeola is often an extremely and rapidly fatal disorder. The greater or less acuteness of the premonitory fever generally affords us a means of judging as to the probable severity of the eruptive stage; and in general it is a mild disease. It is always a bad symptom to have a copious secretion of mucus in the back of the throat, or regurgitation of fluids by the nose. The chest ought to be examined from day to day as sudden inflammatory action is apt to be established, and often it rapidly proves fatal.

Treatment.—The treatment is similar to that of scarlet fever. The functions of the skin are if possible to be stimulated, and Dr. Paterson found that the aqua acetatis ammoniæ in the proportion of two ounces to half an ounce of antimonial wine and four ounces of water, made into a mixture, was the most useful agent. The use of colchicum was also had recourse to with decided benefit.

Dengue—*Scarlatina Rheumatica.*

Definition.—*A peculiar febrile disease, conjoined with sudden severe pains in the small joints, which swell; succeeded by general heat of skin, intense pain in the head and eyeballs, and the appearance of a cutaneous eruption on the third or fourth day. The disease is infectious with an epidemic tendency.*

Pathology.—The chief peculiarity in this disease is that it seems to combine an exanthematous eruption ushered in by fever, with a rheumatic or neuralgic state; and the course of the malady is so divided by intervals and remissions as to give one the idea that relapses are of frequent occurrence in its course. It has been chiefly prevalent in Rangoon, Calcutta, Berhampore, Patna, Benares, Chunaighur, in the East Indies; the island of St. Thomas' in the West Indies; the Southern States of America; the ports on the Gulf of Mexico; the towns of New Orleans, Savannah, Charleston, Philadelphia, and New York. It was epidemic in 1824–28, and nothing appears to have been heard of it again till 1847 and 1850, when it again visited the Southern States of America. It is not known in Great Britain; and the account of it here given is nearly in the words of Dr. Wood. It has also been described by Twining, Mouat, and Goodeve.

Symptoms.—In the greater number of cases the first symptoms have been headache with intolerance of light, restlessness, and more or less chilliness, debility, pains in the back, the limbs, and joints. The small joints swell, and there is soreness with stiffness of the muscles. The skin soon becomes hot and dry, the pulse frequent, the face flushed, and the eyes red and watery. The tongue though red is usually clean. A rash or papular eruption sometimes appears, though not generally at this stage. Painful swellings in the lymphatic glands of the neck, axilla, and groins are common. The testicles also swell and continue so till the subsidence of the other symptoms. The febrile state lasts from twelve hours to three or four days, after which it subsides, leaving the patient very feeble. This remission lasts for two, three, or four days, when a return of the fever and pains, with a thickly coated tongue, nausea, and epigastric tenderness mark another phase of the disease. On the fifth, sixth, or seventh day the eruption appears in the form of a scarlet

efflorescence on the palms of the hands, which spreads rapidly over the body, and gives relief to the symptoms of febrile irritation. The eruption is extremely variable in character, being sometimes smooth, red, and continuous as in scarlet fever, sometimes in patches, rough, and of a dark hue as in measles, and occasionally either papular, vesicular, pustular, or furunculous, often with a mixture of two or more of these forms. The complaint gradually subsides and leaves the patient with some rheumatic stiffness or soreness for a longer or shorter period, with feelings of weakness and mental depression. The duration of the affection varies with the length of the remission; but on the average is about eight days. Decided implication of the mucous membrane of the mouth and throat prevailed in the last epidemic in Calcutta, with an almost entire absence of the articular pains.

Treatment.—Simply palliation and alleviation of symptoms, as they arise, chiefly by opium.

Erysipelas.

Definition.—*A febrile disease, which precedes or arises simultaneously with a peculiar inflammation of the skin, and which very commonly involves the areolar tissue beneath the skin.*

Pathology.—As in other diseases of the zymotic class, it is believed that in erysipelas a poison is absorbed and infects the blood, and that after a given period of latency it produces generally, but not constantly, the phenomena of fever, which sometimes terminates in inflammation of the membranes of the brain. The great specific actions of the poison, however, are made manifest by inflammation of the skin and subcutaneous cellular tissue, which runs a definite course. The inflammation is of a peculiar nature, not yet understood.

This disease is treated of by almost every writer, medical or surgical, from the time of Hippocrates; but, there is no circumstance connected with its history that would justify particular mention in an elementary treatise. In Scotland this disease is known by the name of the *rose*, in England it is sometimes called *St. Anthony's fire.*

The law that the poison occasions primary fever has many exceptions, especially in traumatic erysipelas from slight wounds, as leech-bites, or trifling punctures, as of a dropsical leg or scrotum. Idiopathic erysipelas is, however, very constantly preceded by fever, or, according to Frank, eighteen times out of twenty.

The law that the specific action of the poison is on the skin and cellular tissue has no exception. The affection of the cellular tissue may be trifling, but it is seldom altogether wanting.

The pathological phenomena which result from the action of the poison on the skin, are first, that the cutis is diffusely inflamed, the affected part being either of a bright scarlet or a rose-coloured tint, evanescent on pressure, but returning on that pressure being removed. This inflammation is usually of great extent, occupying very commonly the whole face, head, and neck, or a considerable portion of the trunk, or one or both lower or upper extremities. It runs a course "*tolerably regular and definite.*"

This inflammation of the skin may terminate by resolution, by vesication, or by gangrene. When it terminates by resolution, the rose tint gradually changes to a deeper and more venous hue, and at length fades away, leaving the skin of its natural colour, but with the texture so impaired that desquamation follows. If the inflammation terminates in vesication, the cuticle is raised into a number of vesicles of greater or less size, and sometimes into large bullæ or bladders containing a yellowish transparent serum. The cuticle at length ruptures, the fluid is discharged, and a crust sometimes forms, which, on falling off, leaves the skin underneath either sound or else superficially ulcerated. Should the termination be by gangrene, the skin becomes livid or black, its whole texture more or less disorganized, while the bullæ or phlyctenæ which often form in these cases are filled with a bloody serum. The cutis, when examined after death, whatever may have been the form of the disease, is always found greatly thickened and infiltrated, but the redness, except in cases of gangrene, has entirely disappeared.

It is seldom that erysipelas is limited to a simple affection of the skin, for, more commonly at some period of the disease, the corresponding portion of the areolar tissue becomes the seat of a serous exudation, which may suppurate, or proceed to gangrene. When the termination is by effusion of serum, the quantity of fluid effused is generally so considerable that the head, face, or limb, is greatly and sometimes even hideously swollen ; and if the part be now incised, the vessels are seen enlarged and more numerous than usual, and the cellular tissue loaded with serum, sometimes turbid and flaky. The tissue is also more easily torn than usual. This inflammation may terminate by absorption of the serum, but in a few cases ulceration follows, and in a few others gangrene.

Adhesive inflammation, or a deposit of coagulable lymph, seldom takes place in erysipelas without its being accompanied by a serous exudation, which also suppurates. When the patient, for example, has died from erysipelas of the head, much loose watery lymph is usually found in the integuments of the scalp or other affected part. The lymph thus thrown out, however, sometimes becomes organized, causing a joint to be bound down, and its motions to be impaired, or an eyelid to be either inverted or everted.

Suppurative inflammation is uniformly preceded by serous exudation, and the result may be the formation of an abscess, or what is much more common, pus may be *infiltrated* through the cellular tissue uncircumscribed by an adhesive inflammation, a circumstance improperly considered, by many pathologists, as pathognomonic of erysipelas. The parts more usually the seat of phlegmonous circumscribed abscess are the eyelids, and the integuments covering the cheek-bones, and the pus in these cases is usually of a laudable and healthy character. In all other parts of the body the abscess is diffuse, and the inflammation being of a low type the pus is poor, and often little more than a fetid sanies ; and should the parts slough, it becomes loaded perhaps with a dirty broken-down cellular tissue, generally mixed with some loose lymph. In some instances the suppurative process extends between the muscles, causing extensive and often irreparable mischief. In the event of this inflammation terminating by gangrene, the integuments of an entire limb are sometimes detached, laying bare the muscles, a large artery, or a bone, involving the aponeuroses and tendons, and sometimes destroying the interior of a joint. Gangrene, however, does not equally take place in all parts, for it is seldom seen on the scalp, the face, or the trunk. It is the extremities, then, and more especially the leg and thigh, and also the labia and scrotum, that more particularly suffer from this affection.

The appearances found within the cranium are similar to those found in typhus fever. In a few instances, the mucous membrane of the intestinal canal has been found inflamed or ulcerated, but not so frequently as to be attributable to any action of the poison.

Symptoms.—The symptoms of erysipelas arise out of the fever and local affection, and appear of various degrees of intensity.

In acute cases of erysipelas, the erysipelatous inflammation is generally preceded and accompanied by fever ; and the attack may be sudden, or ushered in by rigors, irregular flushings, muscular pains, accelerated pulse, white tongue, nausea, vomiting, and deranged bowels. Sore throat is an early and constant accompaniment. These symptoms, when they do exist, last for some hours, perhaps till the end of the second night or beginning of the third day, when the fever becomes continued, and shortly afterwards the cutaneous inflammation appears, but without any remission of the fever.

The stages of erysipelatous fever are usually but not necessarily three in number. The first stage is marked by a white tongue, by headache, oftentimes by delirium, and by a pulse varying from 90 to 110 ; and this stage, if the disease be mild, may constitute the whole disease, the tongue not passing into the brown state. More commonly, however, the fever proceeds, and about the fourth, fifth,

or sixth day the tongue becomes brown and dry, the temperature falls perhaps to the natural standard, but the pulse rises to 120 or 140; and the active delirium changing to a low muttering with subsultus, marks the formidable second stage of this dangerous disease. This stage is often extremely rapid, sometimes not lasting more than a few hours, or at most three or four days, when the third stage commences; and if the termination be favourable, the tongue begins to clean, the pulse becomes slower, the delirium subsides, and the patient rapidly recovers; or else, on the contrary, if the disease takes an adverse turn, fatal symptoms fast gather around the patient, and the catastrophe is death.

The whole duration of the fever is generally much shorter than that of typhus; so that in idiopathic erysipelas the three stages are often concluded in the space of five, six, or seven days, and it is only in a few cases prolonged to the fourteenth or twenty-first day. If, however, the local inflammation terminates in sloughing or gangrene, the patient may fall into hectic, and the disease may now last for many weeks or even months. When the local inflammation precedes the fever, as in erysipelas from dropsy, the white-tongue stage may be wanting, the tongue becoming brown in a few hours; and under these circumstances, should gangrene follow, the patient is irrecoverably lost.

The *local* symptoms vary according to the part affected, the mode of termination of the inflammation, and also according to the character and duration of the fever.

When erysipelatous inflammation affects the face, it may begin either in the skin, or else in the subjacent cellular tissue. If the cellular tissue be primarily affected, the face at the inflamed part becomes swollen, but the skin suffers no discoloration for some hours, so that it is impossible to distinguish it from an ordinary attack of swelled face. At length, however, the skin inflames, and the part is now red, hot, and painful as well as swollen, and the disease is fully formed.

At the commencement of erysipelas of the face, the attack is usually partial, and perhaps limited to the bridge of the nose, to one ear, to the lower eyelids, or to one cheek, but in severe cases it gradually extends, often involving the whole of the integuments of the face, head, and neck; so that at the end of three or four days those parts present a strangely swollen, disfigured, and even in some instances, hideous appearance, scarcely a feature being discernible. The nostril, moreover, is imperforate from internal swelling, so that the patient is obliged to breathe with his mouth open, while the inflammation may extend to the auditory passages, and render the patient completely deaf. Extension of the inflammation also sometimes takes place to the membranes of the brain, while the external

inflammation continues. This untoward event is followed by delirium and coma.

On the fourth, sixth, eighth, or some later day, the bright red colour of the skin changes to a deeper hue; the serum effused is absorbed, desquamation takes place, and the skin gradually returns to its natural colour. It is not unusual, however, for abscesses to form, particularly on the eyelids or cheeks, and which being opened quickly, heal, and hardly retard the convalescence of the patient. In some cases the disease becomes *erratic*, and extends over the chest or down the back, and desquamation is seen going on in one part while the erysipelas is spreading in another.

The trunk is occasionally the seat of this disease; and in this case the febrile affection is less violent in the first stage than in inflammation of the face; but in the second stage it is often much longer and of a lower type, so that the whole duration of the disease is increased, and perhaps the termination more constantly fatal. The inflammation more frequently attacks the lower than the upper portion of the trunk, and more frequently the back than the abdomen. It has also a greater tendency to become erratic than similar affections of the face; and when, as it often does, it terminates in effusion of pus among the muscles, the patient seldom recovers.

The extremities are more commonly the seat of erysipelatous inflammation than the trunk, and the lower extremities are more frequently affected than the upper. When these parts are affected, the fever is less severe than in erysipelas of the head; but the local symptoms are generally more formidable, for the degree of heat is greater and the pain so severe that the weight of a sheet can hardly be borne. The inflammation likewise often involves the lymphatic vessels with glands, which can now be traced by white or red lines for many inches, as from the knee or elbow to the inguinal or axillary glands, which sometimes enlarge and suppurate. If the erysipelatous inflammation ends in suppuration, the abscess is always diffuse, and the swollen limb gives a peculiar sensation to the hand, and which has been compared to what a person feels with his feet, on passing over a quagmire. The dark, black, discoloured appearances of gangrene are too obvious to render any description of the parts so affected necessary. Numerous varieties of erysipelas are referred to in practical works, especially surgical, most of which are modifications of the disease as above described.

Besides the *erratic* form just noticed, there is the

Erysipelas Phlegmonodes, in which the inflammation extends deeply into the subcutaneous tissues. It is attended with greater pain and swelling than the more superficial variety, and usually the general symptoms are more severe. Suppuration and gangrene of the areolar tissue are not uncommon; and, if the disease pene-

trates beneath the fascia, the sufferings of the patient are greatly aggravated by the compression of the inflamed parts, and much organic mischief may result from the confinement of pus and the various products of exudation in a gangrenous state.

Erysipelas Gangrenosum.—As the name implies, this form is accompanied with death of parts, and the tendency to death of tissue may be due, either to the inherent depressing nature or malignancy of the cause, the depraved state of the system as of the blood, the co-operating influences of an epidemic constitution, debility, confined air and impure as in crowded hospitals, unwholesome or scanty food, or simply the excessive violence of the inflammation. The peculiar hot and burning pain, with the purple or livid hue of the redness, indicate the tendency to gangrene; and its near approach is shown by the slowness with which the blood returns after removal by pressure, and by the formation of vesicles (phlyctenæ) filled with turbid reddish serum. These vesicles are to be distinguished from those which are to be seen on the skin in severe contusions on fractured limbs. The fluid in the vesicles of gangrene can be pressed from under one part of the cuticle to another, which is not the case in the vesicles on a fractured limb, or a severe bruise. Patients with typhoid fever, infants soon after birth, and young children are most frequently the subjects of gangrenous erysipelas; and it is not uncommon in hospitals, during the prevalence especially of malignant epidemics of erysipelas.

Diagnosis.—The diagnosis of erysipelas is in general easy. For a few hours, perhaps, if a joint be attacked, it may be mistaken for acute rheumatism; or if a surface be attacked, it may be confounded for a short time with erythema, but the intumescence and spread of the disease quickly enable us to rectify the error.

Frank has pointed out a symptom which he considers diagnostic, which is, that whenever a patient has exhibited, for twenty-four or forty-eight hours, an intense febrile movement, attended with *pain, swelling, and tenderness of the lymphatic glands of the neck*, he does not hesitate to announce the approaching development of erysipelas; and in no case has the diagnosis been invalidated by the result.

Cause.—The mystery which hangs over the origin of poisons does so, in a remarkable degree, in erysipelas; for this disease is at all times sporadic, sometimes epidemic, and, so far it would appear, that the poison is derived from, and is constantly present in, the atmosphere. If, however, the doctrine of a spontaneous generation of a poison by the human body be tenable, it is more probably true of erysipelas than of any other disease; for it often happens that the slightest puncture, the opening of a vein, the bite of a leech, or the drawing of a blister, will produce this inflammation;

and the disease thus produced has often been found dangerous and contagious, and consequently, if this poison has an atmospheric origin, slight causes often lay the patient under its influence.

The predisposing conditions are age, mechanical or chemical injuries, as blows or burns; also certain articles of diet, as mussels or periwinkles, and many diseases likewise, as dropsy, typhus fever, or others of a debilitating kind. The effects of age in predisposing to this disease are considerable. New-born children, for instance, are occasionally subject to it, but from that period to adult age it is seldom witnessed. The period of life most subject to acute attacks is from twenty to forty; and to chronic attacks from forty to old age. Both sexes suffer in nearly equal proportions.

Propagation of the Disease.—It is both infectious and contagious. The spread of erysipelas has been so frequently observed, both in the sick room and in the wards of hospitals, that no doubt can exist of this disease being infectious, and the following are instances of it. In the year 1760, this disease spread so extensively through the wards of St. Thomas's Hospital, in London, that a report got abroad that the plague was in the hospital. Dr. Baillie also described it as spreading in St. George's Hospital, London; and Dr. Cullen in the hospital at Edinburgh. It has also been found to spread extensively on board ship; and Dr. Wells, Dr. Watson, and others, have given several remarkable instances of its spreading in families. The infecting distance is considerable.

That it is contagious is shown by Dr. Willan, who says, if a person be inoculated with the fluid contained in the phlyctenæ or vesicles of a genuine erysipelas, that a red painful diffused swelling and inflammation analogous to erysipelas is produced. The danger, however, attending this experiment has not allowed it to be repeated.

Erysipelas also spreads by *fomites*. In hospitals, wards are occasionally obliged to be cleared out, to stop the continued spread of erysipelas. In the navy the spread by fomites is so well understood, that it is even debated whether swabbing the decks or dry rubbing them is the best mode of disinfecting a ship, and preventing the spread of the disease. This disease also spreads extensively, and for long times, in the Birmingham, Edinburgh, Glasgow, and London hospitals, and is at last only got rid of by emptying and whitewashing the wards. It is said, however, that dry rubbing is preferable to washing, moisture appearing to promote the extension of the disease. The old "Dreadnought" hospital ship in the Thames was so impregnated with the *fomites* of erysipelas that she has now been broken up, and a new vessel substituted.

The patient having passed through this illness, has no security against future attacks of the disease, for many persons suffer repeatedly from erysipelas, some periodically. There appears to be a

constitutional predisposition to the disease in some people, and especially in those who have periodic attacks. Some women have attacks every month. Intemperance, and all influences which tend to depress the system, predispose to the disease, and hence partly the prevalence of the disease in hospitals. But there is unquestionably some unknown condition of the atmosphere, to which the name of "epidemic influence" has been given, and which favours the production of the disease. It has been observed that this predisposition to erysipelas exists in the ordinary wards of hospitals at the same time that puerperal fever prevails; and an opinion is now prevalent, in Europe especially, that erysipelas is capable of co-existing with many other poisons. We continually observe erysipelas, for instance, co-existing with the primary as well as with the secondary symptoms of syphilis, and also with typhus fever. It was formerly not an unfrequent accompaniment of small-pox.

Period of Latency.—This disease has occasionally followed a few hours after exposure to the infection. Dr. Elliotson thinks five days elapsed in his own case, and Dr. Watson has given three cases in which the interval was a week. It has been observed in hospitals that a fortnight has elapsed after its subsiding in one case and appearing in another in the same ward. It is probable, therefore, the period varies from two to fourteen days.

Erysipelas and puerperal fever are interchangeable diseases, the one being able to induce the other by personal contact. Destructive epidemics of erysipelas have now and then occurred in Europe, and several parts of America have of late years been the scene of similar ravages, especially in the New England States, the South-Western States, and the interior of Pennsylvania (Dr. Wood).

Prognosis.—This disease is so influenced by treatment that it is difficult to estimate the proportion of deaths or recoveries. Some practitioners give as a result one death in three; while others affirm it to be only as one in ten, or even a much larger number. The influence of any existing epidemic constitution must also be taken into account. In erysipelas of the face the chief danger arises from the membranes of the brain becoming involved.

Treatment.—Broussais states, that when he served with the French armies in Italy, he has seen erysipelas, for want of medicine, allowed to run its natural course, and the result was, that it made immensely rapid progress, and ended either in suppuration, in gangrene, or in fatal visceral inflammation. Some mode of treatment is therefore imperatively necessary to control this, too often fatal, disease.

Erysipelas is admitted to be a highly inflammatory disease; and in the opinion of one party it is a disease of simple inflammation,

and consequently ought to be treated by general and local bleeding; while, on the contrary, the opposite party contend that it is a specific inflammation; and long experience has shown that bleeding is often injurious, while a tonic mode of treatment is much more uniformly successful.

There are very few physicians, from the days of Hippocrates to the present time, who have not bled patients in erysipelas, and consequently this experiment has been made on a large scale; still many of the warmest advocates of bleeding admit that the operation is occasionally followed by unpleasant consequences.

In France, Dupuytren adopted the system of bleeding extensively, in the belief that erysipelas was a disease of simple inflammation, and that energetic bleeding was necessary to subdue it. He gives five cases; and of these, two died; a third lost the use of a limb; while in a fourth, the disease, notwithstanding the treatment, continued to spread; and the fifth only appears to have entirely recovered.

The treatment by bleeding has been often followed by so many unfavourable results, that many physicians, the most intelligent of the profession, affirm that, according to their experience, the practice is not only unfavourable but highly injurious. Andral is reported to have said, "In erysipelas with delirium, bleeding pales the skin, but the disease continues; the cellular tissue remains gorged, and death follows. We open the body but find nothing." Cruveilhier says, "*des erysipèles rentrés*" is a consequence of unusual or too abundant bleeding, and he considers the question of bleeding, in this disease, to have been "*depuis longtemps jugée.*" Blache and Chomel likewise say that "Experience has proved that general bleeding has no other effect than to blanch the eruption without notably abridging its duration." In this country, Drs. Fordyce, Wells, Pearson, Heberden, and Willan all give their testimony to the frequent ill effects of bleeding in this disease; and, in consequence, they, for the most part, recommend a tonic treatment, or by bark; and many practitioners have gone so far as to affirm that bark is a specific for this formidable disease. There seems no reason, however, for considering bark to be a specific.

It is therefore to be recollected, that bleeding will not cure the *erysipelatous* inflammation, in the way that it produces a salutary effect on an idiopathic inflammation of the lungs, occurring in an otherwise healthy person. It is also to be borne in mind that, as a rule, bleeding is not borne well by persons suffering from erysipelas; and also, it is necessary to be ever mindful of the fact that people of a certain class, in populous towns, bear bleeding still less well, than those who pass their life in the country. For instance, a brewer's drayman in London, accustomed to rejoice in the beverage

which he delivers to his customers, would sink suddenly under the influence of a bleeding; when if double or even treble the amount of blood were abstracted from a countryman suffering from erysipelas, but heretofore in good health, it would produce but little effect, and that probably for good. Bleeding, as a rule, is only indicated when there is danger of suppuration or gangrene in consequence of the violence of the local disease, or if some internal or vital organ appears threatened with an inflammatory process; and even then the circumstances of the case demand the most careful study and attention, especially in all those particulars which are indicated in the account given of the pathology and causes of this disease.

Rest, saline laxatives, cooling drinks, and low diet are the elements of treatment in mild and simple cases. An emetic is useful at the commencement; and I have seen, in the practice of an eminent surgeon, that frequent resolution of an erysipelatous attack has followed an antacid laxative, such as of rhubarb powders and carbonate of soda, together with the counter irritation of a mustard plaster over the stomach. Laxative and cathartic remedies are to be selected and apportioned according to the violence of the attack and its nature, as tending to the unfavourable results of the specific inflammation already noticed. Calomel is a most valuable purgative, as a sedative in febrile disturbance, especially when followed by castor oil, or the common black draught. The indications to the use of certain remedies, as given at page 97, in the treatment of scarlet fever, are equally applicable here.

If the febrile state is not subdued, antimonials are of great service for, so far as they are diaphoretic in their action, they tend to subdue the vascular excitement. If symptoms of nervous depression ensue, opium, or opium and ipecacuan are indicated, also wine and quinine, especially in a tendency to a typhoid state. The tincture of the muriate of iron in doses of twenty drops, *three*, *four*, or *five* times a-day, is now also a remedy much in use.

Local applications are potent for good or evil; and must therefore be used with great caution. The effects seen on the skin do not constitute the whole disease; and if the development of these processes on the cutaneous tissue is imprudently interfered with, there is imminent danger to internal organs. To check the advance, and prevent the encroachment upon new territory rather than to subdue it, if already in possession, ought to be the sole aim of local treatment; and to mitigate the local pain and uneasiness. Bland mucilage, such as that of viscid lintseed tea, from which light muslin cloths have been steeped and spread over the inflamed surface, is said to afford relief. Dry flour, or rye-meal, dusted from a dredge box frequently over the erysipelatous patches, are also soothing applications.

To arrest the spread of the process over sound skin, nitrate of silver in very strong solution, or tincture of iodine, are efficient agents. A line of circumvallation is to be painted round the erysipelatous part, so as completely to enclose it. The nitrate of silver should either be employed in the solid stick, or as proposed by Higginbottom, in solution of eight scruples of the nitrate, with twelve drops of nitric acid in a fluid ounce of water. Dr. Wood has practised with success, and recommends the use of tincture of iodine.

Long and deep incisions into the inflamed textures are, sometimes, demanded. This is more especially the case if there is tension of fibrous tissue, such as the subcutaneous fasciæ; and erysipelas of the head is frequently greatly alleviated by repeated innumerable minute punctures, made by the point of a lancet, all over the parts of the face and scalp which are affected.

The Plague—*Pestis.*

Definition.—*A malignant contagious fever which has prevailed at different times and places, epidemically; attended with an eruption of a complex nature composed of buboes or swellings of the lymphatic glands, carbuncles, pustules, spots, and petechiæ of various colours, and distributed in different parts of the body.*

Pathology and History.—Modern medicine restricts the term "plague" to a disease of dreadful severity, and of a peculiar character, which appears to have had its origin in Egypt, and in the neighbouring countries, and which is unquestionably the result of physical causes.

It is impossible to determine the time when the plague first appeared in Egypt. The remotest period to which we can distinctly trace it, is when we find it spreading into other countries; and the plague of Constantinople, which broke out in 544, when Justinian was emperor, is the first which, from its course and symptoms, we can with certainty determine to be the plague of modern times. It was so severe that at one period ten thousand persons are said to have died daily in that city. The symptoms were shivering and fever, at first so slight as to alarm neither the physician nor the patient, but the same day, the next day, or the day after, there appeared swellings of the parotid, axillary, or inguinal glands, with carbuncles, and sometimes gangrene, and from the more usually diseased state of the glands, it was called "pestis inguinaria."

The disease from that period, has raged at short intervals in various parts of Europe, as late as the seventeenth century. Sir Gilbert Blane has calculated there were no less than forty-five plagues

in the seventeenth century. Fourteen of these occurred in Holland, in consequence, it is supposed, of the Dutch having engaged in the Levant trade, about the year 1612; and twelve in England, imported, as has been supposed, from Holland. The last plague which raged in both of these two countries was in 1665, or the year before the memorable fire of London. This plague was termed the "Great Plague," and spread "with such intolerable infection," that 7,165 persons are said to have died in one week, while in one year no less than 68,526 died in the city of London and its suburbs alone; an immense mortality, considering the then comparatively small amount of population.

The plague is still annually epidemic in Egypt, and very constantly rages on the Barbary, Arabian, and Syrian coasts, and also at Constantinople; but has been rarely seen out of the Turkish dominions since the seventeenth century. Nevertheless, it broke out at Copenhagen, in 1712, at Marseilles, in 1720, and at Moscow, in 1771. In the present century it has appeared at some of the Russian ports in the Black Sea. In 1813 it broke out at Malta and at Gozo, when the number of victims were estimated at between 4,000 and 5,000. It subsequently broke out at Noja, in Calabria, in 1816; at Corfu, in 1818; it appeared at Gussemberg in Silesia, in 1819; and lastly, in 1828-29 it devastated the ranks of the Russian army in Bulgaria, and there is reason to believe that at Odessa, towards the end of the recent Russian war there were cases of a malignant fever, with buboes and swellings in the glands of the groin and axilla, which policy prevented calling plague.

The theory of this disease is, that a poison is absorbed and infects the blood, and after a given period of latency produces certain specific actions, which are either preceded, accompanied, or followed by fever. The more specific actions of the poison are an inflammatory state of the brain and its membranes, similar to that of typhous fever in this country; also a singular enlargement of the heart, the liver, or the spleen. But the most constant action of the poison is on the lymphatic system generally,—the cervical, inguinal, axillary, and mesenteric glands being for the most part found enlarged or otherwise inflamed, and thus giving rise to the characteristic bubo. The cellular tissue also appears to be often the seat of a specific action of the poison, it being frequently affected with carbuncles; every organ and tissue of the body is likewise covered with petechiæ, and often the seat of hæmorrhagic effusion.

The extreme danger attending posthumous examinations, and the prejudices of the Mahommedans, long prevented our possessing any satisfactory data respecting the pathological phenomena of the plague; but a commission appointed by Mohammed Ali in 1834-35, and consisting of Clot Bey, Gaetani Bey, Lachesi, and subsequently

of Bulard, examined the bodies of sixty-eight persons deceased of the plague, and the following is a summary of their results.

On removing the cranium the sinuses were found filled with black blood, the arachnoid veins greatly injected, and the arachnoid cavity often infiltrated with serum, and occasionally with a trifling effusion of black blood. The substance of the brain was generally less consistent than in health, and sprinkled with more bloody spots than usual. The bronchial membrane appeared sensibly inflamed, although during life the patient had presented no catarrhal symptoms. The pericardium frequently contained a reddish serosity. The serous membrane covering the heart and pericardium was often extensively affected with petechiæ. The heart distended with blood, was almost always enlarged, or from a third to a half greater than its natural size; its tissues being often pale, and sometimes softened.

In acute cases the stomach was often natural, but more commonly there was a partial redness of the mucous membrane, like confluent petechiæ; but in more chronic cases it was of a deep red or else of a slate colour. It was often softened, the seat of superficial ulceration, especially between the folds, and in one case blood was effused. The small intestines, except being sometimes the seat of livid petechiæ, were rarely found diseased. The ilio-cœcal valve was the only portion of the large intestines found at any time in a morbid state. Its colour was commonly livid, and sometimes it was ulcerated, the ulcers penetrating occasionally the appendix vermiformis.

The liver was almost always larger than natural, and loaded with blood, while petechial spots were often seen at its surface. The gall bladder was the seat of petechiæ, and in two cases blood was effused into the sub-cellular tissue.

The spleen was always twice its natural size, or even more, but was rarely the seat of hæmorrhagic effusion. It was also softened, and deep in colour.

The kidneys were often found immersed in an hæmorrhagic effusion into the surrounding cellular tissue. They were loaded with blood and the pelvis filled with clots. The ureters occasionally contained blood, and sometimes the lumbar glands were so enlarged as to press upon them, and to account for the suppression of urine. The bladder occasionally presented petechiæ, and occasionally the urine was mixed with blood.

Every dissection showed that buboes, wherever seated, always resulted from diseased lymphatic ganglia. These ganglia were always enlarged, and varied in size from an almond to a goose's egg. The least altered were hard and injected. In a more advanced stage, some without any change of colour, and others, again, as richly coloured as lees of wine, were wholly or partially

softened, and some putrescent. Sometimes these glands became agglomerated and formed masses, which weighed two pounds or more, and around these agglomerations was a hæmorrhagic effusion extending into the cellular tissue. The cervical glands often became so enlarged as to form a sort of chaplet united with those of the axillæ and of the mediastinum. The axillary glands again communicated with the cervical, and with those which surrounded the bronchi. Those in the groin connected themselves in the same manner with those of the abdomen, and these might be traced without interruption through the crural arch into the pelvis and along the vertebral column. It was especially among these latter that sanguineous effusion was found in the sub-peritoneal tissue. The mesenteric glands were often so numerous, that the whole of the mesentery seemed covered with them, but they seldom exceeded an almond in size.

The blood is evidently diseased in the plague-patient, although no analysis has shown in what this alteration consists. It is stated never to be buffed; that the serum readily dissolves the colouring matter; and that the lower part of the clot is but feebly coagulated.

Symptoms.—The poison of the plague produces those disordered functions of the great nervous centres which constitute the phenomena of fever, either of a low or of an active character, and sometimes so severe as to destroy the patient in a few hours, and before any secondary actions are set up. "At Aleppo," Dr. Russel says, "in the most destructive forms of the plague the vital principle seems to be suddenly, as it were, extinguished, or else enfeebled to a degree capable, only for a short time, to resist the violence of the disease; and the form of the plague, beyond all others most destructive, exists without its characteristic eruptions, or other external marks considered pestilential. These cases perished sometimes within twenty-four hours."

In milder cases, the fever, of greater or less intensity, is preceded, accompanied, or followed by the secondary actions that have been mentioned. The order of the occurrence of these secondary actions, and the frequency of their accession, is not determined; but buboes, carbuncles, and petechiæ are considered as the characteristic and most frequent symptoms of the plague. Desgenettes thought the symptoms presented three degrees of intensity; so also does Aubert; and this division is also adopted by the *Commission* referred to at page 116,—the first degree being a slight fever without delirium or buboes; the second degree being fever with delirium and buboes; the third degree, high fever, high delirium, buboes, carbuncles, and petechiæ.

The manner in which the plague attacks is very various. Many instances are given of patients being most suddenly seized; as when

conversing, eating, walking, going to bed, or during sleep. More commonly the disease is preceded for a greater or less length of time by "lassitude, loss of strength, general uneasiness, and mental anxiety, to which shivering, headache, vertigo, and vomiting soon succeed; then appear the general and local phenomena, and among them bubo, carbuncles, and petechiæ, preceded or followed by delirium or coma, too often terminating in death."

The *first degree* of the plague is when the symptoms have presented only a slight fever, frontal headache, an altered countenance, nausea, and perhaps vomiting; or should this fever be accompanied by buboes and carbuncles either simultaneously or consecutively, the buboes always terminate by resolution, suppuration, or induration, while the carbuncles, more or less numerous, are always superficial. In this variety the patient rarely keeps his bed, perspiration is readily excited, and the termination is never fatal. This form is common at the height of the epidemy, and is still more so at the decline of the disease.

In the *second degree* of the plague the patient staggers as in drunkenness, has a stupid air, an injected eye, an embarrassed speech; this is accompanied by nausea or vomiting of bilious matters, and often by diarrhœa, while in the last stage the matters vomited are black. There may or may not be heat of the skin; but the pulse is frequent and compressible and the delirium tranquil or agitated. The tongue, at first moist, is often white at the centre, and red at the edges and tip; but on the second or third day it becomes dry, black, and chapped at the centre, while the teeth are covered with sordes. The secretion from the kidneys, also, is affected, the urine being always high coloured, at times sanguinolent, small in quantity, and, towards the termination, often suppressed. From the second to the third day buboes appear in the axilla, groin, or neck, and more rarely in the ham, and about the same time carbuncles and petechiæ; and on the fourth or fifth day, in unfavourable cases, the patient dies comatose. The patient, however, may recover, and the convalescence may be either rapid or prolonged. In the former case, about the fourth or fifth day, the tongue again becomes moist, the skin open, the pulse softer, and the buboes either terminate by resolution, suppuration, or induration; the carbuncles, when they exist, limit their ravages, the petechiæ disappear, and about the sixth or eighth day the patient is convalescent. In cases more severe the black tongue and all the other symptoms continue, the buboes are slow to suppurate, their pus is serous and fetid, and convalescence is not established till the fourteenth to the twentieth day, and during this protracted struggle the patient often sinks. This is the form of plague which predominates at the height of the epidemy, and gradually disappears as it declines.

In the *third degree* every symptom is increased; the habitude and dulness is accompanied by an almost entire annihilation of the intellect, and by a prostration of strength, so extreme, that an upright posture is impossible. The pulse, moreover, is small and frequent, the tongue moist, thick, and purple, the petechiæ of a dark colour, and the patient often dies in twenty-four or forty-eight hours, comatose, livid, and without agony. If, however, the disease should be still further prolonged, the pulse rises, the tongue is red and dry, the skin hot, the eye injected, and the countenance animated; and towards the third day an eruption of buboes, and occasionally of carbuncles, follows. The patient has now a chance of recovering, but such a result is rare. It is in this variety that buboes and carbuncles are sometimes altogether wanting; and this is that terrible form which prevails almost exclusively in the first month of the epidemy, and is occasionally met with till its termination.

The bubo seldom maturates till the fever is on the decline, which rarely happens till the eighth or ninth day; nor are they ripe for opening till between the fifteenth and twenty-seventh day. In general, suppuration has not been so frequent as resolution, and never were the buboes seen to be gangrenous. Aubert considers the bubo as of good augury for the patient, and its suppuration as the sign of his recovery.

The carbuncle is by no means of constant occurrence, Dr. Russel having found it only in 490 cases out of 2,700. It appears more commonly in the middle or towards the decline of the disease. Hardly any external part is free from them, not even the penis, and in one instance a carbuncle formed in the throat, which was fatal. They occur more particularly on the limbs, and more especially on the legs. In some cases they form on the cheek or lips, and by the tumefaction they cause give to the face a hideous aspect; in others the whole of one side of the jaw has been laid bare, while in others they have formed on the eyebrow and on the eyelid, and partly destroyed the eye. Clot Bey, however, observed they never formed on the scalp, the palms of the hands, or on the soles of the feet.

There are three different varieties of carbuncle, and all commence in the same way, or by a small red pimple, which increases, and in the centre of which a vesicle forms, containing first a yellow and afterwards a blackish serum. In the most benign the vesicle bursts and dries up in three or four days from its first formation, the epidermis alone having been infected. The second variety involves the whole thickness of the skin, as well as portions of the cellular tissue, which is moderately tumefied, and surrounded by a dark red areola. The gangrene in this form is circumscribed, and there results an eschar from one to two inches in diameter, which

is detached by suppuration, leaving an ulcer with a sharp perpendicular edge. In the severe forms, the redness and tumefaction cover a large space, and the gangrene rapidly involves the skin, the cellular tissue, and sometimes even the bones. It has been observed that the malignity of the carbuncle is in the direct ratio of the severity of the disease, but their mere existence is not of unfavourable augury. Their number is very various, sometimes only one, at others ten or twelve. When there are several they often form in succession. These tumors are often very painful, and Aubert mentions one seated on the back of an Arab soldier four inches in diameter.

Petechiæ are observed in some seasons and not in others. They present different shades of colour according to the intensity of the disease, rose colour, violet colour, or black. Aubert considered their appearance an almost certain sign of death. The duration of the disease is from a few hours to fifteen, twenty, thirty, or even more days.

Diagnosis.—Clot Bey says the diseases which most resemble the plague are typhus, severe forms of paludal fever, apoplexy, dysentery, parotiditis, and scrofulous or syphilitic affections of the ganglionic system.

Cause.—The plague, and consequently the poison which it generates, has undoubtedly a very limited origin. Clot Bey indeed considers it to originate, and to be endemic, along the whole of the eastern and southern coasts of the Mediterranean ; the principal centres being Egypt, Syria, and Constantinople. But most authors are agreed that Egypt alone originates the plague, whence it is imported into other countries. It seems determined also that the poison is not only generated in Egypt, but also within a very circumscribed space of that country; for Volney states that the plague in Egypt never commences in the interior, but always appears first on the coast at Alexandria, passes from Alexandria to Rosetta, and from Rosetta to Cairo ; and consequently he considers that the poison must be generated in the Delta of the Nile.

Of all the causes mentioned by authors as originating the poison of the plague, the crowded state of the population in Egypt, their misery and insufficient nourishment, are the most prominent. Every writer speaks of their mud-built huts, of their narrow and tortuous streets, and of their habitations, whether isolated, in villages, or in towns, being surrounded in every direction with heaps of dung. In these the Arab lives with his wives, his children, and his servants, and his domestic animals, all huddled together. "Unheard-of filth," says Clot Bey, "reigns in their infected haunts." Again, some authors have considered the pestilential miasma as a product of vegetable decomposition, favoured

by the inundation of the Nile, and the heated blast of the hot Khamsin; others, that it is owing to the mud deposited by the Nile; and lastly, that it is owing to the practice of making mummies of the dead, or of imperfectly or superficially burying them. Clot Bey has examined all these causes, and comes to the conclusion that, taking them conjointly or separately, they are inadequate to account for the origin of the plague. Of the many other hypotheses imagined, the generation of peculiar animalculæ, flying from place to place, is the most ingenious, and perhaps the most unfounded theory. All, therefore, that we can safely affirm of this poison is, that it is probably of secondary formation, has a local origin, is at all times endemic in Egypt, and every five or six years epidemic. It also appears to be, to a certain extent, influenced by season, the plague not spreading in any very sensible degree till December, and attaining its greatest height in June, when it rapidly declines, and is popularly supposed to cease on St. John's day.

The period of the year, however, at which the plague prevails differs in some degree in different countries; but the total duration of the disease in any country, to which it is not native, appears to be inconsiderable, unless kept up by a fresh importation. At Aleppo it lasted from 1760 to 1762, a period of three years. But in Malta, Marseilles, and in the western parts of Europe, it has generally subsided in about a twelvemonth.

We are little acquainted with the habits of this poison as it affects animals. Dogs are said to have died of buboes, either during or just preceding the plague season; and bile taken from a deceased plague-patient, and injected into the veins of a dog, was followed by the death of the animal.

In every epidemy there is only a certain number of persons greatly susceptible of the action of the poison, else every town or city attacked must be depopulated. The proportion of persons, however, liable to be attacked by the plague is very great, for in that of Alexandria, in 1834, it is calculated, out of 42,000 souls, 14,888 perished. In selecting, however, its victims, this poison follows the law of most other morbid poisons, attacking the poor rather than the rich,—women rather than men,—patients labouring under disease rather than healthy individuals,—persons constitutionally feeble rather than the robust, and those addicted to intemperance, or other excesses, than those who more strictly observe the precepts of Mohammed. As to races—the Arab suffers more than the Negro, the Negro than the Turk, and, in Egypt, the Turk than the European.

Modes of Propagation.—The belief in the contagious nature of the plague is so general that it still continues to be the terror of Europe, and the ports of every nation are closed against a vessel

supposed to have the plague on board. The facts by which this precaution is warranted are extremely striking, for every time the plague has appeared in Christian Europe, the arrival of a ship on board of which one or more persons have died of the plague, has been an invariable antecedent. The disease also invariably broke out, at the port or town at which such vessel arrived; and if the proper precautions were not taken, it spread into the interior of the country. The following modern examples of the plague, appearing in the West of Europe, will exemplify this statement.

On the 25th of May, 1720, Marseilles being healthy, a vessel arrived in that port from Seyda, in Syria, having lost seven men by the plague, during the voyage. It was usual to send vessels and their crews, arriving under these circumstances, or having foul bills of health, to perform quarantine at Jaru, an uninhabited island near Marseilles; but this precaution was omitted in the present case, and so negligent were the officers on duty, that the captain and passengers were permitted to land, and even to lodge in the city, while the crew were sent to the infirmary and allowed to associate with the persons attached to that establishment. It appears also that many contraband articles were thrown over the walls. In the midst of this free communication one of the seamen died of the plague, then the *garde de vaisseau*, then the cabin-boy and two porters, and lastly, on the 20th June, the plague broke out in the city itself, and raged with such fury that out of a population of 90,000 souls, it was estimated that 39,134 died. It spread in Provence, and caused considerable mortality in that department; but, nevertheless, it was limited to a comparatively small district of country immediately around the original focus of infection.

In the year 1743, Messina being healthy, a ship arrived on the 20th of March from the Levant, and three men having died during the voyage, the ship was put under quarantine in the harbour. Two days after the captain died of the plague, and shortly after another of the crew; when, in consequence of this, the ship, ten days after her coming to anchor, was taken to a distance, and burnt with all her cargo. Forty days after the plague broke out at Messina, when 38,000 persons are said to have died of the disorder.

In the year 1813, Malta being healthy, a vessel called the "San Nicolo" arrived on the 29th March from Alexandria. On entering the port she hoisted the yellow flag with a black spot in the centre, the signal of the plague on board; and the master reported two men had died on the voyage, and, as he believed, of the plague. The same day also there arrived two other vessels, likewise from Alexandria—the brig "Nelly," and the Spanish polacca "El Dolce," which had likewise lost some men on the voyage.

The arrival of three vessels on the same day suspected of having the plague on board alarmed the city, and the "Nelly" and the "El Dolce" were sent away the next day, while the "San Nicolo," belonging to a merchant resident in the island, was put under quarantine; and on the third day the captain was seized with symptoms of the plague, and died in thirty-six hours; and his servant was seized about the same time, and he also died. On the 16th of April following, the first death from plague occurred in the city of Valetta; and on the 3d of July, the disease had spread so extensively that the organization of a police was begun, for the purpose of isolating the city and "shutting up" its inhabitants. It is remarkable that although the plague spread to many towns or villages in the island, no sooner was the affected town or village surrounded by a cordon of troops, and thus isolated, than the disease was limited to that spot, and never spread in any instance to the troops immediately without it.

It is manifest that the antecedent arrival of a vessel having the plague on board at each of the three ports of Marseilles, Messina, and Malta, and the breaking out of the disease in all those places shortly afterwards, is so remarkable that it can be only explained by admitting the connection of cause and effect. Moreover, the fact of the plague having originated in the preceding instances from imported contagion, and not from any local influence, is demonstrated by the exemption of large bodies of persons "shut up" in the very heart of the pestilence. Thus, in the plague at Marseilles, the large nunnery of Les Dames de la Visitation Sainte Marie "shut up," and, although there was an infirmary on one side for those ill of the disease, and a burying-ground on the other for those who died of it, yet all the inmates of the nunnery escaped. The Hôpital de la Charité of the same city, a sort of poor-house, making up about 300 beds, "shut up," and escaped with complete impunity; but being converted into an infirmary for the plague-patients, 200 of the poor, left in attendance, all died of the malady. In the plague of Moscow, 1770-71, the Imperial Foundling Hospital, containing 1,400 souls, "shut up;" and although more than 100,000 persons are supposed to have fallen victims to this pestilence in that city, yet, excepting some eight persons who surreptitiously went into the city, and were instantly separated, none caught the disease. The exemption also of the Convent St. Augustin, which "shut up;" and of the town of Isola, which "shut up;" and the singular exemption of all the military, "though they surrounded, within a yard or two, camps and hospitals in which the plague was raging, and were subjected to those hard duties which are known to give a predisposition, to inflict on soldiers the

most violent type of the prevailing disease,—but they never caught the plague at all," are further proofs that the plague was not communicated through the medium of the atmosphere.

Another class of facts, demonstrative of the contagious nature of the plague, is the greater number of persons attending on, or in communication with, the sick who fall from this disease. The French army, on first taking possession of Egypt, lost no less than eighty medical officers by the plague, an immense proportion compared with the loss of the army generally. In the English army only one in forty-eight of the military generally died of the plague, while one-half of the medical officers died. On the contrary, in Malta and in Corfu, the medical officers dressed themselves in oil-skin dresses, and, thus protected, often slept in the wards, yet not one of them was attacked. Some few persons also have ventured voluntarily to inoculate themselves with plague-matter, and these have, with hardly an exception, fallen victims to their rash experiments.

Such is a general view of the facts proving the contagious nature of the plague. It must be admitted this law is doubted by Aubert and Clot Bey; but when we find the Pacha of Egypt and his court carefully "shutting up," and that quarantine establishments are formed at Alexandria and Constantinople, it is impossible not to see that these doubts are not entertained by the higher ranks of the Mahommedans, while it is well known that all the Christians of any fortune in the Levant are such contagionists as constantly to "shut up" on all similar occasions.

By the contagion *per fomitem*, as it is termed, the plague has been supposed to spread, not only from person to person, but from one quarter of a town to another, and also to remote and distant countries. The following are instances of this mode of propagation.

"In the plague of Moscow," says De Mertens, "the principal victims consisted of the lower order of the Russians, and these bought up everything that was rescued from the flames." When the French army was in the occupation of Egypt there were so many instances of a connected series of deaths from the transmission of a captured pelisse or other article of dress, that Bonaparte ordered all infected articles to be burnt, causing such great destruction of military appointments as to have led to many remonstrances from the officers. The experience of the British army so entirely coincided with that of the French as to the contagious nature of fomites, that they adopted the same measures. In the plague of Malta, Sir Thomas Maitland conceived that disease to have been introduced into the island of Gozo, by a person released from quarantine, carrying with him a box he had secured in his garden.

The belief in the contagious nature of the plague is so general in the Levant, that persons "shut up" usually encage, send away, or destroy all cats and other domestic animals, which they consider as so many living *fomites;* and in Malta all articles of food were steeped in water for at least half an hour, the wine was delivered in uncorked bottles, and pigeons, fowls, and rabbits when sold were stripped of their feathers or skin, and every particle of hair, wool, or feathers, was removed by pincers and burnt. If the dead body also be considered as a *fomes*, we find that at Malta the grave-diggers and the bearers of the dead suffered in a very remarkable degree. To remove any doubt that might exist on this head, two criminals that had been condemned to death were placed, during the epidemy in Egypt in 1834-35, in the beds of two deceased plague-patients, and they both took the disease.

If the doctrine of the contagious nature of *fomites* can be considered as proved, it is important to determine what length of time the pestiferous miasmata may be preserved in an active state in the substance they adhere to, and modern experience seems to prove that the period is not long. In Egypt and Syria, the day after St. John's day, when the plague has hardly yet disappeared, the clothes of many thousand persons dead of the disease are openly bought and sold in the market-places without any apprehension of infection. Another strong fact is, that the hospital Esbekié, at Cairo, in which more than 3,000 plague-patients had been treated, at the close of the epidemy, and while some of the affected were still left in it, was appropriated to a different class of patients; and, from some neglect of the servants, these persons slept in the same beds, under the same woollen counterpanes, and with no other change than the blankets, and yet no individual caught the plague. It is singular, also, that immediately after the plague of London, "the houses," says Hodges, "which were before full of the dead, were now inhabited by the living, and the shops, which had been most part of the year shut up, were again opened;" and "many went into beds where persons had died, even before they were cold and cleansed of the stench of the disease," and yet it appears there was no evident extension of the disease. Mr. Tully states, that the experience acquired in the plague of Corfu proved, that effects of all kinds can be securely purified by subjecting them to the combined or even individual action of pure air or water, and that the tents employed in the plague-camps, after being washed half a dozen times in salt water and dried in the sun, were delivered into his Majesty's stores, and shortly after employed in the encampment of the garrison. A voyage from Egypt is evidently capable of disinfecting all *fomites*, for no quarantine officer of Great Britain has been infected with the plague since 1665.

It seems, therefore, that when the plague is imported into any country, the infection or contagion must be renewed by the sickness or death of some portion of the crew during the voyage.

Dr. Russel states that at Aleppo he met with 28 cases of reinfection, or 1 in 157 ; and Clot Bey states that he and his colleagues saw many individuals perish of plague in 1834-35 who had formerly survived an attack of the disease.

Modes of Absorption.—This poison being contagious, is necessarily absorbed by the skin, and without breach of surface. Many persons are supposed to have been infected by drinking out of a cup after a person labouring under the disease ; and, if so, it must also be absorbed by the mucous membranes. There are good reasons also, for believing that, being once absorbed, it must infect the blood; for the matter of the bubo is infectious, and blood and bile injected into the veins of dogs have destroyed those animals. Another circumstance also which seems to prove the infection of the blood is, that pregnant women attacked with plague almost always abort, and, according to Dr. Russel, some of the children have borne evident marks of the disease; while there is no instance of a child born of a plague woman surviving more than a few hours. Clot Bey, however, inoculated himself, and also many dogs, with blood taken from the heart or large vessels of patients deceased of plague, and these all escaped infection, a result perhaps owing to the extremely minute quantity and diluted state of the poison.

Period of Latency.—The period of latency is a question of great moment in treating of the laws of the plague, as being that circumstance which ought to determine the length of quarantine for the person. Dr. Russel states he has known persons long shut up taken ill almost immediately, or in a day or two after coming out of confinement. Aubert also gives the case of a Maltese who was taken ill on the second day after his arrival at Alexandria. The minimum period of latency, therefore, is short. As to the maximum period, Dr. Russel says, "I met with no instance of the disease discovering itself later than the eighth or ninth day." Aubert and Clot Bey seem to have adopted the same opinion. Father Maurizio extends this period to fifteen days ; Sir James M'Grigor to seventeen days; while M. Bertrand, from his observations during the plague at Marseilles, places the extreme period at thirty-five days. It is probable, however, that there must be some error in this last observation, and, consequently, that the extreme periods of latency may safely be stated to be from a few hours to twenty days.

Prognosis.—Desegnettes calculated that not more than one-third of the French soldiers attacked with plague recovered. In the

plague of Marseilles 40,000 are said to have died out of a population of 90,000. At Malta, dividing the months of July, August, and September into two equal parts, 90 in 100 cases died in the first half, and 60 in 100 cases in the second half. At Alexandria, in 1834-35, out of a population of 42,000 persons, 14,000 are supposed to have perished. Clot Bey estimates the whole mortality for Egypt in that year to be as one in three of those attacked.

Many instances are given of a patient apparently convalescent, and even walking about, dropping down and expiring; but in general, says Clot Bey, cyanosis and partial coldness of the extremities, petechiæ, and the subsidence of the buboes were the grave symptoms. Pregnant women always aborted when seized with the plague, and all those near their time invariably died, and that even when the loss of blood has been inconsiderable.

The favourable symptoms are, a quick re-action, abundant sweats, and the suppuration of the buboes.

Treatment.—In the treatment of the plague neither the practice of the French nor English medical officers serving in Egypt has led to any happy result. The French first tried rubbing the body with oil, but their frictions only added to the anxiety and apprehensions under which the patient laboured. Cold affusion was then tried, but it caused hæmorrhage ; mercury produced diarrhœa : to scarification succeeded gangrene. Bleeding was likewise tried, but was altogether unsuccessful, so that the French medical officers, baffled in every attempt at heroic treatment, at length confined themselves to watching the disease and palliating symptoms, giving antimony on the accession of the fever, and opium in diarrhœa, while they supported the patient afterwards by camphor, æther, bark, or wine.

In the British army a variety of similar or other modes of treatment were tried, but with an equal want of success. Dr. Whyte relied on the lancet, but every one of his patients are stated to have died. Some gentlemen attached to the Brunonian treatment, kept their patients under the influence of wine and opium, but this practice was so little successful that it was abandoned. Mercury and nitric acid were thought more favourably of, but mercury was only useful when it affected the mouth, and it was a general remark that the gums were unusually insensible to the action of this mineral in the plague.

It is to be regretted that recent experience has not in any degree advanced the successful treatment of the plague. "In the beginning of the epidemy," says Clot Bey, "when the morbid cause acts with a rapidity so great that some hours are sufficient to compromise the life of the patient, every treatment, even the most energetic, is powerless to arrest the course of the disease. When,

however, the intensity of the disease abates we may hope for the recovery of the patient." Many will attribute this happy recovery to nature, but it can hardly be denied that nature may be greatly assisted by art. But what are the means to be adopted? This question is most embarrassing, for, consult twenty different practitioners, and each will recommend a different treatment. One relies, for instance, on narcotics, another on stimulants, a third is the exclusive partizan of bleeding, while a fourth cures all his patients by purging or vomiting, or both. The *Commission* state, "We believe every therapeutic means to have been absolutely useless in the plague, but that under the antiphlogistic treatment the largest number recovered."

The treatment of the *bubo* was first attempted by actual cautery or a blister, but the *Commission* appear to have afterwards abandoned this mode of treatment, and to have applied emollient poultices as a mode of favouring suppuration and of mitigating pain. As soon as matter was formed they immediately opened the tumor.

The treatment of the *carbuncle*, when benign, was also by poultices. If, however, the slough was deep, the part was cauterized down to the living flesh. When the mortification was of great extent, a circular incision was made in the integuments immediately round the tumor, and an iron, heated to a white heat, was introduced into the furrow. The subsequent dressing was lint steeped in the chloride of zinc, and when the part granulated up it was then dressed with a compress.

Dietetic Treatment.—The diet to be observed in the cure of the plague is very imperfectly laid down by the different writers who have treated on the subject; but no doubt it must be the same as that observed in other febrile disorders, namely, that the patient should rigidly abstain from all animal food, and limit himself to slops and a strictly vegetable diet.

Preventive Treatment.—The preventive treatment may be divided into the measures necessary for the protection of the attendants on the patients; into those which are necessary to prevent the introduction of the plague into any given city; and, lastly, into those which should be adopted, supposing that disease to have broken out in any town, city, or camp.

The only mode of preventing personal contamination is for the attendants on the sick to clothe themselves in oil-skin dresses, and to avoid all direct contact with the patient or with any article, whether of linen or of any other kind, that he may have touched, or which has been in any way in contact with his person. The atmosphere of a plague hospital was found, both at Malta and at Cephalonia, to be so little noxious that the attendants slept in the

wards with impunity, provided they secured themselves from all personal contact.

As to preventing the introduction of the plague into any city to which it is not native, it must be admitted there is no other resource than in quarantine, and the length of the quarantine should be the longest period of latency, *plus* the time it takes to overhaul the cargo. The longest period determined by Sir James M'Grigor for the latency of the poison is seventeen days, while the time taken to unload the cargo may be estimated about four to six days, making the longest necessary period of quarantine to be twenty-one, or at most twenty-four days.

When the army was in Egypt, a minute inspection was made of every corps and of every department twice a-week, and any person with the smallest appearance of ill-health was sent to the hospital; also every corps or hospital where a case of plague had appeared was put into a state of quarantine, and of such corps an inspection was made by the surgeons at least two or three times a-day, and every case with suspicious symptoms was ordered to the observation-tent or room, and on the plague appearing, such case was immediately sent to the pest-house. The men were likewise ordered to bathe frequently, and their clothes and bedding to be frequently washed and baked, while the quarters of the army were frequently changed.

Such are the preservative measures which have been raised as a barrier against the introduction of the plague into Christian Europe. "The dread of contagion," says Dr. Russel, "neither can nor ought to be eradicated from the mind of man."

Typhous Fever.

Under this title it is proposed to consider two of the "common continued fevers" which are of most frequent occurrence in this country, in France, in Germany, and in America. There are two forms of *typhous fever*, distinguished by the names of (1.) *typhus fever*, or simply *typhus;* and (2.) *typhoid fever*, or as it has been proposed to be called by Dr. Wood, *enteric fever*. Much has been spoken and written about the identity and non-identity of these two forms of fever,—a sufficient evidence of the great similarity between them.

In the following pages it is proposed to treat of each, separately, as far as their symptoms are concerned; because it is of importance to diagnose, if possible, in practice between them, but believing that they are identical in their pathology. Many practitioners of medicine consider these two forms of *typhous fever* to be entirely distinct and different diseases, specifically; a belief which is the more readily entertained, because they find that they must adopt

a marked difference in the treatment of the fever, according as they are able to diagnose the existence of the *typhus* on the one hand, or the *enteric* (*typhoid*) form on the other.

Others again (and some of these the most eminent pathologists of the age), consider the two forms of fever now noticed, as constituting varieties of one and the same morbid state; brought about by the zymotic-like development of one and the same poison; and to which the name of *typhus* has been applied on account of the condition of "stupor" (τυφος), which gives a common characteristic to both the affections.

If we are to trust to books alone for a knowledge of *typhous fevers*, we are not likely to acquire ideas of a very definite or fixed description regarding them. Very great differences as to doctrine prevail amongst those who teach the practice of medicine, concerning these forms of disease. Having had very extensive opportunities of making myself practically acquainted with the various phenomena of *typhous fevers*, both in this country and abroad, I shall endeavour to record such doctrines only, as I believe to be most consistent with general observation, and most extensively applicable.

General Pathology of Typhous Fevers.

So varied and modified have been the forms under which I have seen the *typhous* poison develop itself, that the opinion taught me in early student days has been strengthened and confirmed by subsequent study and research; namely, that the pathological nature of *typhus* and *typhoid* or *enteric fever* is identical; but that it is of the greatest importance in practice to distinguish between the two forms, if possible, and to modify the treatment accordingly.

Every medical practitioner will admit that cases do occur in which it is not possible to say whether the fever is of the *typhus* or of the *typhoid* form; and when a decided diagnosis has been made, in such cases, subsequent *post mortem* results have not unfrequently reversed the opinion formed of its pathology. Two explanations are given of the existence of such cases. One is, that two diseases are combined in consequence of the simultaneous action of their causes, assumed to be different in each. The other explanation is, that one and the same cause, namely, the *typhous* poison has produced *a disease*, the symptoms and local manifestations of which are at once those of *typhus* and *enteric fever;* that there are no symptoms of sufficiently fundamental importance to ground a distinction upon; and that the morbid changes are a combination of the *typhus* and the *typhoid* forms of the affection. In general, however, and in perhaps the greater number of cases, during some epidemics in some countries, there is little difficulty in making a diagnosis

accurately between the two forms now about to be considered; yet still, there are a great number of cases which, undoubtedly, remain obscure; and whose precise pathological characters are never determined with certainty, because they have the good fortune to recover.

The most eminent French, British, German, and American physicians have now generalized the phenomena of typhous fever, and have determined with great accuracy the forms and conditions under which it manifests itself in various epidemics, countries, and individuals. To Louis especially is due the merit of having drawn special attention to the subject. In this country we have the classic records of Dr. Jenner and Dr. Parkes of the London University, and Dr. A. P. Stewart of the Middlesex Hospital, London, together with those of Dr. Bennett of Edinburgh, and Dr. Graves and Dr. Stokes of Dublin. In Austria we have Professor Rokitansky, who has put the pathology of *typhous fever* on an extensive and sound foundation, together with Professor Virchow's researches, and those of Dr. Lindworm of Munich. In America, we have the observations of Dr. Bartlett, Dr. Jackson, and Dr. Wood of Pennsylvania; and, in Sweden, of Dr. Huss.

About sixteen years ago, the question as to the identity or non-identity of the two forms of fever first began to be actively investigated; and at that time the state of the facts and opinions with regard to the question, are to be gathered from the works of the day which then attracted special notice, an account of which may be seen in the twelfth volume of *The British and Foreign Medico-Chirurgical Review.*

In the study of *typhous fever*, and indeed of *fevers* generally, it is to be observed that the disease may run its course, and destroy life, without leaving any trace of its existence. In such cases the most careful observer will fail to find any anatomical change. During the life or existence of fevers of a specific type, however, there is always a tendency to the production of secondary lesions. In *typhous fever* this is more particularly the case, and the lesions or deposits which may occur are always secondary to the fever, and occur during its progress, without any inflammatory action in the first instance, although the presence of such deposits, like a foreign body, may establish all the subsequent phenomena of a local inflammation. The character of the *typhous fever* is now known to be very much influenced by the position and nature of these local lesions. The subsequent progressive changes in them towards elimination, may produce death in various ways, according to the function of the parts involved. It has also been very justly taught that the *typhous* poison is capable of producing local symptoms, of a most marked and severe nature, without local change.

Geographical Position has considerable influence upon the char-

acter and form of *typhous fever;* and, in some degree, the characters of the fever may be said to be peculiar to the country. As a rule the *typhous fevers* appear to belong exclusively to the north temperate zone, and even here they are not developed in their regular phenomena in the extreme latitudes. In Ireland, maculated *typhus* has, hitherto, been much more common than in England. In France, again, the maculated form gives place to that form in which a local lesion of visceral parts becomes almost a constant complication. And it cannot for a moment be doubted that climate, diet, soil, race, and temperament, exercise an influence which cannot yet be defined in modifying the forms of *typhous fever.* Dr. Stokes relates how a native of France, after a long exposure to contagion in Ireland, contracted the maculated *typhus* there; but its progress was marked by a succession of symptoms widely different from those seen in the spotted *typhus* of the country. He was profusely maculated; and the peculiarity of his case consisted in the irregular manifestation of various local symptoms, and a tendency to remission of the symptoms of excitement and collapse. At Scutari and Constantinople the author saw numerous cases of a like description in 1855; and there is no doubt that the many different descriptions now being given of the *typhous fever* of the army in the East, is owing to the circumstance that the *fevers* were often of a mixed nature as to their lesions and progress; and that they were composed of the elements of the *typhus* and *typhoid* phenomena, combined with remittent symptoms often of diurnal recurrence. Masses of men being then moved from place to place, with a quickness unknown in former times, carried with them diseases of distinct forms, which became modified by the circumstances of the place in which they were subsequently developed; and so the *typhous fevers* spread in still more modified forms.

The Peculiar and Modified Forms of Typhous Fever are those in which while maculæ or petechiæ do not exist (the skin in fact being unaffected), the surface exhales the odour peculiar to typhus, and there is prostration to the last degree, the action of the heart becomes feeble, the intestinal and the pulmonary mucous surfaces show symptoms of local complication, the lips and teeth become coated with sordes, and the tongue is black, dry, and cracked. The breath is fetid, and while the stethoscope indicates a general and severe bronchial affection, there is also a wasting diarrhœa. Such cases are full of the *typhous poison;* but, whether an individual with these symptoms will be called a *typhus* or a *typhoid* patient, is a difficult point for those to decide who wish to distinguish two different diseases. The eruption on the skin is to be looked upon as a local alteration in *typhous fever*, and which, like the other local lesions, may be absent or present; and such absence or presence is

sufficient to justify a certain line of distinction being drawn between the resulting forms of the *typhous fever*, just as thoracic or abdominal local lesion warrants us in doing. Neither the skin eruption, however, nor any other local lesion, is distinctive, alone, as a mark between two different diseases. There is the greatest inconstancy in different epidemics, and in different patients during the same epidemic, as to the seat, the amount, the time of appearance, and the results of these local lesions. The cutaneous eruption is one of the group of secondary affections, and its absence or presence can no more be said to distinguish the disease, than the absence or presence of any of the other secondary affections (Dr. Stokes, *Med. Times*, p. 423, for 1854). These secondary affections appear to bear the same relation to the general *typhous* state, and to the fever, that the sore throat of scarlatina or the eruption of small-pox bears to the fever of these specific diseases.

The Cutaneous Eruption as a secondary affection in *typhous* fever presents very various forms, as follows :—

(1.) *Rose spots* peculiar to the *typhoid* form, the *taches roses lenticulaires*, of Louis. They consist of slightly elevated papulæ, or pimples ; but to detect their elevation, the finger must be passed very delicately over the surface of the skin ; because although pimples, they are not hard, like the first day's eruption of small-pox. Their apices are neither acuminated nor flat, but invariably rounded, and the bases gradually pass into the level of the surrounding cuticle. They are circular and of a bright rose colour, the colour fading insensibly into the natural hue of the skin around; and the margin is never well defined. *They disappear completely on pressure*, resuming their characteristic appearances as soon as the pressure is removed ; and this is a character they preserve from their first appearance to their last trace. They leave no stain, pit, or scar behind. They vary in size from half a line to a line and a-half in diameter; the mean dimension is however the ordinary size. The ordinary duration of each papula is three or four days, and fresh ones generally make their appearance every day or two after their first eruption. Sometimes only one or two are present at first, after which one or more fresh ones make their appearance. The eruption of such spots does not consist of a great number generally, only from six to twenty or a hundred. They occupy usually the abdomen, thorax, and back, but are sometimes present on the extremities. They usually appear between the seventh and fourteenth day of the disease (Dr. Jenner).

(2.) The *maculæ* or *mulberry rash* peculiar to the typhus form. On the first appearance of this eruption it consists of very slightly elevated spots of a dusky pink colour. Each spot is flattened on the surface, irregular in outline, with no well defined margin,

but fades insensibly into the hue of the surrounding skin; *disappears* completely on pressure; and varies in size from a point to three or four lines in diameter. The largest spots appear to be formed by the coalescence of two or more smaller ones; and the shape of the larger spots is more irregular than the smaller ones. After one, two, or three days, these spots undergo a marked change. They no longer remain elevated above the surrounding cuticle, and their hue becomes darker and more dingy than at their first appearance; their margins become more defined, especially on the posterior surface of the body, and they now only fade on pressure, they cannot be entirely obliterated, but a stain of the cuticle remains to indicate where they are. A still further change may take place. The centres of the spots may become dark purple, and remain unaltered by pressure, although their circumferences may fade; or the entire spot may change into a true petechia, becoming of a dusky crimson or purple colour, quite unaffected by pressure, with a well-defined margin, and level with the surface. The spots of such an eruption are generally very numerous, close together, and occasionally almost covering the skin. Sometimes, however, they are very few in number, and situated at some distance from each other; and not to be distinguished at first from the *rose spot* eruption. The *mulberry eruption* usually occupies the trunk and extremities, but is occasionally limited to the trunk, and may now and then be observed to extend to the face. After the first, second, or third day after the eruption is apparent, no fresh spots appear, and each spot remains visible from its first eruption till the whole rash vanishes. When very numerous, the eruption, viewed as a whole, has not an equal depth of colour. Some places are much paler than others, and the spots have a dull appearance as if seen through the cuticle. A mottled aspect is thus sometimes given to the skin, on which ground the darker spots are seated. From this circumstance, the eruption sometimes resembles *measles* so closely, as to be distinguished with difficulty from the eruption in that disease. When the spots on the back are of a much deeper hue than those on the anterior surface of the trunk, the skin is at the same time so much congested at the back that slight pressure with the finger leaves a white mark, which slowly returns to its dusky red colour. The eruption of the mulberry rash usually appears from the fifth to the eighth day of this disease, and subsides between the fourteenth and twenty-first days (Dr. Jenner).

(3.) An eruption of vesicles not peculiar to either form, sometimes called "*miliary* vesicles" or "*sudamina*." Sometimes, however, such vesicles become hard at the top, then black, and then the mass drops out as a slough; leaving a circular ulcer of the skin as if punched out with a gouge. Such a vesicular form of eruption

is an important prognostic of an unfavourable character (Dr. Stokes).

Thoracic Phenomena, as secondary affections in *typhous fevers*, also present very various characters. When the symptoms of such phenomena present themselves, we have a livid countenance, difficult breathing, and the conditions which result from imperfect arterialization of the blood.

In the *typhoid* form there has been observed, mottled congestion of both lungs, passing in some cases to extensive consolidation of the pulmonary tissue. The consolidation may be granular in distinct and well defined patches, at other times the limiting margin to the exudation is not well defined. The general appearance is like that of the second stage of pneumonia. For the most part, in many cases, the exudation is more or less symmetrical when opposite sides are compared.

In the *typhus* form of the fever there has been observed, congestion of the lungs, especially posteriorly, and for the most part combined with diminished consistence of the congested parts. The exudation, often of an abundant serous nature, infiltrates the tissue.

In both of these forms of *typhous fever*, and not peculiar to either, the extent of these lesions varies from the implication of a lobule to a lobe.

During the course of *typhous* fever, there is also another form of exudation into the pulmonary substance, to be described, and which is also not peculiar to either form, but common to both. It is what has been termed *non-granular consolidation*, dependent for its origin, modification of form, and development on a specific cause: and it may be observed not only in the course of *typhous fevers*, but also in *measles*, *scarlet fevers*, and *small-pox*. A portion of the lung in this condition has a mottled aspect. There are patches in it here and there, varying in size from a single lobule to half, or more than half of a lobe, of a deep bluish, chocolate, violet, or purplish-slate colour, bounded by a well defined angular margin, and crossed and mapped out into smaller patches, by dull opaque whitish lines. These are seen to be thickened into lobular septa. Scattered in the midst of the larger patches, one or more comparatively healthy lobules are frequently found, of a pale brightish pink colour, contrasting strongly with the hue of the surrounding tissue. The pleura which covers the part may have a slight milky-like aspect (Dr. Jenner).

The tissue of the darker portions appears tougher than in health, presenting nearly a uniform section; there is no appearance of granules, and the part sinks in water. Dr. Jenner has injected such morbid lungs, and found that occasionally the centre of the

lobule is really the point at which the diseased action is first set up.

In ordinary idiopathic exudations into the substance of the lung, we are able to trace by the microscope the organization of the product through the most perfect forms of cell development. But the specific nature of the *typhous* poison exercises such a modifying influence over the elementary forms which the exudations assume, that organization is much less complete, than that which occurs in the exudation of a common idiopathic pneumonia. The organization of a *typhous* exudation in the pulmonary tissue, is composed of imperfectly developed cells, molecules, and granular matter. Subsequently, softening and disintegration of this deposit takes place, and not unfrequently there results partial or complete death of the involved textures. Generally the specific gravity of the part is greatly increased (1·040 or more); and the texture becomes more friable, except in the non-granular forms of the exudation. Its colour is generally slate-gray or fleshy, and when the deposit is characteristic, it is most commonly limited by a vascular boundary, forming a distinct line of separation between comparatively healthy texture and local lesion. A distinguishing feature in the exudation is the imperfect power of organization which it displays. Molecular and granular matter, associated with particles of fat in unusual abundance, are all the morbid changes that can be detected. Fat is an invariable constituent. Round, irregular, and easily dissolved cells, are the highest forms of organization found in such deposits.—(*Edinburgh Medical and Surgical Journal*, No. 178, p. 31.)

The Abdominal Complications of typhous fever are those to which of late years most attention has been bestowed; and more especially the *enlargement of the mesenteric lymphatic glands, with ulcerations on the mucous membrane of the alimentary canal, and enlargement of the solitary and aggregate glands of Peyer, followed by ulceration.* This lesion in the ileum is diagnostic of the *typhoid* form of the fever. In this form of the fever, ulceration on the mucous membrane of the alimentary canal occurs in the *pharynx*, in about one-fifth of the cases. In the *larynx*, it is less frequent, and in the *œsophagus* about equally less. Occasionally, yet rarely, ulcers are found in the mucous membrane of the stomach, and still more rarely in the duodenum.

Regarding the diagnostic lesion found in the ileum,—consisting of the affection of the solitary and aggregate glands of Peyer, the following remarks may be made. The patches next the ileo-cœcal valve, while they are the largest, are also the most extensively ulcerated; and the thickening and ulceration of these bodies diminish as they recede from that situation. Two varieties in the affection of these glands are observed. In the *first*, the mucous and the sub-mucous tissue is thickened, so that the whole patch

is raised considerably above the level of the adjacent membrane. The mucous membrane of the patches farthest removed from the ileo-cœcal valve is rugose, or as it were pitted all over. The ulceration in the patch is the more marked as the latter is situated nearer to the cœcum. At a variable distance above that viscus, the agminated glands are found ulcerated, the ulcers increasing in depth and in extent as they approach the termination of the small intestine. In the *second* form the thickening of the patch appears due, chiefly, to a deposit of yellowish-white substance in the submucous cellular tissue, splitting it, as it were, into two layers. The patches sometimes stand as much as a third of an inch above the surrounding mucous surface. This form of thickening is also followed by ulceration. The solitary glands at the lower part of the ileum are also frequently enlarged and ulcerated. Ulceration of the mucous membrane of the large intestine, generally of the adjacent parts of the cœcum and colon, is present in about a third of the cases of the *enteric* or *typhoid* form of fever. The mucous membrane of the gall-bladder, the urinary bladder, and the vagina, are in rare instances the seat of ulceration. The mesenteric glands are constantly affected, and the most extensively diseased are those seated next the termination of the ileum. They are invariably enlarged, reddened, and softened, varying in size from a bean to a pigeon's egg. Sometimes all the lymphatic glands are more or less affected (Dr. Jenner).

Such are the more obvious secondary affections which may develop themselves during the progress of a *typhous fever*, and the derangements which these give rise to constitute new phenomena in its course. In some severe cases, however, the fever may destroy the patient in a few days, without leaving a trace of organic lesion in any part of the body.

It is also well known, that the existence of local symptoms in *typhous fever*, do not necessarily imply the existence of any anatomical change. There may be pain of the head and delirium without cerebritis; cough, and dyspnœa, without pneumonia; vomiting, purging, and meteorism, without the enteric lesion. These secondary affections just noticed, all arise after the fever has existed some time; and it appears now to be pretty well established that the intestinal deposit at least, is a special *typhous* deposit, which, in cases of recovery, follows first a progressive or developmental course, and afterwards retrogrades; just as in variola we first observe the development and maturation of the pustule, and subsequently its disappearance. The same may be said of the other local lesions in typhous fever, although the existence of a special deposit is not yet so fully established in the case of the thoracic and cerebral lesions, or in the parenchymatous as compared with the

mucous structures of the intestine. Still, it is believed, that an action more or less analogous to that which occurs in the *glands of Peyer* and *the minute solitary closed glands of the ileum*, occurs also in all the secondary lesions of typhous fever in other parts (Dr. Stokes.) The specific character of the deposit cannot be shown to the eye even by microscopic examination. There is nothing in it to distinguish it from other elementary morbid products which are deficient in the power of organization. Dr. Stokes gives the best illustration of its vital specific attributes, in the absence of any *physical* specific character. He says, if two specimens of pus be taken, one from a pustule of variola, the other from an ordinary ulcer; although they may appear similar, they have separate and different *vital* characters. So has the typhous poison a specific *vital* attribute peculiar to itself.

This typhous poison having been absorbed and mingled with the blood, lies latent a certain period, after which it primarily induces certain changes in the blood, immediately followed by derangements of function of the great nervous centres. The fact is admitted to be indisputable, that the fever-making cause enters the blood in the first instance; and in those cases which end soon, and fatally, without organic lesion of any organ sufficient to account for death, the blood deviates in its most striking physical characters from healthy blood. In such cases, evidence of this is seen in the petechiæ and staining of the skin, from the non-coagulable solution of the hœmatosin which escapes into the cutis.

In *typhous* fevers the microscopical characters of the blood are often such as to prove a marked deviation from its normal state; amorphous heaps of red discs replace the normal rouleaus, and the adhesion of the red discs to each other, in the imperfectly formed rouleaus, is far less complete and long continued than in healthy blood. The red discs part with their colouring matter more easily, and dissolve more rapidly than they do in their normal state. This is shown by the red serosity found in almost every serous cavity, the deep dusky red hue of the flesh, and of every structure in contact with the blood. The blood drawn during life, or found after death in the vessels, is loosely coagulated or absolutely fluid (Dr. Jenner).

The poison, however, does not necessarily make itself manifest through all the series of local secondary affections already referred to, but often exhausts itself on one or more of the structures noticed. Thus, in one year the lungs will be attacked in every case; in others, the membranes of the brain; and in others, the alimentary canal; while in other years such attacks will be rare,—the exception and not the rule of the disease. The order, also, in which the organic lesions are set up varies much in different years. Sometimes the membrane of the brain will be first affected—at others, the

tissues of the alimentary canal; and at others, the substance, or other parts, of the lungs. Such irregularities are common to all morbid poisons, and many years must elapse before the relative frequency and order of their occurrences can be determined, and this intricate problem of pathology unravelled.

In their seat, as well as in their nature, these local lesions during the progress of *typhous* fever, are observed to vary in different countries. On the Continent, at least in France and Germany, the frequency, and probably the preponderance of the secondary diseases of the intestines, is admitted to be a constant feature.

In England, we do not find this preponderance towards the development of the enteric lesion to be so remarkable; but it varies in different parts of Great Britain, and at different periods during prevailing epidemics. In London, for instance, from 1813 till 1832, scarcely a case of fever was examined in which the follicles of the alimentary canal were not found ulcerated, or in various stages of the *typhous* state. In 1832, however, when the cholera appeared, the enteric lesion in *typhous* fevers almost ceased to appear; again in 1837-38, the follicles and the mesenteric glands were commonly affected.

In Ireland, also, there have been epidemics of *typhous* fevers in which the enteric lesion prevailed to a remarkable degree. For example, in 1826-27, and 1828, diseases of the mucous glands of the intestine were so frequent, that its existence might be held to be the rule, and its absence the exception. It is also true that intestinal ulcerations have been repeatedly observed in the maculated *typhous* of Ireland, their amount and frequency varying with the epidemic influence (Dr. Stokes and Dr. Cheyne in *Dublin Hospital Reports*). While the causes or combinations of circumstances, producing the fever, are as constant as can be ascertained to be, the epidemic characters of the fever have varied. Each epidemic has had a special and predominant character. Thus the one alluded to, of 1827-28, was very different from the epidemic which preceded it in 1818, and those which followed it in 1836-37.

In Scotland the enteric affection in *typhous fever* has been hitherto rare. In the epidemic of 1846 and 1847, the thoracic complication was the most frequent next to the deposit in the spleen, which was so generally noticed.

Of the two forms of *typhous* fever (founding the distinction on the absence or presence of *enteric* local lesions), it is a general rule that the *typhus* form is the one most common in this country, and the *typhoid* is the form most common in France and Germany. Both forms, however, have been seen on the Continent, and both forms are seen in this country, and we also find that the same groups of

general functional derangements attend both maladies, apart from the influence of local lesions.

If the symptoms which pertain to particular organs or systems be made the subject of inquiry, no fundamental distinction of moment can be observed in the one form of *typhous fever* that is not observed in the other. The only difference of moment is found in the condition of the intestinal canal and skin. The diarrhœa, the abdominal pain, and the meteorism of France are scarcely met with amongst us, and the eruptions differ in some marked features. But such difference is what ought to be expected physiologically. Taking the cases as a whole, it is to be observed that, while the intestinal lesion is usually absent (the rule in this country), the cutaneous eruption is extremely general and extensive; whereas, when the abdominal complication is almost invariably present (as in France), the eruption is limited in extent, modified in form, and slight in degree. Considering, therefore, the well known reciprocity of function between the skin and the intestinal canal, it is not unlikely, that in a disease of this general and specific character, the lesions of those systems are supplementary of each other, just as the natural functions of these systems are sometimes vicarious.

The frequency, however, with which the lungs are attacked during *typhous fevers* varies greatly in different seasons. Some seasons will pass with scarcely a single case of this action of the *typhous poison*, while in other seasons every case of fever will show more or less affection of the lungs. The bronchial membrane and the substance of the lungs are the parts affected; but the former is most frequently attacked, and is the seat of the exudations already noticed.

The parts which are the most important, as well as the most frequent seat of the action of the *typhous poison*, next to the thoracic and abdominal parts, are the brain and its membranes. Diseased function of the brain, as delirium, exists in five cases out of every six in *typhous;* but delirium of the most marked character is often unattended with any trace of inflammation, either in the membrane or of the brain itself. Dr. Tweedie states, that he examined fifty-four cases that died with well marked symptoms of cerebral affection, yet, in fourteen cases no trace of disease of the brain or its membranes could be found. When the brain is affected, it is generally found to be abounding with more points of blood than usual; a state of parts supposed to indicate diffuse inflammation of that organ. Some small portions at its surface, also, are sometimes softened; but in other respects the brain is healthy. Its membranes are much more frequently diseased than its substance, and are the most specific seat of the poison in the course of the fever; they are liable to all the degrees of inflammation to which they are subject from other causes. The serous form of exudation, how-

ever, is the most common, and the quantity of fluid effused varies from a drachm to an ounce or more, and this is generally mixed with points of lymph or pus.

Causes of Typhous Fevers and Modes of Propagation.—The *typhous* forms of continued fever seem capable of being produced by a great number of causes; or by the combination of a great variety of conditions. It is one of the most important and interesting facts connected with the pathology of continued fever, that the same exciting cause (at least as far as our knowledge of the nature of it goes) is capable of producing different kinds of fever in different persons. One and the same set of combined conditions will in various persons produce the two forms of *typhous* fever; and it is not possible in the present state of our knowledge to define those conditions which will give rise to *typhous* on the one hand, or *typhoid* fever on the other. It is not, therefore, competent for us to make causation a ground of distinction between those two forms of *typhous* fever. We cannot say that a certain cause produces *typhus*, and a certain other and different cause produces *typhoid*. Causation is a ground of distinction, between the two, upon which much stress has been laid by Dr. Jenner. He has made the subject one of special inquiry, the results of which are detailed in an admirable paper in the thirty-third volume of *The Medico-Chirurgical Transactions*. He argues that the material media by which the two forms are propagated are specific and different from each other, according as they are generated by the bodies of those affected with the one or the other form of *typhous* fever. This argument is based upon the fact, that because *certain local foci* send *typhoid* cases to the hospitals, and *certain other local foci* send *typhus* cases there, he therefore infers that different specific causes exist in each focus. But, we know it has happened, and does happen in camps, that cases both of the *typhus* and the *typhoid* forms have come from the same locality and within the same radial limits. We also know that in epidemics where the *typhoid* form prevailed, as in 1827 and 1828 in Ireland, the experience of Dr. Stokes led him to say, "that the attendants on the sick, when they were themselves attacked, presented in more cases than one the symptoms of the genuine *typhus* form. In the Report upon the epidemic fever of Ireland, during 1847 and 1848, it is also on record that cases of the *typhoid* form of fever occurred from the contagion of *typhus* (*Dublin Journal* for 1849). Now, so long as it is not possible to define the specific causes which give rise to the different forms of *typhous fevers*, and say what they are, which produce either the one or the other form, it is not competent to assign causes, *specifically different* from each other, as the origin of two forms of fever which, for that reason, are held to be distinct and specifically different diseases. It is to be hoped that chemistry

nay yet do much to explain the nature of the cause of fever. Dr. Letheby, in his last report on the sanitary state of the city of London, says,—"That so close and unwholesome is the atmosphere of some of the rooms that, by chemical means, I find it is not only deficient in the due proportion of oxygen, but contains three times the usual amount of carbonic acid, besides a quantity of aqueous vapour charged with alkaline matter that stinks abominably; doubtless the product of putrefaction, and of the various fetid and stagnant exhalations that pollute the air of the place."

It is also now a well established fact, that the *typhous poison* is generated in situations where human beings are crowded together, with insufficient or unwholesome food, and in a confined and vitiated air, and in which filth from excretions of man or beast, or both, are allowed to accumulate. It is also considered, that patients congregated together, amongst whom dysentery, diarrhœa, and hospital gangrene prevail, are more apt to generate the *typhous poison;* a fact of which we have had melancholy proof in the bitter experience of the Scutari hospitals during the late war; and the Viennese, in their military hospital, as Dr. Haller tells us, suffered in a similar manner. Under such circumstances, both forms of the disease prevailed; and its appearance is thus common in camps, prisons, ships, hospitals, and garrisoned towns. It usually prevails among the lowest and most filthy people who inhabit the cellars, the lanes, the closely built localities, and the vilest purlieus of cities. They are the fevers of the poor rather than of the rich. Dr. Baillie stated that, in his extensive private practice, he had scarcely met with an instance of typhus fever, and this in seasons when the *poor* were falling in large numbers. The physical condition, the many privations, and the mental sorrows of poverty, are among the most powerful predisposing causes of *typhous fever;* and when, in addition to these, bad draining, defective ventilation, bad supplies of water, increased filth, and overcrowding are present, the mortality is often frightful. In Ireland, from the year 1721 to 1728, there was scarcely a case of fever; but after the latter year, three bad harvests occurred in succession, and provisions rose to an extravagant price, and now fever broke out and continued to be epidemic till 1732. The year 1739 was also one of great scarcity, and fever again broke out and continued to prevail with such virulence, that in 1741, 80,000 persons are estimated to have died in Ireland from this cause alone. In the year 1800 there was a similar scarcity, and a similar prevalence of fever; and again in the year 1816, not only a year of famine, but of great commercial distress, fever again raged to a most distressing extent, not only in this country but even in a great part of Europe. The "famine fever" of Ireland of 1846–47 will be long remembered.

Armies on actual service are exposed for a time to almost all the

severest privations of civil life, together with the addition of great fatigue; and the history of every campaign in Europe has shown that no sooner has the army entered into winter quarters, than, with hardly an exception, fever, of a most destructive nature, has broken out among the troops, spreading along their communications, and devastating long lines of country.

The history of Napoleon's campaign, which terminated in 1807; the campaign of Moscow; the Turco-Russian campaign of 1828–29; the influence of the Bulgarian residence for three months on the health of our army in the Crimea in 1854–55 (see a paper by the author in *Glasgow Med. Journal* for July, 1857); and the records of the Scutari hospitals, all furnish melancholy episodes illustrative of the rise and devastating progress of *typhous fevers.*

"Independent of contagion, we must believe," says Dr. Stokes, "that the causes of fever are various in the extreme, that they are probably numerous and complicated, acting in combination rather than singly, and varying in their effects not only in consequence of their own properties and combinations, but also as regards the condition of the individual in whom the fever is developed." Age, constitution, especially nationality and mode of life, particularly as to food, are important elements in determining the form of fever. As to age, it is known that, while all ages may take the *typhus* form of fever, beyond fifty years of age we never see the *typhoid* form developed; and it is rare beyond the age of forty years. In childhood and youth it is very common, and the age at which the *typhoid* form is most common is about *twenty-two.* Now, we also know, that the follicular glands of the intestine are most active in youth, up to the age of manhood; and also that *Peyer's patches* and the *minute solitary closed glands of the ileum* do not exist after about *forty* years of age. Their functions, whatever they may be, for they are unknown, are no longer in action. The gland substance (whose structure has been so well described by Dr. Allen Thomson, Kölliker, and Boehm), no longer exists, and the place where it once was, may be observed only upon careful examination. A mark of varied form and character, well known to the practical anatomist, may indicate the place of the patch or spot. There is therefore an anatomical reason for the *enteric* form of *typhous fever* never existing beyond *fifty* years of age, and seldom after *forty.* Dr. Wood has attended one female who died in her *fifty-fifth* year of this form of fever. In Dr. Jenner's experience, three cases only have been treated for *typhoid fever,* more than *fifty* years of age; namely, one at the age of *fifty-one,* and two at the age of *fifty-five;* and he also says that the rarity of the *typhoid* form of fever after *fifty* years of age is a fact confirmed by every observer of the disease.

The constitution, especially peculiarity of nation, exercises an influence in modifying the forms of the fever which arise from one

and the same poison. Dr. Stokes has shown in this country how an Irishman and a Frenchman do not exhibit *typhous fever* in similar forms when received from the same contagion, especially when the foreigner has not long been a resident in the place (*Med. Times*, April, 1854). Instances of the same kind were also to be seen in the French and English hospitals at Scutari and Constantinople during the late Russian war. *Typhous fevers* prevail at all times of the year, but more so perhaps in winter and autumn.

Climate and Geographical Position have much influence in determining the existence of such fevers. *Typhous* fevers prevail not only in Great Britain but likewise over a great part of the north of Europe. Indeed its range may be said to be limited to the space between the 60° and 44° of north latitude, for it is little known to the south of the Mediterranean and towards the equator. In North America typhous fevers diminish in frequency beyond the parallel of 45° north, and their limits in this hemisphere are between the parallels of 32° and 48° north latitude, or between the mean isothermal curves of 48° and 52° Fahr.; but in places where the mean annual temperature rises above 62° or falls below 40° Fahr., such fevers prevail but little in either continent. The *typhous* poison appears, therefore, to have a fixed local habitation on the globe.

Modes of Propagation.—When once the *typhous* poison is generated, from whatever cause, it propagates both the *typhous* and the *typhoid* forms by infection and contagion.

The proof of the infectious nature of the typhous poison may be illustrated by the fact, that in hospitals we occasionally see patients under treatment for other diseases becoming affected with *typhous fevers* from their proximity to a person suffering from the disease, notwithstanding measures having been taken to prevent contact with the infected person. Such instances of the infectious nature of typhous fevers seldom extend to other persons in the same building beyond the ward.

The distance to which the miasmata may extend around the patient's person so as to communicate the disease is not accurately determined. Experience, however, has shown that in a large well-ventilated ward a clear space of three feet around the patient's bed so dilutes the poison that the disease rarely spreads. When, however, three, four, or more fever cases are collected in the same ward, nobody in that ward is safe if the ward is a small one, and patients the most remote from the diseased person will take the disease. It is under these circumstances that students, nurses, and hospital attendants of every kind constantly fall from fever in large numbers.

Both forms of *typhous* fever have been proved to be contagious; although it is believed that *typhoid fever* is less so than *typhus*, at least in this country. We have no measure, however, of the in-

tensity of that property. All we can say is, that fewer appear to take *typhoid* fever in this country, from known foci of contagion, than take *typhus*. But towards the southern limits of its geographical range, this appears to be reversed. The proofs of the contagious nature of the disease are numerous. They chiefly consist in the fact that nurses, medical attendants, or others who are brought in contact with the sick are often attacked without any other known cause; and by "*fomites*" without any other connection with the patient, we also find that *typhous* fevers are propagated. Laundresses at fever houses, who wash the clothes of fever patients, take the disease in large numbers. The persons also employed to take care of the clothes of the soldiers sent to the Hopital Salpêtrière, labouring under fever, in the disastrous campaign of 1814, fell ill of that disease in great numbers. Another satisfactory proof of the contagious nature of the disease by "*fomites*," is the endless succession of persons seized with fever in the lodging-houses for the poor throughout the country, caused by the miasmata, as is supposed, adhering to the walls and furniture of the room.

The poison is said to remain active as "*fomites*" for a period extending to at least three months. In ordinary circumstances, when the epidemic constitution favourable to *typhous* fevers does not prevail, the contagious property from a single case does not seem to be powerful, less so at least than the contagious property of small-pox and some other similar diseases.

Latent Period of the Typhous Poison.—The length of time between exposure and attack is not determined. Some persons have sickened immediately on entering the chamber of a person ill of fever, and others have vomited on examining the fæcal matter passed, and have at once been taken ill of the fever; but in general the period is much longer, and its extremes may be stated at from two days to two months. Some are even longer exposed. In my own experience, I was three months in close attendance daily for many hours on cases of *typhous* fever before taking the disease; and many appear never to become susceptible to its influence, although equally exposed. The period of incubation may be stated at from one to three weeks.

Co-existence of Typhous Fevers with other Diseases.—It is not unusual to witness the combination, in the same person, of *typhus* and *typhoid* fevers, with syphilis, or with erysipelas, or with itch. Such fevers, therefore, may co-exist with many other affections depending on morbid poisons.

Prognosis.—The prognosis to be formed of *typhous* fevers varies greatly according to the circumstances in which the patient is placed, and to the severity of the type and the epidemic constitution. Desgenettes says, of 25,000 men who reached Torgau in 1813, after that disastrous campaign, 13,448 perished of typhus in four

months. At Mayence, says M. Fauverge, of 60,000 troops, 25,000, or $\frac{5}{12}$ths, died of typhus. In France, it is estimated that from one in three to one in four and a-half is the proportion of deaths to attacks. In this country, it is calculated that only one dies in six or seven of those attacked. In some years, however, when the fever is mild, the recoveries are much larger; while in years in which the type of the fever is low, the ratio is much smaller. Age has a great influence over recovery. The risk of life in fever is twice as great at thirty-one as at eleven years old; twice as great at forty-one as at twenty-one; and five times as great at sixty-one as at eleven years. The following table, however, from Mr. Watt's inquiry into the mortality from fever, in the great towns in Scotland, is a nearer approximation to the solution of this problem :—

There died per cent. of those attacked in the towns of	Under 10 years of age.	From 10 to 12.	Above 12.
Edinburgh,.....	12 per cent.	... 29	... 70
Glasgow, ...	12 —	... 29	... 70
Perth,.....	15 —	... 30	... 69
Dundee, ...	19 —	... 51	... 48

Dr. Jenner says that the mortality of *typhus* fever is much greater at an advanced period of life than before forty. It is rarely fatal till after puberty. One in twenty-three is the average mortality estimated by Drs. Barker and Cheyne. In the *typhoid* form, on the contrary, about twenty-five per cent. of those who suffer between the ages of six and fifteen years die. One out of seventeen is the average estimated by Dr. Wood.

Duration of the Attack of Typhous Fever.—The mean duration of the illness in the two forms of this fever is a topic which has received considerable attention; and the conclusions arrived at, are capable of being variously interpreted.

Dr. Stewart and Dr. Jenner state the mean duration of *typhus* to be twenty-one days.

With regard to *typhoid* considerable differences of statement are to be found; a circumstance not to be wondered at when the nature and seat of the pathognomonic lesions of this form of fever are recognized as influencing the duration of the illness.

Dr. Shattuck assigns the mean duration of *typhoid fever* to be	22 to 24 days.
The mean duration of the Parisian cases of 1839-40 were.....	19·6 ,,
Dr. Jackson's experience in America gives.....	22 ,,
Dr. Jenner's experience in London leads him to give	30 ,,

The mean of these varied statements gives twenty-three days.

It is now well known, that during the progress of this form of *yphous* fever there is a repetition of the development of exudation

in the individual gland follicles of the intestine, and consequently a succession of retrograde metamorphoses; so that in many extreme cases of this *typhoid* form, it is not unusual to have the malady prolonged throughout a course nearly double as long as that of *typhus;* and that undoubtedly the influence of the secondary local lesions of *typhoid* fever is great, in protracting the disease; thereby tending to give a very indefinite idea of its duration: and as Dr. Jenner has shown, it is of the greatest importance to know when the original fever ceases, after which we are to consider the subsequent symptoms as due to the effects produced by the local lesions.

Such are some of the more prominent and general pathological phenomena common to the *typhous* state, which, combined with the peculiar and marked proportion of strength, and the rapid waste of tissue, are all characteristic of these peculiar fevers. While cases have been noticed of peculiar and modified forms of *typhous fevers*, which could not be referred to either the *typhus* or *typhoid* forms, we have model cases of each of these forms of the fever related with great beauty, clearness, and distinctness, in the classic writings of Dr. Jenner, on this interesting subject. The opinions of the medical profession being thus divided on this topic, there are good reasons, practically and scientifically, for considering and treating the two forms of *typhous* fever, in their *course* and *symptoms*, as distinct varieties. Independent of other considerations, it is absolutely necessary to use distinct and well understood nomenclature by which to express the diagnosis arrived at. For the purposes of study it is also better so to consider them; and much more attention ought to be given to the subject of *typhous fever*, by students, than is usually done.

Typhus Fever.

Definition.—*A continued fever, attended with sluggishness of intellect and confusion of thought, followed and accompanied by an eruption on the skin, appearing generally from the fifth to the eighth day, and remaining for eleven or twelve days. Languor and weariness, prominent from the first, gradually pass into stupidity, oblivion, and complete prostration, which, in still more extreme cases, pass into somnolence, stupor, and sometimes coma, when the prostration becomes profound. The disease may terminate favourably from the thirteenth to the seventeenth day, the average duration of the attack being about twenty-one days. If the disease proves fatal, it is generally between the twelfth to the twentieth day.*

The first authentic accounts of typhus fever are to be found in the early British chronicles, and they describe it as spreading in our courts of justice, and giving rise to what has been termed "the black assizes." The last black assizes happened at the sessions of the Old Bailey in 1756, when the lord mayor, two of the judges, and

several eminent and other persons died, infected, as was supposed, by the prisoners. This fever has had many popular appellations—as the *jail fever*, *hospital fever*, *ship fever*, *putrid fever*, *brain fever*, *bilious fever*, *spotted fever*, *petechial fever*, *camp fever*. We are indebted, however, to Pringle and to Fordyce for having shown that these supposed different fevers are identically the same, and have no such essential differences as to constitute them distinct genera. The phenomena of typhus indeed vary in different years, and in different persons in the same epidemics.*

Symptoms.—The following account of the symptoms are given from Dr. Jenner's writings, chiefly :—

The disease attacks persons of both sexes, and of all ages, from early infancy to extreme old age.

After a longer or shorter duration (generally a few days) of unpleasant sensations, in which general soreness, uneasiness, and fatigue without cause, loss of appetite, and disturbed sleep, are the prominent phenomena, the disease begins and advances gradually. It is not possible in all instances to fix the precise time of the commencement of the attack, but in the majority of cases the patient is seized with chilliness, which sometimes amounts to a rigor, usually followed by heat of skin, and occasionally by sweating, pains in the back and limbs, and frontal headache. During two or three days, the chilliness and rigors occur at irregular intervals. The patient alternately hovers over the fire, or desires to move from it; and although the skin at the time may be felt hot, he yet lingers over the fire, and soon again complains of the heat of the room; so that he feels when near the fire hot and oppressed, and when away from it chilly and uncomfortable. Loss of appetite, and more or less thirst, exist from the first; the tongue is white, large, and pale, sometimes tremulous, indicating the early loss of muscular power and control. The bowels may be confined, or regular; the urine is scanty and high coloured, and nausea with vomiting are often among the earliest symptoms. If sleep is obtained, it is disturbed by dreams,

* As the term typhus is very variously used, and sometimes vaguely, it is necessary to state precisely the meaning of the word. This cannot be more clearly, distinctly, and concisely expressed, than in the words of Dr. Wood.

The disease now defined is sometimes called *typhus*, and sometimes *typhus fever*. In the first instance the term is used "substantively, in the latter adjectively, just as we say ship fever, jail fever, &c. But a state of system, identical or closely analogous with that which characterizes *typhus* fever, is frequently met with in other febrile diseases, as a mere incidental accompaniment. To this morbid state the epithet *typhous* or *typhoid* is applied, the latter being preferred to the former when it is wished to imply resemblance only, and not sameness or identity. Thus we speak of a typhous or a typhoid condition of remittent fever, yellow fever, small-pox, measles, pneumonia, dysentery, or with greater brevity *typhous pneumonia*, *typhous dysentery*. This latter phraseology, however, generally implies a more thorough incorporation of the *typhoid element* with the principal affection, than *typhoid pneumonia* or *typhoid dysentery*, which merely implies a resemblance to the typhous state occurring in these diseases."

or by the occurrence every few minutes of sudden starts. It is consequently unrefreshing, and although the patient may have appeared to sleep for hours, yet he feels that he has not slept. On the other hand there is sometimes a constant tendency to heaviness and drowsiness. The attention cannot be fixed, and the mind ceases to think. Bodily weakness becomes extreme, and the patient takes to bed by the second or third, and not unfrequently on the first day. While there is absolute loss of muscular power and control, there is at the same time an amount of great exhaustion disproportionate by its severity to the muscular action. Giddiness and noise in the ears are amongst the earliest and most loudly complained of symptoms. The debility increases rapidly, so that by the seventh day the patient can rarely leave his bed without some assistance. By this time also the want of control over the muscular movements becomes more decided; the legs and arms shake when raised, and the tongue trembles when protruded. The impairment of the mental powers manifests itself in a variety of singular ways. Memory becomes deficient, the ideas of time are such that it is always supposed to be prolonged. If an event is impressed upon his mind, he will remember it, and it alone. This mazy state of the intellect soon passes into delirium, which becomes manifest first between waking and sleeping, then by night, and finally by day and night. When delirium first sets in, the patient is able to correct himself; if he is made to think he becomes conscious of his mental error, but this power is soon lost, and delirium becomes predominant.

Between the seventh and the tenth day of the disease the headache ceases, if it has not already done so, simultaneously with the commencement of the delirium; and if it should continue with the delirium, it suggests the probability of some commencing secondary lesion within the cranium, to which special attention must be immediately directed.

About the fifth or sixth day of the disease the eruption appears on the skin as described at page 135.

The skin throughout the whole course of the disease is often particularly sensitive, as indicated by the slightest touch occasioning pain. The heat of skin also conveys a burning sensation. Its temperature is usually from 100° to 106° Fah.

At the termination of the first, or commencement of the second week, the tongue grows dry in the centre, and at the same time its white fur is replaced by pale dirty brown mucus.

About the ninth or tenth day, and sometimes earlier, the delirium becomes decided, although the attention may still be fixed by a sharp question. At this time the patient is in some cases violent, and, unless restrained, leaves his bed to wander about the room; and the expression gradually comes to resemble that of a man unwilling to be roused from half-drunken slumbers. It now betokens

complete stupidity and decided prostration. The complexion looks dull and dirty from the first, and in the course of the second week becomes absolutely muddy, the conjunctival membranes injected, and the pupils contracted. The face is now often flushed, the flush being dingy and pretty uniform over the whole countenance; but occasionally somewhat more marked on the cheeks than elsewhere.

The eruption gradually becomes darker in hue, the centre of many of the spots, towards the termination of the second week, are unaffected by pressure, and here and there are to be seen some spots with well defined outline, quite unalterable in appearance by the firmest pressure of the finger. These are true petechiæ. The posterior surface of the trunk is considerably congested, and the spots are there much darker and less affected by pressure, than on the anterior surface.

About the tenth or eleventh day, somnolence sets in, which gradually passes into stupor, or even coma, and the expression indicates profound prostration. The patient lies on his back, unable to turn himself, in the slightest degree, and the urine is often passed involuntarily, or is retained, requiring the use of the catheter for its withdrawal. The tongue is thickly coated, dry and dark brown, or even black, appearing as if baked, and perhaps unable to be protruded. The teeth are covered with sordes, the patient is unable to be roused for more than a minute or two, and then mutters incoherently. The conjunctivæ are intensely injected, and the pupils contracted. The skin is cool and occasionally moist. Miliary vesicles, or sudamina are sometimes observed about the end of the second week, usually in the groins at the epigastrium, and under the clavicles. The abdomen continues flaccid and indolent throughout. The bowels usually act once or twice a-day, the stools being somewhat relaxed.

The pulse, from the outset of the disease, is quickened, and it increases in rapidity until the disease terminates fatally, ranging from 100 to even 150 in a minute; or, after reaching a certain point, its frequency as gradually subsides till health is restored. A little cough and some sonorous râle are now and then present.

The disease generally terminates, if it proves fatal, from the twelfth to the twentieth day; and before death the prostration increases to the last degree. *Subsultus tendinum*, or involuntary twitchings of the muscles of the face and arms, make their appearance. The face becomes dusky or even livid, and the breathing very quick, the pulse becoming so rapid and feeble that it can scarcely be felt. Some want of resonance of the most depending part of the chest may often be observed at this stage of the disease. The respiratory murmur at the same part becomes muffled, as if heard through a covering, and there is sometimes a little coarse unequal crepitation. The urine, which is *now* secreted in large quantities—from three to four pints

daily—is retained or passed into bed with the stools involuntarily. The skin at this time is often bathed in a profuse sweat, the temperature being below the natural standard. The patient lies on his back unable to move, or he sinks, if his head be at all elevated, towards the bottom of the bed. Towards the middle or end of the second week, a slough frequently forms on the lower end of the spinal region, or on the region over the posterior spine of the ilium.

For a day or two before the fatal termination, the condition termed *coma vigil* may come on. In this condition the patient never sleeps. He lies on his back with his eyelids widely separated, his eyes staring and fixed in vacuity, his mouth partially open, his face pale and expressionless. He is totally incapable of being roused to give a sign of consciousness, the breathing is often scarcely perceptible, the pulse rapid and feeble, or unable to be felt, the skin cool, perhaps bathed in perspiration. Life is only known to have ceased by the eye losing its little lustre, and the chest ceasing its slow and feeble movements. Dr. Jenner has never seen recovery from this condition.

If the disease should terminate in recovery, the improvement in the condition of the patient is frequently sudden. Some time between the thirteenth to the seventeenth day he may fall into a profound quiet sleep, and after from twelve to twenty-four, or even more hours, he awakes decidedly improved in all respects. The complexion is clearer, the delirium has disappeared; the pulse fallen in frequency, the conjunctivæ are no longer injected, the tongue is moist at the edges; there is perhaps a little appetite, the skin is softer, the spots paler; the general powers improved. In a few days the tongue cleans, the appetite becomes ravenous, and the patient rapidly regains strength. Dr. Jenner considers the duration of the disease to be measured by the duration of the eruption. There are two very opposite circumstances, under the influence of which the date of the first appearance of the eruption is changed, and its duration shortened. These are:—

(1.) A very mild attack of the specific disease. (2.) The development of severe local complications in the course of the specific disease.

There are cases of *typhus fever* which appear to die within a limited period after the outset of the illness, from the direct action of the poison on the blood or nervous system, and with the entire absence of local lesion, so that even the skin is not affected with eruption.

Secondary Lesions and Complications of Typhus Fever.

1. **Convulsions and Cerebral Affections.**—The most formidable, and fortunately the most rare, is the occurrence of convulsions. When they do occur, the case almost invariably proves fatal, unless the convulsions occur in a patient who has suffered from epilepsy;

and the subjects of them seldom present any morbid appearances after death, sufficient to account for their occurrence. In *The Edinburgh Monthly Journal* for June, 1848, the details of six cases of typhus fever are given, five of which proved fatal by convulsions, in different wards of the general hospital there, and all of them within a period of twenty-one days, in the months of January and February. The following are the days of the fever at which convulsions are stated to have occurred, the number of hours they continued to recur, and the apparent mode of death :—

No. of case.	Day of fever.	Number of hours the convulsion recurred.	Mode of death.
1st, *Edin. Mon. Jour.*,	7th	2	Coma.
2d, ,, ,,	11th	5	Coma.
3d, ,, ,,	15th	6	Coma.
4th, ,, ,,	14th	24	Coma.
11th, of Mary G—, related by Dr. Jenner,	11th to 13th	72	Coma.
13th, of Thomas B—, related by Dr. Jenner,	9th	36	Coma.

Convulsions are found to occur during the invasion, the progress and the decline of many acute diseases, and *typhus fever* is not an exception. Their occurrence in such cases may be fairly referable, in the present state of our knowledge, to the morbid condition of the blood in *typhous* fever, and the altered condition of the nervous system which ensues. Their occurrence may also be influenced by a "local epidemic constitution," as the cases referred to in Edinburgh proved fatal all within about nine days of each other, two dying in the same day in different wards. Puerperal convulsions were then also said to be common in the town. With reference to the absence of any appreciable lesion in the brain, as in these cases, it may be remarked, that our usual instruments of research applied to the nervous texture, are insufficient in all instances to indicate disease, even where it does undoubtedly exist. There are, for instance, physical conditions of texture, which are of the utmost importance in pathology, such as the specific gravity, and which are only appreciable by the proper means and instruments of research, when the tissue of the organ often presents to our senses no external evidence of disease.

The cerebral complications are generally attended with what are commonly called "head symptoms." Dr. Jenner very emphatically calls attention to the fact, that the continuance of the headache complained of spontaneously after the commencement of delirium, is generally indicative of increased vascular action within the cranium. It may also be noticed that the headache which precedes the delirium, is often in such cases of a very severe and constant kind, the face being sometimes pale and sometimes red, and greatly

expressive of the distress the patient suffers. The eye, haggard or brilliant, with its conjunctiva injected, is painfully sensible to the light, and is, therefore, generally closed. The least noise is insupportable, and the patient is troubled with noise in his ears. His temper also is altered, and his answers short and fretful. This condition is that of increased excitement, but not as yet of delirium, and, supposing the membrane to be inflamed, denotes diffuse inflammation of those tissues. At the end of a period of time, varying from two to ten days, the patient becomes delirious. His delirium may assume every character,—joyous or melancholy, furious or tranquil; and in some cases he wanders from subject to subject, while in others he incessantly recurs to the same theme, and even to the same few words. In others, though the cases are few, the disease assumes every character of insanity; and, if permitted, the patient confined in a strait waistcoat, presents the extraordinary spectacle of being able, in typhus fever, to walk about the wards. The phenomena of this stage show that the inflammation of the membranes of the brain has extended to the substance of the brain itself. The commencement of effusion is indicated by the active delirium changing into a low muttering, by the patient no longer requiring restraint, by his muscles becoming spasmodically affected with slight twitchings, or subsultus tendinum, showing how rapidly the nervous power is exhausted, and how feebly supplied; also by the pupil of the eye becoming expanded or contracted; by the fæces being passed involuntarily; by the urine being retained; and by the rapid grouping of those other symptoms, so happily described by Shakespere, as "the stony coldness of the feet creeping upward and upward," "the babble of green fields," and the "fumbling of the bed-clothes," all indicative of approaching death. When the patient recovers, however, from this stage, the appetite improves, the pulse becomes fuller and steadier, the countenance more tranquil, the mind firmer, and the sleep natural, till at last convalescence is fully established.

2. **Erysipelas.**—This complication in some instances is more of a subsequent than a contemporaneous affection, for it comes on very often after the fever has ceased, or the specific cutaneous eruption has subsided. Most frequently it attacks the head and face, and, as supposed by some, takes its start from some inflamed spot or slight abrasion of the surface. It frequently seems to commence in the throat, like a quinsy, and thence extending by the mucous membrane of the nose, outwards to the skin, and downwards to the larynx, where there is imminent danger from œdema of the glottis. At other times it begins as if simultaneously, in the pharynx and on the skin of the face, over the ridge of the nose near the eyes.

3. **Secondary Pulmonary Complications** are perhaps the most

common of any in *typhus fever*, in the form of what is sometimes called *typhoid pneumonia*. The congestion of the blood in the posterior parts of the lungs may give a tendency to this, and its presence may be suspected from the livid expression of the face, the existence of cough with rusty expectoration, the diagnosis being confirmed by the usual ausculatory means. It is seldom that pain is complained of. The part of the lungs affected for the most part is that which rests against the hollow of the fourth, fifth, and sixth ribs between their tubercles and angles; the position of the patient appearing to determine the place of consolidation. The morbid anatomy of the pulmonary secondary affections have been described at pages 136–7. Although such consolidations have received the name of "*typhoid pneumonia*," they are not to be regarded as analogous to what we see in an ordinary pneumonia, occurring in an otherwise healthy person. They follow in their origin and development the general laws of other lesions, secondary to *typhous fever*. The incubation of the disease is latent, and the symptoms are masked, and the nature of the complication is only to be recognized by careful physical examination. The full expression of the morbid state is often for some time undecided, the exudation being slow to solidify on the one hand, and yet the symptoms of resolution do not appear on the other. Dr. Hudson, of Dublin, attaches some importance to a certain tympanitic resonance, which becomes manifest over the diseased lung as a sign of the existence of the *typhous* lesion. He describes it as "a tympanitic clearness over the solidified lung without air being present in the pleura." Dr. Lyons explains this abnormal clearness as the result of the increased pressure of the respiratory column of air in the permeable portions of the pulmonary lobules, which become expanded beyond their natural volume, and thus a condition of temporary emphysema is produced, which yields a clear sound on percussion (Dr. Stokes in *Medical Times and Gazette*, May 26, 1855).

In some cases of pulmonary lesions there also appears to be a combination of circumstances which lead to a fluid or purulent form of the exudation, resembling the third stage of pneumonia as described by Laennec.

The conditions which lead to this form may be stated to be—(1.) A sudden exudation and abundance of exuded matter; (2.) A great amount of tissue involved; (3.) Diminished vascularity and consequent (4.) Abeyance of absorption, tending to (5.) Increased fluidity of the exuded products; (6.) Breaking up or solution of the perfect cellular elements of the exudation.

A lung in this condition seems to pass, as it were, at once into this state without any well marked hepatization.

4. **Gangrene of the Pulmonary Tissue** is by far the most for-

midable of the thoracic secondary lesions of *typhus fever.* The hepatization of the lung is not, as in the last instance, obscure, but the consolidation is at once sudden, complete, and extensive, involving perhaps the greater part of a lung, and coming on without any marked physical signs different from what are to be heard in the simple congestion of *typhus.* A gangrenous cavity forms in the substance of the solidified mass, and is only indicated by the fetid expectoration and the accompanying physical signs of a cavity. Large eschars, also, are apt to form towards the pleural surface, surrounded often with well defined lines of demarcation where separation of the slough proceeds. In this gangrenous slough any simple element of the pulmonary tissue becomes disintegrated, sometimes perfectly liquescent; and sometimes, also, it happens that the gangrenous cavity does not communicate with the bronchial tubes, and then the morbid state is difficult to diagnose, and its existence is often unknown till after death. With physical signs, the expression of the countenance of the patient is often highly suggestive. It suddenly becomes small, pinched, contracted, ghastly, miserable, and death-like. The eyes are sunk, and void of lustre; and along with languor, the patient feels nausea, and sometimes vomits.

Sometimes, as in a case recorded by Dr. Jenner, there are several distinct gangrenous centres, as if the deposits had been, from the first, disseminated or lobular. The analogy which is thus established between the gangrenous metamorphoses of the *typhous* deposits in the lungs and in the glands of the intestines, cannot fail to impress itself on the pathologist.

5. **Secondary Bronchial Complications.**—Like the pulmonic complication, the bronchial lesion in *typhus* fever is equally common in this country in some epidemics, and might with equal impropriety be termed *typhoid bronchitis.* It no doubt stands in the same relation to the fever as the other secondary lesions do. It is a *typhous lesion* of the bronchial mucous membrane. The distinguished pathologist, Rokitansky, gives the following account of it, and says:—"In primary broncho-typhus the general disease originally localizes itself here, avoiding all other mucous membranes, even that of the intestine, for which in general the typhus process shows the most decided preference. The latter mucous membrane exhibits, however, in many cases, a recognizable, though always subordinate and secondary development of the follicles, in which the adjacent mesenteric glands participate; and, in such cases, it is very often a difficult matter to distinguish the typhus in the above-named affection of the bronchial mucous membrane. The peculiar stasis of the spleen and of the great *cul de sac* of the stomach, the remarkable intumescence of the former, and the singular character

of the blood, the typhus nature of the general disease, and especially the altered condition of the bronchial glands, invariably serve, together with other symptoms, to indicate the typhus nature of the bronchial affection. The alteration occurring in the bronchial glands is of the same character as that affecting the mesenteric glands in abdominal typhus. They become swollen to the size of a pigeon's, or even of a hen's egg, are of a dark violet colour, which afterwards becomes lighter, present a relaxed and friable appearance, and are infiltrated with a medullary typhus matter. Like typhous mesenteric glands, they may become the seat of a tumultuous metamorphosis, and thus either with or without perforation of the adjacent mediastinum, may give rise to pleurisy. This form is often combined with pneumo-typhus and typhus pleurisy, and is, beyond all doubt, the basis of the spotted contagious typhus, and very probably also of the Irish and North American typhus, which, in the majority of cases, run their course without any intestinal affection. With us (in Germany) this affection is rare, and, in point of frequency, is not to be compared with abdominal typhus."

Perhaps the best account of this state during life is that recorded by Dr. Stokes in *The Medical Times and Gazette* for July 22, 1854, p. 78, and following papers. He shows how very silently the complication sets in; and runs a course exactly analogous to that of the other secondary affections of *typhous* fever. Coming on "silently" it gradually advances to its maximum, and ultimately produces death by asphyxia. In the best marked cases it may be detected about the fourth or fifth day of the disease, but may supervene at any period. It also subsides spontaneously; and must not be treated as one of inflammation. According to Dr. Stokes, the pulmonary and the bronchial secondary lesions are much more common and more fatal in hospital than in private practice.

6. **Deposit of Tubercle during Typhus Fever.**—There is still another pulmonary condition which sometimes occurs in *typhus* fever, and which may either complicate the progress of the case, or come on subsequent to it. It is the development of tubercle. Usually when recovery takes place from *typhus* fever it is complete, but in some cases, especially where there is hereditary predisposition, an impetus or tendency seems to be given to the development of tubercles in the lungs. If the physical signs of bronchitis continue beyond the thirtieth day, or fourth week, combined with hurried and difficult breathing, and with the signs and symptoms of great irritation of the lungs, then there are good grounds for suspecting that the deposition of tubercle has commenced in the lungs. Dr. Stokes gives two sets of cases in which this deposit takes place. In one set, a great quantity of tubercular matter seems to be secreted

during the existence of the typhous state; and although, sometimes, such an occurrence may not have been suspected, yet the expectoration of calculi at periods of different duration after the convalescence, furnish strong proofs that such a lesion had taken place. In other cases, again, the cure may be effected through absorption, or by suppuration of the minute tuberculous points over the mucous surface of the bronchia. A doubtful convalescence, a quick pulse, and a hectic state, suggest such a state of things, especially when combined with persistent bronchitis.

7. **Secondary Cardiac Lesion.**—This lesion assumes the form which Dr. Stokes has called "typhous softening of the heart." He is also inclined to consider that the muscles of the larynx and the circular muscles of the trachea are also sometimes similarly affected, as well as the involuntary muscles generally. This complication has for the most part occurred when there was a great amount of the secondary bronchial disease. The wasting of the involuntary muscles is always great in typhus. In the heart it is more obvious than in the arterial or systemic portion.

Typhoid or Enteric Fever.

Definition.—*A continued fever attended with apathy or sluggishness of thought; followed and accompanied by an eruption on the skin, appearing generally from the eighth to the twelfth day, occurring in crops, each spot continuing visible about three days. Languor and feebleness are prominent from the first, attended by headache, abdominal pains and diarrhœa, which increases. With the advance of the disease the typhous state becomes more and more expressed. It may terminate favourably by a gradual restoration to health during the fourth week; and the average duration of the fever is about twenty-three days. Death, in the majority of cases, occurs towards the end of the third week. There are symptoms also associated with the characteristic lesion of this form of fever, namely, fulness, resonance, and tenderness of the abdomen, gurgling in the right iliac fossa, increased splenic dulness. The secondary lesions are enlargement of the mesenteric glands with deposit in the glands of Peyer and minute solitary glands of the small intestine.*

Symptoms.—Like *typhus fever* it begins gradually, so that its commencement is not always able to be fixed; and to avoid repeating the symptoms of *typhus*, I shall only state here the phenomena by which it is distinguished from that form of fever.

This form of *typhous* fever is described under a great variety of names, by various writers, such as *typhus mitior, nervous fever, abdominal typhus, common continued fever, enteromesenteric fever, dothinenteritis follicular enterities.*

Amongst the early symptoms, the most characteristic are abdominal pains and diarrhœa, which continue to increase. The countenance indicates anxiety, the mind continues clear, the conjunctivæ pale, slightly injected, the pupils normal, the cheeks are somewhat flushed, and epistaxis sometimes occurs, at repeated intervals during the first week. The belly enlarges as in mesenteric disease, and is resonant on percussion. Gurgling on firm pressure may commonly be detected in the right iliac fossa, and there is often tenderness on pressure in the same situation. From the eighth to the twelfth day the eruption appears, described at page 134, and in some cases there is no eruption. As a rule, the flushing of the face is more marked towards evening. During the third week the abdomen becomes more distended; the diarrhœa increases, the stools often amounting to *five*, *six*, or even *eight* and *ten* a-day. They are liquid, pale, brownish-yellow with flocculi of an opaque whitish-yellow colour floating through them, like coarse bran, and as the patient loses strength they are passed involuntarily. Pain is rarely complained of unless perforation of the gut occurs; and hæmorrhage from the bowel is an occasional symptom during the third or fourth week. The frequency of the pulse often varies much from day to day, without any appreciable coincident alteration in the general or local symptoms. Pulmonic complication is not uncommon, indicated by sonorous and mucous râle.

In cases that recover a remarkable fatuity remains behind long after recovery; and there appears to be some diminution of intellectual power for some time after convalescence is restored. Dr. Jenner has seen many cases in which childishness of mind remained for more than a month after apparent restoration to health. The secondary abdominal lesion has been described at pages 137–8.

One of the most alarming symptoms is the occurrence of hæmorrhage from the bowels. It occurs most frequently during the third and fourth weeks of the disease; about the time when the sloughs of deposit in the glands of the mucous membrane are beginning to separate. It varies from a mere stain to a large amount, and is sometimes discharged in clots. Blood from the bowels is usually dark, but in this disease it is generally red, which may be accounted for by the rapidity with which it is passed out, and also, as Dr. Parkes has shown, by the alkaline re-action of the contents of the intestine. It may cause immediate death by syncope or by reducing the strength of the patient so as to render him unable to cope with the disease; and whenever blood flows from the bowels, it may always be concluded that extreme local lesion exists.

Another symptom, often very painful, is *meteorism*, or the accumulation of air in the large intestine. This is present in a greater or less degree in one-half of the cases, and when considerable, it always

marks a grave affection, and one generally fatal. On the contrary, the abdominal muscles are, in a few cases, tense, and strongly contracted. It is, however, the experience of all physicians that there is no condition so low, and no symptoms so severe, from which the patient may not recover; and, on the other hand, there is no case of this form of *typhous* fever so slight that it is to be considered free from danger. The prognosis must therefore be cautious, because perforation of the intestine may follow the mildest case; and death from peritonitis ensue.

Treatment of Typhous Fever.

Before considering the treatment of typhous fever, it is of the greatest importance to be aware of the changes which go on in the system during its progress. Dr. Parkes has observed the nature of these changes in a most conclusive manner. His observations are of great scientific interest, and of important practical bearing (Gulstonian Lectures in *Medical Times and Gazette* for February 28, 1857). In an uncomplicated case of typhus fever, the body loses flesh rapidly, owing not only to diminished ingress of food, but also to increased egress of bodily structures in the form of excretory products. The metamorphosis of tissue, as judged by the urine, is augmented. The following is an analysis of the urine for two days during the height of the fever, in an uncomplicated case of *typhus*, when no medicine whatever was given:—

In each twenty-four hours.

Day of disease.	Temperature.	Action of skin.	Action of bowels.	Quantity of urine—ozs.	Urea—grains.	Cl Na. grains.	SO_3 grains.
8th	103° F.	Nil	Nil	26	522·67	Traces.	38·325
9th	103° F.	Nil	Nil	27	542·00	Traces.	39·673

The following inferences are drawn from this table:—

(1.) In spite of the many pints of fluid drank, a small quantity of water left the system by the kidneys and skin, and none at all by the bowels. This retention of water is not peculiar to typhus, and its cause is quite unknown.

(2.) The amount of urea was greatly increased. The normal amount of urea excreted by active men, on good diet, between twenty and forty years of age, weighing 145 lbs., is 491 grains in twenty-four hours. A boy ill of typhus, aged seventeen, weighing not more than 129 lbs., excreted not less than 532 grains daily, although he was on fever diet, and taking scarcely any nitrogenous food.

(3.) The chloride of sodium is excreted in health at the rate of 180 grains daily. In this case of typhus fever it was present only in traces, the amount being too small to be determined. Like the water, this retention is common to the pyrexiæ.

(4.) Metamorphosis of tissue was more active by one-fourth daily.

From most careful observations such as these, Dr. Parkes thus gives an outline of the principles upon which fevers are to be treated. The treatment of fever (and *typhus* and *typhoid* fevers are not exceptions) may be summed up as being a combination of measures *to reduce excessive heat*, to insure *proper excretion*, and *to act on the semiparalyzed nerves.*

The external application of cold, as practised to an extreme degree by Currie, has a great effect in bringing down the temperature, probably by abstracting heat. In health, such an application tends to increase metamorphosis (LEHMANN, SANDERSON). Blood-letting or hæmorrhage also tend to reduce temperature. Hæmorrhage from the bowels has reduced the temperature in *typhoid* fever several degrees, and seemed to do good in those cases which were not already too weak. In *typhus* the paralysis of the nerves appears to be more marked than in *typhoid*, and loss of blood cannot be borne. Purgatives and emetics have the same effect as blood-letting, but in a less degree; and the temperature soon rises after the diarrhœa ceases, whether that has been induced by drugs, or coming on spontaneously as in *typhoid* fever.

To insure proper excretion in fever is much more difficult than to reduce temperature, which latter condition for obvious reasons it is not always wise to attempt.

Perhaps the best general method to insure proper excretion is to supply the system with abundance of *alkaline salts*, which are not now given in the food. *Chloride of sodium*, the *alkaline salts of potash*, and probably also those of *soda*, tend to aid the formation of urea and its elimination. In the use of *nitrate of potash* and of *iodide of potassium*, which are not natural constituents of the frame, Dr. Parkes has observed that at the first employment of these there is often a marked lessening of excretion, as if the chemical processes then going on in the body had been interfered with, for afterwards the elimination again increases as if the system had accommodated itself to the remedy.

Purgatives tend to insure a proper excretion, probably by removing from the blood some of the abnormal products formed in fever. The great relief which sometimes follows their use, as well as the fall of temperature, seem to show this. Where there is retention of urea, they aid its elimination, because we know that urea passes off sometimes by the mucous membrane of the stomach and bowels.

In the *typhoid* form of fever, however, their use is forbidden on

account of the special lesion in the glands of the intestinal mucous membrane. To reduce heat and to regulate elimination are but secondary indications in the treatment of *typhous* fevers compared with the influence which must be exercised over the nervous system; and one of the greatest objects of therapeutics at the present day is to find substances which will act on the nerves, and restore them in some way to their normal action.

In *typhous* fevers the administration of food (simple) and of stimulants are constantly demanded, and they convey nutriment and strength, and it is perfectly good practice to stimulate with wine, or whisky, and at the same time also eliminate by purgatives.

Alcohol has a beneficial stimulant effect when it reduces the pulse and diminishes the respirations; but its effects must be carefully watched, for overloading the blood with its products leads to increased contamination.

Quinine has been largely employed, and sometimes with great benefit. It was much used by the French medical officers in the treatment of the *typhus* fevers amongst the sick at Constantinople during the late war. The author witnessed frequently its good effects in cases treated by M. Casselas, whose account of the fever is to be found in *The Medical Times and Gazette* for August 2, 1856. It was given in doses of from eight to ten grains, five, six, or seven times a-day. Such large doses reduced the action of the heart; but they had the disadvantage of tending to bring on the poisonous action of the drug as indicated by the persistent headache.

The beneficial effects of ammonia are often very marked in the latter stages of *typhous* fever when the heart's action is very rapid, apparently from the paralysis of the vagus. Lately, infusion of coffee as a drug has been given by Dr. Parkes with a beneficial effect. It relieved the headache of typhus, and the pulse became fuller and slower under its use; and there seems good reason to try the effect of coffee in the form of a strong infusion as a drink in severe cases of *typhous fevers* with delirium and rapid wasting. Böcker and Julius Lehmann have shown that the use of coffee in health has an extraordinary power of delaying the metamorphosis of tissue, and of powerfully exciting the nervous system.

Such are some of the general indications to be followed in the treatment of *typhous* fever, and some of the special remedies which may fulfil such indications.

It is necessary now to notice some special indications which are to be followed under particular circumstances in *typhous* fevers, and the means to be adopted in their treatment; and at the same time, in the language of Dr. Jenner, let the caution be conveyed, that "in no disease is the advantage of refraining from meddling more clearly displayed than in *typhus* fever. In no disease is the prompt

use of powerful remedies more clearly indicated than in *typhus* fever. It is in determining when to act, and when to do nothing, that the skill of the physician as a curer of disease, or as an exciter of death, in the case of fever, is shown. Interfere by depletion or by stimulation, when nothing should be done, and the patient is lost, who if it had not been for you, would have been safe. Refrain from depletion or withhold stimulants, when the one or the other is required, and the patient sinks into that grave from which judicious treatment might have saved him."

The Expectant Treatment is, in the vast majority of cases of uncomplicated typhus, the one on which the judicious practitioner will rely for the safety of his patient; and he will manage thus:— Castor oil will be given when the bowels are confined. The hair will be removed, and cold applied to the scalp, when the pain and heat of the head becomes severe or excessive, or if delirium supervenes. A large well ventilated apartment, fresh air, a cool but not a cold atmosphere, quiet, abstinence from solids, and a free supply of water, milk and water, coffee, weak broth, beef tea, according to the discretion of the physician, are the conditions and remedies on which a large majority of cases will recover.

If headache should persist after delirium sets in with a rapid pulse (*e. g.*, 120), attended with nausea, some saline effervescing mixture, with four drops of hydrocyanic acid, may be given every six hours. In the persistence of headache, dry-cupping, such as has been recommended by Dr. Sieveking, might furnish an aid to guide the treatment by determining whether it may not depend upon repletion or emptiness of the cranical vessels. When applied to the nape of the neck, it may afford relief if repletion has to do with its continuance; but if anæmia, as may be suspected from the state of the vascular system, then stimuli are called for. Four to six ounces of wine may also be given in divided doses during the day and night of twenty-four hours. If the pulse continues to get weaker, the wine must be increased.

Sesquicarbonate of ammonia may be given in doses of five to eight grains every four, six, or eight hours, according to circumstances.

Stimulants are indicated by the following conditions:—Feebleness of pulse, commencing dryness of the tongue, sordes on the teeth, coolness of the extremities or general surface. Sulphate of quinine may be given in doses of *two* or *three* grains every two hours. The alcoholic stimulants are to be regulated by the effects produced. Opium is to be given in exciting doses, and the effect watched so that stupor is not induced. A quarter of a grain, half a grain, or a grain may be given in various cases. The best form of administration is that of Dover's powder. Carbonate of

ammonia may be given from two to ten grains each dose, and repeated every hour, or every two hours, as necessary, and is best combined as an emulsion with gum arabic and sugar. Increase of pulse, increase of heat of surface, increase of delirium, and stupor, warn the physician to stop or to suspend the use of the stimulant. If the pulse becomes slower and stronger, if the skin becomes softened, even although delirium may not abate, the physician is encouraged to persevere in the use of stimuli.

The condition of the heart, as shown by Dr. Stokes, is sometimes a guide to the use of wine. There are three conditions of the heart which must be distinguished as a guide to treatment; namely, (1.) A violently excited heart all through the disease, with cold surface, cold breath, and feeble pulse. (2.) An opposite condition, in which the systolic force of the heart is diminished, as shown by the loss of impulse, diminution of the first sound, or even extinction of the first sound while the second remains. Both these conditions demand wine, and the latter will very probably recover under a perseverance in its use. The prognosis of cases of fever with the first mentioned symptoms of the heart is exceedingly doubtful even with the use of wine. (3.) Cases in which the heart is not implicated. Such cases may, nevertheless, demand wine, under the conditions already noticed above.

There seems to be differences in the demand for stimuli by the *typhus* of different countries. Dr. Wood tells us that in America cases requiring wine or brandy are extremely rare. Dr. Stokes says that the *typhus* in Ireland demands large quantities of wine. In Scotland, also, wine is the great mainstay of the *typhus fever*, requiring often to be administered largely.

Throughout the whole course of *typhus* fever, if there is constipation, the bowels should be kept open by cathartics. There is absolute necessity for accumulated excreted matters collected in the intestines being removed by remedies. The dark offensive matters collected in the alimentary canal in typhus have undoubtedly a bad effect on the system through absorption. Cathartics have a beneficial effect in removing this condition. Calomel and rhubarb with aloes, or senna, are the best medicines to use; the dose and its repetition being regulated by the state of the strength of the patient.

Bleeding (general) as a rule is not borne by *typhus* cases.

The patient must be roused from sleep to give him food and medicine. He must be constantly watched, and there is no disease where the attentions of a well instructed nurse are more demanded; and there are no class of patients in hospital who are so much neglected by the attendants, especially as to the regular administration of the remedies prescribed. It is not uncommon to find that the

wine allotted for the day has been administered at a draught, when it ought to have been given in small quantities at regular intervals, with care and watchfulness. How often do we see almost hopeless cases recover under the careful nursing of an intelligent mother, regulated by the dictates of common sense, and maternal solicitude, and guided by the judicious directions of a physician who knows well the nature of the disease with which he has to deal.

With regard to general blood-letting, especially in the typhoid form, some differences of opinion exist. Dr. Jenner considers that it is not beneficial; that the course of the disease was more rapid and fatal in proportion as the bleeding was large and practised at the earliest period of the disease. He also adds, that the delirium was aggravated rather than relieved, and that it caused no sensible alleviation of the abdominal affection—results certainly anything but favourable. Cruveilhier also states that this disease ought not to be treated after the manner of diseases essentially inflammatory. Such is the evidence against bleeding, and demonstrating that operation to be the exception and not the rule of treatment in this formidable disorder—a deduction which is perfectly in accordance with all we know of morbid poisons—it being proved by repeated experiment that when an animal is poisoned, the poison is more rapid in its course, and more fatal in its consequences, in proportion to the degree the animal has been bled.

We should therefore never forget, in the treatment of this disease, that it has a course to run; and, secondly, that in most cases there is a series of local lesions developed which no art can prevent; and also, that the general as well as specific actions of the poison are, for the most part, greatly increased by large bleedings, or by severe and unnecessary depletion of any kind. The utmost, perhaps, that can be said for bleeding, is, that in certain cases it may sometimes be practised with impunity, by local measures, or its beneficial effects obtained by dry cupping.

With respect to the few positive rules in the treatment of this fever, experience has shown that they vary, in some degree, according to the nature of the affections of the secondary lesions. When, for instance, the follicular structure of the intestines is inflamed or ulcerated, it seems proved by a large number of cases that a local treatment by enemata composed of a decoction of half a pound to a pound of barley in boiling water, to each of which some tincture of opium or syrup of poppies may be added, gives the most satisfactory results. These exhibited night and morning remove all those causes which can irritate the inflamed part, and thus soothe and tranquillize the system generally. In addition to this, if the abdomen should become meteorized, a large linseed poultice should be applied over the surface and kept on for many hours. In this

form of the disease no advantage appears to have been derived from the application of leeches or blisters to the abdomen or temples. Neither has wine in large quantities been useful.

When the mesentery of the mucous membrane is affected, or the membranes of the brain, or both, and the disease is of moderate intensity, the old method of treatment is probably to be preferred; namely, to give saline medicines as long as the tongue is white, and perhaps to apply a few leeches to the temples if the eye be injected; and as soon as the tongue becomes brown, to support the patient by means of port wine with sago, strong broths, and such like stimuli and food given often daily. If meteorism should take place the linseed poultice should be applied as in the former instance.

Should the disease, however, be decidedly of a low character, and the lungs loaded, a powerful stimulant treatment is perhaps to be preferred from the very commencement of the attack. Thus, ten grains of camphor dissolved in two ounces of gin, and given night and morning may be successful in many of these doubtful cases.

In all instances the patient is benefited by checking those secretions which are in excess, and restoring those which are in defect. Such are the most general rules for the treatment of the typhous fevers.

Dietetic and Preventive Treatment.—The patient's diet should be strictly farinaceous, with the addition of broths and subacid fruits throughout the whole course of the disease, or until the nates, as they sometimes do, slough, and in that case a mutton chop must perhaps be prematurely hazarded; but its effects should be watched with much caution.

The preventive treatment includes the three great principles of *cleanliness*, of *ventilation*, and of *separation*. The chlorides or boiling vinegar may mask or destroy smells, but do not neutralize or destroy contagion; for when the Hôpital Salpêtrière at Paris was used for fever patients, in the campaign of 1813, even those who superintended the fumigations fell ill of the disease. Cleanliness, such as frequent change of linen and the removal of all evacuations, are not only grateful to the patient, but, by preventing an accumulation of miasmata, are a safeguard to the attendants. Ventilation has likewise the same good results; and in every case of fever the bed curtains should be undrawn and the door or window occasionally opened for the admission of air. Cleanliness and ventilation should not be limited to the person of the patient, but should extend also to the apartment; and, on his recovering, the chamber in which he has lain should be well washed, and such parts as will admit of it be whitewashed. It is owing, perhaps, to the neglect of this precaution that fever so fatally prevails in the

lodging-houses of the poor. One family falls ill of fever, and another succeeds, which suffers the same fate, till the walls become impregnated with the miasmata, and the apartment becomes a real focus of infection. Even where the party has a permanent habitation, but ill ventilated and dirty, the same result follows: thus, in London, the Rookery of St. Giles's, the Mint in the Borough, and the narrow courts of Holborn and Whitechapel are hardly ever quite free from fever. In every epidemic, therefore, it is the duty of the parish authorities to see that the houses of the poorer quarters of towns be cleansed and whitewashed. Separation, however, is as necessary as ventilation and cleanliness; for when fever cases are heaped together fever of a most dangerous character prevails; and even our largest hospitals become, under these circumstances, a focus of pestilence and contagion, and special fever hospitals are to be deprecated.

Relapsing Fever.

Definition.—*A continued fever, attended by rigors and chilliness, headache, vomiting, white tongue, epigastric tenderness, confined bowels, enlarged liver and spleen, high coloured urine, frequent pulse, hot skin, and occasionally by jaundice, and terminating in apparent convalescence in from five to eight days. On or about the seventh day from this favourable crisis a relapse occurs, in which the patient exhibits a series of morbid phenomena similar to the first attack, which terminate, like the first attack, in from five to eight days. In some cases a second relapse occurs.*

Pathology.—The name by which this disease is known is derived from one of the most constant and striking peculiarities of the fever. It is also sometimes described under the various names of "*five*" or "*seven-day fever*," "*seventeen-day fever*," "*bilious remittent fever*," "*mild yellow fever*," "*synocha*," "*short fever*," and "*short relapsing fever.*" Epidemics of this form of fever have been recognized to prevail on different occasions since 1739. In Dublin it prevailed at that time, and in several subsequent years. Sometimes it has been described as a variety of a well known form of fever; and at other times as a new disease. This relapsing fever, with the two forms of *typhous fever*, already described, and the *ephemeral fever*, or *fibricula*, are all commonly confounded under the name of "*common continued fever*" in this country, not only in ordinary but in some important official medical reports. In Scotland, Drs. Christian and Walsh first described its occurrence in Edinburgh in 1817-18, and subsequently it has become well known from the excellent descriptions by Drs. Craigie, Cormack, and Robertson of its epidemic form in that city and in Dublin during 1842, 1843, and

1844. Still more recently it has been described by Dr. Mackellar, in 1847, who unfortunately fell a victim to the typhus epidemic at that time; and by Dr. Robert Paterson, of Leith, in his account of the epidemic fever of 1847 and 1848, which prevailed in Edinburgh. About this time also it appeared in London, and again in 1850. Its phenomena there have been most carefully recorded by Dr. Jenner, who has shown that its characters have remained constant since they were first described by British physicians.

Hitherto the disease has not been observed in America, but it has been described by Dr. Wood from the writings of the physicians already noticed.

Like other fevers its cause is unknown, but it selects its victims from the poor and ill-fed, who live miserably in crowded, filthy, ill-ventilated apartments, rather than from the wealthy and well fed, who live in comfort and in well aired abodes. Its poison appears to be of a specific kind, and the phenomena of the fever are very different from those of *typhous fevers*. Patients recovering from either form of *typhous fever* may catch, by contagion, the *relapsing* fever, while patients convalescent from *relapsing* fever may also take either of the forms of *typhous fever*. It has been supposed by some (Dr. Cormack) to be identical with *yellow fever*, but there is not sufficient evidence to establish the point. It seems more nearly to approach in its nature some forms of remittent fever, on account of the repetition of the rigors, often at regular daily periods for two or three days (Dr. Peacock).

Symptoms, Diagnosis, and Lesions of Structure.—The seizure is frequently sudden. Sometimes on waking in the morning, or when employed in business, severe rigors at once come on, with a sense of chilliness and frontal headache. If premonitory symptoms exist, they usually manifest themselves by pains in the limbs and lassitude, nausea, and perhaps vomiting, with feeling of prostration. Subsequently, and very soon, febrile reaction sets in, sometimes violent, expressed by intense heat of skin, severe headache, throbbing temples, intolerance of light and sound, suffusion of face, sleeplessness, remarkable anxiety of countenance and jactitation, with a very rapid pulse, so rapid as to range from 110 sometimes as high as 140 beats in a minute; the tongue is coated with a white fur, and, in a great majority of cases in some epidemics, there is constraint and uncontrollable vomiting of greenish, bitter fluid, with or without epigastric tenderness, and great thirst. The pains in the muscles and joints are sometimes so severe as to resemble rheumatism, and when the pain in the back is severe, together with the rigors, the vomiting, and the headache, it may not be possible in the first instance to say that the attack may not prove to be one of small-pox. But the pain in the back is not generally so severe, nor is the vomiting

so incessant as symptoms of *relapsing fever* as they are as symptoms of *small-pox*. The headache is to be distinguished from what is commonly called a "sick headache" or "bilious headache," by the circumstance that the "bilious headache" is in most cases *occipital*, and the heat of skin, combined with the quick pulse, serve to distinguish an attack of relapsing fever at its outset from one of "bilious headache." From idiopathic head affections relapsing fever is distinguished by the suddenness of the attack, the rigors, the hot skin, the pain in the joints and limbs, and the white tongue (Dr. Jenner). The symptoms generally of *relapsing fever* are so severe that the patient takes alarm, and takes to bed at once. He does not feel weak, but he feels so giddy that he is unable to remain out of bed, or off the horizontal position.

In some cases also, there is pleurodynia in a severe degree, but without any stethoscopic indications of pleural inflammation.

By the second or third day the heart often beats 100 or 120 or even 130 strokes in a minute, with anxious and oppressed breathing. Almost no sleep is obtained, and what little is got is dreamy. Delirium does not generally supervene on the first attack, although by the *fifth* or *sixth* day, just before the crisis, it has been in some cases of a violent kind. The bowels are constipated. After continuing in this state for a period varying from five to eight days a sudden change takes place, immediately preceded in most cases by an exacerbation of all the symptoms, generally on or about the *seventh* day, and rarely prolonged beyond the *eighth*. This change is ushered in by a most profuse perspiration, which breaks out from the whole surface, and in the course of a few hours the patient appears nearly well. More rarely the change would be indicated by epistaxis as well as by perspiration, or by profuse diarrhœa ; but after either, or all of these apparently critical changes have been established for a few hours, there is a complete and abrupt cessation of all the bad symptoms. The pulse quickly regains the natural standard, the tongue cleans, the appetite and sleep return, the countenance resumes its tranquillity. This alteration is very often effected within a few hours, and on the following day the patient generally considers himself in all respects quite well, and may so continue to improve rapidly for *four* or *five* days. During this period, however, there are some patients who suffer from violent muscular pains in the limbs.

About *seven* days after this critical change, or between about the *twelfth* to the *twentieth* day from the commencement of the illness, a sudden relapse occurs "in ninety-nine cases out of every hundred." This relapse commences suddenly, like the first seizure, by rigors, headache, loss of appetite, vomiting of green fluid, which is quickly followed by a hot skin, quick pulse, and a coated white tongue, con-

fined bowels, followed by delirium, so that the phenomena may be exactly represented as a repetition of the first attack. In the interval of convalescence between the first and second attack, the pulse often becomes slow to an extreme degree, as slow even as forty-eight beats in the minute; suddenly, on the relapse commencing, it again rises to 120, or more. In ordinary favourable cases, perspiration would again occur in *two, three, four*, or five days, and the patient would be relieved as before. In other cases, however, uncontrollable vomiting, great thirst, very rapid pulse, a hectic-looking circumscribed flush of countenance, jaundice, watchfulness, delirium, and death, may terminate the case.

In some cases the relapse is very slightly marked, and indicated merely by a comparative increase in the rapidity of the pulse and a greater heat of skin than were present on the previous day.

If blood be taken from the arm it is generally buffed, but it is *not* to be augured that *therefore* the lancet must be used in *relapsing fever*. So far as can be ascertained, no local inflammation attends the fever.

In nearly a fourth of the cases, according to Dr. Jenner, jaundice is present, and is sometimes intense. If present during the first attack it may disappear before the relapse, and not occur, or, it may occur only in the relapse; and it is important to notice, that while the jaundice continues, the stools still retain their natural hue, and may even be darker than common, and at the same time the urine may be frequently loaded with bile.

There is a tendency, in *relapsing fever*, to the occurrence of sudden death. It may happen by syncope, immediately after the critical periods, when the pulse becomes so very slow. It may also happen during the progress of the case, during either of the severe periods: namely, during the primary attack or during the relapse. It is indicated by a deep dusky hue of the face, lividity of the hands and feet, and a purple marbling of the whole surface. The trunk feels cool, and the hands feel cold, and without suffering any severe pain, or without sustaining any sudden discharge of fluids, a state of collapse insidiously comes on, from which the patient is unable to be roused, and death may follow in a few hours, generally from *twelve* to *twenty-four*, even after it was supposed that danger had been escaped. But death is a rare termination to relapsing fever; and when it does occur, the fatal event more commonly happens during the primary fever than during the relapse (Dr. Jenner).

Epigastric tenderness is most marked in the cases where vomiting occurs. When pregnant women are attacked with *relapsing* fever they usually abort, and this event renders the prognosis more doubtful in proportion.

A second relapse, and even a third, are reported to have occurred by almost all historians of the epidemics of *relapsing fever*, but the cases are of rare occurrence.

The *relapsing fever* is very exhausting in its effects upon the constitution ; and dating the period of convalescence from the termination of the last attack, the time taken to recover was in most cases unusually long.

To those who suffered from more than one relapse, it was almost impossible to have health restored ; they became a prey to various sequelæ of fever, or they continued sickly for months, with pallid countenances, puffed ankles, palpitations, extreme debility, noises in the ears, dimness of vision, diarrhœa, or dysentery. Dysuria was a frequent complication amongst women during the relapse. In many instances during the epidemic of 1847 and 1848 in Ireland, convulsions also occurred in cases which otherwise seemed to be progressing favourably, and death invariably followed them. Dr. Wm. Robertson observed in Edinburgh (and the Irish physicians record a similar observation) that delirium of a violent character occurred during convalescence, or after the critical discharge had taken place. It generally came on suddenly, with incessant talking, a rapid weak pulse, followed by perfect unconsciousness, flushed face, and contracted pupil.

No special anatomical lesion has been pointed out as peculiar to *relapsing fever*. The most constant lesion is enlargement of the spleen, the size attained by that organ being on the whole larger than in either typhus or typhoid fevers. Dr. Jenner has recorded the weight in one case to have been as much as thirty-eight ounces, and of a size in proportion. As a rule there is but little congestion of the lungs, the weights of which contrast singularly with the weights of organs in subjects dead of typhus fever.

The blood in a few cases has been found fluid throughout the body. The liver is generally large, and the gall bladder filled with dark thick bile.

Treatment.—All physicians agree that in the primary attack little medicine is required, after opening the bowels by calomel and rhubarb and keeping them open with castor oil or saline cathartics. The symptoms are not readily under the control of remedies ; the vomiting is often especially persistent. *Five* grains of calomel, with *one* grain of opium, has been found more efficient in subduing the severity of the symptom than counter-irritation or effervescing draughts. The violence of the headache is best subdued by leeches or cupping, in the well fed, otherwise healthy patients; and by blisters to the nape of the neck, or by dry cupping there, in the poor, weakly, and ill fed. Till the crisis comes the symptoms may be mitigated, but not altogether relieved, and cases of ordinary severity

are better left to nature, without interference on the part of the physician.

No means hitherto discovered will prevent the occurrence of the relapse.

Febricula.

Definition.—*A continued fever of very short duration, lasting for twenty-four, thirty-six, forty-eight, or seventy-two hours, attended with high and rapid pulse, hot and dry skin, a white tongue, with a scanty discharge of high coloured urine.*

Pathology.—Except to complete the history of continued fever, this disease scarcely merits notice. It is never fatal, and, in the present state of our knowledge, it is not to be distinguished from the *first* stage of the *relapsing fever*. It does not appear to be contagious, and its cause is unknown.

The four forms of fever hitherto noticed are comprehended under the term "continued fever," in the nosologies of Cullen, Segar, Vogel, and Sauvages. But the doctrine is now almost universally received, and is taught in all our large medical schools in America, France, Germany, and Great Britain, that there is at least a practical difference between *typhus fever*, *typhoid fever*, *relapsing fever*, and *febricula*, and that they ought now to have a distinct and separate place in all nosological classifications.

Croup—*Trachealia.*

Definition.—*Fever of an inflammatory type accompanying the exudation of an albuminous material upon the mucous membrane of the epiglottis, glottis, larynx, or trachea, and sometimes over all of these parts, indicated by accelerated, difficult, wheezing, or shrill respiration; short, dry, constant, barking cough; voice altered by hoarseness, with spasm of the interior laryngeal muscles, and pain and constriction above the sternum; frequently followed towards the close of the disease by expectoration of a membranous albuminous substance, or even a cylindrical cast of some portion of the breathing tube. The disease occurs in children, and may terminate fatally either in suffocation or exhaustion of the vital powers.*

Pathology and History.—It has often excited much surprise that a disease so distinctly marked in its symptoms should not have been accurately described before the middle of the eighteenth century, when Dr. Francis Home published a treatise on the *suffocatio stridula* or *croup*, in 1765, as it was observed in Leith, Musselburgh, and the vicinity of Edinburgh. It has also been described under the name of *cynanche trachealis*; and Dr. Farr now proposes the name of "*trachealia*" in scientific nosological nomenclature.

Before the time of Dr. Home, however, there is reason to believe that the disease was confounded with other affections of the throat and breast resulting from exposure to cold. It was certainly also described and distinguished by Martin Shisi, in 1749, at Cremona, and by Starr, in Cornwall, in 1753. Many physicians have described the disease since that time, and none with more minuteness than Dr. Cheyne of Leith, who observed it for several years, and illustrated its pathology by careful dissections.

The most remarkable pathological phenomena of croup are to be observed in the exudative process which attends the inflammation in the windpipe, and the formation of a false membrane, almost peculiar to children. When death takes place after an illness of four or five days, the windpipe is found to be lined with a white or gray substance. The membranes thus formed vary much in thickness and consistency. Some are so thin that the mucous membrane is readily seen through them, while others are many lines in thickness, exceeding even that of the mucous membrane itself, and consequently opaque. With respect to their consistency, some are so little coherent, that they are almost diffluent, while others can be detached for a considerable extent without rupturing. The false membrane, though occasionally only partial, yet more commonly embraces the entire circumference of the larynx, forming a complete hollow cylinder, adapted to the walls of the larynx. The membrane is in most instances limited to the larynx, but in some cases it extends down the trachea to the bifurcation, while in a very few cases it reaches even to the minutest branches of the bronchi. M. Hussenot says, of 120 cases he examined in 1778, it did not extend beyond the larynx, while in 42 cases it invaded the trachea or bronchi. The membrane thus formed is, in a few instances, removed by the cough, but more generally it adheres with so great tenacity that Gendrin conceives that it can only be detached by a thinner and more serous secretion taking place from the mucous membrane beneath it, which loosens and displaces it. The extent of the exudation, as indicated by the surface covered, is perhaps the most interesting and practically useful part of the pathology of the disease. The place first and most particularly affected is the upper part of the *trachea*, about an inch below the *glottis*. In that part patients complain of a dull pain. External swelling has been observed there; and the morbid membrane is found stretching from that place downwards. The back part of the trachea, where there are no cartilages, seems to be its first and principal seat (Home). According to Guersent, false membrane is never entirely absent from the larynx. Sometimes it is confined to the glottis, and sometimes lines the whole interior of the larynx, including the ventricles, and not unfrequently it extends throughout the trachea,

and, for a greater or less distance, into the bronchial tubes. Dr. Wood instances a case in which he saw the false membrane line the upper portion of the bronchia, the whole trachea and larynx, and the pharynx as low down as the œsophagus. More frequently, he says, the exudation is in the form of patches or long narrow ribbons, and occasionally, in the earlier stages, has a granular aspect, with the red mucous membrane appearing in the intervals of the imperfectly connected patches. According to Cheyne, in none of the cases recorded by him was membranous exudation observed in the laryngeal mucous membrane; and if the inflammation extended to this part, it was only slight, and its effects were seen in a little puriform fluid in the membrane of the circoid or thyroid cartilages. Some state that it is essential to the constitution of croup that the larynx should be more or less involved in inflammation, or high vascular irritation, accompanied with spasms of the internal muscles of the larynx (Wood). Others say that the inflammation in croup is truly tracheal and bronchial (Craigie, Copeland). In the more acutely inflammatory form it may extend to the larynx and epiglottis, in some cases; in others, to the first ramifications of the bronchi, and sometimes in both directions (Copeland).

Dr. Copeland, who has paid particular attention to the pathology of croup, states the following as general inferences from his observations:—"(*a*) That the mucous membrane itself is the seat of the inflammation of croup; and that its vessels exude the albuminous or characteristic discharge, which, from its plasticity and the effects of temperature and the continued passage of air over it, becomes concreted into a false membrane;—(*b*) That the occasional appearance of blood-vessels in it arises from the presence of red globules in the fluid when first exuded from the inflamed vessels, as may be ascertained by the exhibition, upon the approach of the symptoms, of a powerful emetic, which will bring away this fluid before it has concreted into a membrane; these globules generally attracting each other, and appearing like blood-vessels, as the albuminous matter coagulates on the inflamed surface;—(*c*) That the membranous substance is detached in the advanced stages of the disease, by the secretion, from the excited mucous follicles, of a more fluid and a less coagulable matter, which is poured out between it and the mucous coat; and, as this secretion of the mucous cryptæ becomes more and more copious, the albuminous membrane is the more fully separated, and ultimately excreted if the vital powers of the respiratory organ and of the system be sufficient to accomplish it;—(*d*) That sub-acute or slight inflammatory action may be inferred as having existed, in connection with an increased proportion of fibro-albuminous matter in the blood, whenever we find the croupal productions in the air-passages; but

that these are not the only morbid conditions constituting the disease;—(*e*) That, in conjunction with the foregoing,—sometimes only with the former of these in a slight degree,—there is always present, chiefly in the developed and advanced stages, much spasmodic action of the muscles of the larynx, and of the transverse fibres of the membranous part of the trachea, which, whilst it tends to loosen the attachment of the false membrane, diminishes, or momentarily shuts, the canal (of the larynx) through which the air presses into the lungs;—(*f*) That inflammatory action may exist in the trachea, and the exudation of albuminous matter may be going on for a considerable time before they are suspected,—the accession of the spasmodic symptoms being often the first intimation of the disease; and these, with the effects of the pre-existing inflammation, give rise to the phenomena characterizing the sudden seizure;—(*g*) That the modifications of croup may be referred to the varying degree and activity of the inflammatory action, the quantity, the fluidity, or plasticity of the exuded matter, the severity of spasmodic action, and to the predominance of either of these over the others in particular cases, owing to the habit of body, temperament, and treatment of the patient, &c.;—(*h*) That the muco-purulent secretion, which often accompanies or follows the detachment and discharge of the concrete or membranous matters, is the product of the consecutively excited, and slightly inflamed, state of the mucous follicles, the secretion of which acts so beneficially in detaching the false membrane;—(*i*) That a fatal issue is not caused merely by the quantity of the croupal productions accumulated in the larynx and trachea, but by the spasm, and the necessary results of interrupted respiration, and circulation through the lungs;—(*k*) That the partial detachment of fragments of membrane, particularly when they become entangled in the larynx, may excite severe, dangerous, or even fatal spasm of this part, according to its intensity relatively to the vital powers of the patient, and that this occurrence is most to be apprehended in the complicated states of the malady where the inflammatory action, with its characteristic exudation, spreads from the fauces and pharynx to the larynx and trachea, the larynx being often chiefly affected in such cases, and from its irritability and conformation giving rise to a more spasmodic and dangerous form of the disease;—(*l*) That the danger attending the complications of croup is to be ascribed not only to this circumstance, but also to the depression of vital power, and the characteristic state of fever accompanying most of them, particularly in their advanced stages;—(*m*) That irritation from partially detached membranous exudations in the pharynx, or in the vicinity of the larynx or epiglottis, may produce croupal symptoms in weak, exhausted, or nervous children, without the larynx or trachea being themselves materially

diseased; and that even the sympathetic irritation of teething may occasion the spasmodic form of croup, without much inflammatory irritation of the air-passages, particularly when the prima via is disordered, and the membranes about the base of the brain are in an excited state;—(*n*) That the predominance in particular cases of some one of the pathological states noticed above (*g*), as constituting the disease, and giving rise to the various modifications it presents, from the most inflammatory to the most spasmodic, may be manifested in the same case, at different stages of the malady, particularly in its simple forms, and in the relapses which may subsequently take place; the inflammatory character predominating in the early stages, and either the mucous or the spasmodic, or an association of both, in the subsequent periods;—(*o*) That the relapses, which so frequently occur after intervals of various duration, and which sometimes amount to seven or eight, or are even still more numerous, may each present different states or forms of the disease from the others; the first attack being generally the most inflammatory and severe, and the relapses of a slighter and more spasmodic kind; but in some cases this order is not observed, the second or third, or some subsequent seizure, being more severe than the rest, or even fatal, either from the inflammation and extent of exudation, or from the intensity and persistence of the spasmodic symptoms,—most frequently from this latter circumstance. The above inferences, however minute or trite they may seem, should not be overlooked, as they furnish the safest and most successful indications of cure, and are the beacons by which we are to be guided in the treatment of the disease."

No correct scientific name has been adopted for this disease. Dr. Farr proposes, and I have adopted *trachealia*. It is also useful to know the name by which a disease has been known and described, more especially as progressive improvements are made in nosology, by the correct nomenclature of diseases. The name of *croup* by which this disease has hitherto been known in this country, is of Scottish origin. Cullen's *cynanche trachealis*, and the more modern *tracheitis*, are objectionable terms, because they lead to false notions of the pathology of the disease. The "choak," "stuffing," "rising of the lights," and "hives," are all designations by which the disease has been described, and some of them are still names in vogue amongst the common people of the country.

The disease is almost peculiar to infancy and childhood; and there are two forms of this disease which can generally easily be distinguished from each other, but which are also often confounded. One form is very manageable, the other very fatal. In the former variety, the mucous membrane chiefly secretes mucus, pus, or muco-purulent fluid. In the more dangerous form, an albuminous

or fibrinous exudation forms upon the inner surface of the air-passages the false membranes already described. The first form seems to be the one common in America, of which not more than *one* in *fifty* dies. The latter is the more common European form, of which the deaths used to be *four* out of *five*, and still are about *a-half*. About one child, in twelve deaths of children, dies from this disease; and the ratio borne by croup, to 1,000 deaths from all causes, in 1854, was as 9·249.

Symptoms and Course.—The mildest form of croup differs from an ordinary catarrh only in the addition of spasmodic symptoms; but this form may also run into the more severe form, so that it is not possible to determine, in the first instance, which form the disease may ultimately assume.

The catarrhal croup of Dr. Wood embraces the spasmodic as well as the catarrhal croup of Dr. Copeland. Spasmodic action of the laryngeal muscles is, however, common to both, and is characteristic; but the inflammation and exudation is not in general more severe than that which attends a common catarrh.

The disease may be ushered in by sore throat, by catarrhal symptoms, or by a short dry cough, or it may occur *per se*, and without the general health being sensibly impaired. In either case the attack commonly takes place during the night, the sleep of the child, which was perhaps more or less agitated, being interrupted by fits of hoarse coughing. These become more frequent, the respiration more difficult, and marked by a peculiar wheezing, which has been described as like the sound of an inspiration forcibly made with a piece of muslin before the mouth, or like to the sound of air passing through a brazen tube. The little patient also feels a sense of restriction about the throat, as shown by carrying the hand often to it, and grasping the larynx. After the paroxysm has lasted some hours, there is an interval of ease, which perhaps lasts for some hours.

By the end of the second or third day, sometimes sooner, the tongue becomes white, the heat of the body increased, the pulse frequent, the countenance livid and distressed. From this point the disease now rapidly advances, the croupy sound attains its height, and Dr. Home describes it as "vox instar cantus galli;" others have compared it to the noise which a fowl makes when caught in the hand; while the child often puts its fingers into its mouth, as if to pull away something which obstructed the passage.

As the disease draws towards a close the paroxysms become more frequent, the cough more severe, the pulse more rapid, suffocation more imminent, and the extremities cold and livid. The final close of the disease is often by convulsions, sometimes almost tetanic; and Dr. Ferriar once was present when the struggle was so violent

that after death, the corpse in a great measure rested on the occiput and on the heels.

Often, however, the symptoms are much more moderate; although it not unfrequently happens that symptoms of the severer form come on, indicated by a huskiness of the voice, till no sound can be heard above a whisper, by a muffled cough, and a wheezing noise, which attends the inspirations. It is seldom that children expectorate; but in happier cases than the above, mucus, tinged perhaps with blood, is coughed up, and later, perchance, the false membrane is detached and thrown up, and the patient recovers.

The croup which has been described, is of the most acute kind; but, in many cases, its course is much more chronic, the symptoms generally milder, and the intervals of ease longer and more complete, during which the breath is free, the child cheerful, and the appetite good. In the course of a few days, however, a violent paroxysm seizes the child, and destroys him with every appearance of one strangled.

The internal fauces, as the tonsils, uvula, and velum pendulum palati, are sometimes seen inflamed and ulcerated; while in other cases the fauces are healthy.

According to Barth, on the stethoscope being applied to the larynx, we hear a sort of "tremblotement," as if a moveable membrane was agitated by the air; and he considers this phenomenon as an unerring evidence of the existence of a false membrane in the larynx.

Laryngitis in the adult is marked by the same difficulty of breathing, the same lividity of countenance, the same constriction of the throat, the same paroxysmal attack, and by the same exemption from any severe constitutional affection. The voice, however, instead of being sharp and shrill, is generally deep and hoarse, although sometimes altogether lost; differences, depending perhaps on the greater size of the glottis, and on the fact of the parts being the seat of ulceration, rather than of the effusion of lymph. At length the patient is cut off in one of the paroxysms. The duration of this disease, when acute, is short. The celebrated Dr. Pitcairn died on the fourth day from the first attack, and Sir John Hay, physician to the forces, died within the same period. More commonly, perhaps, the disease passes into a chronic state, when the patient may survive many weeks, or even months. Several cases are on record of croup having terminated in twenty-four hours; more frequently, however, the child lives to the third or fourth day, and in chronic cases much longer. From one day, to one or two weeks, may be given as the variable periods of the duration of this disease.

Diagnosis.—It is generally between croup and the following

diseases :—namely, the different forms of sore throat, as in *scarlet fever* and *measles, bronchitis, chronic, laryngeal, and tracheal inflammation, hooping-cough,* and the differential symptoms of each of these from croup, must be studied by comparing the definitions, symptoms, and course of each of these diseases.

Cause and Modes of Propagation.—Croup is said to be more frequent in cold and moist climates than in those which are warmer. It is also much more severe in Europe than in America ; and its existence and progress is considerably influenced by changes of season, weather, and temperature. It is prevalent in Switzerland and Savoy, in the eastern counties of England and Scotland, the north-west countries of Europe, and in the northern parts of America.

While the annals of medicine are rich in descriptions of epidemic and endemic croup, opinions are very much divided as to the nature of the epidemic influence, and whether or not the disease is contagious or infectious.

Age has, perhaps, the greatest influence in predisposing to the disease, and while rare in adults, it is seldom seen in early infancy. It is most prevalent between the *first* and *seventh* years of life. According to the experience of Dr. Wood, the disease appears to run in families, and vigorous fleshy children, with rosy complexions, are frequently those who suffer most.

Prognosis.—It is to be determined from the violence of the local symptoms and the frequency of the paroxysms, rather than from the constitutional symptoms. Children, however, seized with croup recover in a very small proportion in this country, but in a larger proportion in America.

Treatment.—*Every case of croup demands the most active, efficient, and energetic treatment.* When the croup in children commences in the larynx, its course is so rapid and so fatal that the measures for its suppression must be early. Bleeding, and especially local bleeding, should be employed, and in most cases to a considerable extent, and two to twelve leeches, according to the age of the patient, should be applied over the larynx ; and after these have fallen off, the bleeding should be encouraged by the application of a linseed poultice to the throat. This first bleeding often gives great relief, and sometimes stops the disease ; but if not, the leeches, after a few hours, may be repeated. As soon as some relief is obtained a blister should be applied, and after that is removed the part should be dressed with strong mercurial ointment. Besides this local treatment, it is usual to give mercury by the mouth ; some practitioners even give it as largely as one to two grains every hour, and Brettoneau says he has given as much as three scruples in twenty-four hours. This ultra active treatment, however, looking to the great mortality attending croup, can seldom have been successful ; and it may be doubtful

whether in many instances it has not accelerated the fatal termination.

In addition to bleeding, blistering, and mercury, many practitioners prescribe emetics; first, because their depressing effects, and the large evacuations they produce, lower the vital power and favour the resolution of the inflammation; and again, because the effort of vomiting may be the means of detaching and of expelling the false membrane, should it have formed.

Bleeding, blistering, and mercury, although the rule of treatment in idiopathic infantine croup, are, for the most part, entirely inefficient in those cases in which the affection begins in the fauces, as in the case of many epidemics, and especially after scarlatina. In these cases, the best treatment, if the false membrane be not already formed, is to relieve the throat by the application of a few leeches as in scarlet fever, and then to support the little patient with a moderate quantity of wine diluted with water. If the false membrane has formed, perhaps an emetic affords the only chance of relieving the patient; and, indeed, so soon as croupy cough and dyspnœa occur, an emetic of *ipecacuanha* with *tartar emetic* ought at once to be given in doses suited to age. Four to six grains of ipecacuanha combined with a quarter or a third of a grain of tartar emetic, will be found sufficient for a child of two or three years of age. The action of the emetic may be aided with benefit by a warm bath of 98° to 100° Fahr. in temperature. If it becomes obvious that the exudation has assumed the form of a membrane, especially if indicated by a diphtheritic coating over the fauces, a solution of the nitrate of silver varying in strength from two scruples to two drachms to the fluid ounce of distilled water should be applied to as much of the fauces and larynx as can be reached. A sponge on the end of a piece of whalebone, as sold by the instrument makers ready made, should be loaded with the weaker solution and squeezed against the *rima glottidis*, two or three times a-day. Bleeding has no effect in removing or modifying the false membrane; but the system must be brought as speedily as possible under the influence of mercury. Mercury appears a powerful resource in these cases; and, introduced either internally or by inunction, so as to affect the mouth, uniformly gives relief as soon as the constitutional affection is established. Unhappily, however, the amelioration is transitory, for almost as soon as the mouth is healed the symptoms return, and the patient again lies in imminent danger. Another salivation produces another cessation, but equally temporary, and the patient ultimately dies.

Expectorant medicines should be given with the mercurials, and be continued after them. Ipecacuanha and seneka have the most efficient influence over the mucous membrane.

Five grain doses of iodine of potassium every two hours; and of chlorate of potassa, have been used with benefit. The use of a vapour bath also, from 75° to 80° Fahr. may not be neglected (Budd).

The medical treatment of croup is so frequently unsuccessful, that tracheotomy has often been had recourse to as the means of prolonging life, and consequently, as affording an additional chance of the patient's recovery. Guersent has performed this operation repeatedly at the Hôpital des Enfans, but almost always without success. On the other hand, M. Trousseau states that he has saved one-third of his patients by its means, and of twenty cases, Bretonneau saved six. Perhaps the experience of the profession, generally, is equally discordant on this point, at this moment; for those who operate early, contend they save some portion of their patients, while those who wait till a case is advanced and beyond medical treatment before they resort to this measure, for the most part lose all their patients. It appears to me that tracheotomy ought to be resorted to much oftener, as a remedy for croup, than it has hitherto been, and *at a much earlier period in the disease.* That this is the secret of success in France and in this country, is shown by the experience of able physicians and good surgeons, of whom the names of M. Trousseau, Mr. Jones of Jersey, Mr. Henry Smith and Dr. Fuller of London, and the late Dr. Cruickshank of Dalmellington, in Scotland, may be stated as authorities. In country districts, the performance of tracheotomy in a case of croup is almost imperatively called for in a majority of cases as a rule, *if some symptoms of amelioration do not follow the steady use of the most approved course of medical treatment, pursued for twelve or sixteen hours.* I know that in a wild country district of Scotland, where croup was very common and fatal, the late Dr. Cruickshank saved eight out of eleven cases during two years. A valuable paper, by Mr. Smith, in *The Medical Times and Gazette,* 26th January, 1856, and another, by Mr. Jones of Jersey, in the 8th November of that year, go to support the same conclusion, namely, that an earlier introduction of air, by the operation of tracheotomy, for croup, would not only give us a larger per centage of recoveries in this country, but would place the operation in the same favourable light in which it is now regarded in Paris, and other parts of France. The cause of death after the operation is often extremely perplexing, for the patient, whether a child or an adult, often revives, breathes freely, and the local inflammation, from the use of the knife, is generally trifling, and yet the patient dies. Some physicians attribute this result to congestion and disease of the lung itself; but as the patient often lives for three or four days tranquil, and almost without cough, this hypothesis does not appear satisfactory.

The fatal result, therefore, seems rather to depend on a cause acting generally on the system, and which ultimately destroys the patient. This cause gives a difference of type to the disease in this country from what it has in France; but as this difference appears, in the first instance, to be aggravated by the obstruction to the passage of air, there is thus a still more powerful reason why the operation of tracheotomy must be resorted to early.

Whooping-Cough.

Definition.—*An infectious and sometimes epidemic disease, preceded and accompanied by fever of variable intensity; attended in the first instance by catarrh, and subsequently by paroxysmal fits of coughing, which occur by numerous short, rapid, spasmodic, convulsive movements of expiration, suddenly followed by a prolonged inspiration, which is marked by a characteristic sound of a sonorous kind, and variously named the "kink," "hoop," or "whoop." These paroxysms of expiratory and respiratory convulsive movements alternately recur several times, till the fit ends by a quantity of mucus being brought up from the lungs, or till the contents of the stomach are evacuated.*

Pathology and Morbid Anatomy.—The theory of this disease is, that a specific cause produces slight primary fever, which for the most part subsides on specific or secondary actions being established. These are catarrh followed by a peculiar cough and vomiting, due to irritation of the *vagus* by the specific poison.

Very different opinions have, however, at various periods been entertained as to the nature of this disease. Its origin appears to have been comparatively of no very distant date, Sprengel not having been able to trace it beyond 1510, when it was endemic in Paris; but its epidemic character was not determined till 1580, when it destroyed a prodigious number of children throughout Europe. The disease prevails now all over the world. It is distinguished in scientific nomenclature by the term *pertussis*. It is sometimes fatal to a large proportion of children; and like other diseases of this class, it appears as a rule but once during life, and attacks chiefly infants and children. Dr. Watson gives an instance of a child born with hooping-cough. There are instances, however, of its occurring not only late in life, but also a second time (Heberden). Some consider the disease simply as a variety of *bronchitis*, and accordingly class the disease with inflammatory disorders of the bronco-pulmonary mucous membrane. Inflammation, however, is not necessarily found to accompany the disease, although a state of the mucous membrane exists, by which it is morbidly irritable, or susceptible to impressions. Many cases have been examined in which no trace of inflammation

or other morbid change has been discovered in any part of the body. If, however, the disease be of great intensity, it very commonly produces structural changes in the lungs, stomach, intestinal canal, or the membranes of the brain.

Rostan says, "I have examined some children that have died of this disease with great care, and I have constantly found alteration of structure of the respiratory organs. The most common of these alterations is peripneumony, either single or double, with pleurisy and catarrhal inflammation of the bronchial membrane." Emphysema of the lungs has also been observed.

Dr. Watt, on examining the body of his son, Robert Watt, found, that "on laying open the stomach, the internal surface had numerous red streaks, the marks of inflammation. There was also an universal crust of exudation, and much of it was collected on the upper surface, and not owing to the position of the viscus." In two cases that died at the London Foundling Hospital, in addition to the usual inflammatory appearances of the lungs, the mucous membranes of the stomach were in each case singularly red and injected. Both stomachs, also, were filled with glairy matter vomited up in the disease. We occasionally, on opening patients that have died of hooping-cough, find the *bronchial glands* considerably enlarged, a circumstance which can hardly be considered accidental, when Blache states it existed in five cases out of nine that he examined. It is also sometimes found that serous fluid distends the ventricles of the brain. It has been a question whether the cerebral symptoms were the result of the violence of the cough, or was peculiar to the nature of the disease. The patient sometimes has died with formidable convulsions, and yet no alteration of texture has been discoverable. When, however, lesions of structure do exist, the membranes are injected, and serum effused into their cavity, and into the lateral ventricles. The substance of the brain, also, has more puncta cruenta than usual, and some very limited portions are said to have been found softened.

From some of the appearances now enumerated pathologists have ascribed the complaint to a morbid condition of the pneumogastric nerve, an explanation supposed by some to be confirmed by the circumstance that that pair of nerves are sometimes found red (Kilian, Autenrieth), with the medullary matter altered in colour, dense in texture, and of cartilaginous firmness. Others believe that a specific poison acts on some part of this nerve (Todd).

The results of nineteen observations made by Dr. Graily Hewitt during a recent epidemic of this disease (1855) in children varying from one month old to four years, showed the chief lesion found after death to be collapse of the lung substance, a condition also known under the various names of *fœtal condition*, *carnification*, and *atelectasis*.

The experimental test to detect the presence of this morbid collapse is that suggested by MM. Bailly and Legendre, and consists in inflating the lung, the effect of which is to produce uniform distention in a simply collapsed lung, but the force necessary to distend the carnified parts is more considerable, and some portions are not capable of inflation by any force. The air cells, most distant from the roots of the lungs, were most liable to this change, and the margins of the lungs were chiefly affected; and there is generally emphysematous distention of the air-vesicles adjoining the collapsed portions of these organs.

Other pathologists have ascribed the disease to cerebral irritation (Webster in *Medical Gazette*). But facts tend to show that the cerebral symptoms are effects, rather than the cause of the disease. In short, the formation and development of *whooping-cough* seem to follow the application of a contagious agent of an unknown kind, but which is communicated by the atmosphere, and seems to affect directly the pulmonary mucous membrane like *influenza* and *measles*, and like them the disease sometimes becomes epidemic.

It is observed that catarrhal symptoms exist in the first instance, attended by fever, and the secretion of a viscid mucus from the bronchial mucous membrane. The irritation arising from the combined influence of the cause on the pulmonary membrane, and the secretion which follows, is attempted to be got rid of by coughing, and in these expiratory efforts the air is expelled with great violence, and so repeatedly and irresistibly, that the lungs are ultimately almost emptied of air. At the conclusion of these expiratory efforts, the condition of the lungs resembles that produced by *asphyxia*. A sudden inspiration now necessarily and suddenly follows, the air being drawn through the glottis, by the gasping patient, with a force and velocity, which gives rise to a shrill, sonorous sound, not unlike the crowing of a cock, and which has been variously named a *kink*, a *hoop*, or *whoop;* and the disease has accordingly received various names, such as *kink, host, hooping-cough, whooping-cough, chincough.*

These anxious and distressing inspirations are scarcely completed, when the convulsive expirations of the cough are again renewed, and again followed by the gasping and crowing inspirations, till a quantity of mucus is brought up from the lungs, or till the contents of the stomach are rejected by vomiting. Such are the phenomena of the fit. After it is over, the patient in ordinary cases appears to be but little affected, and returns immediately to play, or to any other occupation which takes the attention at the time.

When these phenomena are prolonged, secondary effects are produced, whose morbid appearances have been noticed. The immediate consequence of the violent fits of coughing is to interrupt the

ree transmission of blood through the lungs, and the return of blood from the vessels of the head. This causes not only the swellings, redness, and lividity of the face which attend the fits, but also the discharges of blood from the mucous surfaces of the eyes, nose, and ears. A more extended knowledge of the pathology of this disease may be obtained by a careful study of its *symptoms* and *course*.

Symptoms.—The symptoms of whooping-cough arise out of the fever, the cough, the vomiting, and also the different inflammations with which the disease may be accompanied.

The rule that fever precedes the cough, though generally true, has many exceptions; for the paroxysms of cough are often established, and more particularly in summer, without being preceded by any febrile phenomena. The severest attack, indeed, seldom confines the patient to his bed, so that the fever rarely exceeds in severity that accompanying ordinary catarrh. Whooping-cough varies greatly in intensity, and, therefore, may be divided into—

Pertussis mitior, and into *Pertussis gravior*.

Most authors divide the group of symptoms of whooping-cough into three stages. The first stage comprehends the period from the first symptoms of illness until the whoop confirms the nature of the cough. This is the period of development. The second stage commences as soon as the nature of the cough is determined, and lasts till the violence of the cough and the danger of the inflammation is past. This is the period of spasmodic paroxysms, characteristic of the disease. The third stage is the convalescence of the patient, until the final and happy termination of the disease, or else the occurrence of those symptoms which destroy the sufferer.

First Stage.—The early symptoms of the whooping-cough are noticed more especially in the spring and fall of the year, and are those of a common cold—as hoarseness, sneezing, a watery discharge from the eyes and nose, much oppression of the chest, a short dry cough, and such fever and other derangement as usually attend an ordinary cold. This stage may last from one to eight days, but Willan has estimated it from one to two or three weeks, and Lombard has extended it to six or eight weeks.

Second Stage.—It is not until the fever remits, and is about to pass away, that the cough, which had distressed the patient, is followed by the characteristic whoop. On the occurrence, however, of this symptom, the disease is fully formed, and now consists of a series of fits or paroxysms of severe coughing, which occur at uncertain periods; while, during the interval, the patient often enjoys his usual health, recovers all his gaiety, returns to his

play, and relishes his food with good appetite. A paroxysm, or fit of the hooping-cough, generally comprehends the following phenomena :—

The approach of the fit is often denoted by an unpleasant titillation of the glottis, by a sharp pain in the chest, or else by a spasmodic contraction of the diaphragm. As soon as the child is thus warned, he instinctively runs to his nurse, and either grasps her arms, or lays hold of her chair, or her dress, to support himself during the paroxysm, which in a few minutes or seconds is about to follow. In severe cases the cough is quite convulsive, and so rapid is the action of the diaphragm, that the air is almost instantly expelled from the lungs, and the patient, half suffocated, turns black in the face. and frequently passes his urine. At length the crisis approaches, the diaphragm relaxes, and a violent inspiration follows, accompanied by the characteristic whoop. This sound perhaps remits, but after a few seconds returns; and thus convulsive inspirations and expirations continue, till the patient is at length relieved by a copious expectoration, or else by vomiting. The matters expectorated from the lungs are frequently thick, viscid, and muciform. When vomited from the stomach, the patient throws up a glairy fluid of much tenacity, semi-transparent, and frequently amounting to the greater part of a pint; and should he have recently eaten, the food often returns with it. It frequently happens, however, that the stomach retains the food, and rejects the offending matter. If the fit be violent, the fluid rushes not only from the mouth, but also from the nostrils; and in some instances is mixed with blood, for blood occasionally bursts forth in considerable quantities from the congested vessels of the mouth, the nostrils, the ears, the eyes, and in some instances, also, from the rectum.

If the stethoscope be applied to the chest previous to the fit, we sometimes detect the mucous ronchus, common to catarrh; yet in most cases the respiration is natural. During the act of coughing the respiration appears completely suspended, and is not sensible to the ear in any part of the chest. On the whoop, however, taking place, the air is heard to rush with remarkable violence into the trachea ; but at this point it stops for one or more seconds till the bronchial tubes relax, and the air is then admitted into the lungs.

The fit having subsided, the eyes, which seemed to have started from their orbits, resume their natural position, but are inundated with tears, or else the conjunctiva is more or less gorged with blood : the natural expression and appearance of the countenance returns, and in a few minutes, in favourable cases, the good spirits of the little patient are renewed, and he eats with appetite. On the con-

rary, in severe or unfavourable cases, long continued exhaustion, headache, and some fever, are the preludes to convulsions, inflammation, or the other more severe forms of the disease.

The paroxysm varies greatly in frequency and severity; but, in general, its frequency is, as its severity. In ordinary cases, it returns every two hours, but in severer cases, and especially during the second and third week, it returns every half or every quarter of an hour, or even oftener. This disease commonly reaches its acmé at the end of the third, fourth, or fifth week; after which the paroxysms diminish in frequency, the intervals are prolonged, and the patient is to a certain degree convalescent. The duration of this second stage is from two to six or eight weeks.

Third Stage.—The third stage commences with the convalescence of the patient, when the paroxysms become milder, the intervals longer, the expectoration more natural and less in quantity, and the vomiting ceases, so that the general health of the patient is much improved. The duration of this stage, however, is often long and variable, and the cough may still harass the patient for many weeks, or even many months. It is to this stage that the term chronic is usually applied.

The whole duration of the stages of hooping-cough are liable to greater variations than in almost any other disease; for the complaint may terminate in two or three days, and after a very few paroxysms, or it may last two, three, or four months, or even for more than a year.

Such is the progress of an ordinary case of pertussis mitior; but in particular seasons, and in particular persons, many accidents may arise to complicate the symptoms, and to increase the danger, as inflammation of some of the tissues of the lungs, of the mucous membrane of the stomach or intestines, or of the serous membranes of the brain.

Inflammation of the mucous membrane of the bronchia is the most usual complication of the hooping-cough. The form of inflammation may be that in which the secretions are in defect, so that the mucus is not only greatly diminished in quantity, but is thick and viscid, teazing the patient with fruitless efforts to free it from the lung, and thus causing a frequent recurrence of the paroxysm. In other cases it may assume the form of purulent inflammation, the pus secreted being formed into sputa, and moderate in quantity, or else it may be thrown up pure, as from an abscess, and so enormous in quantity as to amount to one or two pints in the twenty-four hours. The inflammation of the bronchial membrane may spread to the substance of the lungs, when the danger, as well as the symptoms of some of the various forms of pneumonia will be added to the disease; but the most formidable accident is when the pleura

is inflamed, for then the patient's sufferings during the paroxysm are fearfully increased, from the agonizing pain inflicted during the paroxysm of the cough.

The mucous membrane of the stomach and intestines is also often the seat of inflammation; and this is denoted by pain in the epigastrium, and by the suppression of the glairy fluid thrown up by vomiting, so that on the termination of the fit the patient often lies in a state of complete exhaustion, unable to discharge anything either from the stomach or lungs, or even to whoop, and he is now said, by the people, to labour under the *dumb kink*.

In mild cases the bowels are little affected in this disease, except that the patient sometimes passes his fæces during the paroxysm. In severe forms the stools are often either black and offensive, or else consist of a colourless mucus, the latter evidently depending on an inflamed state of the mucous follicles.

Headache is a symptom which usually attends the catarrhal stage, but generally ceases when the fever subsides. In some instances it continues throughout the disease, and is not unfrequently the forerunner of fatal convulsions, or epilepsy, or of inflammation of the membranes of the brain, terminating in delirium, coma, hydrocephalus, and death.

Diagnosis.—It is impossible to determine whether the febricula of the first stage is the result of simple catarrh, or will, on its subsiding, prove to be whooping-cough. As soon, however, as the cough has been followed for two or three paroxysms by the whoop, the diagnosis is perfect, no other disease being accompanied by this symptom.

Cause and Modes of Propagation.—That whooping-cough is induced by a specific agent there is little doubt; but in what manner this agent is generated is not determined. This disease is always sporadic, sometimes epidemic, and the "epidemic influence" is the most common cause and mode of propagation.

The predisposition to this disease is so strong that few persons pass the period of childhood without suffering from it; but it may occur at any subsequent age. The early age at which the large majority of patients pass through the disease is, however, a sufficient reason for our very slight acquaintance with the predisposing causes.

When the whooping-cough is once excited, the patient evolves a poison which is both infectious and contagious.

The public are unanimously of opinion that this disease is infectious, and no parent will permit his yet unaffected child to mingle with such as may be labouring under it. The profession also, are, with a few exceptions, of the same opinion. It is supposed to have been first introduced into Van Diemen's Land by a

female prisoner, and subsequently to have spread both to the settlers and natives.

The infecting *distance* of the poison must be considerable, from the utter impossibility of isolating the patient at home, or of preventing the spread of the disease in schools.

The fact of the contagious nature of this affection cannot be strictly demonstrated. The communication, however, of this disease by *fomites* gives some ground for the belief that it is so; and it is probably most contagious at the period of its highest development.

Rosen conceives that, without being aware of it, he has often carried the disease from house to house. Frank also says, it is often propagated from patient to patient, from house to house, and from village to village. Lombard says, that in Geneva, he has often traced the first cases occurring in that city to a neighbouring town, or to a sick child from the country. Whooping-cough was some years ago introduced into St. Helena, where it proved very fatal, the captain of a ship having some children labouring under whooping-cough on board, allowed their dirty linen to be sent on shore to be washed, and so introduced the disease among the inhabitants.

Whooping-cough, as a general principle, affects the same person but once, and the exceptions to it are exceedingly few. Blache, however, gives a remarkable instance of a grandfather and grandmother catching it a second time from their grandchild, and all of them labouring under the disease together.

The poison of this disease may co-exist with many other poisons, and in this case they often greatly influence each other's actions. The small-pox and whooping-cough have often co-existed; and a very common and fatal combination is measles and whooping-cough. Whooping-cough and cow-pox are not unfrequently combined. Indeed, the lower classes look upon vaccination as, in many instances, a cure for the whooping-cough.

If it is established, that whooping-cough is both contagious and infectious, it follows that the poison must be absorbed both by the mucous membranes and by the cutaneous tissue.

Period of Latency.—Our knowledge of this fact is at present extremely imperfect, but the more generally received opinion is, that the period of latency is about five or six days.

Prognosis.—The proportionate number of deaths to recoveries, in whooping-cough, is not determined, but greatly varies in different years; for in one year, says Frank, hardly a death will occur from the disease in a large city, while in another year many children will die. In general, however, the milder forms of the disease are rarely fatal, while the more severe and protracted cases very commonly are so. Lombard thinks station in society greatly affects the mortality;

for he says, that of ten fatal cases nine belong to the poorer classes. The reports of the Registrar-General show that the mortality is greater from this disease in towns than in the country, being in the metropolis, in 1838, ·111 per cent., while in England and Wales it was ·061. In the year 1839, also, it was for the metropolis ·061 per cent., while for England and Wales it was ·053. Lombard gives the ages of forty fatal cases as follows :—

Ages.	Cases.	Ages.	Cases.
From birth to 6 months,	6	From 4 to 5 years,	2
,, 6 to 12 months,	7	,, 5 to 6 years,	2
,, 1 to 2 years,	10	,, above 6 years,	0
,, 2 to 3 years,	6		
,, 3 to 4 years,	7	Total	40

Danger from bronchial inflammation is to be dreaded rather towards the end than the beginning of the disease. Convulsions are apt to occur if dentition is going on at the time; and if they arise from the congestion or effusion within the cranium, are generally fatal.

If a predisposition to tubercle exists, whooping-cough may determine the development of phthisis.

Treatment.—The stage of invasion is seldom marked by symptoms of greater severity than those of common catarrh, and consequently, except putting the patient on a low diet, and attending to his bowels, there is little occasion for medicine.

The whoop having confirmed the nature of the affection, and the second stage being established, the disease will run its course, and one of two indications of treatment may be followed. The first is to prevent, if possible, convulsions, or any attack of inflammation, either of the lungs, the stomach, or of the membranes of the brain. The second indication is, after the period of danger is past, to prescribe such medicines as may interrupt the course, and anticipate the time of the spontaneous cessation of the disease.

The best mode of obviating the danger of cerebral irritation, or of inflammation of any of the organs that have been mentioned, is to mitigate and control as far as possible, the frequency of the paroxysms, to check those secretions which are in excess, and to excite those which are in defect, and these objects are best obtained by mild opiates, combined with gentle purgatives or laxatives.

The choice of the opiate has been considered a matter of much importance. The continental physicians have bestowed much praise on belladonna, others on hemlock, others on henbane, while some have contented themselves with opium. It must be admitted, however, that none of these narcotics possess any specific property in controlling this disease, so that the selection of the particular one

must be left to the discretion of the practitioner. But supposing the patient to be a child, as the head is especially the organ to be protected, the mildest, as hyoscyamus, or the syrup of poppies, are the safest and best. Should, however, *belladonna* be selected, if the child be under *four* years of age, the dose ought not to exceed *one-eighth of a grain;* or if *hyoscyamus, half a grain* to *a grain*, every six or eight hours; while if it be the *syrup of poppies*, this medicine should be given in such *fractional* doses of a *drachm* as are suited to the age.

But an opiate, in the early stage of the disease, ought not to be administered alone, and some purgative or laxative ought, as a general rule, in all cases, to be combined with it. The selection of the particular medicine is perhaps unimportant, and any vegetable or saline purgative will perhaps answer equally well, as the confectio sennæ, rhubarb, castor oil, or manna. The neutral salts, however, sit easiest on the stomach, and (as the medicine must be continued) are the most agreeable to the patient. Opium is the most efficient remedy in allaying the cough, but is liable to the objection of being apt to check the mucous secretion.

Towards the close of the second stage the symptoms may, in a few instances, become unfavourable, and cerebral irritation, with convulsions, or inflammation of the membranes of the brain, of its substance, or of the tissues of the lung, or of the alimentary canal, may complicate the disease, and now the treatment of the case is always exceedingly difficult, and frequently unsuccessful.

If the convulsions should come on suddenly, and without headache, or other symptom of inflammatory action, small doses of any opiate, and mustard poultices to the feet, often relieve the patient; but should the convulsions still continue, an asafœtida injection may be administered. It often happens that the convulsions are combined with a suppression of the vomiting, and of the usual glairy discharge; and in these cases leeches, followed by a large linseed poultice, should be applied to the epigastrium. If the disease should proceed, and headache or other symptom show an affection of the membranes of the brain, leeches should be applied to the temples and cold to the head.

When the poison excites inflammation of the tissues or substance of the lungs, bleeding to a limited amount is imperatively required; but we should be satisfied with such mitigation of the symptoms as may obviate immediate danger, and even that is not always obtained, since the affection is not to be subdued by bleeding, as in simple inflammation; for, being dependent on the action of a morbid poison, it will run a given course. Blache, for instance, bled in nine cases, either with the lancet, by leeches, or by cupping, and in one case no less than five times; yet, he adds, with a desolating want of success, and eight out of the nine cases terminated fatally.

This result makes him add an axiom, in which every practitioner will agree, that there is in severe whooping-cough, as in typhus, cholera, and many other affections, an unknown element which modifies and gives a specific character to all these intercurrent inflammations.

If the intestinal canal be affected, some sharp purgative, combined perhaps with calomel, may be necessary, to act on the bowels and free them from their contents; and, if the stools be white and muciform, and the patient not relieved, an enlarged state of the follicles may be suspected, and consequently a linseed poultice should cover the abdomen for some hours, preceded, perhaps, by an enema of syrup of poppies and barley-water, and which should be administered night and morning. Many other modes of treatment have been recommended for the cure of whooping-cough, and more especially a treatment by emetics repeated every second day. Ipecacuanha is the best emetic, and may be given every second day as such, with smaller doses in the interval every two or three hours, so as to sustain a slight degree of nausea.

The disease having passed into the third stage, and the inflammation or other threatening symptom, if any has existed, having subsided, it is desirable to attempt to abridge the duration of the cough, which often extends to a most distressing length; and for this purpose tonics, antispasmodics, and other remedies, either external or internal, have been recommended.

The more stimulant antispasmodics, as asafœtida, musk, castor, oil of amber, cantharides, and camphor, are the remedies which have obtained the most suffrages in the cure of this stage of the whooping-cough. But the two first are most esteemed, and some persons even consider asafœtida to be a specific, not only in this, but in every other stage of the disease. It should be given in emulsion in the dose of one or two grains to a child two years old, repeated three or four times a-day, or even as often as every two or three hours. Cullen, however, preferred cinchona to asafœtida, and considered it "the most certain means of curing the disease." Many other remedies have been mentioned, as alum, hydrocyanic acid, oxide of zinc, arsenic, and many preparations of iron, and all of these remedies have perhaps been found to a certain extent useful; but in estimating the results of remedies we should be careful not to mistake temporary recovery for cure.

When internal remedies have failed to make any impression on the whooping-cough, the cure is often attempted by means of local treatment, or by derivatives. The early physicians applied actual cautery to the nape of the neck; the modern ones, blisters to the spine, or directed the back to be rubbed with the unguentum antimonii cum potassio tartarizati, or with some liniment or em-

brocation, as the liniment of camphor or of ammonia, or with asafœtida, oil of amber, oil of turpentine, or the tincture of cantharides. The general opinion, however, is, that these do little good unless they contain some opiate, whose absorption they facilitate. Foot baths and the warm bath have also been used, and often with much efficacy.

When ordinary remedies have failed, a change of air is a resource of great value, and was first mentioned by Dr. Forbes, in his thesis *De Tussi Convulsivi*, in 1754; and since that period it has been recommended in dangerous cases by most physicians, with that praise it so eminently deserves. While it is determined that a change from the bad air of a town to the purer air of the country is at all times of great benefit, Lombard contends that he has found a change from the country to the town to be beneficial, and that the patient is benefited even by the removal of so short a distance as half a mile. Indeed, it is impossible to witness more striking instances of the advantages of treatment than we occasionally observe in patients when removed from large towns to their environs, for even in a few hours they often recover from an apparently hopeless state. A sail across a river is also beneficial, although the distance may be short.

Dietetic and General Treatment.—The patient should not be allowed animal food from the commencement almost to the termination of the disease. It is desirable also that the temperature of his apartment should be regulated, and that he should not be exposed to any considerable or sudden change from heat to cold. In mild weather also, if no local symptom forbids, he should be permitted to take exercise in the open air. He should likewise be recommended to wear flannel.

There are no known means of prevention, except an entire removal from every source of contagion.

Influenza.

Definition.—*A catarrhal affection, frequently prevailing as an epidemic, attended with lassitude and prostration to an extreme degree; chills and great sensibility to cold over the surface of the skin, the eyes injected and tending to fill with tears, the nostrils discharging an acrid fluid, attended with fixed and intense pain in the head, mostly frontal over the eyes, sometimes also attended with giddiness, nights sleepless, with delirium, or lethargy; cough prevails, with yellow expectoration, most troublesome at night, and tending greatly to increase the headache. Fever generally attends the disorder, sometimes slight and sometimes severe, and of a type varying*

in different epidemics and localities. The sense of taste is generally greatly disordered, and there is great anxiety and oppression over the region of the heart.

Pathology.—We have no credible accounts of the existence of influenza previous to the tenth century. Towards the close of the twelfth and thirteenth centuries it was observed that catarrh was not only endemic in particular districts, but that it occasionally spread over large portions of country, while still later, or in the year 1557, it was found to prevail epidemically, not only over the whole of Europe, but even over the whole of the northern hemisphere, beginning in Asia and proceeding westward till it terminated in America. In the eighteenth century, having advanced westward till it reached the Elbe, it passed over the intermediate countries and reached England, where the stream broke into two branches: the one crossing the Atlantic to America, while the other retrograded south-east through France, Spain, and Italy, till it was lost in the Mediterranean—a course similar to that described by cholera.

Influenza has occasionally originated as far eastward as India, but more commonly it has broken out in the north of Europe, as Moscow, Warsaw, or Dresden. It seems probable that, like the poison of Cholera Indica, its spread may be limited to a small number of primary foci; for we find, in every volume of the *Calcutta Transactions*, accounts of some catarrhal fever spreading for a season along the banks of some principal river, and then subsiding; so that it is evidently only occasionally and at long intervals *erratic*, as in 1729, 1743, 1775, 1782, 1831, 1833, and 1837. The influenza, therefore, is both endemic and epidemic; and, in the latter case, we find it, at least in Europe, spreading from east to west, prevailing in the depths of winter as well as the heights of summer, lasting nearly the same space of time in the different towns and cities it attacks, or from four to six weeks, affecting contiguous places in different degrees and at different times.

On looking to the habits of this poison, it is probable that its actions are not limited to men; for in most years, when influenza has been epidemic, a similar disease has been epizootic, especially among horses.

A specific poison is believed to be absorbed and to infect the blood, when, after a given period of latency, it produces disordered functions of the great nervous centres, causing great general depression, together with slight or severe remittent fever. The specific actions of this poison are on the mucous membrane of the eyes, of the nose, and of the bronchi, causing common catarrh. In a smaller number of cases, on the mucous membrane of the fauces, causing sore throat, and in a still smaller ratio on the substance of

the lungs, and on the pleura, causing inflammation of those organs. In most instances the disorder terminates in diarrhœa. These different pathological phenomena vary in frequency and complexity in different seasons and places.

In most cases, when the poison is of sufficient intensity to produce fever, the type is remittent in this country, with exacerbations in the evening. Its usual duration is two, three, or four days, when it terminates in an abundant sweat, and which not unfrequently leaves great debility behind it. In Germany the fever is sometimes intermittent.

At the same time, however, or else preceding or succeeding the fever, the patient has in general been seized with a slight inflammation of the ocular and nasal membranes, followed by coryza, or the serous discharge of a common cold or catarrh; and this inflammation generally extends to the larynx and trachea, or to the lungs.

The pneumonia occupied most commonly the middle and lower lobes, and only rarely the summits of the lungs: out of forty cases observed by M. Landau, the inflammation occupied twenty-one times both lungs, eleven times the right lung, and eight times the left. The forms of pneumonia are principally serous inflammation and red hepatization, the latter occasionally interspersed with a few points of pus. Gluge states, that in the fatal cases of pneumonia connected with influenza he has found exudations in the bronchia, which he can only compare to the false membrane of croup. Such exudations were seen in the hepatized portions of the lung as white elastic firm cylinders filling the bronchia, from the fourth or fifth divisions of these tubes, into such as are not more than a quarter of a line in diameter. The inner membrane of the bronchia in such cases was extremely reddened, but not softened.

Symptoms, Course, and Complications.—The symptoms of influenza often assume a variety of different forms. Thus, catarrh often exists without the fever, and, in a smaller number of cases, the fever without the catarrh. Severe nervous depression, prostration, anxiety, and præcordial oppression, were frequently the most prominent symptoms, while in other instances the bronchial affection alone harassed the patient.

Whichever of the forms prevailed, the disease usually began with shivering, general soreness, headache, and pains in the limbs; and these symptoms were frequently accompanied by fever, slightly increased towards evening. Patients were usually seen about the third or fourth day, and then they were found complaining of cough, tightness of the chest, of pain in the epigastrium, and also of dyspnœa. The face was likewise flushed, and sometimes swollen,

the alæ of the nose red, the lip vesiculated, the eyes streaming with coryza, and the voice altered as in a common cold. The tongue was moist, or coated with a yellow mucus, and taste was vitiated, the skin soft, and without morbid heat, the pulse little augmented in frequency. But although each of the particular symptoms might be mild, there was a languor, debility, and dejection of spirits far beyond what might have been expected, and almost exceeding that of common fever. These symptoms were, in many instances, long in subsiding.

In mild cases such phenomena constituted the whole disease, and the patients recovered about the eighth or tenth day, after suffering for a few hours from sharp diarrhœa. In many instances, however, the patient, in addition, suffered from mild or severe sore throat, or a cough came on and continued for many weeks. In a few cases the symptoms were of a more aggravated character, the fever being more marked, the pulse accelerated, the skin hotter, and the cough more troublesome; and these conditions have often been followed by inflammation of the lungs.

Inflammation of the substance of the lungs seldom occurred till the second or third day, and more commonly not till the fifth or sixth ; and, although generally, was not always preceded by shivering, or even bronchitis. The pneumonia in some years has been characterized by well-marked symptoms, as pain in the side, dyspnœa, and by purulent or sanguineous expectoration, so that nobody could mistake it ; but in general the pneumonia has been adynamic in character, and presented a striking contrast to the usual symptoms, there being scarcely any local pain, the pulse, ordinarily so large and full, has been slow and small, and though sometimes counted between eighty and ninety, has ranged more commonly from sixty to seventy. The face also, instead of being full and red, has been sharp and pale, the lips blue, and the extremities cold. The patients also, who generally preserve a good deal of power in the ordinary forms of pneumonia, were now so weak that they were obliged to be supported while auscultated ; and even this mode of exploring the chest did not afford the usual indications, for crepitation was rare, and the respiratory murmur heard, except in a few points, all over the chest, while there was little or no bronchophony. The expectoration likewise had not the characters observed in simple pneumonia, for instead of being purulent and mixed with blood, it was thin, transparent, and viscid, and, if fever accompanied it, it was usually of an andynamic character, marked by a brown tongue, an accelerated pulse, and occasionally by delirium. Throughout the progress of this disease the symptoms of nervous derangement are much more prominent than in ordinary catarrh, and the muscular debility is great, which is the most dis-

tinguishing feature of the disease. So great is this prostration that in some instances the patient has fainted merely by attempting to sit up. This extreme debility often continues after all other symptoms have passed away. The disease generally terminates favourably by perspiration, or by a copious secretion of mucus from the bronchia, or a copious discharge of urine which deposits a sediment on cooling.

Causes and Modes of Propagation.—The attack of influenza is for the most part so universal, that large portions of the population of every country in which it has prevailed, without respect to age, sex, or condition, have been commonly infected. In general, however, women, from being less exposed to the weather, have suffered in a smaller proportion than men, and children less than either. In all of these epidemics the aged suffer greatly. According to Dr. Blakiston's results, the ages from ten to sixty furnish the most patients. The age from thirty to forty furnish most males and from twenty to thirty most females.

It has been remarked, in several epidemics, that the low parts of towns have been more generally and more severely affected than the higher and more healthy districts.

The nature of the "*epidemic influence*" which gives rise to *influenza* is quite unknown.

Susceptibility Exhausted.—Few persons suffer more than one attack of influenza in the same epidemic, although many relapse; but one attack of this disease in no degree protects the constitution from a second attack in another epidemic.

Latency.—It is extremely difficult to determine the period of latency of an epidemic disease. There are instances of persons being seized within twenty-four hours after their landing from a voyage from a foreign country. In other cases, however, the period has appeared to vary from ten to twenty days.

Diagnosis.—It is extremely difficult to say in what influenza differs from a common cold, either in its symptoms or in its consequences. It seems probable, however, that they both depend on the action of the same poison, varying perhaps in intensity and general diffusion. In the year 1783 it was conceived that the debility which always accompanies the influenza, and the rapid manner in which it was formed, give the most obvious distinctions, and perhaps no better diagnosis can be found.

Prognosis.—Children and persons under forty died in a very small proportion, unless in a previous state of ill health. The mortality, however, among the aged has in every country been great from this disease. It has been remarked, also, that the disease, if not fatal in itself, left the patient, of whatever age, often greatly debilitated in body and depressed in spirits, and that those with

tender lungs who suffered from it frequently fell into phthisis, or continued to cough for several months afterwards, so that a complete recovery was often long and tedious.

Treatment.—As a general rule, the great majority of cases in epidemics of influenza have scarcely required any medical treatment. In that of 1782 it was observed that "many indeed were so slightly indisposed as to require little or no medicine; nothing more was wanted to their cure than to abstain for two or three days from animal food and fermented liquors, and to use some soft diluted tepid drink. A lenient purgative at the beginning of the disease was useful in moderating the fever, and nature seemed to point out the repetition of it afterwards when there was pain in the stomach and bowels, and a tendency to diarrhœa. The same was observed in 1762. Nothing likewise was observed so successfully to mitigate the cough, as a gentle purge to open the bowels, and afterwards to give a gentle opiate at night. In the year 1837 it was also remarked, as long as the symptoms were limited to cough, hoarseness, headache, or other pains moderate in degree, that the patients all recovered by putting them on a low diet, by attending to their bowels, and confining them for a few days to the house; and if more was attempted it was quickly found that the disease ran a course scarcely influenced by medicine. A smaller number, however, required medical attendance, either from the severity of the bronchitis, the occurrence of pneumonia, of angina, of the disordered state of the bowels, or more frequently from the debility induced by the disorder.

In general, when the bronchitis was severe, but the substance of the lung as yet unaffected, leeches to the chest, or cupping, or moderate bleeding were borne extremely well, and the patient relieved; while in the aged, blisters to the chest, followed by a series of linseed poultices, were often of essential service; and this treatment, together with neutral salts, opiates, and diaphoretics, in general effected the cure. In all the great epidemics of influenza, however, it has been remarked that the whole class of expectorants were either useless or uncertain in their action.

In pneumonia, it has been found that although a few persons bore the loss of a considerable amount of blood, yet in general, blood taken beyond a very limited quantity either did not relieve the complaint, or was actually prejudicial. It is in this form of pneumonia that large doses of the *tartrate of antimony* have been found so advantageous. Indeed it seems distinctly proved that this form of pneumonia will not bear that powerful antiphlogistic treatment which is necessary when it arises from general causes, and is of a more sthenic character.

When the patient was affected with angina, it yielded readily to

small bleedings when the tonsils were swollen, and to small quantities of wine when the tonsils presented little or no increase of size. The derangement of the bowels also readily yielded to purgative medicines when constipated, and when affected by diarrhœa and accompanied by pain, to mild purgatives and opiates, or else to the compound powder of chalk with opium.

When the fever and other immediately alarming symptoms of the influenza had ceased, there frequently remained a teasing cough, and the convalescents in general complained of languor, want of appetite, and that their sleep was broken and unrefreshing. For removing these complaints, change of air and riding on horseback were most effectual, and to some they were absolutely necessary; and in addition to these, mild tonics, or the natural chalybeate waters drank at the spas were of singular service.

Dietetic and Preventive Treatment.—In slight cases it was sufficient to limit the patient to white fish and puddings, and in the severer forms to slops and light puddings. The night air was universally prejudicial. It does not appear that any precautionary treatment was of service in preventing the spread of this disease among the attendants on the sick; for when four-fifths of the population were labouring under the disease, it can hardly be considered as having spread by contagion.

Dysentery.

Definition.—*A febrile disease, accompanied by tormina, followed by straining, and scanty mucous or bloody stools, which contain little or no fœcal matter. The surface and minute glandular apparatus of the mucous membrane of the large intestines, and sometimes of the small, are the chief seat of the local lesion.*

Pathology.—Dysentery is a disease which varies considerably in different countries and localities, and sometimes also in apparent accordance with the supposed exciting cause, or prevalent "epidemic constitution." Sporadic cases, which now and then occur in our large towns, are not generally so violent, and are less fatal than the epidemic cases, or those which occur in tropical climates. The effects on the constitution are no less varied and severe.

Dysentery has at all times proved one of the most severe scourges of our fleets on foreign stations, and of our armies in the field, even during campaigns in temperate regions. It is sometimes so prevalent that it exceeds the number of sick from all other diseases put together. In the words of Mr. Martin, "It is the disease of the famished garrisons of besieged towns, of barren encampments, and

of fleets navigating tropical seas where fruits and vegetables cannot be procured. During the Peninsular war, the first Burmese war, and the late war with Russia, *dysentery* was one of the most prevalent and fatal diseases which reduced the strength of the armies.

In England, generally, however, *dysentery*, as a cause of death, has been decreasing since 1852.

It is a dangerous and frequent disease throughout our inter-tropical possessions, as the following tabular statement, furnished by Sir Alexander Tulloch to Mr. Martin, sufficiently testifies :—

Prevalence and Mortality of Dysentery in various countries, by Sir Alexander Tulloch, K.C.B.

STATIONS.	Period of observation.	Aggregate strength.	DYSENTERY.		
			Attacked.	Died.	Proportion of deaths to admissions.
Windward and Leeward commenced,...	20 years.	86661	17843	1367	7·7 per cent.
Jamaica, ...	20 ,,	51567	4909	184	3·7 ,,
Gibraltar,.....	19 ,,	60269	2653	64	2·4 ,,
Malta,.....	20 ,,	40826	1401	94	6·6 ,,
Ionian Islands,.....	20 ,,	70293	3768	184	4·8 ,,
Bermudas, ...	20 ,,	11721	1751	36	2·0 ,,
Nova Scotia and New Brunswick, ...	20 ,,	46442	244	18	7·4 ,,
Canada, ...	20 ,,	64280	735	36	4·8 ,,
Western Africa,.....	18 ,,	1843	370	55	14·2 ,,
Cape of Good Hope,.....	19 ,,	227111	1425	44	3·0 ,,
St. Helena, ...	9 ,,	8973	751	69	9·0 ,,
Mauritius, ...	19 ,,	30515	5420	285	5·2 ,,
Ceylon, ...	20 ,,	42978	9069	993	11·1 ,,
Tenasserim Provinces, .	10 ,,	6818	1460	137	9·3 ,,
Madras,.....	5 ,,	31627	6639	559	8·3 ,,
Bengal, ...	5 ,,	38136	5152	411	8·0 ,,
Bombay, ...	5 ,,	17612	1879	151	8·0 ,,

The disease presents a variety of forms, both as to the rapidity and severity of its course, as well as to the anatomical peculiarities which characterize its pathology. It has been usual to describe cases of *dysentery* as being either *acute* or *chronic;* but there are also cases belonging to a third class which may be termed *complex.*

Acute Cases of Dysentery.

In this form, the inflammatory action does not confine itself to the tissues of the mucous membrane only, but extends to the serous covering of the intestine, or even to such solid viscera as the liver, spleen, or kidneys; and when ulceration or sloughing of large portions of mucous membrane and exudation are going on together, there may be very little corresponding fever at all commensurate with the severity of the lesions, so that while the disease is acute, it is at the same time, in many instances, of a marked and almost latent nature. Death frequently takes place within the first ten or twelve days in such cases, or the disease may terminate gradually and spontaneously, or as the result of appropriate treatment, by the end of the third or fourth week. On the other hand, the disease may not end, but, evincing a marked and obvious resistance to treatment, it may advance unchecked; the morbid changes being slow in progress, often extending over several months, and then the case passes into

Chronic Dysentery.

It is then one of the most hopeless and intractable forms of disease. Under the influence of the slow morbid changes about to be noticed, the wasting of the tissues of the patient progresses steadily, till one sees a human form literally reduced to the state of a living skeleton, whose bones are held together by skin and ligament. The skin acquires a dry bran-like furfuraceous aspect, and the epithelium desquamates in scales and powdery particles.

During the progress, more especially of chronic cases, various intercurrent morbid states become developed, not necessarily connected with the primary affection, but forming secondary lesions to the disease, and constituting the third form in which *dysentery* must be studied, namely,

Complex Cases of Dysentery.

There are various secondary lesions which render cases of dysentery complex, and which are regarded by some as directly connected with the primary affection. There are also secondary lesions connected with antecedent forms of disease which sustain a renewed impulse to their development by the dysenteric state. These secondary lesions may be shortly stated to consist—(1.) In lesions of the small intestines, and of various solid viscera, more or less connected with the dysenteric state; and (2.) In lesions which may be referred to the co-existence of certain morbid states of the patient

with the dysenteric condition, such for instance as the *typhous*, and *scorbutic*, and the *tuberculous* state.

Anatomy of the Morbid Tissues in Acute Dysentery.—It is the mucous membrane of the great intestine, and especially of the rectum and lower portion of the colon, which is the seat of the characteristic lesions in dysentery. The exudative process is generally diffuse, involving the whole tissues of the mucous membrane. In other cases it is seated in the solitary glands in the first instance, and neighbouring mucous tubular glands.

The morbid anatomical states which I have been able to distinguish throughout numerous dissections of men who died at Scutari, during the late Russian war, may be stated as follows :—

1. Forms of exudation obvious on the surface of the mucous membrane of the rectum and colon.

2. Forms of exudation not obvious to the unaided eye, but which were seen, in all the cases examined by the microscope, to fill the mucous tubular follicles of the large intestine.

3. Forms of exudation obvious to the eye, and demonstrable by microscopic examination, as being developed in the solitary vesicular glands of the large intestine.

4. Changes in the exuded material, which tend first towards its organization, and subsequently to its destruction and removal by ulceration.

5. Ulcerative changes in the tissues of the mucous membrane itself.

6. Similar dysenteric lesions extending into the *small intestines*.

The extent of the exudative process varies much. In some cases a considerable portion of the *colon* and *rectum* only is affected ; in other instances not only is the whole tract of the *great gut* the seat of some form of the exudative process, but the lower portion of the small intestine also. The most commonly affected portions, however, are the *rectum*, the *sigmoid flexure*, and the *descending colon*. When the *caput cœcum* of the colon is involved, the vermiform appendix participates in the process. Creamy-like exudations have been seen to fill its tubular glands, which in some cases opened up by ulceration.

The exuded material, in its more recent state, forms a layer which varies from a thin but opaque membrane, to three or four lines in thickness, of a homogeneous substance, tolerably consistent, and capable of being detached and raised in flakes from the subjacent mucous surface. During the earlier stages of the disease, the surface of the mucous membrane appears unchanged below, except, perhaps, by the existence of a little increase of vascularity. The colour of the exuded matter may be uniform or red, white, or pink in patches, and discoloured in some instances by intestinal gases,

the biliary secretion, or by the admixture of blood, and the changes consequent thereon. The most common appearance in severe cases is that of a dark olive-green passing into a bluish-black. The surface of the exudation may be uniform, or the whole aspect may be mammillated, with here and there a *mammillation* projecting greatly above the others in a fungating mass, surrounded by dark fissures in the exudation. These fungating masses are soft towards their centres, with numerous red vascular points here and there on the surface. A section through the mass shows the base thickened and firm.

The dysenteric process, as seen after death, is generally found to have advanced farther in one part of the intestine than in another; usually, it may be stated to have been farther advanced in the *rectum* than in the *descending colon*, and farther in that part than towards the head of the large intestine. In well marked and extreme cases, the entire mucous surface, from the *caput cœcum* to the *rectum*, may be seen to present all the possible stages of the dysenteric process. Three stages can in general be distinguished, namely,—(1.) Ulceration of exudation, and mucous membrane more or less advanced towards the *rectal end* of the great intestine; (2.) Exudation in various forms towards the *middle* of the *colon* upwards from the *rectum*; (3.) The exudative process visible microscopically in the tubular glands, and sometimes also obvious to unaided vision in the solitary vesicular glands of the great intestine, towards the *caput cœcum*.

Microscopically the exudation in its most recent condition may be seen to be composed of fine cells and nuclei with elongated nuclear cells. It appears to be chiefly exuded into the follicular and tubular apparatus of the mucous membrane, and gradually accumulating there, it is pushed upwards to the mucous surface, which it finally overspreads as a whitish coat, coherent and uniform, susceptible of vascular organization, and tending to ulcerate.

Anatomy of the Morbid Tissues in Chronic Dysentery.—In the true chronic form of dysentery, the exudation already noticed undergoes various changes. It may be thrown off from the mucous surface altogether, leaving that surface bare and raw looking, as if ulcerated, but a close inspection will show that the surface is entire and highly vascular. If it is not thrown off it may undergo a considerable amount of organization; after which it appears that a process of ulceration may be established upon its surface, just as in any other soft tissue. This ulcerative process may extend through the whole exudation, even to the surface of the mucous membrane, which it may penetrate also, and involve the tissues of the intestine in the ulcerative process, close to the peritoneal coat. Perforation of the peritoneum is by no means uncommon. In vertical sections of the exudation, down to and through the mucous membrane, I

have seen fine blood-vessels in loops and bulbous cœcal ends, shooting upwards beyond the mucous surface into the exudation; and when such exudation was removed from off the mucous surface, the membrane on which it lay was found to be highly vascular, and numerous minute ruptured vessels were distinguishable by minute points of exuding blood. When such a state of vascular action in the mucous membrane and exudation has existed for a lengthened period, the tissue of the gut becomes greatly thickened, and, at the same time, less coherent. The new material evinces a disposition to contract, the calibre or bore of the gut gradually contracts, and its texture becomes so brittle that slight force in pulling up a piece of such intestine out of its place will readily cause it to *break* asunder.

Ulceration may also commence in some part of the mucous surface itself. "Dr. Parkes considers *dysentery* to be a process of ulceration *universally* commencing in the solitary glands of the large intestines." Others consider that dysentery is a simple inflammation of the mucous coat (Raleigh). Neither of these extreme statements conveys the exact truth. The descriptions and interpretations of the appearances seen on the mucous surface in cases of dysentery are very various amongst those writers on *dysentery* who have seen the disease extensively, and who have described what they have seen. Our standard authorities (now of more ancient date) are Monro, Watson, Stark, Pringle, John Hunter, Moseley, Baillie, Jackson; our more recent authorities are Craigie, Copeland, Sir George Ballingall, Sir James M'Grigor, Johnson, Macpherson, Marshall, Parkes, Bleeker, and Martin.

Most minute descriptions of states of the intestine in *dysentery* have been given by each and all of these writers; but I do not know that any of them distinguish the ulcerative and other changes which are primarily established in the newly exuded material, which has become organized, from those changes which commence in the mucous membrane itself. Some describe lesions to be ulcerations of the mucous membrane, or even gangrene of that tissue, which are merely similar lesions confined entirely to the exudation; and a close inspection of such lesions will show that the mucous membrane is still sound below. As Dr. Copeland remarks, from his extensive experience, "Dysentery is neither so simple in its nature, nor so unvarying in its seat and form, as some recent writers in this country have stated;" and "that writer will but imperfectly perform his duty who, in giving a history of a most prevalent and dangerous malady, confines himself to the particular form it has assumed during a few seasons, within the single locality or the small circle of which he is the centre, and argues that it is always as he has observed it."

Recent microscopic examinations of the mucous membrane of the great intestine in *dysentery* has shown that, in the first instance, the exudation is extensively poured out into the *tubular glands*, and into the *solitary vesicular glands* of the gut, and that it appears subsequently to spread upon the mucous surface; and while changes of an ulcerative, sloughing, or gangrenous kind are apt to occur in the exudation, it also appears that similar changes may occur in the mucous tissue itself, commencing in the *tubular* and *solitary glands*. These are constantly found filled with exudation similar to that on the general mucous surface; and which appears to be similarly liable to change, finally tending to ulcerative destruction of the walls of the *solitary vesicular gland*, or of several *tubular glands*. Thus, ulcers are established of variable dimensions, on the mucous surface. When such an event happens, any superjacent exudation is separated and drops off; or if organized, it is involved in the ulcerative process. In some forms of *dysentery* the essential lesion appears almost entirely confined to the *solitary vesicular glands* of the large intestine, and to circumscribed adjacent portions of the *tubular gland* substance. Many instances of this form of *dysentery* I dissected at Scutari, and Dr. Lyons observed similar cases in the Crimea during the late Russian war. In such cases the *colon* presented here and there small, rounded, prominent little masses about the size of a pea, which broke readily on pressure, and gave exit to a small quantity of well formed pus. These pustule-like bodies were observed in different stages of development, from slight distension of a solitary vesicle, to an enlarged irregular excavation, the result of distension, absorption, and ulceration; the ulcer appearing as if punched out by a sharp instrument from the mucous tissue.

When the *solitary vesicle* becomes distended, the exudation within it ultimately softens, and, combined with the condition of increased vascularity in the vicinity, an abscess forms, which opens upon the mucous surface, through the little canal leading from the gland, imbedded in the sub-mucous tissue, up to the surface of the mucous membrane. These little abscesses give a peculiar character to the dysenteric process; and sometimes they are arranged in symmetrical double rows along the colon.

Sufficient observations are not yet recorded to establish this anatomical lesion as an independent form of dysentery. Associated with the usual dysenteric exudation, this lesion is observed generally towards the head of the colon. In such cases where it appeared to be the only lesion, there was no evidence to show that the usual dysenteric exudation had not existed and been cast off.

Some of the authorities already noticed have described this form of *dysentery* by such accurate characters, that this pustular form may be readily recognized under the various names which have been given

to this dysenteric state, such as "tubercles," "pustules," "small-pox-like" elevations. Hewson, Pringle, John Hunter, and Craigie, have each of them described this pustular state; and Dr. Craigie states exactly that "These hard pustules are muciparous follicles enlarged, indurated, and hypertrophied by the processes of inflammation;" while Dr. Parkes, as I have already noticed, considers that ulceration universally commences in the solitary glands of the large intestine.

In the chronic forms of dysentery there is also a very constant morbid change to be observed, consisting in the deposit of black matter on some parts of the mucous membrane. It may be regarded as the result of excessive vascular action, and of subsequent changes in the extravasated blood, elements which mark the site of the melanic spot.

The sigmoid flexure of the colon is perhaps the most frequently and the most extensively diseased, and is most marked towards the rectum. In very severe cases, the exudation extends over the whole extent of the mucous surface of the *colon*, which appears covered with black, grumous, carbonized looking masses, even to the upper part. Ulceration is most frequently seen in the *sigmoid flexure*, destroying at once the exudation and the mucous membrane, so as to expose the muscular tissue of the gut, which is red and irritable. An *appearance* of ulceration often extends in lines across the gut, so as to embrace its whole calibre, in some parts. This is sometimes, however, only an appearance of ulceration, caused by the separation of the exudation, when it is thick, exposing the highly vascular mucous surface below, which looks raw and ulcerated. When the gut is opened in the usual way after death, and extended on a flat surface, the change from the hitherto curved condition of the intestine is so great as to cause rupture, or separation between masses of the exudation, especially in places where it is thick, and so to give rise to the appearance noticed, and which has sometimes been described as ulceration. In long continued chronic cases, the rectum is generally studded over with punched-out looking ulcers with bloodless bases, and thin anœmic edges; and the melanotic deposit, already noticed, is here seen in the greatest abundance. Evidence of healed ulcers, with partially renewed mucous tissue covering them, are not uncommon in this locality, their place being indicated by the amount of black matter. The gland tissue, however, is not reproduced in the cicatrix substance.

Anatomy of the Morbid Tissues in Complex cases of Dysentery.—In the class of dysenteric cases which may be called *complex*, there are a variety of lesions, the pathological significance of which as to extent, form, origin, and locality, renders the cases of dysentery

in which they are found, of a very complex kind. The morbid lesions which chiefly tend to render cases of dysentery complex, are, (1.) Extension of the dysenteric process over the mucous membrane of the small intestine; (2.) Deposits and ulcerations in the glands of Peyer, as well as in the general tubular structure near the ileo-cœcal valve; (3.) Atrophy of the glandular parts of the mucous membrane of the alimentary canal; (4.) Secondary lesions of serous membranes; (5.) Secondary lesions of solid viscera in the *abdomen* and *thorax*; (6.) Secondary lesions due to the scorbutic, typhous, or tubercular states.

In some rapid and acute cases of *dysentery* it has been noticed that the process by which the *dysenteric lesions* were developed in the large intestine extended beyond the ileo-cœcal valve, and brought about an action in the small intestine similar to that in the colon. As much as the lower two-thirds of the ileum have been involved in this process, while the upper portion has been found intensely congested. In one case of *dysentery*, Dr. Cheyne says, he found an exudation of lymph extending nearly over the whole of the jejunum. If the stomach participates in the disease, the mucous membrane may be merely diffusely inflamed, or of a red or violet-colour, its surface granulated, and its texture broken by the slightest touch. More commonly, perhaps, the colour of the mucous membrane is natural, but on its surface a number of ecchymose spots or else small ulcers, are seen with edges as sharp, clean, and perpendicular, as if made with a punch. In other cases the tubular glands, as well as the solitary and aggregate glands of Peyer, have shown various stages of morbid action.

By far the most common condition, however, in chronic cases of *dysentery* especially, is that which is due to atrophy of the mucous membrane. As an atrophic change, it may be ascribed to the general wasting (marasmic) processes which take place to a great extent throughout the system in cases of *chronic dysentery*. In this complex state the mucous membrane of the *small intestine* appears pale, thin, and worn; a condition which pervades the greater part of the alimentary canal, and which is especially made manifest in the living as well as in the dead, by the condition of the mucous membrane of the mouth. On turning down the lips, the mucous glands are seen distinctly projecting through the thin pale labial and buccal mucous membrane. When such cases are examined after death, the structure of the solitary glands, and of Peyer's patches, are found to be degenerated and wasted; no gland cells are to be seen, and their place is supplied by fibroid tissue, with some vascular injection round the reticulated spaces. In other instances a deposit of black pigment surrounds the locality of the glands, which indicates the long continued process of vascular action previous to their atrophy.

Associated with this general atrophic state, some gland patches were also observed in an apparently opposite state, that is, distended and sometimes engorged, but on examination, their contents appeared to be undergoing a molecular, melanotic, and generally fatty degeneration, probably preparatory to complete evacuation and destruction of the gland element. These two apparently opposite conditions co-existing in the same cases, appeared to indicate that the one condition is but the antecedent of the other; and that the atrophy and degeneration was the last result of a series of morbid processes commencing in the engorged gland cavities.

In parts of the mucous tissue which exhibited the opposite conditions of extreme hypertrophy and extreme atrophy, the specific gravity of the former indicated 1·046, while the thin and wasted part of the intestine indicated a specific gravity of 1·036 to 1·030.

There is now abundance of evidence to show that in some endemic cases, or in epidemics of *dysentery* in some places, there is a tendency to the secondary engagements of organs or parts, during or subsequent to the development of the dysenteric process. Some look upon these secondary processes in relation to the dysentery, as in the relation of effect following a cause; or that there is an immediate and direct connection between the primary dysenteric process and the secondary lesion. Such a relationship has not been shown to exist in all cases; and it is more probable that the *dysenteric* process, when it operates on the system during a protracted period, predisposes, as many other morbid states do, to the development of secondary local lesions in distant parts.

The arachnoid, the pleuræ, the pericardium, and the peritoneum have each and all of them in some instances been the seat of opacities or of fluid exudations in dysenteric cases.

Of morbid states of the solid viscera, associated with dysentery, by far the most frequent complication is that with the *liver;* and this association of hepatic disease with *dysentery* would seem to be most frequent in the climate of the East Indies, and in such climates as have a common influence (Martin). In the Bombay army, out of thirty fatal cases of *dysentery*, twelve were attended with hepatic abscess (Morehead). Dr. Macpherson, Sir James Macgrigor, Dr. Parkes, and Mr. Henry Marshall, give similar statistical results of their experience at Calcutta, Moulmein, and Ceylon. The French surgeons also in the province of Oran in Algeria, state that hepatitis and consequent abscess were frequently coincident with dysentery. Dr. Parkes also observes, that if the functional morbid state of the liver is to be judged of by chemical analysis of the secretion of that viscus, the liver is found to be diseased, more or less, in every case of dysentery. The tendency to hepatic complication was found in Algeria to increase with age, and with the length of service in that

country. It was also observed by Dr. Martin that certain portions of the large intestine, namely, the cœcum and the rectum, appeared to be most affected when the complication in dysentery has been of the hepatic nature. It however appears also that hepatic abscess is but rarely associated with dysentery in natives of those warm climates; and amongst British subjects in their native climate it seems equally rare. In the Millbank prison, "out of many hundred cases not one has been complicated with hepatic abscess." It does not appear, however, that the influence of the climate of the East on Europeans alone tends to the hepatic complication, for "in the Peninsular army, under the Duke of Wellington, the spleen, the liver, and the mesentery were generally found diseased in cases of dysentery; so were these viscera in the epidemic dysentery of Ireland" (MARTIN). In the dysentery of the allied armies in the hospitals of the East during the late Russian war, hepatic abscess, however, was of rare occurrence.

Regarding hepatic complication in dysentery the following conclusions are stated by a reviewer in *The Lancet*, and given by Mr. Martin in his excellent account of the acute dysentery of Bengal:—

1. That dysentery, in a great number of cases, commences and runs its course uncomplicated by hepatic disease.

2. That hepatic disease *may*, in some cases, be the predisposing or exciting cause of *dysentery*.

3. That a large majority of the fatal cases of *dysentery* are complicated with hepatic abscess.

4. That in a much larger majority of these cases, ulceration of the intestine is the primary disease and the source of the hepatic abscess.

Nevertheless, although the connection between abscess of the liver and dysentery as a clinical fact is indisputable, the exact relationship and pathological significance of the morbid state are still open questions.

The occurrence of hepatic abscess has been viewed as a result of phlebitis; but Dr. Parkes, after the most careful observation of such cases, says, that he has never found the slightest trace of inflammation in the small veins of the intestine, while no direct proof has been advanced of the mediation of the portal blood in the process; and in conclusion, writes Dr. Henoch, "I believe we must give the preference to that view which regards the two diseased processes, dysentery and abscess of the liver, as without mutual relation, but as running their course together, dependent upon one and the same cause; in favour of which view is the circumstance, that in hot climates abscess of the liver also very frequently occurs associated with remittent fevers, or consecutive to them, without

dissection exhibiting any ulceration of the mucous membrane of the intestine" (*Brit. and For. Med.-Chir. Review*, July, 1854).

The spleen and pancreas are sometimes also found diseased; and Mr. Twining notices the former as one of the most fatal complications of dysentery in the East Indies. These viscera are found either enlarged and softened, or enlarged and indurated, the spleen being sometimes the seat of abscess.

Of thoracic viscera, the lungs have sometimes exhibited a great tendency to secondary morbid processes in dysenteric cases. This was especially the case in the dysentery of the allied armies during the late Russian war, where otherwise pulmonic lesions were rare.

The pulmonic lesions associated with the dysenteric process were as follows:—(1.) More or less extensive lesion of the bronchial membrane, the finer ramifications of the tubes being filled with frothy mucus and pus-like exudation, and associated with extensive vesicular bronchitis; there were well marked spots of lobular pneumonia. (2.) Exudations into the pulmonary parenchyma, chiefly in the form of isolated deposits of considerable density, disseminated through the substance of the lungs. These masses passed into a purulent condition, and microscopically they were composed of broken up cells, granular matter, and pus elements.

The last class of conditions which render cases of dysentery complex is the alliance of other disease-processes with dysentery. Such cases are generally of a very protracted duration; and the associated morbid lesions are not only complex from the number of morbid processes developed and the organs attacked, but they are complex from the variety of the kind, degree, and extent of the co-existent affections. Many disease-processes may be observed to co-exist in one patient. Dysentery, *scorbutus*, *tuberculosis*, and the *typhous* process I have in more than one instance seen to co-exist; and such complexity of disease-processes tends greatly to multiply the number of the anatomical local lesions, and thereby to complicate the case still more.

Dysentery, as Martin remarks, "is found to complicate readily in all climates with the prevailing fevers." Within the tropics it is frequently associated with *remittent* and *intermittent fevers;* in the geographical region of *typhous fevers* it is a most frequent complication, under various circumstances, and becomes contagious; and lastly, it is also occasionally complicated with *scurvy*. When dysentery follows upon or is associated with intermittent fever, the spleen will frequently become enlarged, indicated in the outset by general anœmia, or splenic cachexia, with a low asthenic type of dysentery.

The scorbutic complication is developed in *dysentery* when the supply of food is unwholsome, or when it consists in whole or in

the greater part of salted meat. Sir Gilbert Blane asserts that the complication has been known to arise among prisoners of war, living entirely on fresh diet, and solely imputable, therefore, to confinement in bad air, a dull uniformity of life, depression of spirits, and the indolent habits of captivity.

"The most terrible instance of suffering from this cause," writes Dr. Martin, "was that of the European portion of the force employed in Ava, during the first Burmese war, where they were for six and a-half months fed on salt rations, and where forty-eight per cent. perished within ten months, principally by dysentery with the scorbutic state." Such disasters have since been equalled, if not surpassed, by the sufferings of our troops in the camp before Sebastopol during the winters of 1854–55, under the influence of continued rations of salt meat and green coffee.

There is still another light in which the pathology of this disease requires to be studied, namely, in the

Types and Forms of Dysentery.—These have been very variously described as the (1.) purely inflammatory, acute, hyper-acute, or sthenic form. In this form, while the phenomena indicate acute and severe inflammatory action, there is no tendency to the great depression of the nervous, circulatory, and muscular function, which gives a marked character to some of the other types of the disease, such as (2.) the asthenic forms. In the *asthenic* forms, besides the depression of the functions just noticed, there is much greater tendency in these forms to spread by infection, or under an epidemic influence. These asthenic forms are sometimes described as *adynamic*, *typhoid*, *malignant*, *bilious*, *intermittent*, or *remittent*, according as certain phenomena prevail characteristic of these states.

Symptoms of Dysentery.—An ordinary attack commonly commences with *diarrhœa;* but in twelve or twenty-four hours disagreeable feelings begin to attend the frequent loose discharges from the bowels. These are irregular pains, commonly called "gripes," along the course of the large intestine, and sometimes described as "shooting" or "cutting." Technically, such symptoms are called *tormina.* They are momentarily relieved by discharges from the bowels. But after a short time a sense of heat ascends from the rectum, and pain extends to the epigastrium, till the whole abdomen is painful. There is a frequently returning inclination to go to stool; the griping and straining continues without the patient being able to pass anything more than a little bloody mucus. These symptoms are generally aggravated during the night and early morning, and they leave behind them the exhausting sensation that there has always remained in the bowel something which has yet to be discharged. This feeling is technically called *tenesmus*, and ultimately becomes the most striking

feature in the case. The acute pain in the abdomen, although it may extend to the iliac regions or flanks, generally concentrates itself at last about the rectum.

The discharges from the bowels are at first scanty, consisting of mucus and blood; or, bloody slime, as it is sometimes called. As the disease progresses the evacuations become more copious, tinged with bile, and carrying off shreds of the exudation thrown out on the mucous surface of the intestine. Hardened balls of fæces, called *scybalæ*, are also sometimes discharged; and if much feculent matter pass there is always considerable relief. When the disease is fully established the discharges exhale an odour, different from the smell of fæces, and which is almost peculiar to dysentery and very offensive. It is important to observe the character of the discharges, and especially as to the relative amount of blood and mucus. If the disease advances, besides the constitutional symptoms becoming aggravated, more blood and mucus also appear in the discharges from the intestines, together with shreds or large sloughs of exudation, which are often described as pieces of mucous membrane. Such, however, they are not, but, like the dysmenorrhœal membrane which forms on the internal surface of the uterus, the dysenteric slough varies in consistence, thickness, and strength; it may be washed perfectly white in water, and its minute histology shows no character of a mucous membrane. The hardened balls of fæces are much more rarely seen than they have been described to be. When the skin is dry and of a pungent heat, the tongue furred, and the thirst urgent, the urine scanty and high coloured, and the pulse increasing in frequency,—these are symptoms of increasing danger in dysentery. Throughout the disease there is febrile distress, the nights are passed without sleep, or, when it is obtained, it is in short periods, dreamy and disturbed; and when the patient awakes he is unrefreshed, and his spirits low and desponding. In the majority of cases the disease takes a favourable turn between the sixth and tenth days, the symptoms are then mitigated, the pain ceases, the number of stools diminish, and the flow of urine is restored. On the contrary, if it terminates fatally in this stage, hiccough, vomiting, a small and rapid pulse, and pale sharp features, denote the approach of death. The intellect, however, is perfect, and the patient, often deploring the fate which he sees inevitably to await him, dies after a short agony. If the disease proves fatal in the chronic form, the patient generally becomes rapidly altered and prostrated by his sufferings, is strikingly emaciated, and often earnestly prays to be relieved from a life disgusting to himself and entirely despaired of by others. Death begins at the heart. On the contrary, the patient in a few rare instances recovers, the local symptoms gradually yielding,

till his health and strength are ultimately restored, in a moderate degree. Convalescence is slow, rarely complete, and there is perhaps no disease which makes so persistent and pernicious an impression on the human constitution as dysentery.

Causes and Modes of Propagation.—It may be stated, as a general proposition, that there is no country where paludal fever exists that dysentery is not an endemic and prevailing disease. In the East and West Indies, in China, the Ionian Islands, Gibraltar, Malta, the Canadas, Holland, the coasts of Africa, as well as in many different parts of France, of the Peninsula, of the continent of America, and of the eastern parts of Great Britain, the prevalence of intermittent or remittent fevers and of dysentery is notorious.

This connection is so intimate that a given number of persons being exposed to the action of paludal miasmata, as, for example, a boat's crew sent ashore in a tropical climate, the probabilities are that of the men returning on board, part will be seized with dysentery, and part with remittent fever.

Paludal fever and dysentery, moreover, are not only conjoined in locality, but they often also co-exist, precede, or follow each other in the same individual, so that the fever frequently ends in dysentery, and the dysentery in remittent fever. This proof of the common nature of these diseases is corroborated by every writer of any celebrity, and more especially by those who have detailed the diseases of our armies. But dysentery also prevails where there is no other evidence of the presence of malaria. Nevertheless, the evidence in favour of malaria being the common, though probably not the sole cause of dysentery, appears to be much the stronger. It seems also determined that dysentery prevails generally in the inverse ratio of the intensity of paludal fever. In Jamaica, for example, when the white troops suffered in the large proportion of 91 per cent. annually from paludal fevers, the cases of dysentery were to those of fever as one to nine; while in the Madras presidency, when the troops suffered from fever in the much less ratio of only $30\frac{4}{10}$ per cent. annually, the cases of dysentery were to those of fever as forty-seven of the former to thirty of the latter. It appears also that dysentery is less common in the hotter than in the colder months, or arises under circumstances less favourable to vegetable decomposition. Thus in India and China it is from the middle of November to the latter end of February, or when remittent fever changes into intermittent, that dysentery greatly prevails.

Our knowledge of the predisposing causes is derived from what principally occurs in the military and naval service; and from the sufferings of the troops we learn that exposure to the night air, to wet, or to fatigue, together with the intemperance and improper

diet incident to the life of a soldier, especially on active service in the field, have at all times been found to be powerful predisposing causes to dysentery.

The effects of *salt* diet in the production of dysentery being less known than the other predisposing causes, it may be as well to state, that by an experience of twenty years in the West Indies, it has been determined that in the Windward and Leeward Command, where the rations issued to the troops consist of salt provisions five days in the week, the mortality from diseases of the stomach and bowels among the officers is as two to four per cent., while that among the soldiers is as 20·7, or a tenfold ratio. On the contrary, in Jamaica, where salt provisions are issued to the troops only two days in the week, the mortality from the same diseases approximates so nearly between these two ranks as to be almost an equality. And corresponding facts to these have been observed in Gibraltar, on the coast of Africa, and at St. Helena.

The Sierra Leone commissioners on the western coast of Africa, who investigated this subject on the spot, were of opinion that the large proportion of salt rations mainly contributed to the sickness and mortality from diseases of the stomach and bowels in the form of dysentery and diarrhœa; and the following statement, given by Sir Alexander Tulloch in his statistical reports (page 11) on the sanitary condition of the troops in West Command, shows the marked reduction which took place in the deaths from this class of diseases subsequent to the introduction of fresh meat diet; the mortality being reduced to a *tenth* part of its former ratio :—

Previous to Alterations in Rations.						Subsequent to Alterations in Rations.					
Year.	Mean Strength.	Dysentery and Diarrhœa chiefly.		Ratio per 1000 of Mean Strength.		Year.	Mean Strength.	Dysentery and Diarrhœa chiefly.		Ratio per 1000 of Mean Strength.	
		Admitted.	Died.	Admitted.	Died.			Admitted.	Died.	Admitted.	Died.
1825	571	235	32	411	56	1828	232	139	1	600	$5\frac{1}{10}$
1826	471	256	26	543	56	1829	114	50	—	439	
1827	345	209	13	606	38	1830 to 1836	42	22	1	524	
				Average.	Aver.						
Total...	1387	700	71	505	51					Average	
						Total...	388	211	2	543	$5\frac{1}{10}$

In the navy also the same effects of ill-regulated diet have been observed, and the good effects of a change. "In 1797," says Dr. Wilson, "the victualling (of the navy) was changed, greatly improved, and consequently immediate to the change the health of the seamen improved strikingly. Scurvy, typhoid fever, *dysentery*, and ulcer, which, up to the period of the change, had produced

great havoc, became comparatively rare in occurrence and light in impression," and, it may now be added, are hardly known except by name.*

The last appearance of dysentery in London was apparently owing to an insufficient diet, and occurred at the Penitentiary, Millbank, shortly after its completion. This prison is built on a marsh below the level of the Thames at high water, the river being banked out by a narrow causeway. As long as the prisoners were allowed a full and ample diet they appear to have resisted the action of the paludal poison, and to have enjoyed good health. No sooner, however, was the quantity and quality of their dietary lowered than dysentery of a very fatal character broke out, and made it necessary to clear that establishment for a time of all its inmates. There are few facts to enable us to determine the proportions in which the different ages suffer from dysentery, but the returns of the troops from the Mauritius show that the mortality from this disease falls principally on soldiers advanced in life (TULLOCH).

FORCES IN THE MAURITIUS.	AGE.			
	18 to 24.	25 to 33.	33 to 40.	40 to 50.
Aggregate strength of seven years, ...	3892	5361	1215	300
Died of dysentery,.....	26	63	24	8
Ratio per 1000 of mean strength,.....	6·7	11·8	19·7	36·6

Besides unwholesome solid food, water of an impure kind and from an impure source, also favours the development of dysentery. Drained from swamps and used for drinking and cooking purposes, as it was on the Chinese coasts, it exerted a marked injurious influence both in exciting and in maintaining the disease.

Many other causes bring about the disease, especially amongst soldiers in active service, namely, long marches in hot weather, bivouacking at night in the open air, often extremely cold both absolutely and relatively to the day; want of sufficient clothes and bedding, may be mentioned as the chief.

It does not seem to be clearly established that dysentery is contagious, but that being a frequent complication or concomitant of

* As Dr. Christison justly observes, the salt meat of military and naval rations is not the same as the salt meat of civil life. The former is highly salted, in order to keep for two or more years in every climate. Its nutritive value is thus greatly overrated, and its nutritive constituents are still further diminished by the process of washing out in water before it can be eaten. Thus, besides the irritant effects of the salt diet in producing dysentery, another element exists as a cause of disease, namely, the insufficient nutrition which the salt ration diet is able to impart.

contagious fevers, it has been believed to inherit similar contagious properties.

Prognosis.—The prognosis in dysentery depends much on the country in which the disease occurs, but in hot climates it is calculated that the deaths vary from one in nine to one in twenty; and on actual service the chances of recovery are much diminished. In all returns, however, the total deaths recorded give a faint idea and inaccurate representation of the real mortality resulting from dysentery. If it were possible to trace out the men who were invalided from the army and navy services from the effects of this disease, it would be found that the mortality is very much greater than is represented by tabular returns. It is a malady which, once fairly engrafted on the system, never leaves it till life itself becomes extinct (Bryson, and others). It is sometimes also insidious in its mode of attack and progress, and there is such a desire, on the part of soldiers especially, to avoid the restraints of hospitals, that the disease is sometimes beyond the power of medicine before coming under treatment, especially in tropical commands (Tulloch). There may be diseases of a more rapidly fatal character, but there are few which entail so great an amount of suffering. When once the disease has passed into the chronic form, it slowly, but not the less surely, continues by a most loathsome process, to exhaust the vital energies, until death relieves the patient of an existence rendered almost intolerable by pain, debility, and the offensive nature of the discharges (Bryson).

Diagnosis.—It is difficult, perhaps impossible, in the first stage, to distinguish dysentery from diarrhœa; but the blood, the number of the stools, and small quantity of fæcal matter passed, will, in times when dysentery is prevalent, indicate the true nature of the disease.

Treatment.—Every conceivable mode of treatment has been tried in this disease. The success has been various, more especially according as the patient has been treated while still subjected to or in the midst of causes which tended to induce the disease, or when he has been removed to another climate at an early period. After what has been written regarding the nature and the causes of dysentery, it is the obvious duty of the physician to direct his attention, in the first instance, to the *prevention* of the disease. Next, he ought to insure the means of detecting the disease early, for time is of the greatest importance in its cure and prognosis. "He who would treat this disease with success," writes Mr. R. Martin, "while he shuns exclusive means, must assign to each remedy its proper value. Blood-letting, sudorifics, and purgatives, constitute the most universal remedies, and in simple uncomplicated dysenteries they will prove all-sufficient.

But when the abdomen is tumid, and there is pain in the liver, or in any other region, while the nature of the discharges indicates advancing inflammation, calomel, conjoined with sudorifics, and repeated to meet the occasion, will powerfully aid the curative effect through its influence on the depurative functions, on the circulation, by unloading, jointly with purgatives, the gorged vessels of the abdominal organs, on the blood and on secretions generally, and on the very sudorific function which we wish to excite. While calomel is a most powerful agent when used judiciously, as an aid to blood-letting, pushing it to the extent of ptyalism is by no means to be recommended; nor should mercury in any shape be used in adynamic forms of the disease, in the splenic cachexia, nor in states of anœmia, for in all these conditions of the system its actions are most injurious."

The favourable and almost specific actions of mercury in many of the secondary actions of the paludal poison make an investigation into the effects of this substance in the cure of dysentery a matter of much interest, especially as it has been extensively used, and in many cases with unquestionable benefit. We regret, however, that much difference of opinion exists as to the circumstances under which it should be administered. Some prescribe it in the acute stage, others restrict its use to the chronic stage, some give it in every stage, while others think it ought to be withdrawn when the tormina is relieved. Some also give it in scruple doses, others more moderately, but push it till the mouth is affected, while others give it in only small doses. In the midst of all this confusion Sir James Macgrigor seems to think this medicine is applicable only to the dysentery of particular countries, and that the dysentery of India and of Europe are different diseases,—dysentery being readily cured by calomel in India, while in the Peninsular war, that medicine was only decidedly useful in dysentery complicated with liver complaints. If given under other circumstances, or in the early stage, and before venesection, or in the more advanced stage, particularly when there was hectic, with extensive erosion or ulceration of the intestine, it was invariably found to aggravate the symptoms and to hasten the fatal termination. Ipecacuanha also was formerly much in vogue as a specific in the treatment of dysentery, but although highly useful in some conditions, it has no pretensions to any such property. Neither bleeding, calomel, nor ipecacuanha are antidotes to this disease, and consequently there is no exclusive plan of treatment applicable in all cases. Admitting, therefore, the necessity of occasionally employing general and local bleeding, and also calomel, in cases of hepatic complications, we have beyond this only the general principles to guide us of allaying irritation and of controlling, if possible, the diarrhœa;

and the best general rules that we possess are those recommended by Sir James Macgrigor to be adopted in the army, acknowledged by him to be derived from Dr. Somers, and those given by Mr. Martin, and already detailed.

"We commenced," says Sir James Macgrigor, "by copious venesection, and immediately afterwards gave twelve grains of compound ipecacuanha powder every hour, which was repeated three times, with plenty of barley water, and profuse sweating was encouraged for six or eight hours. A pill of three grains of calomel and one of opium was administered every second night, and in the intervening day two drachms of sulphate of magnesia dissolved in a quart of light broth. The venesection was repeated while the strength and pulse permitted it until the stools were free, or nearly free, from blood. Dover's powder as a sudorific was always given after the blood-letting.

"In cases where the pains were excruciating, and attended with tenesmus, the warm bath gave instantaneous relief. This plan being steadily persevered in for a few days, the inflammatory diathesis of the intestinal canal which had excited symptomatic fever throughout the general system, was found gradually to be relieved, and paved the way for returning health. In this stage gentle tonics, with light nourishing diet cautiously exhibited, and at first given in moderate proportions, were introduced with the happiest effects.

"The disease was not unfrequently cut short by this method. If, however, the disease became chronic, a different mode of treatment was pursued, and not unsuccessfully, if the disease had not been of long duration, the intestinal canal not much disorganized, or not complicated with other diseases."

"The first indication in this chronic state was to relieve the tenesmus and procure easy stools, and with this view ipecacuanha was given, sometimes with calomel, sometimes without it. The neutral salts were given, or castor oil, jalap, and various other medicines of the same class. The second indication was to relieve the number of the stools, and to restore tone to the alimentary canal. With this view Dover's powder, the compound powder of chalk with opium, astringents, and demulcents, with aromatics, were given, occasionally interspersing laxatives, and obviating particular symptoms as they occurred. Lastly, an infusion of bitters was given to restore tone to the relaxed intestine."

In addition to these remedies Sir James Macgrigor states, that the balsam of copaiba, an infusion of Calumba, hæmatoxylon, kino, and catechu, assisted by opium occasionally, gave much relief, and also the administration of a variety of enemata, and especially one of a strong solution of superacetate of lead; while in cases of liver

affection he adds, "that friction of the abdomen with mercurial ointment, gave the least irritation, and at the same time produced less debility."

Such is a statement of the practice pursued in dysentery during the Peninsular war, and on a scale whose magnitude has seldom been surpassed, even in modern times. If, however, we look to the returns, we find it highly probable that not more than two out of three of those attacked ultimately recovered.

In general the dysenteric patient is not admitted into the hospitals of our large towns until the disease has passed into the second stage, and there is no class of disease which then offers so few chances of recovery. On the Continent the neutral salts and mild purgative medicines are highly spoken of; but it is difficult to understand how these substances, having no specific power over the disease, can be beneficial in a highly ulcerated state of the intestine. Of all the purgatives, however, two ounces of an infusion of ipecacuanha (in the proportion of one drachm to a pound of boiling water), combined with five to ten drops of the tinc. opii, and exhibited every six or eight hours, appears to be best; but the disease, though mitigated, is seldom cured by these means. Vegetable tonics, containing tannin, as kino, hæmatoxylon, or catechu, however prepared or combined, give temporary relief, but are ultimately inefficient. When the disease has fairly gained the ascendant it does not appear that one remedy is better than another. Dr. Bryson writes that he has seen all the astringents, both mineral and vegetable, mercury, both externally and internally, with many other medicines, tried without any benefit; but there were some means which were useful in relieving the more urgent and distressing symptoms, and as it were smoothing the path to the grave. Amongst these he mentions a well regulated farinaceous diet, opium suppositories, anodynes, astringent injections, minute doses of calomel in combination with opium, cascarilla, resinous astringents, and the application of leeches to the rectum when tenesmus was distressing, or over the course of the colon when there was deep seated pain. An injection of warm starch (two ounces) with laudanum in it, will often give relief.

The value of a change of climate, as a curative measure, is forcibly illustrated by Dr. Bryson. He says that the crews of vessels improved in health almost immediately after quitting the station where dysentery prevailed.

Diarrhœa.

Definition.—*A frequent discharge of loose or fluid alvine evacuations, without tormina or tenesmus.*

Pathology.—This affection is rather a consequence or a symptom of certain pathological states, than of itself a disease; yet, as there are many agents, both of a moral and physical nature, that act upon the human body, and as there are also many known morbid poisons which bring about this state, it merits some notice in the class of diseases now under consideration. It is a morbid action of function rather than any disease of structure, being unassociated with any definite, specific lesion of vital parts. It may be regarded generally as the immediate result of unwholesome diet, excess in food or drink, cold, wet, fatigue and exposure, and various functional derangements of the biliary and gastro-intestinal apparatus.

Symptoms and Forms of Diarrhœa.—Nosologists have generally divided the disease into varieties, founded on the different states of the discharges; but as these do not depend upon definite pathological states, the classification is of little use. Nevertheless, the state of the discharges furnishes important indications in the treatment of the disease. The most common appearances are due to the predominance of fluid, feculent matter, or to bile, mucus, serum, chyle, or where undigested masses of food pass unchanged, giving rise to what is termed a "lientery." But the discharges are more often of a mixed kind, made up of several of those states.

The idiopathic forms of diarrhœa which require notice are, (1.) *Diarrhœa of irritation;* (2.) *Congestive or inflammatory diarrhœa;* (3.) *Diarrhœa with the discharge of unaltered ingesta* (*lientery*).

1. *Diarrhœa of Irritation.*

This form comprises most of the cases denominated *feculent* by authors. It is induced by stimulating or irritating substances received into the stomach, excesses in eating or drinking, or even by a small quantity of unwholesome food, or of what constitutionally disagrees with the patient. In infants it is often brought on by unwholesome conditions of the milk, such as the persistence of colostrum in it. Nausea, with severe griping pains before each evacuation, a foul, loaded tongue, copious feculent stools, watery, mucous, or bilious and becoming frothy, are the phenomena of this form of diarrhœa.

2. *Diarrhœa from Increased Vascular Action.*

This variety is caused by whatever induces a greater flow of blood to the intestinal mucous surface, and at the same time lessens or obstructs the cutaneous elimination of fluids; the application of cold to the cutaneous or pulmonary mucous surfaces, or to both at once; cold acid drinks, or ices taken when the body is overheated; suppression of perspiration or of accustomed discharges; checked menstruation or lochial discharge.

The evacuations are watery or serous, mixed with the feculent matter, and exhibit every shade, from a dark brown, greenish-brown, to a pale grayish or whitish colour; and they contain, in some cases, pieces of thick, gelatinous mucus, or thin, glairy, and stringy mucus. In other instances whitish, albuminous flocculi are abundant in the stools; and in a few instances large, membranous, or albuminous shreds or flakes, present a mould of the internal surface of the gut.

In addition to the symptoms noticed in the former variety, there is, in this form of diarrhœa, a dry, harsh skin, with increased temperature of the trunk, a flatulent state of the bowels, a small, frequent, constricted, but soft pulse, a furred or loaded tongue towards its root, with red edges and point, and scanty, high coloured urine. In infants this variety is known as the "watery gripes," and often precedes fatal exhaustion in them.

3. *Diarrhœa, with the Discharges of Unaltered Ingesta.*

This is essentially an atonic form of diarrhœa, and very different from the last variety. It corresponds to the "*diarrhœa lienterica*" of the older authors. The most marked and characteristic phenomena which attends it is the almost total suspension of the digestive, assimilative, and absorbent functions; the *egesta* often differing but little in appearance from the *ingesta*. It occurs most frequently in children before the period of the second dentition, than at later periods. It is frequently the consequence of previous inflammatory irritation of the alimentary mucous surface, and disease of the mesenteric glands. It seems as if, in this variety, the stomach had lost its tone or vital energy, as well as the mucous membrane of the alimentary canal; and it no doubt results, in the first instance, from indigestion. This was a frequent form of diarrhœa amongst the soldiers in the Crimea, as observed by Dr. Lyons; and the soldiers themselves observed it, and were in the habit of saying, "it was of no use eating, as our food passes through us in the same state as it goes in." The appetite is usually voracious; and when this form of diarrhœa continues long, the debility becomes extreme; and when death takes place, it is from stupor and exhaustion.

In a practical point of view, these are the principal varieties of idiopathic diarrhœa which require to be distinguished; and the diagnosis of the form of diarrhœa symptomatic of the invasion of other diseases are noticed under the special diseases of which they form a part.

Treatment.—For practical purposes the treatment of these three forms of idiopathic diarrhœa may be founded on the following indications, namely—*first*, that in which the *tongue is clean*, the pulse quiet, and all constitutional re-action absent; and, *second*, that in

which the *tongue is white* and coated, the pulse accelerated, some fever present, and the pain or soreness constant, and increased by pressure. The stools in either case may be black, green, white, or mixed with blood indifferently.

When the *tongue is clean*, if the disease be quite incipient, the most usual practice is to give one dose, consisting of an opiate, combined with a gentle cathartic. The form may be, one grain of opium, combined with a drachm of compound rhubarb powder, or combined with five grains of calomel. To remove any offending matter that may be present, their action may be aided by castor oil, or a saline cathartic, such as a seidlitz powder. These medicines having produced their intended effect, we may now exhibit medicines more distinctly astringent. In many cases a drachm of syrup of poppies after each stool is sufficient. In severe forms of the disease, a scruple to half a drachm of the compound chalk powder, in some aromatic, such as peppermint or cinnamon water, every four or six hours, is an excellent prescription; and these medicines may be used whether blood be or be not in the stools. If the opiate and aromatics contained in the above medicine should prove insufficient, it may be necessary to add to each dose some of the class of pure astringents, as a drachm of the tincture of kino, or of catechu, or hæmatoxylon.

There are cases of diarrhœa with a *clean tongue*, which will not yield to opiates, astringents, or stimulants, either singly or combined, and which probably depend on a want of tone in the intestine; and in these cases five grains of salicine every four or six hours have often stopped a diarrhœa that appeared fast hurrying the patient to his grave.

When diarrhœa is accompanied by a *white furred tongue*, together with pain and soreness, it is necessary to exhibit opiates, combined with some mild purgative. Thus, half a drachm to a drachm of Epsom salts, with a drachm of the syrup of poppies; or fifteen minims of the tincture of hyoscyamus; or, in severe cases, with three to five minims of tincture of opium, every *four* or *six* hours, are remedies on which, as a general principle, we may very confidently rely. In other cases rhubarb, castor oil, or any other mild purgative, may be substituted for the Epsom salts. In cases of diarrhœa, accompanied by vomiting, a drachm of syrup of poppies alone, repeated every half hour, or every hour, for two or three times, often quiets the stomach, and enables it to bear the other remedies; or soda water, or the effervescing draught, with a table spoonful of brandy, with or without a few minims of tincture of opium, often remain when everything else is rejected.

Most practitioners lay great stress on the colour of the stools, and the necessity of correcting the supposed morbid states of the liver;

ut the various colours of the stools are in many instances caused ther by morbid secretions from the surface of the mucous membrane the intestines, than by any defective state of the bile in the gall-ladder; and the conclusion from this consideration is, that in simple iarrhœa, mercury in any form is either unnecessary or injurious n the great majority of cases, except as a purgative. In a smaller umber, however, it is sometimes necessary, and more especially in hildren under four years of age. One general rule may be acted n in the cure of diarrhœa, which is, that in the adult, whatever be he form of the diarrhœa, if the stools be dark at first, and then ecome light coloured, purgative medicines are no longer beneficial, nd in no instance ought they to be continued longer than is suffi-ient to remove any irritative substance accumulated in the alimen-ary canal.

Sulphuric acid, in doses of the officinal diluted drug, of twenty to hirty drops, with water simply, or combined with the compound incture of gentian, has also been found a useful remedy. The sul-)huric acid may be also alternated with the nitro-muriatic acid, and)rescribed in a similar manner.

The dietetic treatment should be limited to slops, puddings, and vhite fish, and the drink to weak brandy and water, which acts ocally as an astringent, and generally as a diffusible stimulus.

Cholera.

Definition.—*A disease essentially of miasmatic origin, developed nder certain atmospheric and terrestrial local conditions in Europe, 1sia, and America, and capable of being propagated, or diffused, o a certain extent, over the surface of the earth, through the atmosphere, r in some other way, and also by means of human intercourse between he healthy and the sick. It is characterized by premonitory diarrhœa, r sudden muscular debility, tremors, vertigo, occasional nausea, and spasmodic griping pains in the bowels, depression of the functions of respiration and circulation, and a sense of faintness; copious purging f serous fluid, succeeded with vomiting and burning heat at the stomach, coldness and dampness of the whole surface of the body, coldness and ividness of the lips and tongue, cold breath, a craving thirst, a feeble rapid pulse, difficult and oppressed respiration with extreme restlessness (a state expressed in physiological language by the term "anxietas"), suppressed urinary secretion, blueness of the entire surface of the body, a sunken and appalling countenance, a sunken and peculiarly suppressed voice, a peculiar odour from the body, partial heats of the præcordia and forehead—fatal collapse, or re-action and secondary fever.*

Pathology.—Cholera has probably always existed in England, and was described by Sydenham in the seventeenth century. The lucid

summary by Dr. Farr in the seventeenth annual report of th Registrar-General, of the facts of the death statistics, *before* an *during* our recent cholera epidemics, in this country, in 1849 an 1854, confirms the opinion, that cholera is, now at least, indigenou to this country; and that it is but an aggravated form of a diseas continually present amongst us, its intensity appearing to depen "chiefly on local and meteorological circumstances." During recen years volumes have been written on the nature and causes o cholera; and the description of it, which I here give, is chiefl drawn from the writings of men, who, while they have been them selves original observers of the disease, throughout an extensiv experience in this country, in India, and in the north of Europe have since been the able expositors and philosophical critics of th numerous official and independent scientific accounts of it whic have been lately given to the world. Dr. E. A. Parkes, Mr. Martin Dr. Charlton, Dr. E. H. Greenhow, and Dr. Berg of Stockholm appear to me to have given the fairest description of the state of our knowledge at this time regarding cholera in various countries.

The remote cause of this disease is unquestionably a poison, for at no former period has a person in good health in this country been known to become in a few minutes shrivelled up; his whole body to be of an icy coldness; his face and extremities to turn purple, and with or without vomiting of a peculiar fluid like rice-water, to die in a few hours. Neither is it explicable on any other hypothesis than that of a poison, that this disease should spread over countries which, in respect to climate, soil, geological formation, and also to the moral and physical habits of the population, are the most opposite to those where it first originated.

The doctrine, now universally accepted, regarding the pathology of cholera, is, that a poison has been absorbed and infects the blood, and that, after a longer or shorter time, it produces a primary disease of the blood; and that changes are induced in the function of respiration directly consequent upon this alteration of the blood. The phenomena, resulting from these changes, are the proper and distinctive symptoms of the disease; and the term "*algide*," first used by the French pathologists, very happily designates one of its most remarkable and constant symptoms, namely, the diminution of animal heat.

The algide symptoms, in truth, essentially constitute the disease. In proportion to them is the malignity and rapidity of the case. They afford the only measure of its severity, and from them only can a correct prognosis be formed. The vomiting, purging, and cramps, are now considered as non-essential phenomena; for authentic cases of cholera are on record, by several of the most eminent writers on this subject, entirely divested of these symptoms; and

the suddenness with which the poison sometimes extinguishes life is extremely remarkable. When the cholera reached Muscat, instances are given in which only ten minutes elapsed from the first seizure before life was extinct. In one instance a Jewish merchant was closing a bargain, when he suddenly vomited twice, fell down, and expired. Many natives at Hooghly were attacked while walking in the open air, and having retched, complained of vertigo, blindness, or deafness, fell down, and expired in a few minutes. At Punderpoor also the disease is said to have been fatal in an equally short time, so much so that 350 persons are reported to have died in the streets, "tumbling over each other lifeless," or, according to another authority, "as if knocked down dead by lightning." Instances of death taking place in two, three, four, or more hours are extremely common. When the disease broke out at Teheran, in May, 1846, Dr. Milroy states that those who were attacked dropped suddenly down in a state of lethargy, and at the end of two or three hours expired, without any convulsions or vomitings, but from a complete stagnation of the blood. In Bulgaria, also, during the outbreak of cholera in the allied armies, in the summer of 1854, the rapidly fatal character of the early cases was notorious. Such records confirm the views developed by Dr. Parkes, as to the essentially poisonous nature of the disease, and the very rapid depressing influence of the poison; it is plain, also, that a poison so powerful, so suddenly overwhelming all Nature's efforts at resistance, does not allow time, in many cases, for any secondary or specific actions to be set up. In those patients, therefore, who have fallen in the first stage, or within forty-eight hours of the attack, rarely has there been found any alteration of structure in any organ or tissue. After this period, however, when death takes place, the following lesions have been noticed. The follicular structure of the intestinal canal has been found to be enlarged, and the intestine filled more or less with a turbid, inodorous, semi-diaphanous fluid, usually compared to a thin starch or rice-water, the remains of that immense secretion which has taken place during life, and which, being tested, has been found sometimes acid and sometimes alkaline. It is found in its most unmixed condition in the small intestines. It consists of a thicker and thinner portion, and it appears to be the latter which chiefly constitutes the "rice-water" stools, which may be passed off without admixture of the thicker substance. A layer of grayish mucus has also been found coating the whole of the mucous membrane of the alimentary canal, but without a trace of bile, although the gall-bladder is usually filled with that fluid. If the first stage has been prolonged the mucous membrane of the alimentary canal is of a livid colour, and in some instances has presented a mammillated appearance, caused by an

enlargement of the tubular glands, from which a white opaque fluid can be squeezed out, and the mammillated appearance effaced.

The liver, the spleen, and the kidneys, have in general been found gorged with blood, and this engorgement extends even to the bones, which, Louis says, appear as if the animal had been fed on madder. The bladder is contracted and empty. The membranes of the brain and cord are in general congested, and the substance of the brain dotted with more puncta cruenta than usual. The most common appearances in the lungs are the presence of blood in the large vessels, chiefly or solely; the collapse and the deficient crepitation, arising from the more or less complete absence of air and blood, and from the approximation of the molecular parts of the pulmonary substance. In other cases there is more blood in the minute structure, a corresponding dark colour of the lung, and a variable amount of frothy serum. The right side of the *heart* and the pulmonary arteries were generally filled, and in some cases distended with blood; the left side and aorta were generally empty, or contained only a very small quantity of dark blood; the left side evidently had received little or no blood, but had continued to contract, in some cases even violently, on the last drop of blood which had entered it. It was curious also to notice, that the icy coldness of the body in the stage of collapse passed away after death, when the temperature sometimes rose to 102° or 104° Fah.

Such are the appearances which the body has presented, when the patient has died in the first, the asphyxiated, or pulseless stage. The enlargement of the follicles is supposed to be peculiar to those cases in which diarrhœa, or other disorder of the alimentary canal, had for some time preceded the fatal attack. This development bears no relation to the intensity of the disease; being often most conspicuous in the least severe cases; and it is an appearance now considered of secondary importance, and consequent on the purging. In the experience of Dr. W. T. Gairdner, it has been found in about two-thirds of the cases.

When the patient has survived until re-action has taken place, and the second or febrile stage has been formed, the body no longer presents that shrunk, worn, and livid appearance it did on death taking place in the first stage; but, on the contrary, rather a full and plump appearance. The injection of all the large organs also disappears, the blood being recalled to the surface of the body. The alimentary canal is no longer distended with the turbid secretion peculiar to cholera, but contains a thin yellowish *purée* of fæcal matter, having the usual odour. The mucous membrane of the alimentary canal has now, however, been found more or less diffusely inflamed, sometimes in all its divisions, but more especially in the pyloric portion of the stomach, and also in the duodenum. The

Pláques of Peyer, as well as of the solitary glands, though occasionally found enlarged, were seldom found ulcerated; but when that was the case the corresponding mesenteric glands were also enlarged, being sometimes pale or purple, and when cut into gave issue to a dark liquid blood.

The post mortem appearances, as well as the order of the symptoms, unequivocally tend to show that the blood is obstructed in its passage through the lungs; and, that the loss of animal heat, embarrassment of the respiration, and gradual arrest of circulation, are produced by some aberration of, or impediment to the proper respiratory changes. But as the mechanical part of respiration remains perfect, and as there is no impairment in the voluntary command of the respiratory muscles, and as the heart evidently beats in many cases till stopped by the want of blood on the left side, and by its accumulation on the right side; "we are compelled to look," says Dr. Parkes, "for the cause of such arrest of the circulation, in the only remaining element of respiration, namely, in the blood itself." Dr. Parkes, and Dr. Garrod, of London, and Schmidt of Dorpat, have made the most important researches on the chemistry of the blood in cholera. The latter observer has attempted to trace out the exact chemical steps which attend the period of transudation *from* the blood into the intestinal canal. The most prominent phenomena of cholera, during this period of transudation, consists in "separation of the water and of the salts of the intercellular fluid (of the blood), through the mucous membrane of the intestinal canal, and the retention in the blood of an important excess of albumen, and of blood cells, with apparent less, but in reality great diminution of the salts and fibrine." The period during which this transudation takes place is generally one of short duration (about thirty-six hours), and in it the serum and fibrine (intercellular fluid of the blood) is first affected; and water, salts, and a small portion of albumen, pass off, and form the well known liquid stools. The order in which the constituents of the serum are affected, is thus stated by Schmidt. The water transudes before the solids of the serum; the inorganic before the organic solids; the chlorides before the phosphates; the salts of soda before the salts of potash; and, it is interesting to observe, that the order is very much the same as takes place during the action of some purgative medicine, such as elaterium. Very soon after this, transudation of some of the constituents of the serum commences, an important change occurs in the blood; the normal diffusion-currents between its fluid part and the fluid in the blood cells alter; and the constituents of the blood cells transude into the serum, in the same order as the constituents of the serum transude into the alimentary canal; that is to say, the water diffuses more readily

than the solids; the inorganic solids more readily than the organic; the chlorides, and of these the soda salts more readily than the phosphates. The result of all these changes in the fluid of the blood and in the blood cells, is that at the height of the transudation period, the constitution of the blood is profoundly altered. The inorganic constituents of the blood, if compared to the water, are during the first four hours increased, because at this time the water is passing off with great rapidity; afterwards, as the salts pass off, the disproportion is lessened, and, after eighteen hours, or so, the proportion of salts is greatly diminished, and, if compared with the organic constituents, the diminution is enormous. With respect to the individual salts, there is in the blood a relative preponderance of phosphates over chlorides, and of potash salts over soda salts. By the end of eighteen hours, or so, the blood corpuscles are left in a most abnormal condition; the great loss of water and of salts, especially of the chloride of potassium, a most important constituent of the blood cells, at once leads to the conclusion, that their functions must have been greatly impaired. Schmidt, accordingly, found that the amount of oxygen contained in them was lessened by one-half.

Another physical character of the blood in cholera is the defective or imperfect power of coagulation. In little less than a quarter of the whole number of cases observed by Dr. Parkes, the presence of fibrine in the blood was not indicated by any coagulation, either in or out of the body; and whether coagulated or not, the blood has usually a dark colour; but it generally acquired an arterial tint when brought into contact with the air, in thin layers. He also made the interesting observation, that a few drops of the thick substance, taken from the intestines, had sometimes the effect of restoring the vivid arterial colour of the blood. During the transudation into the intestinal canal, it also appears that the diffusion-currents *from* the blood into various structures, are diminished; while, on account of the density of the blood, the inverse-currents *from these structures to* the blood—are augmented in rapidity. In this way fluids are drawn from the muscles, the viscera, and, in fact, most of the tissues; and it is probable that these fluids are changed with substances (such as sugar, &c.,) which, under ordinary conditions, are taken very much more slowly into the blood, and are soon decomposed when they get there. The extent to which the blood is contaminated and injured by this admixture, and also by the retention of urinary constituents, is not yet accurately known. "When we remember," says Dr. Parkes, "the great share taken by the blood globules in the respiratory and heat-furnishing processes, it is scarcely possible to avoid concluding that their loss of salts is connected with the characteristic cyanosis and lowered temperature in cholera. In *most* cases there is vomiting and purging before there

is loss of heat, though this very soon follows in a slight degree, and then gradually augments. In other words, the diarrhœa coincides with the first chemical changes in the blood, the transudation of some of the constituents of the serum ; and the lowered temperature follows afterwards, at the time when we know that the diffusion from the blood cells into the serum must be taking place, and augments gradually as the diffusion increases." The phenomena of the disease may thus be traced from the transudation of serum constituents as the starting point, all the other chemical changes in the blood and the most marked symptoms, such as the abnormal respiratory process, follow as a matter of course.

Such is the nature of cholera, according to the observation of Drs. Parkes and Schmidt ; and thus "an early theory of the nature of this disease has received the support of one of the best chemists of the day, namely, that the blood is the primary seat of the disease, and becomes contaminated by the absorption of a specific poison introduced (probably) by the lungs."

Symptoms and Various Forms of Cholera.—Cholera Indica has many degrees of severity, and hence many pathologists have divided it into *Cholera Indica mitior*, and into *Cholera Indica gravior*. The French have termed the slighter forms of the disease *Cholerine;* and this name has been also recently used by Dr. Farr to designate the zymotic matter of cholera.

The Cholera Indica is divided into two stages, or into the cold, pulseless, or asphyxiated stage, and into the febrile stage, when the patient outlives the first. This latter stage, however, is not essential to the disease, and has been observed in India in a small proportion of the cases only. In Europe, however, the febrile paroxysm has followed in the majority of instances. The duration of the cold stage varies from a few minutes to twelve, twenty-four, forty-eight, or even more hours, while the febrile stage lasts from four to eight or more days, making the total duration to vary from a few hours to two, three, or even four weeks.

The attack of this fatal epidemic is most commonly sudden, the patient at the time of his sickness being apparently in his best health ; yet not unfrequently slight diarrhœa or other general indisposition has preceded it. In India in some cases the premonitory symptoms are vertigo, noise in the ears—the latter sometimes so loud as to have been compared to the humming of a swarm of bees, to the beating of drums in the camp, or to the roaring of the surf on the Coromandel coast.

A classification may be made of the disease into three principal varieties, which coincide in their phenomena with many of the changes known to take place in the blood (PARKES).

1. The slighter forms commence with much watery purging and

vomiting, and pass into the second and third varieties in varying times. There may be from ten to fifty copious watery stools, and frequent copious vomiting, before there is any great loss of heat and failure of circulation. But there is always some degree of this even in the slightest cases, else the case would be mere watery diarrhœa, attended only by exhaustion, and not by the symptoms peculiar to cholera. Cramps are seldom present till the stools put on the true choleraic character, viz., of copious white flocculi suspended in a watery fluid. The algide symptoms come on gradually, and are less intense than in the following forms; recovery is also more common.

2. If the causes act with greater intensity, we have the second variety, in which there is less physical alteration in the fibrine, and the circulation is carried on for a longer time. Consequently, the characteristic change is not evidenced solely or chiefly in the interior of the vessels; but is partly transferred to the exterior of the vascular system. The proteine constituents, fibrine, and perhaps albumen, are effused in large quantities, and in all parts of the body, though chiefly on the free surfaces of the skin, alimentary mucous membrane, and more rarely the bronchial mucous membrane. This effusion, and its general nature, form two characteristic distinctions between cholera and diarrhœa; for diarrhœa is a disease confined, in the first instance, to the eliminating part, viz., the large or small intestines, as the case may be, and is unattended, as a general rule, by the effusion of albumen and fibrine. The worst forms of this variety are seen in those cases in which, after two or three choleraic stools, severe and long continued cramps come on, accompanied and followed by intense algide symptoms; after death the small intestines are generally found distended with the thick, white, flaky substance. Other cases of this variety present infinite modifications in severity, according as watery elimination is added to effusion of the fibrine; in other words, according as they tend towards the slighter forms.

3. Thus, if the final change at once occur, and there is a complete and rapid arrest of the circulation, either from the intensity of the cause or from constitutional predisposition, the worst variety is produced, in which "a mortal coldness comes on from the beginning." As the circulation is soon almost entirely arrested by physical alterations in the blood—presumably, changes in the fibrine—there can be little purging and comparatively little sweating; there is always some effusion of the thick white substance into the intestines, but often little of the watery part of the blood. The symptoms might be inferred from a statement of this condition: we might have presupposed a very rapid loss of animal heat, loss of voice, deafness, and vertigo, total arrest of all secretions, defective aeration of the blood, consequent dark colour of the surface, and early and deep coma.

The more usual course of the disease in this country, when limited to the cold stage, is as follows:—

After the patient has been troubled for a few days with diarrhœa (the more insidious and dangerous because it is *painless*), but more commonly while he is yet in perfect health, and has retired to rest, and has slept soundly till the middle of the night, or onwards till early morning, he is suddenly seized with an unaccountable sickness and vomiting, together with a most profuse discharge from the bowels. These evacuations are attended with severe pains down the thighs, and more especially by an indescribable and subduing sense of exhaustion, the patient often fainting in the water-closet. In an instant not only are the physical powers of the body exhausted, but its temperature sinks rapidly below the natural standard, and an icy coldness benumbs it; while the skin is sometimes rendered so insensible as to resist even the action of boiling water or other powerful chemical agent. The breath also, as it issues from the mouth, has a glacial feel. Still, notwithstanding this great loss of temperature, the patient complains of being oppressed, and is incessantly throwing off the bedclothes, and cold water is grateful to him, copiously and eagerly drank, yet affording no relief to his insatiable thirst.

The extreme coldness of the first stage is further accompanied by a blue, livid, or purple discoloration of the hands and feet, extending not only a considerable way up the arms and legs, but sometimes over a great part of the body. These parts often also become, in a few minutes after the seizure, not merely shrunk, but singularly wrinkled, like the hands of a washerwoman after a day's hard labour. These symptoms are rendered still more distressing by the shrieks and groans of the poor sufferer, often tortured by spasms, which affect the fingers, the toes, the arms, and the legs,—spasms which clench the jaw, fix the walls of the abdomen in contact with the spine, or draw the trunk into singularly contorted forms. The patient thinks he obtains some relief from friction, and his cries are incessant to his attendants to "rub hard."

As the disease proceeds the countenance assumes a character peculiar to this great struggle, the "*facies choleritica*," the eye being deeply sunk, red, and injected; while the aqueous humour transuding its coats leaves the cornea flat and depressed as in the dead body; a broad and livid band also encircles the lower portion of the orbit; every feature, moreover, is sharp and pinched, as after a long disease; the complexion thick and muddy; the lips and tongue purple; and all these great changes have been known to take place in a few minutes.

In addition to this sad state, the vomiting is constant, the purging most incessant, and the pulse, though generally natural, some-

times rapid, yet in some cases is not to be felt, even from the first moment of the attack, either in the large superficial arteries or at the wrist. The voice also is strangely altered, its firm and manly tone has changed to a low, feeble, unnatural, and almost sepulchral sound. The urinary secretion is likewise entirely suppressed, while no bile flows into the intestines. The only organ which seems to preserve its powers is the brain; and the patient often to the last moment of his life retains the power of thinking and of expressing his thoughts distinctly, sometimes full of hope, while at others he seems indifferent to the fate which too often inevitably awaits him.

On the accession of the spasms, the vomiting, and the purging, the disorder is fully developed, and the crisis is at hand which in a few hours must decide the fate of the patient. The termination may be favourable or unfavourable; if unfavourable, he may die with all the symptoms narrated strongly marked; or should it be favourable, they may abate, and a happier prognosis be formed. Unfortunately, however, it too often happens that, although the stomach retains what is taken, and the purging appears checked, and the patient falls into a dose, yet the weakness, the entire cessation of the pulse, the coldness and lividity of the surface, and the ghastly expression of the countenance, show that a few hours must close the scene. This melancholy result occurred to Gendrin in seventeen out of twenty cases, and often with so little struggle that death was only marked by the phenomena of cadaveric contraction, which sometimes continue active in the muscles for some hours after death.

If the patient should happily survive the cold stage, the disease may terminate by a rapid recovery, or else may pass into the second or febrile stage. The former is the more usual course in India, the latter in Europe. The first symptom of returning health is the patient falling into a sleep of unusual soundness, during which the respiration becomes light and easy, the pulse freer, while a gentle, warm perspiration bedews the whole body. This grateful pause in the disease appears to be the result of the returning powers of life, uninfluenced by medicine, for it often occurs where none has been given. After this balmy slumber the patient awakes refreshed, and often recovers so rapidly, that in the natives of India it almost resembles a restoration after syncope. In all the presidencies, indeed, and especially in Bengal, the recovery of the European has in general been followed by a stage of re-action, usually slight, but in some cases assuming the form of the bilious remittent fever of the country, and which has occasionally terminated fatally.

In Europe, restoration after the cold stage, and without febrile re-action, is by no means so frequent or so rapid as in India. Sometimes the re-action is trifling, and sleep may indeed have ensued, fæcal evacuations containing bile may have passed, the urine may

again have flowed, the purging, vomiting, and spasms may have subsided, the pulse may have risen, the blueness may have disappeared, and the temperature of the body may have increased, yet in many instances this amelioration of the symptoms was only temporary;—the patients relapsed and died.

In most cases, however, the re-action was more considerable, and the patient, in a few hours after the subsidence of the cold stage, laboured under a severe form of fever in no degree dissimilar to, and not less fatal than the typhoid form of typhous fever. These *typhoid* symptoms, common in Europe and America, are unknown, or nearly so, in India, where, if a secondary fever ensues, it assumes the form of the remittent fever of that country. For the first few hours after the febrile re-action, the tongue is white, but quickly becomes brown and dry, while black sordes incrust the teeth and lips. The eye is now deeply injected and red, the cheek pale or flushed, the pulse rapid, and the temperature of the body a little above or below the natural standard; and the patient, either delirious or comatose, lies in a state resembling the last stage of the severest typhoid fever of this country. This struggle usually lasts from four to eight days, when the symptoms either gradually yield or death ensues. In a few mild cases the fever assumes an intermittent type, or sometimes a quotidian, sometimes a tertian form; all these cases usually recover. Such is a general outline of the symptoms of this formidable disease.

The blood in cholera varies according to the stage, and that taken in the cold stage is usually of an unnaturally dark colour and thick consistency, so that it flows with difficulty from the veins, and very imperfectly separates into clot and serum. Blood also taken from the temporal artery has been found equally black and thick. After the secondary fever is formed the quantity of serum increases, till at length it is much more abundant in the blood than natural; and it is singular that this takes place, notwithstanding the secretion of urine is re-established.

Origin and Modes of Propagation of Cholera.—One of the most interesting facts brought out by Dr. Farr, in his report already noticed, is, that diarrhœa, summer cholera, and diseases of a choleraic character, have been unusually fatal in England in several years of the present century; that the mortality from them suddenly rose in 1827, and progressively increased till 1831, and that diarrhœa has continued to go on, gradually increasing in fatality, since 1838. It proved fatal, *per se*, evidently as a variety of cholera, chiefly to young children and to old people, who did not so commonly exhibit the spasms of cholera (which we have seen are not essential to the disease), but died with nearly all the other symptoms of the malady. It also proved fatal as a cause of death in other diseases. "It killed

sick and dying men;" and now, at least, we believe that cholera is indigenous to this country; and assuming, therefore, that it is produced by the action of a poison, whence does it originate, and how is it produced?

The chronological and geographical history of cholera has commonly been considered as affording *primâ facie* evidence that it is an exotic disease, the product of another climate, which has in this country met with conditions favourable for its development. Some believe that it has been transplanted by human intercourse into this country; others, that it has spread from its Eastern birth-place in Jessore, by means of some hidden telluric influence.

Several explanations, or theories, have been proposed, to explain the production of cholera in this country. According to Mr. Martin, they may be referred to the following six heads:—

1. That the disease spreads by an *atmospheric influence or epidemic constitution*, by a succession of local outbreaks, and that the particular localities affected are determined by certain "*localizing conditions*," which are—first, all those well known circumstances which render places insalubrious; and, second, a susceptibility to the disease in the inhabitants of such places, produced by the habitual respiration of an impure atmosphere.
2. That the cause of cholera is a morbific matter which undergoes increase only within the human body, and is propagated by means of emanation from the bodies of the sick, in other words simply by contagion.
3. It is supposed that the poison of cholera is swallowed, and acts directly on the mucous membrane of the intestines, and is at the same time reproduced in the alimentary canal, and passes out, much increased with the discharges; and that these discharges afterwards, in various ways, but chiefly by becoming mixed with the drinking waters in rivers and wells, reach the alimentary canals of other persons, and produce the like disease in them.
4. Assuming that the cause of cholera is a morbific matter or poison, it is supposed that it is reproduced only in the air, and within the bodies of those whom it affects, and that its diffusion is due to the agency of the atmosphere.
5. It is supposed that the cholera poison is increased by a species of fermentation, or other mode of reproduction, in impure, damp, and stagnant air, and it is maintained that it nevertheless is distributed and diffused by means of human intercourse, it being carried in ships, and other vehicles, and even in the clothes, especially in the foul clothes of vagrants, and the accumulated baggage of armies.
6. It is assumed that the material causes of the disease may be increased and propagated in, and by, impure air, as well as in and by the human body.

All the theories agree in assigning an Eastern origin to the poison of cholera, which is believed to have either reached this country by means of direct human intercourse, as by fomites or individual contagion; or the poison itself is assumed to be migratory,

and to have come hither by a kind of wave-like extension from India. All of the suppositions (with the exception of the *third*, propounded originally by Dr. Snow), consider the existence of certain local conditions, or of a predisposition in the inhabitants of infected districts, as usually necessary to give strength and vitality to the poison. It is also to be observed, that while each of the six opinions, or theories, just noticed, is apparently supported by a large amount of evidence, direct and circumstantial, each is also equally opposed by a "considerable number of obstinate facts." All of them, however, agree in two main points,—namely, that cholera is induced by a special poison, and that this poison is of foreign extraction.

But on the other hand there are good grounds for believing that cholera has not in the present century for the first time appeared in this country, and extended itself over the greater portion of the habitable globe. The "*cholera morbus*" of Sydenham, prevalent in his time, and the "*griping in the guts*," or "*plague in the guts*," as recorded in the mortality bills of 1665, and described by Willis, and subsequently by Dr. W. Heberden, jun., do not seem to differ in their essential phenomena from the disease supposed to be imported into this country from the East.

There are also abundant facts which seem to show, that, under a different name, cholera was one of the most fatal epidemics by which the population of London was formerly afflicted. And there is, also, no doubt that cholera, like every other epidemic disease, varies in its type, as it does in severity; for, if it is conceded that the diarrhœa, so prevalent during an epidemic of cholera, arises from the same cause, and is, in fact, the same disease in a different degree of intensity; "there is as much variety in the aspect and symptoms of cholera as of scarlet fever; between the malignant cases of which, and the extremely mild ones, there is so vast a difference."

There are also facts which seem to show that the population of this country has been undergoing a morbid change, as regards the tendency to diseases of the flux character, during the second quarter of this present century; and which, while taken altogether, they are opposed to a common opinion that cholera is imported by means of human intercourse, yet, they are nevertheless not incompatible with this opinion, or with that expressed by Dr. Farr, "that while the materials were smouldering in England, the flame which threw the mass into combustion has been of Asiatic origin." A very careful inquiry into the history of the earliest cases of cholera in London by Dr. Parkes in 1848, and in Newcastle by Dr. Robinson, shows that the poison could not have been brought by the clothes or baggage of any persons coming from infected districts in England, or elsewhere on the Continent. Some analogous observations were

also made in Scotland, for example: in one of the western islands, the most remote from the main land, the disease suddenly appeared, when so little intercourse existed with the place that the clergyman of the island continued regularly every Sunday for eighteen months to pray for King William the Fourth as if he had been alive, after our gracious Queen Victoria had ascended the throne.

It seems on the whole, therefore, not improbable that the modern cholera is but the re-appearance of pestilential disease amongst us, in a form familiar to our ancestors, and known as a yearly autumnal visitor since the days of Sydenham; that now, at least, the evil is of indigenous growth, and "that the poison of cholera consists of some peculiar chemical condition of home-bred elements, called into being by the gradual growth of new evils, consequent upon the vast comparative extension of our own town populations during this century."

But other and occasional circumstances are required to give energy to the development of the poison of cholera. These have been described under the two heads of "*meteorological conditions*," and "*localizing causes.*"

Of the first of these, temperature appears to have a marked influence. The average temperature of 1846, in which the mortality occasioned by diarrhœa, cholera, and dysentery was very large, was 4° higher than that of 1845, and 3° above the average of the six preceding years, and the fall of average temperature was accompanied by a corresponding fall of mortality, from the choleraic and flux diseases. Dr. Barton, of New Orleans, has found that cholera has always existed there with an east or south-east wind; a temperature above 70° Fahr. increased as the disease attained its maximum, a dew-point of from 60° to 70°, and a barometric elevation of over 30°. The maximum barometer occurred on November 18, 1853, and was 30·46° (a very unusual height), soon after which cholera broke out. During December the wind continued from the east, north, and north-east: the maximum barometer was 30·48° on the 2d, when the cholera was at its height, and declined to its minimum, 20·57°, on the 30th. The cholera ceased soon after the middle of the month.

The first epidemic of cholera in this country, during the present century, began in the north of England, in October and November 1831. The preceding summer was unusually fine, the nights being warmer, in proportion, than the days. In November, December, and January, the atmosphere was observed by many independent observers, both on land and sea, to be *singularly stagnant, unusually still, close, and hot*, so that it was impossible to ventilate even large houses, in which no change of air "seemed to take place for almost a week together." According to the delicate and accurate observations of Mr. Glaisher, the meteorological phenomena of the

three visitations appear to have been remarkably similar (excepting as to temperature), and especially as to the misty condition of the atmosphere, which was thin in high places and dense in low, the absence of motion in the air, remarkably high readings of the barometer, and a total absence of ozone. Indian medical officers, and those of the Black Sea fleet, give similar accounts of these meteorological phenomena which attended the outbreaks of cholera in their experience. Such meteorological conditions have a marked tendency to favour the chemical decomposition of organic substances, and to render the season defective in those atmospheric changes, which by decomposing and dispersing into space the products of decomposition renew the purity of the air. "The effect of temperature upon the Thames water is very remarkable in tainting the surrounding air, and is exhibited in the well known fact that diarrhœa and summer cholera become prevalent among the inhabitants along the banks of the Thames after the temperature of the river has attained to 60°, and as the water declines from this temperature so do these diseases in its vicinity."

The general result of all such observations is, "that whilst cholera may prevail within a considerable range of temperature, a moderately elevated one is most suitable for its development; and this, accompanied by a still, stagnant, and peculiarly oppressive condition of the atmosphere (more oppressive than the elevation of the thermometer can account for), and a moderate amount of moisture." With regard to the apparent anomaly as to temperature in the case of its outbreak in Moscow and in the northern counties of Europe, such as in Sweden and Norway, it must be remembered that the internal atmosphere of the Russian, Swedish, and Norwegian houses are maintained at a high elevation during the winter months by means of stoves.

But in order to give character and energy to the development of cholera, there are other conditions required besides those meteorological phenomena just noticed. These other conditions are described by Dr. Barton as the "*terrene element*," and correspond with what in this country have been termed the "*localizing causes*" of cholera.

That some local circumstances play a very important part in the evolution of cholera is evident from the following facts:—

1. An analysis of the history of cholera epidemics shows, that they are most frequently made up of a succession of partial local outbreaks, not only in different districts, but even in the same place.
2. The pestilence has also been observed to linger in some few favourite haunts throughout the entire course of an epidemic; and, that now and then, after visiting a place at the commencement of an epidemic it has returned to it again, after an interval of complete immunity, before its close.

3. That some places escape an epidemic visitation at the very period when others in the immediate vicinity are suffering severely from its presence, the meteorological influences being the same. Even in the same town, whilst the inhabitants of some streets or courts are being decimated, those dwelling in others not far distant altogether escape; or, as frequently happens, the inmates of certain houses suffer severely, whilst their neighbours are entirely spared.

4. That the limits of a tainted district are sometimes clearly marked out. In illustration of this, the amiable *emeritus* professor of medicine of Edinburgh University, Dr. W. P. Alison, quotes a most striking example in his paper on "The Exciting Causes of Epidemics," in *The Medico-Chirurgical Review*, for 1854. He says, that *one* wing of a cavalry regiment, just arrived from England, and in high health, ascended the Ganges from Calcutta in boats, there being no cholera at the time in Calcutta. At a certain period of the voyage the troops arrived at a part of the country where cholera prevailed in the villages on the banks of the river, *but with which they did not communicate*. Here cases of cholera occurred in the boats; the men were advised to push on rapidly, and after a few days, when they had passed the limits of the existence of the disease on the banks, it ceased to show itself in the boats. What makes the case peculiarly conclusive is, that the other wing of the regiment followed afterwards by the same mode of conveyance, became "*affected with the disease at the same point, and lost it again at the same point.*"

Although very great differences of opinion prevail, as to the part which obvious local causes of insalubrity bear in the production of cholera, yet it is almost universally considered that they are necessary for the development and propagation of this disease in its epidemic forms. Drs. Barton, Carpenter, Pettenkoffer, and Snow, all agree in this general proposition. But Dr. Carpenter also believes that the disease, being zymotic, may be induced by personal, as well as by local causes.

Impure water, *lowness of site*, and *the emanations arising from the decomposition of animal refuse* are the local causes now satisfactorily determined to have a more or less constant connection with the development and propagation of cholera.

That *impure water* has a powerful influence over the intensity of cholera outbreaks is now unquestionably established, by the observations of Drs. Sutherland, Acland, and Snow, and the specific inquiries of the Registrar-General. Yet still it is also found that *impure water* is not a necessary element in the generation of the cholera poison, as shown in the report of Dr. Baly, page 201-5; and just as unwholesome food, or the injudicious use of purgatives are determining causes of cholera, so is water impregnated with organic impurities.

As regards London it has been shown by Dr. Farr that *the elevation of the soil* has a more constant relation, with the mortality from cholera, than any other known element; the mortality from

holera being in the inverse ratio of the elevation. Yet like the ondition of the water, the elevation of the soil has not been always ound to be a necessary localizing condition, and there is now only eft to be noticed *the influence of an atmosphere contaminated by the ffluvia arising from decaying animal matter.* Dr. Cullen long ago emarked, and every industrious dissector knows, that the effluvia rom very putrid animal substances readily produces diarrhœa. Yet it also appears that the nature of the decomposing matter, and of the transforming process it undergoes, have some influence in nodifying the effects on the human constitution. Districts in which the most powerful putrid odours tainted the air have sometimes almost entirely escaped, whilst others contiguous to them have suffered severely. Dr. Chisholm, quoted by Dr. Alison in his paper already referred to, gives numerous pointed illustrations of this, in the cases of "bone manufactories," "manufactories for the conversion of dead animal matter into a substance resembling spermaceti," "of places where blood is putrefying, waiting to be used by sugar refiners," and "of leather dressing establishments." In dissecting rooms also, where the process of animal putrefaction goes on to a great extent, diarrhœa is comparatively rare. During my experience, as Demonstrator of Anatomy, in the University of Glasgow, for a period of six years (including the severe epidemic of cholera there, in 1848-49, and during which time almost all the subjects for dissection had died of cholera), yet not a single student suffered; and when the proper agents are used, such as the injection of arsenical solutions into the dead body, which have the effect of arresting and modifying the putrefactive changes, I believe the production of diarrhœa is an exception, and may be found to have as significant a cause in errors of diet, as in too close an attendance in the dissecting room. That the poison of cholera does not attach itself to the *dead body* in a certain state of decomposition, at least, is also a fact confirmed by the experience of those connected with the dissecting rooms in Edinburgh. It is certain that these were supplied during the greater part of 1848-49, as they were also in 1832, almost exclusively by cholera subjects, and in neither year was there a single case of the disease among the numerous students attending these rooms (Dr. Alison).

Much pains has been taken by Dr. E. H. Greenhow to investigate the precise conditions, which, from their more uniform co-existence with cholera, might be supposed to produce or to aggravate epidemics of it. The result of his observations tend to show that "an atmosphere impregnated with the products of *fermenting excrement* is at once the most obvious and most constant concomitant of cholera. Such exhalations were often found, even in a concentrated form, in houses where the existence of any palpable cause of insalubrity

would scarcely be suspected, and thus the fact is in some measure explicable, that the pestilence, sometimes passing over slums and rookeries, knocked at the door of the comfortable annuitant or the wealthy tradesman." It was found that persons appeared to suffer in proportion to the contamination of the air they breathed, with the "*privy odour*," and that immunity from this appeared to secure immunity from cholera." These observations of Dr. Greenhow are confirmed, also, by the investigations of Dr. Pettenkofer at Munich and at the village of Gaimersheim. Dr. Barton, of New Orleans, Dr. Milroy in his report on the epidemic at Kingston, and Dr. Buckler in his account of the outbreak in the Baltimore alms-houses, give similar evidence confirmatory of the injurious influence of the *fermentive decomposition of animal excrement.*

The outbreaks of cholera in some of the camps in Bulgaria and the Crimea, especially at Aladyn and Alma during the recent war, also furnish sufficient illustrations, and I believe the outbreak of cholera at Scutari, in November 1855, which suddenly commenced in the camp of the Osmanli Horse Artillery, had a similar origin.

Propagation of Cholera by Human Intercourse.—When cholera appeared in its epidemic form in this country in 1831, the majority of European practitioners were decided contagionists. Subsequent to that period a re-action of opinion occurred, and the question was discussed for many years without any definite result. In 1848, when the disease again became epidemic, many of the higher authorities coincided with "the solemn declaration of the Board of Health, that the malady was not in any way contagious, and that no danger was incurred by attendance on the sick.

"A large body of evidence, however, now renders it certain that human intercourse has, at least, a share in the propagation of the disease, and that it, under some circumstances, is the most important, if not the sole means of effecting its diffusion" (Dr. Baly). But, at the same time, it is also argued, that although thus spreading in many cases by the agency of human intercourse, it does not follow that the material cause spreads by true contagion:—that is, by reproducing itself in the bodies of men and there only. Men only carry the disease with them in their clothes, in their ships, and in their caravans. That such is the case, we have now ample evidence in the *Bengal Report*, by Dr. Jamieson of 1824; in cases related by Dr. J. Y. Simpson in 1838; in *The Edinburgh Monthly Journal* for 1849, by the late Dr. Cruickshank at Dalmellington in Ayrshire; by Dr. William Robertson, detailed in *The Edinburgh Monthly Journal* for August of that year, and more recently the account of the outbreak at Arbroath in Scotland, in 1853, by Dr. T. Trail; and cases by Dr. Alison in 1854, in the paper already noticed; in the report of Dr. Berg of Stockholm,

in 1848, in the Norwegian Reports of 1850-53, in the Report of the College of Physicians of London in 1854. These records afford undoubted instances which show that human intercourse is occasionally influential, in some way, in transmitting cholera into detached localities, where it may seize upon two or more individuals and then cease. But it is also no less certain, that its general extension over the world cannot be accounted for by human intercourse alone. Its propagation by this means seems to be the rare exception, its spread from other causes being the common rule.

According to the accurate observations of C. T. Kiërulf in the vicinity of Bergen, it appears that when the disease is propagated by human intercourse, from one to four days elapsed from the supposed period of infection to the outbreak of the disease. Most frequently the disease appeared on the second day after exposure to the infection; and he also found that the diarrhœa, so frequent during the invasion of cholera, is a part of the disease, and itself capable of infecting others with true cholera.

The inoculation experiments of Namias with needles loaded with the evacuations from cholera, and the experiments by tasting the vomited fluids by M. Foy, and his coadjutors, have given entirely negative results. So also the influence of exhalations from the blood and evacuations of patients with cholera, as designedly experimented on, and observed by Dr. Jannicher, M. Foy, Deynert, and Schmidt, has been of a negative kind.

Nevertheless, there can be no doubt, as already stated, that under circumstances of great concentration, or otherwise, some unknown poison is probably communicated by *fomites* through human intercourse, and as emanations, of some kind or other, passing through the air, they act as poisons on the gastro-pulmonary mucous membrane of susceptible persons. Dr. Parkes has shown, in his Indian experience of cholera, that it may pass with extreme slowness against the wind (even the trade or monsoon wind), which only retards its course, and that a favourable wind promotes its transmission; and that it sometimes travels in this way, and not by the shortest route of human intercourse, or even by the route of greatest intercourse between places.

Predisposing Causes of Cholera.—The influence of these is chiefly apparent in the age and sex, food, fatigue, filth, misery, and intemperance of the people.

Both sexes and all ages, including new-born children, are liable to the disease. Dr. Farr's results show that males suffered more than females at all ages under twenty-five years, but between twenty-five and forty-five the females suffered more than the males. The deaths from cholera in Paris were estimated at 18,402 in 1832, and it was remarked that the mortality was least from six years to

twenty, greater from thirty to forty, and greatest of all in old age. The influence of *sex* in predisposing to cholera can hardly be said to be determined; for in Calcutta, of the native inhabitants attacked with cholera, the males were to the females as four to one, while in Bombay the proportion was as seven to twenty-five. In Canada the soldiers' wives were observed to suffer nearly in an equal proportion with their husbands; and this was the case among the civil inhabitants of Gibraltar.

In all countries the *lower classes* have always suffered in a much greater proportion than the upper classes. In Calcutta the disease ran a wide career of destruction in the native town, while the "City of Palaces," inhabited by the English, was much less affected in proportion to their numbers, and the same disproportion has been observed in Bombay. In general, also, it has been observed among the native inhabitants of India, that the Brahmin and Banian merchant suffered less than the Ryot or farmer, while the poor outcast Pariah suffered the most of all. In every town in Europe also it has been observed, that the lower classes, and especially those resident on the banks of rivers, have suffered infinitely more than the upper classes.

In military life, it has been supposed, that the Sepoy suffered more than the European soldier, living in India. This, perhaps, is true, in some instances; but the returns of the Madras army show this not to have been the fact in that Presidency; for the European soldiers attacked appear to have been as one to three, while of the Sepoy force it was only one in four and a-half. In the Indian army also it appears to have been universally observed, that the officer suffered in a less proportion than the soldier, the cavalry than the infantry, and the infantry less than the hard-labouring ill-fed camp-follower. The troops on march likewise universally suffered more than the troops in quarters; and this influence of long marches appears to indicate something more powerful than mere fatigue in bringing about the disease. Dr. Balfour has proved that of the native soldiers of the Madras army thirty-two died of cholera in cantonment, and eighty-six when marching, to an average of 10,000 strength; the number attacked being respectively 85 and 200 in 10,000. Dr. Lorimer's reports show that the men were more frequently attacked on long than on short marches, the men (as Dr. Farr observes) being longer exposed to the causes of disease. These causes are those, as Mr. Martin observes, which are incidental to the life of a soldier on the march, such as lying by the banks of rivers on low marshes, jungly grounds, sleeping on the ground, and, I may add, encamping amongst the filth of encampments recently occupied, but abandoned, of which indiscretion there were many melancholy examples during the late war. I may notice here the

occupation of the evacuated camping ground at Aladyn in Bulgaria, and that on the heights above Alma, previously occupied by the Russians, the consequences of which were so fatal to the first and fourth divisions of our army.

The effects of a poor diet in predisposing to cholera will perhaps be better understood, by stating that the European suffers less than the Mohammedan, and the Mohammedan, who is better fed and better clothed, than the Hindoo, except during their rigid fasts, when the Mohammedans suffer in a much larger ratio. During the epidemic of 1848 and 1849, in Edinburgh, Dr. William Robertson of that city found that anœmic persons were those most predisposed to cholera.

Susceptibility to Cholera.—The actual number of persons attacked out of any given population appears to have varied very greatly. Mr. Scott has stated, that in the marching corps it has varied from 17 to 330 per corps of about 1,000 men; and in no instance, even in all the wretchedness of the Indian towns, has the community suffered to the whole extent of the population. In Europe, Moreau de Ionnès has given the following estimate as an approximation to the probable numbers attacked in this part of the world:—In France, 1 in 300; Russia, 1 in 20; Austria, 1 in 30; Poland, 1 in 32; Prussia, 1 in 100; Belgium, 1 in 120; Great Britain and Ireland, 1 in 131; Holland, 1 in 144; Germany, 1 in 700. The circumstance of one attack by no means armed the constitution against a second in the same or any subsequent year; still a repetition of the disease in the same person in the same year was rare.

Diagnosis.—The phenomena of the first stage of cholera are so unlike those of any other disease that they cannot be mistaken. The second, or febrile stage, is similar to some of the forms of typhous fever, and is not to be distinguished from them, except by the previous history. The cholera Indica differs from the cholera morbus of Sydenham in the lividity of the extremities, in the more rapid loss of the pulse, and in the greater amount of collapse, and the duration of the fatal cases, half of which in this country have terminated within twenty-four hours of the first appearance of decisive symptoms, while half of the cases of common cholera (morbus of Sydenham) terminated *in three days*, and half the cases of diarrhœa or cholerine extend over *six days*.

The cholera Indica, as seen in India, differs also from that of Europe, according to Drs. Barry and Russell, in the evacuations of the former being more profuse and ungovernable, and again from the patient being much more frequently convalescent, without passing through the febrile stage.

Prognosis.—The mortality from cholera in all countries is very

great. Taking the whole number attacked, it is said that the number of deaths in Astrakan were as one to three; in that of Mishni Novogorod as one to two; in Moscow and Casan as three to five; and in Penza, in the country of the Don Cossacks, as two to three. In the summer of 1831, the mortality at Riga, St. Petersburg, Mittau, Limburg, and Brody, according to the *Berlin Gazette*, was about one-half, while at Dantzig, Elbing, and Posen, it was about two-thirds of the whole number attacked. The period of the epidemic, however, greatly influenced the mortality; for, on the first onset, nine-tenths of all those attacked perished, then seven-eighths; and the proportion of deaths forms a gradually decreasing series of five-sixths, three-fourths, one-half, one-third, till towards the close a large proportion of those attacked recovered. The uniformity of this law in every country affected with cholera, whether Europe, America, India, or China, is extremely remarkable.

The chances of recovery are much diminished in young children and in the aged; the age of greatest number of recoveries being from fifteen to twenty. The feeble in constitution, the sick and the convalescent, were in all cases the surest victims of cholera. But whatever the age of the patient, Gendrin states he lost every case which became pulseless.

Treatment.—There are few diseases for the cure of which so many different remedies and modes of treatment have been employed as in cholera, and unfortunately without our discovering an antidote to the poison. In Moscow, it is said that twenty different modes of treatment were practised at different hospitals, and that the proportionate number of deaths was the same in all. In the same city, also, it is supposed that the mortality was not greater among those destitute of medical aid than among those who had every care and attention shown them. It may be fairly inferred, therefore, that in the severer forms of the disease, the action of this poison is so potent, as to render the constitution insensible to the influence of our most powerful remedial agents. When, however, the disease is mild, or on the decline, much may be done by obviating symptoms to promote the recovery of the patient.

The heroic remedies that have been employed in cholera, are bleeding, and calomel, and opium, either separately or conjointly. With respect to bleeding, it may be stated, that in every country the patients bore bleeding badly in any stage, and that the practice in Europe was at length limited to a few leeches occasionally to the head. As to calomel that medicine was used to the greater part of an ounce in the twenty-four hours, but with so little success as an antidote, that many patients have been seized and have died under the full influence of mercury. On the appearance of cholera in Europe, opium was administered in the doses recommended by the Indian

ractitioners, to the greater part even of an ounce of laudanum; ut it was soon seen that, in the cold stage, it was inefficient in ontrolling the vomiting or purging; that it did not allay the pasms, and, moreover, hardly produced any narcotic effect. The ction of the accumulated doses of opium, however, though sus- ended during the cold stage, was often fully developed in the ot stage, and occasioned so much affection of the head, that most ractitioners either abandoned its use, or else limited it to a mere ractional dose of that exhibited in India, namely, from *three* to *welve* minims of the tincture of opium, or half a grain to a grain f solid opium every four or six hours.

Another heroic plan, peculiar perhaps to this country, and which was practised when the inefficiency of medicines was generally admitted, was an injection of a solution of half an ounce of muriate of soda, and of four scruples of sesqui-carbonate of soda, in ten pints of water, of a temperature varying from 105° to 120° Fahrenheit, into the veins of the suffering patient. This solution was injected slowly, half an hour being spent in the gradual introduction of the ten pints, and the immediate effects of this treatment were very striking. After the introduction of a few ounces, the pulse which had ceased to be felt at the wrist became perceptible, and the heat of the body returned. By the time three or four pints had been injected, the pulse was good, the cramps had ceased, the body that could not be heated had become warm, and instead of a cold exudation on the surface, there was a general moisture; the voice, before hoarse and almost extinct, was now natural; the hollowness of the eye, the shrunken state of the features, the leaden hue of the face and body had disappeared, the expression had become animated, the mind cheerful, the restlessness and uneasy feelings had vanished, the vertigo and noises of the ear, the sense of oppression at the precordia had given way to comfortable feelings; the thirst, however urgent before the operation, was assuaged, and the secretion of urine restored, though by no means constantly so. But these promising appearances were not lasting; the vomiting continued, the evacuations became even more profuse, and the patient soon relapsed into his former state, from which he might again be roused by a repetition of the injection; but the amendment was transient, and the fatal period not long deferred. Of 125 patients thus treated at Drummond Street Hospital, Edinburgh, under the direction of Dr. Mackintosh, only twenty-five recovered,—a lamentably small proportion.

The great want of success that has attended these heroic methods, has caused every substance at any time known in the pharmacopœia to be tried as an antidote. Every metal, from arsenic to platina, has been exhibited; also every vegetable and mineral acid; the various alkalies, and most of the neutral salts; phosphorus; strych-

nine and quina; hæmatoxylon, kino, and every known vegetable astringent; hydrocyanic acid; the entire class of narcotics; the large class of essential oils, balsams, turpentines, and spices, and most tonic medicines; and when these failed, the patient has been made to respire oxygen, or nitrous oxide gas; and with a view of imparting new powers to the sinking frame, transfusion of blood has not unfrequently been performed; but all these means have been more or less unsuccessful.

The failure of all these powerful means at length caused most practitioners to confine themselves to checking the diarrhœa which so frequently precedes cholera, and lays the foundation of the future attack, and subsequently to obviating symptoms. For this purpose moderate doses of opium or morphine, either alone or combined with stimulants, as the confectio opiata, or the pulvis cretæ compositus cum opio, were often sufficient. In more obstinate cases some vegetable astringent was added, as the tincture of kino, or the decoctum hæmatoxyli, and these remedies frequently prevented the attack altogether. If, however, the disease proceeded, and the cold stage of cholera formed, the same remedies were prescribed, moderate in quantity, and often out of an effervescing draught. Heat was also now applied, and the patient wrapped up in warm blankets and hot bottles, or bags of heated sand placed around his cold and benumbed body. The warm bath was at first tried, but discontinued from the uncontrollable nature of the vomiting and purging, and the oppressive heat it produced to the patient's feelings. Mr. Dalton's vapour bath was next used, but without benefit, and to the disappointment of the hopes which had been entertained of it. Other methods of restoring warmth were also had recourse to, as frictions with the hand, or by flesh-brush, or rubbing the body with some stimulant embrocation, compounded of garlic, capsicum, camphor, cantharides, or other powerful irritants. Mustard poultices also were often applied to the feet and abdomen, blisters with or without an addition of oil of turpentine, the part having been previously rubbed with hot sand; and in more urgent cases, the mineral acids, and even boiling water were employed for the purpose of producing instant vesication. And again, other practitioners tried to stimulate the waning powers of life by galvanism, acupuncture of the heart, issues, setons, moxas, actual cautery along the spine, and lastly, by small pieces of linen dipped in alcohol, and distributed over the body, and then set fire to.

In a few instances these efforts were rewarded with success, reaction and the second or febrile stage formed. It was at this period that some physicians thought that calomel should be exhibited in moderate doses, for the purpose of producing a flow of bile into the intestines, and of emulging the gall-bladder and ducts, as well as of

restoring the other suppressed secretions. The indications, however, more generally followed, were to treat the case as we should a similar state in typhous fever, namely, to moderate the affections of the bowels by mild opiates, by enemata, and by sinapisms to the abdomen; also to relieve the head by leeches and cold lotions, and subsequently, as the tongue became brown, to support the patient with wine, sago, strong broths, and a generally cordial treatment.

When medical men have charge of large numbers of people, as in the army, navy, prisons, workhouses, asylums, hospitals, and the like, it is incumbent on them to make frequent inspections of those under their care, and to seek out any cases of incipient diarrhœa. Responsible people should also be made to take notice of those who go more than once a-day to the water-closets at times when the cholera epidemic influence prevails.

Litoral, Malarial, or Paludal Fevers.

By one or other of these names three varieties of fever are indicated, having many essential characters in common. These are *yellow fever*, *intermittent fever* or *ague*, and *remittent fever*. By some the "yellow fever" is considered as one "sui generis," and specifically different from remittent and intermittent fevers. Others believe that these fevers are the same in kind but various in degree. So great are the differences induced by the common poison, that "if any one had seen only the milder forms of *remittent fever*, and had no opportunity of tracing up its several grades, he might well believe, when he saw suddenly the severest variety, that he had before him a distinct affection" (Alison). Such a belief is entertained by not a few. "When I first saw a case of yellow fever," writes Dr. Wood, "I was at once struck with it as something I had never seen before;" and this distinguished physician, for various reasons, believes *yellow fever* to be a disease of a specifically distinct kind, and different, pathologically, from *remittent fever*.

On the other hand, believing with Dr. Alison, Mr. J. Ranald Martin, the late Dr. Williams, and many others, that all of the three fevers now about to be considered are similar, pathologically; that all take their origin from terrestrial aëriform emanations, in connection with human beings congregated together, and in certain relations as to physical climate, and particularly temperature; and that all of them may be occasionally propagated by contagion, at least in the geographical regions, where they are endemic, they are here brought together and classed under one head.

Pathology.—In these forms of fever, a malarial poison of an unknown kind, generated chiefly in paludal regions or litoral districts, is absorbed and affects the blood: as cholera, typhous, and other

miasmatic poisons do. The poison, in the absence of any better name, is known as "*malaria*," and as physicians have merely inferred the existence of such a poison, no exact knowledge has yet been obtained as to its nature and source. After a period of latency, more or less long, functional disorders of the great nervous centres are brought about, terminating in the phenomena either of intermitting, remitting, or yellow fever. These fevers may exist without any alteration of structure being set up, and the patient often dies from the severest forms, with hardly a trace of disease being discoverable. In the milder forms of these fevers, however, a greater number of organs and tissues are morbidly altered than perhaps in any other disease, as the liver, spleen, lungs, heart, brain, and the serous and mucous membranes of the body generally. The specific actions, then, of the malarial poison, within certain limits, may be said to be in the inverse ratio of the intensity of the fever which attends its action. The affections of the liver and spleen also vary greatly, according to the country; for in some parts of India the spleen is the organ chiefly affected, while in other districts it is the liver; the nature of the country, perhaps of the soil, impressing evidently some peculiar character on the poison.

The patients labouring under intermittent fever in and about London generally recover under medical treatment without any manifest derangement either of structure or of function of any organ or tissue. When, however, the disease is neglected the liver may suffer, the disordered function of that organ being generally indicated by jaundice; or inflammation of the liver may ensue, of which jaundice may or may not be a symptom; and this inflammation may be acute or chronic, diffuse or limited to suppuration at one place. If a liver, previously healthy, becomes the seat of diffuse inflammation, it is of the deepest hepatic tint, and loaded with blood; and we find it also often greatly hypertrophied, filling the abdominal and pelvic cavities, and according, perhaps, as the inflammation is acute or chronic, either greatly indurated or else so softened as to be easily broken down. In a few instances this inflammation may terminate in abscess, and generally of the usual phlegmonous character. On the contrary, if the liver be previously diseased, its colour, even when the seat of abscess, or otherwise most acutely inflamed, may be of the palest yellow, and its texture sometimes so soft and broken down that the larger blood-vessels may be dissected out with the fingers, or else so indurated as to form a shapeless mass of varying magnitude. When abscess forms it may rupture into the duodenum, or into the cavity of the abdomen, or it may point externally.

The paludal poison also often produces structural alteration of the spleen. In these cases that organ has been found sometimes

so enlarged as to weigh ten to thirty pounds, greatly exceeding the liver in size (ague cake), while in other cases it is sometimes even less than natural. In consistency, also, it varies from a state of almost fluidity, a mere bag of blood, to a hardened mass, with a distinct indurated edge. It is also sometimes the seat of abscess.

The functions of the peritoneum may be alone deranged, so as to produce dropsy; but every form of peritoneal inflammation, may precede or accompany the ascites,—as the serous or the purulent, with diffuse or partial local adhesions; and these forms may be either acute or chronic, but more commonly they are acute.

These are the most usual alterations of function and of structure in the mild paludal fevers in the present day; and in estimating the relative frequency of these secondary affections, ascites is the most common, then jaundice; while peritonitis, hepatitis, and splenitis are less frequent, and occur, perhaps, in nearly equal proportions.

The pathological phenomena which attend severe intermittent and remittent fever, are much more severe, and extend over a greater number of organs. The information afforded us by the dissections of Davis and the observations of Sir Gilbert Blane, in the cases of the Walcheren remittent; of Jackson in those of the West Indies; of Burnett in the Mediterranean, enable us to understand at least the tendency of the morbid action. Sir Gilbert Blane, in his observations on the Walcheren fever, remarks, that the structural derangements were more frequent, swelling of the liver and spleen then taking place in a very few weeks; which in England seldom occur, except under a long continuance of the disease, or after frequent relapses. The morbid changes also extended to the mucous membrane of the stomach, which in a few instances was inflamed and ulcerated, and the ulcers had generally a sharp perpendicular edge, as if made with a punch. In cases which died dysenteric, the large intestines, and more particularly the sigmoid flexure and the rectum, were always much contracted, thickened, inflamed and ulcerated; the ulcers being often so numerous and so confluent that the whole inner surface of the gut appeared in a state of granulation. There is a marked tendency in the phenomena of these paludal fevers to become inflammatory, the congestion of some organ proceeding at once to exudation from the blood-vessels into its parenchyma, which appears to be the cause of prostration and of fatal results. "The significant term *bilious*," writes Mr. Martin, "as applied to these fevers of the East, is not an accidental or a misapplied term, as modern statistics fully show. A severe disturbance of the hepatic function is almost universal in the progress of the remittent fevers in the East."

There is another remarkable tendency to be noticed in the persistent effects produced by intermittents, namely,—that they im-

press a character of periodicity to subsequent ailments, especially neuralgic affections; and the disposition to the recurrence of these diseases seems to last for life. Susceptibility to the action of the paludal poison does not diminish, but rather increases by continued residence where it prevails. The returns published by the War Office and Army Medical Department show such a result in the West Indies. Thus, while the annual mortality among the troops resident one year in Jamaica was 77 per 1,000, mean strength, in those resident two years it was 87 per 1,000, while of those still longer resident it was no less than 93 per 1,000.

"In making calculations of efficient force," writes Sir James Macgrigor, "this description of men could not be relied on for operations long continued in the field" (speaking of men who had suffered from an attack of paludal fever), for "we found that in those who were convalescent or lately recovered from ague, the causes next prone to re-produce the disease were exposure to a shower of rain, or wetting the feet, full exposure to the direct rays of the sun, or to cold, with intemperance, irregularity, or great fatigue." There are many instances also of the same party being repeatedly attacked with the West Indian fever. Mr. Martin writes with regard to himself, that "after a residence of ten years in Europe, I happened to pass three nights at the best hotel in Strasburg, at a time when ague prevailed in the garrison amongst the French soldiers who had served in Algeria; and two days after quitting the town I was seized at the hour of eleven A.M. (the hour at which ague used to commence with me in India) with ague, and I was the only person of the party who was so affected."

The peritoneum is very generally inflamed, especially that portion which covers the different organs, caused perhaps by extension of the morbid irritability of those parts, and from this circumstance the different viscera often adhere to each other and to the walls of the abdomen; and sometimes it also happens that an encysted abscess forms between the adherent surfaces. In other cases the intestines were often seen floating in serum or pus, or else were glued together. In dropsical and dysenteric cases the peritoneum was unusually thickened, while abscesses occasionally formed in the folds of the mesentery.

The serous membranes of the chest were also frequently the seat of disease. Sometimes a dropsical effusion filled the cavity, in other cases the pleura pulmonalis was almost universally adherent to the pleura costalis, while in others the whole surface of the membrane was covered with recently effused coagulable lymph. In some cases the anarsca was general, but the more remarkable effusion of serum was around the epiglottis, when it formed a large tumor, completely closing up the rima glottidis and suffocating the patient.

The epiglottis also was in some cases found ulcerated and thickened. Bronchitis and laryngitis were not unfrequent, while the substance of the lung was sometimes the seat of severe inflammation, terminating either in the red or grey hepatization, or with effusion of serum.

The heart itself did not always escape, for the pericardium was frequently found inflamed and covered with lymph, or else the seat of serous effusion.

The membranes of the brain were also often the seat of much inflammation, lymph or serum being often effused between them, while much fluid was occasionally found in the ventricles. The substance of the brain also, especially in dropsical cases, was so soft as hardly to bear the knife.

The yellow tint of the skin so often observed in severe remittent cases, appears to depend on changes in the blood, in the capillary vessels of the skin, and conjunctivæ, and not always on bile, as popularly believed. So long as the capillary vessels continue distended, and the blood they contain remains more or less stationary, its component parts undergo a partial separation.

The numerous minute vessels which give the skin of the face its red distended appearance, the conjunctivæ an injected aspect, and the eyes a ferrety look, ultimately renders the skin slightly yellow, and the conjunctivæ yellow, dull, and muddy. In some cases, however, there is no doubt that bile also produces this effect.

When the paludal or litoral poison produces the severer forms of remittent and of yellow fever, it does not occasion any great amount of disorganization. In this respect the paludal poison follows the great law of poisons generally; namely, the dose being in excess, the patient dies before sufficient time has elapsed for the poison to set up its specific actions. "In cases of the Wynaad fever," says Mr. Walsh, "though black vomit and yellowness of the eyes were frequent, and they terminated fatally in four or five days, there was scarcely any vestige of local injury or of disorganization."

As a general principle, in the West Indies, in Africa, and indeed in all countries in which remittent fever is of the highest degree of intensity, the traces of continued diseased structure are always trifling, and limited to the stomach, the brain, the liver, or the spleen. When the stomach is affected, the mucous membrane of the pyloric orifice is for the most part inflamed, easily detached, and sometimes ulcerated. The contents of the stomach also are either a viscid mucus, or a black melanic matter which is sometimes thrown up, or else pure blood. In 7-10ths of those examined at Barcelona, in 1821, the stomach contained melanic matter, like soot mixed with water, or coffee-grounds, while in 1-8th it contained pure blood. The duodenum and small intestines, and not unfrequently the gall-

bladder, were also inflamed. Dr. Barry and Mr. Rufz speak of having observed Brunner's glands to be enlarged, but never Peyer's. The small intestines also are filled with the same matters as the stomach, but more viscid, thicker, and more resembling tar; and in the large intestines these matters were often mixed with clotted blood. The liver and spleen have usually been found healthy. Louis states, that in the epidemic at Gibraltar he found the liver of a pale yellow colour, a circumstance he considers to be the great pathognomic sign of the disease. It is probable, however, that this generalization is hasty, for it was not observed by our own officers, and has since been found wanting in the epidemic at Martinique. The substance of the brain is in general healthy, and sometimes a little softened, while the membranes are only occasionally inflamed and the usual effusion of serum exists.

The most general and constant anatomical fact observed amongst the morbid appearances after death from *yellow fever* is the almost universal *bloodiness* of the areolar, or binding tissues of the body, and organs generally.

When the textures are cut into, blood flows out from the subcutaneous binding tissue; the mesentery is loaded with it; the tissue binding the gullet and windpipe, and aorta, to the vertebral column, is also full of blood; and so also the areolar tissue in the mediastinal spaces, and surrounding the kidneys. From congestions, or extravasations into the submucous binding tissue of the intestines, they appear slate coloured, and as if gangrenous, when seen through the peritoneum. The cortal pleura has the same sanguineous appearance. The same condition of bloodiness pervades the parenchyma of the solid viscera.

The next most general anatomical characteristic is the altered condition of the mucous membrane. The epithelium is peeled off generally, or partially, or the whole depth of the membrane is softened, as if acted on by an alkali, or is eroded through to the submucous coat.

The kidneys often present a peculiar hypertrophy of the cortical part after the bloody stage passes away, and is then of a dull ochrey colour. This condition seems due to the impaction of the tortuous tubuli uriniferi, with epithelial and exudative matter, which constitutes the sediment of the urine, in which casts of the tubes may also at this stage be observed.

In some of the excretions which occur in *yellow fever*, such, for instance, as in "the flaky sediment of the black vomit," "the glairy opaque expectoration with red spots," "the white vomit," the urine, Dr. Blair has found the existence of broken capillary vessels one of the commonest microscopic appearances in the disease. In the black vomit he has also found the glandular cells of the liver, and

also what he conceived to be the "radical secreting ducts of the liver" disengaged from their attachments (or sloughed off) "by that destruction of capillary tissue" which he is satisfied is the essential anatomical lesion in yellow fever.

"If ever there was a disease," writes William Ferguson, "which the humoral pathologist might claim as his own, it is *yellow fever*. The crasis of the blood is as much broken down before death, and its vitality destroyed, as it would be by the introduction of the poison by the serpent's fang." "That fatal *yellow fever*," says John Hunter, "is the death of the blood;" and now, as Dr. Blair has shown, not only the blood, but the minutest capillaries of the binding tissue throughout the body, are disorganized by the action of the poison, and are passed out in substance by the various excretory ducts, such as the hepatic capillaries by the biliary ducts; the renal capillaries by the tubuli uriniferi; and the capillaries of the mucous membrane by the mouth in the vomit, and by the rectum in the dejections.

There can be now no doubt that the most plausible opinion regarding the pathology of *yellow fever* is, that it is, "*an intense form of the bilious remittent* of the tropics."

The investigation of this point, however, is attended with extreme difficulties, and is to be carried out with reference to two questions especially, namely—(1.) The type or mode of progress of the symptoms in mild and severe cases, compared with cases of remittent fever in all grades of severity and stages. (2.) The pathological characters of the morbid processes which take place in yellow fever, compared with those of remittent.

Three opinions have been held regarding the essential nature of yellow fever. These are—(1.) That it is an intense and virulent form of remittent, and which becomes more or less a continued fever (Cleghorn, Lind, Hunter, Alison, Craigie, Martin). (2.) That it is a continued fever of a specific kind, different from all other continued fevers (Cullen, Chisholm, Blane, Wood). (3.) That it is a mixed fever, of a type variable between the remittent and continued forms (Jackson, Moseley).

The grounds upon which the first of these opinions is now all but universally accepted are—that in the symptoms and effects, progress and pathology, of remittent fevers and ordinary cases of yellow fever, we are unable to discover any essential differences, but merely what is due to intensity of morbid action, degree, and rapidity of progress. Comparisons have been drawn in this way between the summer and autumnal *remittents* of the south of Europe, the *remittent* fever of the Mediterranean, the tropical *remittent* of the East and West Indies, and Central Africa, the Bulam fever, or the fever of Sierra Leone and Fernando Po, on the

one hand, and between the *yellow fever* of Cadiz, Gibraltar, Malaga, Carthagena, Leghorn, Vera Cruz, Havanna, Jamaica, St. Domingo, the West Indies generally, and the United States, on the other. There are also cases in which no distinction can be drawn between the symptoms, the effects, or the rapidity of action, if the case (considered to be a remittent) is compared with yellow fever. In other words, it is not possible to distinguish some cases and say with certainty that they are cases of remittent rather than of yellow fever, or of yellow fever and not remittent. Dr. Craigie has put the case in the most distinct terms, as follows:—"We remark," says he, "the same intensity of headache and suffusion and muddiness of eye at the commencement, the same anguish and pain at stomach, the same unquenchable thirst and incessant vomiting, the same temporary abatement at the period when cerebromeningeal effusion is commencing, the same yellow suffusion of the skin of the superior parts of the body, the same exacerbation of symptoms at the commencement and establishment of gastro-enteric disorganization, the same character of discharges, the same mode of termination, and the same morbid changes in the dead subject, in remittent and in yellow fever. The islands of Sicily, Sardinia, Corfu, Cephalonia, and Zante, present annually many cases of exquisite yellow fever in the form of the endemic remittent of summer and autumn.

"Conversely, we observe in all yellow fever epidemics cases of ordinary fever, in which no difference can be traced between their symptoms and those of the remittents which prevail in the summer and autumn of Spain, Italy, and the Mediterranean coasts and islands, of the East and West Indies, Central Africa, and the southern division of the United States. Among the cases of the virulent yellow fever of Vera Cruz, the Havanna, the West India Islands, and the United States, the physician daily recognizes cases which resemble, in all respects of symptoms, progress, and termination, the remittents of these countries during ordinary seasons. The most practised and accurate observer can trace no palpable difference unless in degree; and even this is not always cognizable. In the different yellow fever epidemics of Leghorn, Cadiz, Gibraltar, and Carthagena, there appeared numerous cases of fever which, under other circumstances, would have been admitted to be examples of remittent fever. The general epidemic prevalence, however, caused the whole to be classed as yellow fever.

"If any further proof were required of the identity in nature of the summer and autumnal remittent, and the disease named yellow fever, it may be found in the fact, that the fever which originated at Bulam, on the outlet of the Rio Grande, in 1792, has been admitted to be yellow fever, and has not only unphilosophically, but in complete defiance to historical facts, been allowed to give

its denomination to that disease. That yellow fever, that is, a remittent of extreme virulence, with yellowness, black vomiting, and other fatal signs, arose at Bulam, in 1792, is matter of fact, and that fever of a similar character originated in 1816 on the Island of Ascension, from the crew of the 'Bann,' which had recently arrived from the coast of Africa.

"Lastly, while we remark that the forms of remittent fever differ not in kind, but in degree only, that difference is so graduated, that it has attracted the attention of physicians in almost all ages. It has been long observed that the remittents of Holland, France, and Germany, were only milder in character and longer in course than those of Spain, Italy, Greece, and the Mediterranean Islands, and that those of the latter were merely milder in symptoms, and less rapid in progress, than those of the tropical regions. This was remarked by Cleghorn, Lind, Senac, Pringle, John Hunter, and Jackson. More recently it has been observed by those who have treated the remittent of the Mediterranean, that this disease bears the same relation to the endemic yellow fever of the West India Islands when sporadic, which the remittents of France, Holland, and Germany do to the Mediterranean fever. It appears, therefore, chiefly by its epidemic character, that the virulent yellow fever is to be distinguished, whether occurring in Europe or in the Antilles.

"In conclusion, I conceive it is impossible to resist the inference, that in favourable situations, such as the Mediterranean islands and coasts, the west coast of Africa, especially Senegal, Sierra Leone, Fernando Po, and the Bight of Benin, and in the East and West Indies, remittent fever may, in certain seasons, and in proper subjects, assume all the usual characters of exquisite yellow fever, and, providing there may be a sufficient supply of subjects, may prevail among them so extensively as to display the epidemic character.

"One or two ships' crews, one or two regiments, or a body of colonists, from colder, more temperate, and more salubrious countries, are quite adequate to supply the materials for such epidemic attacks, and to enable the febrific principle to betray all its energy, and all its malignity.

"These principles, which are indisputably established by numerous facts in our military, naval, and colonial history of late years, are of the greatest importance in suggesting the means of prevention, and in showing that in countries, essentially insalubrious, all attempts at colonization must be abortive, and that the necessary evils of physical situation, climate, and season, ought to be counteracted by precautions in encampment, in clothing, in regimen, and discipline."

Causes and Modes of Propagation.—Facts tending to establish

the concurrence of certain terrestrial, gaseous, or meteorological phenomena as necessary to the generation and development of these fevers, are of a very conflicting nature. The concurrence of some, however, are sufficiently obvious, and are applicable to the litoral and paludal fevers generally.

By numerous observations it has been established that some aëriform material of a poisonous nature is exhaled from marshy or wet grounds in the progress of drying. Agues have always been observed to be the diseases of moist or marshy districts; and to prevail most in low, swampy, and humid countries, where seasons of considerable heat occur. The vicinity of marshes, or of a district that has at some recent time been under water; the banks of great lakes, and the shores of great rivers and seas, where the water flows slowly, and in some places stagnates in shallow rivers over land alluvial, low, and flat; extensive flat tracts of wood, where much moisture is constantly present, where the process of drying is uninterrupted, and yet the surface constantly exhaling humidity. These are some of the terrestrial physical conditions in which the paludal and the litoral fevers are found to abound. It must also be admitted, however, that these diseases do not prevail in *all* marshy districts, and they cannot, in some cases, be traced to a residence in the vicinity of marshes. Dr. Wood gives an interesting example of the occurrence of ague from an *irritant cause*, combined with the force of habit. "For seven successive nights M. Brachet bathed, at midnight, in the river Saone, towards the close of October, when the water was cold. Retiring to bed after each bath, and covering himself warmly, considerable re-action took place, which terminated in perspiration. At the end of the seventh day he ceased to bathe, but was, nevertheless, nightly, about the same hour, attacked with a regular intermittent paroxysm, consisting of the cold, hot, and sweating stages, which returned for about a week, when it ceased spontaneously on the occurrence of an event which kept him out of his bed at the hour of paroxysm, and induced him to take a ride on horseback, which excited and warmed him." Cases having their origin in such causes, however, are of exceedingly rare occurrence, so far as the records of medicine show.

It is found that simple moisture is not adequate to the production of ague. Sailors on shipboard are not affected until they approach or land on the coast; and the chemical analysis of marsh air has not furnished any useful information in relation to its fever-bearing properties.

The concurrence of circumstances under which paludal and litoral fevers have been observed to become developed may be shortly stated as follows:—(1.) A certain degree of heat. (2.) A certain relation as to season, variable with the geography of the locality

in which such fevers prevail. (3.) A certain amount of heat and drought acting upon a more or less extensive moist alluvial soil. (4.) Although it has been observed that absolute marshes do not always produce agues, nor that agues are always due to obvious marshes, yet it is generally found that in districts where such paludal fevers abound, the surface is porous, penetrable, and retentive of moisture, although it does not appear on the surface of the ground, that this district had been at one time submerged, and that it continued slowly but constantly to undergro the process of desiccation; or while, at certain seasons it imbibes moisture from local or meteorological sources, at other seasons it undergoes the drying process under intense solar heat. Such are some of the most sickly and febriferous districts in Europe and America. For example, the Maremma of Italy; the district of the Lakes near Varna, in Bulgaria; many newly cleared tracts in North America; many parts in the south of Spain. In most of these places the conditions of the surface of the ground are very much alike. While no obvious appearance of a marsh exists, the vigour of vegetation is extreme, amphibious animals abound of the batrachian kind, plants and cephalapodous mollusca of notoriously marshy regions find a habitat, and the rich alluvial soil is so imperfectly cultivated, that the process of vegetation is not adequately exhausted, and a surface of humid ground is exposed to the solar heat, and so exhales a material which exercises a persistent deleterious influence on the human frame. Dr. Ferguson, in *The Edinburgh Philosophical Transactions*, vol. ix., p. 273, was the first author who clearly proved that the drying of all porous soils, from which watery fluid readily evaporated, was the genuine source of exhalations capable of producing the paludal fevers; and that the febriferous activity of these exhalations was influenced by the character of the season, the moisture, the temperature, and the aërial movements of the atmosphere.

The evidence regarding the geological nature of soil as a cause of ague, is somewhat conflicting (see pages 33–36 ante). It is a fact that the usual localities in which paludal fevers abound are those in which the soil consists of mineral, vegetable, and animal matters, mixed together in such proportions and of such constituents chemically as tend to absorb moisture and retain it. Such soils are known as *alluvial*. Paludal fevers abound, however, where soils of a different nature predominate. Level plains of sand, or dry, loose, open gravel, are soils where malarial fevers have prevailed.

"The first time I saw intermittent and remittent fever become epidemic in an army," writes Dr. Ferguson, "was in 1794, when, after a very dry and hot summer, our troops in the month of August took up an encampment at Rosendaal, in South Holland. The soil was a level plain

of sand, with perfectly dry surface, where no vegetation existed, or *could* exist, but stunted heath plants. On digging it was universally found percolated with water to within a few inches of the surface, which, so far from being at all putrid, was perfectly potable in all the wells of the camp."

Rocky places, such as Ciudad Rodrigo, Gibraltar, and Malaga, have now and then been ravaged by epidemics of litoral and paludal fevers, "and the rocky shores and islands of the Mediterranean, for instance, Minorca, Sardinia, Sicily, Cephalonia, and all the Cyclades, abound as much in these fevers as the most level parts of Holland; and the West India Islands, most of which are coralline rocks, are the native soil of these diseases." Soil composed of tenacious or stiff clay (argillaceous) is highly retentive of moisture, and is difficult either to dry or to drain. The basin of the Thames, comprehending Middlesex, Essex, Surrey, and Kent, is almost entirely clay land, and is the district of England where agues most of all prevail, especially along the banks of the Medway and the Thames. In the days of Sir Gilbert Blane, agues had almost entirely ceased to occur in London, and the cases which he treated he believed to have been imported from malarious districts around, and the same may be said of those at the present day. A hundred years before the time of Sir Gilbert Blane, however, we find that agues prevailed in situations in the town of London where they are now wholly unknown, such as Russell Street, Covent Garden, Fleet Street, Fetter Lane, Newgate Street, Paternoster Row, Cheapside, Smithfield, Fenchurch Street, &c. At the present time ague rarely occurs in London except on the south side of the river, especially in Bermondsey and Rotherhithe, and chiefly in persons who have recently been exposed to malaria in Kent or Essex, and who have come from these marshy neighbourhoods either quite recently, or within a few months. The malarious influence still in the metropolis itself, however, seems sufficiently powerful to imprint a periodic character upon various local affections, and occasionally to give rise to fevers of a remittent type. Recently (in 1856) such affections have been unusually prevalent, but the forms of ague now met with in London are more tractable and milder than those which formerly prevailed (Dr. Peacock).

It is observed that the surface of the earth may be dried either by the direct rays of the sun, or by currents of hot, dry air wafted over it, or by both combined; but it is principally by the direct rays of the sun that the deleterious material of the soil is liberated; and it seems to be at a certain period of this drying process that the exhalations are more potent than at another time in developing paludal fevers.

There appears also to be a certain state of the human frame which renders it more than usually susceptible to this disease. The

natives of warm and tropical climates are much less frequently and less violently attacked with paludal or litoral fevers than settlers or visitors from other lands, such as the natives of Europe or the northern parts of America. In the Mediterranean, along the coast of Africa, in the East Indies, in West India Islands, in the southern States of the Union, new comers from the northern latitudes are almost invariably attacked and suffer much more severely from the fever than those who have been long in the country. It has been also noticed that those who, after residing in a territory where paludal fevers abound, have been out of it for some time, an augmented susceptibility to renewed attacks of the fever becomes manifest on their return (CRAIGIE).

Other causes, also, predispose to those fevers, and none more than laborious or fatiguing duty in military or naval operations, labouring in the sun, excess in eating or drinking, intellectual exertion combined with bodily fatigue, and a crowded state of the population. Indeed, *insolatio*, or heat apoplexy is regarded by many as a form of remittent fever (JOHNSTON, MARTIN, HILL).

The following observations by Dr. Craigie regarding the periodic prevalence of paludal fevers, and the predisposition to them, might be made not only regarding such fevers as we are now considering, but also of cholera.

When a remittent fever, or other paludal or litoral fever, has, under certain concurrent circumstances of weather, season, and physical peculiarities, made its appearance in any locality, it necessarily attacks all those who are by constitution, habit, and age, susceptible and predisposed; and the majority of these, especially if enfeebled by previous dynamic or organic disease, it destroys. The population, therefore, which outlives such an epidemic visitation, are no longer equally susceptible, and are greatly less likely to be attacked the ensuing season, unless it is more febriferous than the past, which, though sometimes, is not generally the case. The effect of this, therefore, is, that while the endemial disease continues for a season to attack and destroy its *ordinary* annual proportion of the population, it does not for several years attack the *extraordinary* proportion, because that proportion is not yet ready for, or susceptible of, its attacks.

In the course of a few seasons, however, during which the young have grown up and become adult, the adult have become careless, and perhaps irregular and incautious by long immunity, and their constitutions have become less able to resist deleterious or morbific impressions, and the whole population of the place has become generally augmented by the arrival of persons from various other countries, a considerable number of susceptible persons is gradually formed; and at the end of five or six years, a place of 25,000 or

30,000 inhabitants becomes augmented perhaps by an additional fifth, or even by a third. The majority, or the totality of these persons, are all more or less predisposed and susceptible; a season of excessive drought ensues, in which solar desiccation and little wind form conspicuous characters; fever appears, and spreads at first slowly and gradually, but afterwards springing up in many points, rapidly coalesces; and in a short time is so general and fatal, that it assumes an epidemic character. The usual mortality in the meantime takes place; all the susceptible and predisposed subjects pass through the disease or are cut off; and the population of the place is once more reduced to its state of epidemic insusceptibility and endemic or ordinary liability. This is the usual course of epidemics of paludal or litoral fevers in all countries within the tropics, and, indeed, within the 45th degree of north and south latitude.

The yellow fever appears to have two modes of propagating itself,—1st, By a peculiar endemic malaria; 2d, By an infectious principle, especially generated in an atmosphere tainted by aggregation of the sick.

It immediately results from the history of yellow fever, that it is the spontaneous product of the coasts of the West India Islands, and the American equinoctial continents. All over the Carribbean Sea the disease takes place sporadically, or in insulated cases every season, more or less numerous, according to the subjects and the number of new visitors, and there never is a season in which a few cases do not occur. At Vera Cruz, Havanna, and other towns on the Spanish Main, yellow fever invariably attacks Europeans or Canadians who may land there between the months of May or June, and October or November; but so long as such cases continue few, isolated and sporadic, they attract no attention, and the disease is not heard of in ordinary years. It seems to prevail for the most part in towns situated on the sea or river coasts of alluvial countries in warm climates; and that while the banks of these rivers or seas are liable to occasional alternate periods of inundation and drying up, the fluctuations of the tides co-operating with these contribute powerfully, under intense solar heat and a windless atmosphere, to render the towns along the shores of such districts the seat of yellow fever. "While ague is the offspring of the marsh or its margins, and remittent is the effect of a more concentrated form of the same exhalation from some moist surface in the process of solar desiccation, yellow fever appears to be the exclusive product of that state of the atmosphere which takes place after a long continuance of solar heat, with little or no wind, in those points chiefly where the atmosphere of the sea and that of the land are in constant communication and interchange. It is, indeed, a remarkable

fact that the intense form of fever, which has been distinguished as genuine yellow fever, is rather rare in the interior of countries, and is seldom found in towns even situate on rivers higher than the influx of the tide. The fevers which appear in these situations are more of the remittent character; and in the interior of the American continent, there is little doubt that the *lake-fever* represents the *yellow fever* of the coasts. Even in Europe, while the towns on the sea coast and on rivers were labouring under the ordinary epidemic yellow fever, the sickliness in the interior approached more to that of the remittent or remittent-continuous type" (CRAIGIE). For this reason the term *litoral* as well as *paludal* has been used to designate this class of fevers.

The endemic conditions under which the malaria gives rise to yellow fever might be referred—(1.) To thermometric temperature of the air; (2.) To the state of the atmosphere as to currents of winds and electricity; (3.) Local peculiarities of surface already referred to; (4.) Constitutional susceptibility, and crowding together of masses of people.

That intense solar heat contributes greatly to the development of yellow fever, is shown by the situations of those parts where it is peculiarly endemic, in relation to the prevailing temperature. Thus, it is found to prevail chiefly in places situated in the eastern regions between 10° of south latitude and 42° of north latitude. On the Continent of Europe it has generally prevailed in places situated between the 36° and 38° north latitude, and has never gone farther north than Barcelona on land, or in latitude 48° north on the sea. That it has gone farther north, it has been alleged, but the authenticity of the statement is doubted. In these northern latitudes it is also observed that the malaria of yellow fever cannot pass over a thousand yards of water without being deprived of its power.

The following observation was made by Sir John Pringle on the fevers of Walcheren and South Beveland, in 1747:—

"These epidemic fevers, by reason of the great heats of the season, not only began more early than usual, but were fully as fatal to the natives as to us. But Commodore Mitchell's squadron, which lay all this time at anchor in the channel between South Beveland and Walcheren, in both of which places the distempers raged, was neither afflicted with fever nor flux, but amid all that sickness enjoyed perfect health; a proof," he says, "that the moist and putrid air of the marshes was dissipated or corrected before it could reach them."—*Diseases of the Army*, p. 58.

The very same observation was made at the very same spot, fifty-two years after, by Sir Gilbert Blane:—

"I had, in the course of this service (at Walcheren, in 1809), an opportunity of observing the extent to which the noxious exhalations extended, which was found to be less than I believe is generally known.

Not only the crews of the ships in the Road of Flushing were entirely free from this endemic, but also the guard ships stationed in the narrow channel between this island and South Beveland. The width of this channel is about six thousand feet, and although some of the ships lay much nearer to the one shore than the other, there was no instance of any of their officers or crew being taken ill with the same disorder as that with which the troops on shore were affected."—*Med.-Chir. Trans.*, vol. iii., p. 27.

It is now also generally believed that yellow fever cannot exist, except in places where the average range of temperature is high throughout a considerable part of the year; and for this reason it is believed that it will not become a disease of this country, and although cases may be imported here in ships, the disease will not spread from them as foci. Sir Gilbert Blane asserted that it never appeared either in tropical climates, or in the temperate latitudes, unless when the atmospheric heat has been for some time steadily at or above 80° Fahr., 21° of Reaumur, or 26·67 Cent.; according to Humboldt, 75° of Fahr., or 24° Cent.; and according to Matthei, 72° Fahr., or more. The disease is also found not to prevail in mountainous situations; according to Humboldt it has never ascended to 3,044 feet above the level of the sea; and according to Mr. J. R. Martin never above 2,500 feet, and below the former limit the Mexican oaks do not flourish, showing that the constant average temperature below this is of a tropical character. In Jamaica, according to Dr. Craigie, it rarely ascends 1,600 above the level of the sea. "In Jamaica the medium temperature of Spanish Town in the hottest months is about 85° Fahr., or between 83° and 85°; and in Kingston it is much the same, ranging from 85° to 90°, and rarely falling below 80°, from May to the end of September. At the more elevated parts, however, the temperature diminishes, being only about 70° at Stoney Hill, elevated about 1,300 feet; at Cold Spring, 4,200 feet above the level of the sea, only 60°; and at the summit of the Blue Mountains, which are estimated to be 7,200 feet above the level of the sea, the thermometer is found to range in August from 47° at sunrise to 58° (Hunter) at noon, or at an average 60° (Moseley).

"At Stoney Hill, the first of these places, yellow fever has sometimes, though not very often, displayed its epidemic virulence in a very bad form; but it has never been known much higher than this point, whether from the want of subjects, or the low temperature and free ventilation.

"In the island of Trinidad, however, the ridge behind Port of Spain, which is a limestone rock elevated 1,500 feet above the level of the sea, has been highly productive of yellow fever, and has cost the lives of many men in attempting its clearing and fortification.

"But even at elevations much less yellow fever is not capable of existing. Thus the outer Cabritt at Prince Rupert's Head in Dominica, which is only 600 feet above the level of the sea, is comparatively cool, pleasant, and healthy; and Daxon's Hill, which is 1,010 feet; One Tree Hill, which is 1,300; and Mount Pleasant, which is 1,360, are very salubrious stations, and totally free from this disease" (CRAIGIE).

It is, however, observed that high temperature, or intense and continued atmospheric heat, is not the only essential generating cause of *yellow fever*. Many other co-existing circumstances must concur. Of meteorological causes, the most essential appears to be that which has also been observed to be the most constant in cholera, namely, the existence of a calm windless state of the atmosphere, preceded often by unusual weather, and a great and unusual accumulation of electric matter in the air.

The composition of the soil has been believed to exercise some considerable influence on the production of yellow fever. On this subject, however, the facts are discordant. While alluvial soils are those where yellow fevers have mostly prevailed, as at Granada, St. Domingo, New Orleans, Philadelphia, New York, Boston; or calcareous, as in Jamaica; it has also been observed that a beach, bank, quay, or wharf, is the place where the disease first makes its appearance, when such beach, bank, quay, or wharf is alternately immersed in sea water and exposed to the drying effects of great solar heat. The drying effects of great solar heat have also been supposed to extricate some deleterious material from the green wood of new ships (WILSON), and also from forests of mangroves (INGRAM, HUMBOLDT, WILSON).

In all those localities where the disease is endemic, it seems to manifest a decided preference for the natives of the colder regions. Thus the British, Germans, Swedes, Danes, are more liable to suffer than Italians, French, or Spaniards; and in ordinary years the natives, and especially the coloured population, are rarely attacked. That the disease is both introduced and propagated by means of an infectious principle, especially generated in an atmosphere tainted by aggregation of the sick, there is now no doubt. It stands in the same category, in this respect, that cholera and dysentery does, which under certain circumstances is known to spread by a specific poison from the sick to the healthy. In like manner it is now believed that, malaria arising from the earth's surface, and producing only remittent or intermittent fevers in general, may in certain circumstances, and at certain times, excite fevers which take a continued form, and which may propagate their kind by a specific poison from the sick to the healthy. An admirable paper by Dr. Alison in *The British and Foreign Medico-Chirurgical Review* for January,

1848, fully illustrates this doctrine. When the disease appeared with great virulence in the island of Granada in 1793, its spread by infection first attracted notice by the arrival of the "Hanky" from Bulam, on the west coast of Africa, on the 19th February, 1793, some days before the fever broke out on the island. In this vessel, at Bulam, the fever had prevailed for five months before to a great and fatal extent (CHISHOLM, SIR WM. PYM). The introduction of yellow fever to the island of Ascension was by the crew of her Majesty's sloop "Bann," which arrived there on the 23d of April, 1823, after which the garrison of the place began to suffer from the disease. The extension of the yellow fever to the remote island of Boa Vista in 1845-46, is another now well known instance of the introduction of the disease by the "Eclair" from the African coast, and its fatal spread among the inhabitants of that island (MACWILLIAM). Two points have been established by Dr. MacWilliam satisfactory to the great body of the medical profession, namely, that the fever on board the "Eclair" had become contagious; and secondly, that the disease was propagated from the ship to the inhabitants of Boa Vista (MARTIN). "In the face of such facts," writes Dr. Alison, "it would be wrong to assert on the breaking out of yellow fever, or unusually virulent remittent fever, in any climate known to be fitted for its extension, that it will not spread by contagion; but we are fully justified by observation of that disease in asserting on such an occasion, that whether it spreads by contagion within certain limits or not, it will, in all probability, be confined to *tainted districts*, even in that country."

INTERMITTENT PALUDAL FEVER, OR AGUE.

Definition.—*Febrile phenomena occurring in paroxysms, and observing a certain regular succession, characterized by unnatural coolness, unnatural heat, and unnatural cutaneous discharge, which prove a temporary crisis, and usher in a remission. These phenomena are developed in an uninterrupted series, or succession, more or less regular, which pass into each other by insensible steps.*

Symptoms.—The disease may be sudden in its attack, and without previous illness, but more commonly it is preceded by general indisposition, headache, weariness, pain in the limbs, thirst, loss of appetite, white tongue and frequent pulse, high coloured urine and dark coloured discharge from the bowels. These prodromes are accompanied with well-marked exacerbations and remissions of fever, displaying a periodic tendency. After this feverish state has lasted from four days to a fortnight, the patient is seized with severe rigor, and the ague is manifested. The phenomena of a paroxysm are the following:—

The paroxysm, like the disease, may be of sudden invasion, and the patient may be in good health up to the time of attack; or it may be preceded by languor, debility, frequent yawnings, and great unwillingness to make the least exertion. In whichever way the cold stage begins, the patient experiences first a sensation of coldness of the extremities, then of the back, and lastly of the whole body; at the same time the nails turn blue, the features shrink and become pale and sharp, and if the case be severe the whole body shrivels up, turns purple, and is "goose-skinned." The coldness increasing, the motor nerves of the fifth pair are affected, and the teeth begin to chatter; and this tremor extends to every muscle, till the whole body shakes with rigor. Cough, dyspnœa, and oppression of the præcordia now occur, with a painful sensation round the temples and down the back. The patient also often suffers from nausea and vomiting, and the latter symptom is speedily followed by the hot stage. When the cold stage has lasted a period varying perhaps from half an hour to two hours and a-half, a re-action takes place, accompanied by partial warmth, or flushings. These extend, and at length the whole body acquires a heat greater than natural, or from 105° to 107°. As the heat returns so also does the colour, and the body, especially the face, becomes now preternaturally swollen and red. The hot stage being now formed, the heart and arteries beat with unusual violence, and headache, with a frequent full pulse, and all the distressing symptoms of continued fever, are present. "The mean duration of this stage is from three to eight hours. At its close a gentle moisture breaks out, first on the forehead, and thence extends till the patient lies in a general sweat, sometimes so profuse as to soak the bed and linen as completely as if they had been dipped in water. After the sweat has continued to flow for some time the fever gradually abates, a state of apyrexia ensues, and the paroxysm is terminated, and, a sense of exhaustion excepted, the patient feels restored to health. Sometimes, however, he continues pale, debilitated, and incapable of all exertion, till, on the recurrence of the paroxysm, the symptoms just described are repeated.

Upon the approach of the attack the pulse is slow and feeble, but as the sense of coldness increases it becomes small, rapid, and irregular. When the hot stage forms it becomes full and strong, and on the sweat breaking out it again becomes soft, less rapid, and at length natural. In the course of the paroxysm there is a considerable change in the urine, which, during the cold stage, is abundant, colourless, and without sediment. In the hot stage it is high coloured, but still void of sediment; but as soon as the sweat begins to flow a sediment, commonly lateritious, is deposited, and this deposition continues for some time after the paroxysm is terminated. According to all observers there is a considerable increase

of uric acid in the urine. The tongue, in mild forms of the disease, is clean in the cold stage, white in the hot stage, and again cleans after the sweat has flowed. In severe cases the tongue is white during all the stages, and also during the apyrexia, while in the worst cases the tongue is brown in all the stages. Excepting some unusual instances, attended throughout with diarrhœa, the patient seldom passes a stool till towards the close of the paroxysm, when it is generally a loose one. It frequently also happens during the cold stage that tumors subside, or ulcers dry up, but the tumor generally reappears, and the ulcers discharge as soon as the sweating stage is formed.

The paroxysm of intermittent fever, of whatever description, is conventionally considered to terminate in twenty-four hours; for, if prolonged beyond that time, it is termed remittent fever. The duration, however, varies in different types. Dr. Brown conceives the mean length of a quotidian to be sixteen hours, that of a tertian ten hours, and that of a quartan six hours.

The febrile paroxysm, or fit of intermittent fever, has three stages: a cold stage, a hot stage, and a sweating stage. These three stages are not necessarily of an equal duration, but vary greatly in different cases. The duration of the cold stage is from a few minutes to five or six hours, and in general, if the case be severe, the shorter the cold stage the longer the hot stage. The hot stage may last from half an hour to any period less than twenty-four hours. The sweating stage is generally shorter than either of the former, and sometimes does not exist at all. The rule, however, is, that the quotidian has the shortest cold stage and the longest hot stage; the tertian a longer cold stage and a shorter hot stage than the quotidian; while the quartan has the longest cold stage and the shortest hot stage of all the varieties.

The varieties of intermittent fever are distinguished from each other by the interval of time which elapses between each paroxysm. For instance, when the paroxysm returns every twenty-four hours it is termed a *quotidian*, when every forty-eight hours a *tertian*, and when every seventy-two hours a *quartan;* and these primary types have been extended by early writers to every period comprised within a mensual or bimensual period.

Of these primary types it has been supposed that in this country the tertian is by far the most common, then the quartan, and lastly the quotidian. But this law is by no means general, for M. Maillot treated 2,354 cases of intermittent fever occurring in the French army in occupation of a portion of the northern shores of Africa, and he found of that number 1,582 were quotidian, 730 tertian, and 26 quartan. In the Peninsular war the quotidian was likewise the prevailing type, and at one time they were in the proportion of 16

to 1 of any other type. In the West Indies the tertian and the quartan are only about one-twelfth of the whole number of intermittents treated, the rest being quotidians.

Most authors who have written on intermittent fever have stated that the accession of the quotidian paroxysm occurs early in the morning, that of the tertian about noon, and that of the quartan in the afternoon, between three and five o'clock. But to this law there are many exceptions; for, according to Maillot, of 1,582 quotidians 1,089 occurred from midnight to midday, and 493 from midday to midnight; of 730 tertians 550 occurred from midnight to midday, and 180 from midday to midnight; out of 26 quartans also 13 were seized from midday to midnight, and 13 from midnight to midday. As the most general conclusion, the paroxysm returned in a great majority of the quotidian cases from ten to twelve o'clock, and in the tertian from nine to twelve o'clock.

Treatment.—The treatment of agues varies in a great degree with the complications of the disease; such as the splenic and hepatic congestions, and the inflammatory affections of these and other organs, which are apt to be established during the existence of an intermittent fever. During each paroxysm, and subsequent to it, the condition of the two important organs referred to ought to be carefully observed; and it ought to be observed also, whether any symptoms exist of congestion or actual exudation into the cranial parts, or abdominal organs generally. When the type of the fever is malignant, or of a severe and complex kind, or when the complications are locally severe, it is difficult to cure an ague, which otherwise is a very manageable disease. During the cold stage, especially if it is of long duration, the liver, and especially the spleen, become turgid, the symptoms of which generally disappear with the sweating stage of the fever. It is when the endemic influences are severe, or when the attacks are prolonged over months and years, that these organs begin to suffer permanently from organic disease.

It is useless to attempt the cure of intermittent fever if the sufferer is permitted to remain within the sphere of malarial influences, or even in those geographical latitudes which may be said to be peculiarly malarial. It is now an established fact that none can become acclimated so as to withstand the influence of malaria. When organic complications exist, they must, if possible, be remedied, because they maintain the morbid sensibility during the intermission, and prevent the cure of the ague.

In the warmer latitudes the following account of the treatment of intermittent fever is that laid down by Mr. Martin. During the cold stage of the fever, while emetics seem to be indicated, they are not in repute. Warm drinks, ammonia, ether, camphor, and other diffusible stimuli, with the application of external warmth, seem to

be preferred by most practitioners. During the hot stage, a full dose of calomel, with James's powder, should be given at once, and in three hours this should be followed by a brisk cathartic, diluent drinks being freely used meanwhile, along with some cooling diuretic. The tartarized antimony with nitrate of potash is recommended, as it answers the double purpose of exciting to action the functions of the skin and the kidneys. On the following morning, the intermission being completely established, the sulphate of quinine is to be administered. The influence of this medicine on a person in health, as observed by Dr. Ranke, is to diminish the quantity of uric acid in the urine (*Med. Times*, May 30, 1857). It is to be given at intervals of three hours during the day, the patient being kept in bed, and supplied with farinaceous food only. In the simple cases, when removed from the sphere of malarial influence, it may not be necessary to give mercurials more than once or twice, but active purgatives are always beneficial in relieving the full and congested state of the abdomen generally, during the continuance of intermittent fever. There are cases of intermittent fever, however, complicated with hepatic and other engorgement, and which continue to recur despite of all means, until a few doses of calomel, followed by purgatives, are administered; then the quinine, which before failed, will speedily cure the disease. It appears that certain morbid conditions, both of liver and spleen, may produce and maintain the tendency to recurrences of ague. Ramazini relates the case of a patient harassed by an obstinate ague, and who was cured by mercurial frictions administered for syphilis. The influence of splenic disease in keeping up the morbid train of actions of the original fever, and in producing relapses has been recorded by M. Piorry. In more than 500 cases of ague in which he observed the state of the spleen, he comes to the following conclusions: namely, that the organ is invariably enlarged during the progress of the fever, and that by the use of quinine the spleen diminishes in size; that its reduction in size bears some relation to the quantity of quinine taken; that the effect it produces upon the fever is in proportion to the reduction of the spleen; that the disease cured simultaneously with the subsidence of the splenic enlargement; and that the fever is apt to recur so long as the spleen exceeds its normal size.

When the fever is severe, accompanied with præcordial oppression, pain, fulness of the spleen or liver, or both, or where there is severe headache, or headache with giddiness, or an oppressive fulness of the chest, a general or a local blood-letting, or both combined, is imperatively demanded, as a means of promoting cure and preventing future evils. The antiperiodic power of bark, quinine, or arsenic, then becomes more easily developed. According to Dr.

Copland, such depletion is almost an indispensable preliminary to the administration of quinine or bark, especially in the complicated and congestive forms of the disease. Without such depletion the medicine will either not be retained, or if retained, it will convert congestions or slight forms of inflammatory irritation into active inflammation or serious structural changes. It is chiefly to a neglect of such a mode of practice that unfavourable consequences have so often followed the use of bark, quinine, or arsenic, for their influence is at first to interrupt secretion, or to over-excite, and subsequently to inflame organs already loaded, obstructed, and congested. Blood should be drawn at the very onset of the hot stage, or that of re-action; and it should be regulated by the constitution, the age, and the habit of the patient, as already explained.

When, on the contrary, the fever assumes a low adynamic form, or when the patient is anæmic, mercurials must be carefully avoided in the treatment under all circumstances, and reliance placed on change of air, quinine, and chalybeates, and improved diet. With regard to liver complication in such cases, the nitro-muriatic acid is to be used instead, internally in doses of ten drops, three, four, or five times a-day, and externally in the form of baths.

With regard to the doses of quinine, some give very large quantities, such as twenty or thirty grains before the expected paroxysm (Maillot); others begin to administer the quinine on the subsiding of the paroxysm and during the sweating stage. According to the experience of Mr. Martin, which has been great in various countries, the most rational plan is to give the quinine every three or four hours during the interval of freedom from fever, and in such doses as the urgency of the symptoms may demand. It is to be administered in solution, dissolved by a small quantity of *dilute* sulphuric acid. He also recommends antimony to be conjoined with the quinine in plethoric subjects; and, on the contrary, if the patient is feeble, irritable, or exhausted, he adds a few drops of tincture of opium to the antiperiodic. When arsenic is given in large doses, and its use prolonged, it permanently injures the circulating system and the mucous membranes of the stomach and bowels. It should be given in small doses, and not persevered in for more than eight or ten days. From six to eight drops of the solution of the College formula may be given every three hours during the interval of freedom from fever.

When the intermittent fever has become chronic, or when there is organic disease of the liver or spleen as a secondary affection, change of climate becomes a measure of necessity, and should never be neglected. Mr. Martin's personal experience does not allow of his writing in favourable terms of the practice of bleeding *in the cold stage of ague*. After quoting many eminent authorities, both for and

against the practice, he remarks, "that in Europe at least, the treatment of intermittent fevers by blood-letting in the cold stage, whilst it has the show of being prompt and energetic, proves, in effect, haphazard, systemless, operose, and tedious; and from all that I have seen and heard in the East, the result there has not been more favourable." The rule of practice laid down by Pringle and Cleghorn has received little or no addition in more recent times. Where general blood-letting is had recourse to in the treatment of intermittent fevers, whether simple or complicated, it should, as in the case of all other fevers, be performed at the very outset of the stage of reaction.

Remittent Paludal Fever.

Definition.—*Febrile phenomena with exacerbations and remissions. The fever is characterized by great intensity of headache, the pain darting with a sense of tension across the forehead. The symptoms rise and fall in daily succeeding paroxysms, causing a stage of remission and a stage of exacerbation.*

Symptoms.—There are so many grades of intensity in remittent fever, varying as it does from a severe intermittent to yellow fever, and so many different modifications impressed on it from the great variety of country by which the poison is generated, that it is extremely difficult to generalize the phenomena.

The severer forms of remittent fever may be preceded by languor, restlessness, or chilliness, symptoms which usher in a short cold stage; but in other cases the attack is sudden, and the patient, for instance, immediately after a hearty dinner, may be seized most unexpectedly with faintness, vertigo, confusion of thought, and these almost without a rigor; a hot stage, usually of much greater intensity than that which accompanies the worst forms of intermittent fever, follows.

The hot stage is usually marked by much cerebral affection: as severe headache, a painfully acute state of every sense, an injected state of the conjunctiva, and great action of the carotid arteries. These symptoms are frequently accompanied by delirium, sometimes of a violent character. When giddiness is distressing and proceeds to delirium at an early period, and runs high, a severe form of fever may be expected. In other cases the patient is oppressed with great drowsiness, lethargy, or coma. The stomach also is often the seat of great pain and uneasiness, followed by vomiting, and the matters vomited are either colourless or bilious, or else blood. The duration of this paroxysm varies considerably, and when the disease is mild it may terminate in six or seven hours, but if severe it may last fifteen, twenty-four, thirty-six, or even forty-eight hours; and Dr. John Hunter once saw a case in which there was no remission

for seventy-two hours. The fever, however, at length remits, sometimes with sweating, but at other times without any sensible increase of perspiration.

The duration of the remission which follows is as various as that of the hot stage. Sometimes it does not last longer than two or three hours, more commonly it extends to ten, fifteen, thirty, or even thirty-six hours. The fever then returns, and in some cases assumes a quotidian type, and has an exacerbation every day, and perhaps nearly at the same time, yet more frequently there is no regularity in the times either of its accession or remission.

The second paroxysm is always more severe than the first, if the progress of the fever has not been checked during the remission, and usually neither any cold stage, rigor, nor even chilliness precedes it. On the other hand, all the febrile symptoms run much higher, the skin is hotter, the pulse more frequent, the headache greater, the senses more confused, and the delirium or coma, when that exists, more violent in degree and more sudden in its accession; and these symptoms sometimes persevere with or without the black vomit, till they terminate perhaps in convulsions, and at length in death. The severe forms of the fever are sometimes accompanied with a yellowish hue of the skin and white of the eyes. The yellowness is said to be less where there is a copious bilious diarrhœa, and where the urine is of a dark yellow-brown colour.

There are great varieties in the degree of severity of this fever, more especially as they occur in England, France, Holland, and Germany, compared with those which occur in Spain, Italy, the Mediterranean Islands; or still more so in Africa and the East and West Indies, and accordingly some authors distinguish (Craigie) three varieties : *e. g.*—(1.) The autumnal remittents of temperate countries, as England, France, Germany, Holland, Hungary. (2.) The summer and autumn remittents of warm countries, as Spain, Italy, Greece, the Mediterranean coasts and islands generally, the Levant, the north of Africa and Asia, and the United States. (3.) The endemic remittents of hot and tropical climates, as in the south of Asia, Central and Western Africa, Equinoctial America, and the West India Islands. Accordingly remittent fever has received different names from the localities where it prevails. Thus we have the gall sickness of the Netherlands, the Walcheren fever, fever of the Levant (Irvine), Mediterranean fever (Burnett), Hungarian sickness, puka fever of the East Indies, jungle fever, hill fever of the East Indies, bilious remittent of the West Indies and Mediterranean, Bulam fever, Sierra Leone fever, fever of Fernando Po and Bight of Benin, African fever, Bengal fever. Prevailing on the borders of inland lakes, as in America, it is sometimes called the *lake fever*.

Treatment.—With fever so various in its degrees of severity it is

not possible to do more than indicate the nature of the treatment which may be followed, as every special case must be prescribed for and treated by its own special indications, and with a due regard to the nature of the prevailing epidemic.

The extent to which blood-letting can be carried, as recommended by Drs. Irving and Cartan and Mr. Goodison, will depend on the constitution of the patient, the season, the climate, its immediate effect, and whether the prevailing epidemic is of such a kind as to be benefited by blood-letting. From the testimony of Dr. Hennen as to Corfu, Mr. Muir as to Cephalonia, Mr. Goodison as to Zante, and Mr. Boyle as to Sierra Leone, those who have long resided in these places do not bear blood-letting so well as strangers from colder and more temperate regions. I know also that bleeding was not borne by the sick of the British army in Turkey during the recent war. When blood-letting is beneficial its effect is in general to abate remarkably the pain, throbbing, and constriction of the head, and the pain of the orbits, to relieve epigastric oppression and tenderness, to render the pulse slower, less tense and oppressed, and to render the motion of the blood freer and less embarrassed. In some instances in which delirium is urgent, leeches applied to the occipital region are of the greatest benefit.

Local depletion over the epigastric region is also often of great service, and enables the stomach to retain fluids and medicine. Purgatives are also indicated to unload the alimentary canal, and to relieve the congestion of the visceral blood-vessels; as also compound powder of jalap with calomel given in a bolus, and followed by three or four ounces of infusion of senna. Sometimes ordinary doses of purgatives have little effect till the local depletion has been effected over the region of the stomach; and it is also a good plan to change the purgative every day.

In every form and variety of the fever one of the most important guides in the treatment is to be derived from the nature of the prevailing disease, whether endemic or epidemic. Too much attention cannot be given to every means of knowing the type of the epidemic fever, and to study each individual case in relation to the prevailing type. First, the *duration of the stage of the fever* must be ascertained, *i. e.*, whether it be of some hours' or of some days' duration, and whether when the practitioner sees the patient for the first time, the actually existing paroxysm is at its accession or its decline. It is known by experience that the means of treatment which would be salutary during the first few days, cannot be used later to the same effect and in the same amount. There is less tolerance of remedies, and their effects are less therapeutic. Again, it is also known that the means which would arrest fever and save life, if applied at the accession of the paroxysm, would induce a dangerous collapse, or

even destroy life, if applied at the stage of its decline, or towards its termination.

The various theraputic agents which have been employed with various degrees of success in the treatment of remittent fevers are :— *emetics, the warm bath, tepid and cold affusions, cold drinks, blood-letting, purgatives, diaphoretics, mercury, quinine* or *bark, arsenic, wine,* and *opium.* A review of the prominent modes of treatment of remittent fever, by the most eminent of British army surgeons, has led Mr. Martin to make the following general remark, namely, that a disease so varying in its nature, so general and complicated in its influence on the system, is not to be justly treated by one remedy. Bark and calomel, each a remedy of great power, will nevertheless not succeed in the cure of fever, if used exclusively, and so it is with the most powerful of all means, blood-letting. Each remedy must therefore have its proper place in the treatment.

The first and most immediate object of treatment, is to reduce the force and frequency of arterial action during the paroxysm. If the patient be seen in the forenoon of the first, second, or third paroxysm of an ordinary remittent fever, and if he is of a sound constitution, and not beyond middle life, blood-letting from the arm while the patient is in the recumbent posture, should be practised to the extent of relieving the sufferer from præcordial oppression, from visceral fulness and congestion, or from the intensity of the head-ache, whichever may predominate. The quantity of blood to be taken is to be regulated by the effects produced, and not by any arbitrary measure in ounces. Evidence of relief from visceral congestion is obtained from the following indications, namely, reduced force and frequency of the pulse, reduction of morbid temperature, and gentle relaxation of the skin. This relaxation of the skin ought not to proceed to sweating with further symptoms of depression of the vital powers. If it should do so from untoward circumstances, from half a grain to a grain of opium, or from fifteen to twenty drops of laudanum, with as many of chloric ether, should be administered. The object of the administration of either of these medicines being to influence and soothe the heart's action, and to allay gastric intestinal irritation ; and it is only in cases of depression that opium is to be administered thus early in the treatment of fever.

One general blood-letting will generally be found sufficient to relieve the patient from abdominal or cerebral oppression ; and it will further have the effect of simplifying and rendering more efficient all the subsequent means of cure. Within an hour after the bleeding, a dose of *calomel,* with *compound extract of colocynth* and *James' powder,* should be given, followed in two hours by a powerful cathartic, such as *infusion of senna* with *sulphate of magnesia.*

After the free action of these remedies some degree of remission will be obtained in the afternoon, and the patient should be directed to take at bedtime from six to ten grains of *calomel* with four of *James' powder*, if the skin be dry; and during the past eight or ten hours he may have the free use of cooling drinks. On the early morning visit of the following day the remission will probably be more complete, when the *sulphate of quina* alone, or in combination with the purging mixture, should be freely and repeatedly administered. Mr. Martin recommends that it be given *with* the purgative mixture. By the forenoon the paroxysm may again recur in a milder degree, though to such an extent as to demand the application of leeches to the epigastric region, if any oppression or uneasiness exist there, or behind the ears if headache persist. A mixture composed of *antimonial wine* with the *acetate* or *nitrate of potash* should be given every two hours, so as to soften the skin and determine increased action of the kidneys. By these measures the daily decline of the disease is seen, and consequently there is a daily diminishing occasion for the use of active measures of cure, till towards the fifth, sixth, or ninth day convalescence is established.

If, however, remittent fever has existed unrestrained for several days, and the patient has not been seen till the accession of the third or fourth paroxysm, or even later, a general blood-letting is still the principal means of saving life, *provided the general powers of the constitution remain uninjured;* and it is to be followed by calomel, purgatives, and quinine in the manner already indicated.

If the paroxysms have become indistinct, running into each other, with brief or ill-defined intervals, while abdominal or cerebral complications arise, as indicated by epigastric fulness, or by approaching stupor or delirium, *blood-letting* may even now constitute the principal means to save life, but the blood *must be still more gradually abstracted* than before, whether generally or locally. Generally speaking it is to be done by leeches at the accession of the paroxysm. *Antimonials* are also to be used—cold must be applied to the shaved head; and while sinapisms and blisters must also be applied, on the influence of calomel chief reliance is to be placed, and the very first dawn of remission is to be seized upon to give quinine. We are not, in such cases, to wait for a clean tongue, the absence of heat of skin, or local complication. It must be given every *three* or *four* hours, with an occasional mild aperient in the intervals, until the dangerous symptoms shall have yielded, a result often observed to be coincident with the manifestations of the mercurial influence. Dangerous symptoms, such as those just noticed, will sometimes rise suddenly without any loss of time on the part of the medical attendant or neglect in treatment. If such symptoms are associated with yellowness of the skin, in persons

broken in health, or of feeble constitution, or of dissipated habits of life, or who may have undergone much mental distress, the chances of a fatal termination are imminent.

When the spleen is enlarged, mercury is not to be used in the treatment of the fever; and blood-letting, either general or local, is not borne well. The blood is changed in such cases; it is more or less dissolved, and a general cachexia prevails.

The period of convalescence demands no less careful attention on the part of the medical attendant, especially as to diet and a timely removal from all malarious influences, by a voyage to sea or a change of climate. It is to the mismanagement of convalescence, and a too early discharge from hospital principally, that we must refer the numerous and fatal relapses in the fevers and dysenteries of our seamen and soldiers (MARTIN).

Relative Mortality of Remittent Fever at the Foreign Stations of the British Army, by Sir Alexander Tulloch.

STATIONS.	Period of Observation.	Aggregate Strength.	Number Attacked.	Died.	Proportion of Deaths to Admissions.
Windward and Leeward commenced,	20 years.	86661	17799	1966	1 in 9
Jamaica, ...	20 ,,	51567	38393	5114	1 ,, 8
Gibraltar,.....	19 ,,	60269	*y. f. 314	28	1 ,, 11
			1522	423	1 ,, $3\frac{2}{3}$
Malta,.....	20 ,,	40826	384	16	1 ,, 24
Ionian Islands,.....	20 ,,	70293	6934	623	1 ,, 11
Bermudas, ...	20 ,,	11721	*y. f. 19	6	1 ,, 3
			277	101	1 ,, $2\frac{3}{4}$
Nova Scotia and New Brunswick,	20 ,,	46442	15	—	1 ,, 15
Canada,.....	20 ,,	64280	294	18	1 ,, 16
Western Africa,.....	18 ,,	1843	1601	739	1 ,, 2
Cape of Good Hope,..	19 ,,	22714	15	1	1 ,, 15
St. Helena,.....	9 ,,	8973	25	1	1 ,, 25
Mauritius,.....	19 ,,	30515	6	1	1 ,, 6
Ceylon, ...	20 ,,	42978	4643	868	1 ,, $5\frac{1}{2}$
Tenasseum Provinces,	10 ,,	6818	594	22	1 ,, 27
Madras, ...	5 ,,	31627	1139	54	1 ,, 21
Bengal, ...	5 ,,	38136	1311	89	1 ,, $14\frac{3}{4}$
Bombay, ...	5 ,,	17612	2854	114	1 ,, 25

YELLOW FEVER.

Definition.—*Topographically it is a disease not proved as yet to be one* sui generis, *endemic only in low districts on the sea coast, but*

* y. f., yellow fever prevalent.

under certain circumstances sporadic in other places, never appearing beyond 48° *of north latitude, nor without a temperature of* 72° *Fahr., at least, somehow promoting its production and propagation, nor above the elevation of* 2,500 *feet above the level of the sea, depending, in part, on causes not yet known; but in circumstances favourable to its extension, capable of being propagated by contagion.**

Symptoms.—The following account of the symptoms are chiefly taken from the observations of Mr. Martin and Dr. Blair, and are intended to embrace the slighter, the severer, and the more fatal seizures. Like cholera it is ushered in suddenly, and generally in the night, or early morning, by a sense of coldness, a rigor, or actual shivering, followed by a vascular re-action proportionate to the amount and duration of the previous congestive cold stage. Heat and dryness of the skin follow, with pain of the loins and limbs, headache and pain of the eye-balls, which are suffused and of a gloomy drunken-like aspect. The tongue is loaded and the edges red. The headache is generally supraorbital, and is a valuable diagnostic symptom in old residents and dark races. There is also to be observed a *specific capillary irritation* in the flush of the face as characteristic as the hectic of phthisis, or the fuliginous expression of typhus. This suffusion generally occupies a zone over the eyes, and about an inch above and below them. The eyes become injected like those of a person *just awoke*, but generally without any lachrymation or photophobia, although the injection may be as intense as in ophthalmia. The nails may also be observed to be injected, with a coarse vascularity, the lips crimson or vermilion colour, the tongue scarlet at the tip and edges, the fauces, palate, and uvula covered and connected with a reticular network of capillaries. There is also nausea, with a sense of rawness of the fauces and æsophagus, and uneasiness at the epigastrium. This sense of nausea, and a disposition to vomit, is generally induced by pressing down the tongue previous to any examination of the fauces. These symptoms may terminate in health as a remittent fever would at the end of twenty-four or thirty-six hours. If the disease proves persistent, these symptoms continue and become aggravated, and the ejections from the stomach, at first of a clear fluid, soon become dirty brown, and eventually are succeeded by the true *black vomit*. The complexion now becomes more or less generally of a yellow-lemon colour, and this colour extends rapidly over the whole surface of the body. These symptoms progress from bad to worse. A bloated, desponding, anxious, inquiring countenance expresses the distress of the patient, combined with incessant and distressing jactitation, which

* See *Edinburgh Medical and Surgical Journal*, vol. xxvi., and *Medico-Chirurgical Review* for April, 1854.

ends rapidly in exhaustion and death. In youthful or plethoric Europeans the symptoms are of exceeding violence and danger. The heat is a burning pungency, while the skin is dry and constricted, the headache is intense, the countenance appears to be agitated by the most fearful apprehension, or approaching delirium. The bowels are constipated. The tongue is red, clean, and tremulous, and indicates increase of gastric and intestinal irritation, and consequent increase of danger. The urine is scanty and surcharged, and ultimately all the secretions are suppressed. There is distension of both hypochondria, with pain and burning heat, and anguish at the epigastrium. Eructations, hiccough, and vomiting continue, at first of a clear glairy fluid, which alters to a brown or dark colour, like coffee grounds, and the quantity ejected exceeds greatly that which has been used in drink. In persons of a sanguine complexion the countenance is apt to assume a livid yellow putrid-like appearance, with a black encrusted tongue, and in most cases the whole of the surface of the body becomes more or less yellow, which indicates the most severe form of the malady, and the patient may be carried off, exhausted in all his functions, so early as the second, but more generally on the third day. "Cases of long standing chronic disease," says Dr. Blair, writing of the epidemic of British Guiana, "terminated suddenly and fatally by the black vomit, without any precursory fever, to the surprise and consternation of the bystanders." Dr. Wilson also remarks that the term insidious has often been applied to the West India fever, and with great propriety; for he states, that while the poison is frequently sapping the powers of life there is often little to inform us of the mischief that is going on within, so that the symptoms frequently do not prepare us for the fatal issue. "In the midst of our security," he adds, "and when we are imagining all is going on well, we are shocked by the sudden eruption of the black vomit, or the accession of profound coma, rapidly producing death." The insidious nature of this severe form of litoral disease was remarked also by Dr. Barry at Sierra Leone. "The state of the patient's mind was also most peculiar, for the poor sufferer appeared entirely unconscious of his hopeless state, and generally expressed himself as being much better, until, the vital heat receding from the surface, dissolution took place, sometimes preceded by violent straining of the eyeballs and incoherent expressions, or else by some convulsive motions. At Gibraltar the patients died without taking to their beds, or "on foot," as it was termed. The following case is given by Louis :—Dr. Matthias, who died at Gibraltar after an illness of four or five days, experienced no other symptoms than severe pains in the calves of the legs, and a suppression of urine. He had no nausea, and did not vomit, and his mind was clear during the whole course of the disease. He

noticed, however, the suppression of urine, dictated three or four letters to a friend, begged him to write rapidly the last, that he might sign it, then devoted a short time to an affectionate intercourse with this friend, and soon after, becoming speechless, he thanked him by a sign, and in a quarter of an hour was dead. Sometimes the full complement of standard symptoms are present, sometimes they are imperfect and deficient, and sometimes displaced. At one time the diagnostic symptom is the supra-orbital headache. At other times the tongue symptoms are alone diagnostic, or their equivalents are expressed in the uvula and fauces. Intense surface heat, albumen early in the urine, and early black vomit, are among the later symptoms; and smoky pale urine, with perfect blood corpuscles, takes the place of the straw coloured or bilious urine, with its sediment of tube casts and epithelial matter.

The general appearance of the tongue is uniform redness of the tip and edges together, which are always clean. Subsequently the fur separates from its middle surface, and lies in white wavy flakes; and the next series of changes consists in separation of the epithelium, which begins at the tip and proceeds to the edges down the raphe, and may continue till the whole surface is denuded, the papillæ obliterated, and the tongue becomes smooth and dryish, and of the colour and appearance of raw beef. Such a desquamation may extend into the larynx and bronchi, causing complete aphonia and sonorous dry sounds under the stethoscope.

A rare manifestation of capillary irritation in yellow fever consists in an efflorescence of the skin in the form of a subcutaneous rash on the chest, and extending over the abdomen and arms. On fine delicate sensitive skins rose coloured spots have been noticed, of a somewhat circular shape, varying from the size of a flea bite to what might be covered with the point of the finger. They result generally from mosquito wounds, and become hæmorrhagic at the end of the disease, when it terminates fatally.

Bloody furuncles appear late in the order of symptoms, and are to be regarded rather as sequelæ. Their most common site is on the wrist, over the metacarpal joints, along the front of the legs, below the scapulæ and over the hip, in the parotid, and over the forehead and lip. They are generally in close proximity to the smaller arterial branches, such as the ulnar, radial, anterior tibial, gluteal, intercostal, and facial arteries. They become tender, acuminated, and inflamed, and sometimes form large abscesses of purulent matter, with a pale or inflamed surface, and this chiefly when below the scapula, or over the hip. Generally on the legs they are flat, present no inflamed appearance, but show a flat, purplish vesication, about the size of a split pea, or a sixpence. "If you open one of these vesications," continues Dr. Blair, "a little watery, curdy

sanies will be discharged; and you will believe that that is all, and of no consequence. But if you clip away this vesicle, and wipe the bare cutis, you will perceive in the centre of it a circular perforation, into which a probe easily passes, and which goes down through the true skin cellular tissue to the surface of the deep fascia or the muscle. And if you now squeeze on each side of the vesication, one or two little dark clots or pellets will start up, and be accompanied or followed by a little purulent matter. There is no base or hardness; there seems to be no cyst of any consequence; and the whole affair will close up and heal, and require no further treatment than the emptying it. Now this is the simplest form of that morbid manifestation. But when it occurs over a joint, or below a strong confined fascia, abscess, with diffuse phlegmonous inflammation—or in a vascular tissue, as the parotid gland, death, from destructive infiltration of blood, gangrene, and hæmorrhage, may follow. The formation of these bloody furuncles, it is probable, is not confined to the external parts of the body. Post mortem examination, in one case, disclosed a condition of the kidney which was probably due to this cause."

There is great irregularity in the temperature of the surface. Sometimes the forehead is the hottest part of the body, occasionally it is the chest. The uncovered parts, in the later stages of the disease, are easily reduced in temperature, and thus while the exposed chest and extremities may feel cool to the touch, the axilla may raise the thermometer to 102° or 103° Fahr. The highest temperature Dr. Blair has observed was 107° in the axilla.

Observations made on the urine, in yellow fever, by Dr. Blair, shows that it is always acid in the first stage, and continues so generally till convalescence, when it becomes alkaline, or until it becomes heavily charged with bile. During the early stage the urine is normal in colour, clearness, and quantity. About the third day the colour alters, and becomes of a sulphur, primrose, straw, or light gamboge hue, perhaps slightly turbid, and with a little floating sediment. The colour deepens till it becomes yellow or orange, and if the case ends in convalescence, the urine is copious and may appear black. Sometimes the urine has a pale watery smoky appearance, with a layer of blood corpuscles in the sediment, and sometimes it is very bloody.

Albumen appears on the second or third day generally; in some cases as early as the first day; and in a few cases it did not appear till the day of death, and after black vomit had set in. Albumen appeared in every fatal case of normal duration. It sometimes ceased suddenly in convalescence, and always before the yellow suffusion of skin and eye, or bile in the urine had disappeared. Between the eleventh and twentieth day of grave cases it generally disappeared.

Its colour was never white. When the urine appeared turbid, it was due to the presence of mucous epithelial matter, coagulated albumen, coats of the urinary tubuli, or fine capillaries of the kidney or mucous membrane passed out with the urine. The tube casts are generally short, thick, club-shaped, and opaque, attended with large organic cells and epithelial scales. Crystalline deposits are rare.

In females the catamenia are sure to appear, whether due or not.

No sign is so dooming as a suppression of urine, *black vomit* not excepted.

The alvine evacuations may be black towards the close of the disease, or very dark green, and bilious; but after the black stools have ceased, they are succeeded by evacuations which resemble fine dark sandy mud, and named the "caddy stool." As the disease still further advanced, and towards its fatal termination, the dejections again changed their character. They became scanty and mucous, of various consistence, and colour. The stools were sometimes of a grass, olive, or spinage-green, sometimes fawn coloured, sometimes primrose, sometimes rusty, and sometimes *brown*, or *black*, or *streaked*. These mucous stools almost always appeared *after* black vomit, and were contemporaneous with the scanty urine before described. The alvine evacuations in yellow fever, from the beginning to the end of the attack, are always alkaline, except in one instance, that of the black vomit stool: in that it is always acid. Its chemical quality is evidently due to the admixture of a portion of the black vomit, which has descended (if not found in the intestines) by peristaltic motion into the intestines, and mixed with the scanty mucous stool, and in such quantity as not only to neutralize it, but to be in excess. The scanty thick mucous stool—almost a jelly—has generally a little thin serum around it in the bottom of the pot. The bulk of all these varieties of the scanty mucous stool consists of mucus, broken-up epithelial matter, and myriads of epithelial granules. Sometimes little wavy flakes, like morsels of cuticle, are also to be found. They also frequently contain the crystalline bodies of the caddy stool, particularly when they are rather thin and serous. By appearance, they would be taken for rectal stools, and the results of tenesmus; but such is not the case. A burning sensation is often complained of, but seldom any tenesmus, and no doubt these stools consist of that mucous matter which we find after death lining the intestinal canal generally. In a few cases where there has been total suppression of urine, these stools have become diarrhœal.

The first ejections from the stomach of a yellow fever patient are seldom seen by the physician. Mucus and bile soon appear, occasionally with a streak or speck of blood, and with violent retching. The ejections are alkaline. Generally after the first

vomiting the stomach becomes tolerably settled, until the second stage sets in, on the second, third, or fourth, or as late as the fifth day of the disease. Then, without warning or nausea, but on any trifling provocative, the stomach suddenly ejects a quantity of clear, pale, limpid, or slightly opalescent *acid fluid*—the *white vomit*, which indicates the beginning of the stage of acid elimination, and is generally cotemporaneous with the first shedding of epithelium from the tongue. Sometimes the evacuation of this vomit has a critical effect, equivalent to the perspiration of intermittent fever. True white vomit consists of serum, more or less acid, which remains clear on the application of heat and nitric acid.

The transition of symptoms from *white* to *black vomit* is generally gradual; and is attended with a "suspicious sediment" of "snuff-like specks" before it merges into well defined *black vomit*. The stage of acid elimination continues to the close of the disease, and is most intensely manifested during the production of the *black vomit*. The presence of ammonia in black vomit is universal, and may be considered as one of its tests; and its specific gravity 1·004 to 1·006, the temperature of the air being 86°. Its sediment consists of coagulated albumen and the debris of blood cells. Another test is acidity, and a third is to be observed in the phenomenon that the sediment is dissolved by liquor potassæ, which disengages ammonia.

Another feature in the pathological symptoms of yellow fever may be expressed by the fact that the urea of the suppressed urine is eliminated from the system as a volatile salt by metamorphosis into a carbonate of ammonia, which as such is frequently found in the breath, in the normal black vomit, in combination with an acid, almost always in the stool, and apparently pervading all the tissues of the body.

After convalescence recovery is rapid and thorough, but relapses are of frequent occurrence, especially after primary attacks not well expressed (and to which Dr. Blair gives the name of "aborted attacks"); but they are rare after the disease passes into its second stage.

The mode of death may be by syncope, uræmia, apoplexy, or asphyxia.

Uniformity in the order and character of the symptoms must not be looked for in yellow fever. All the best writers on the subject, whether recording their experience in the West Indies, the west coast of Africa, or the south coast of Spain, are uniform and unanimous to the contrary, and consequently while direct and faithful descriptions may have been given of each epidemic, yet the results are not general nor uniform. Certain symptoms in certain epidemics vary in their nature and in the time of their accession, while others, common to former visitations, are wanting in those which follow. Hence two, three, or even four forms of yellow fever,

have been described by authors, for example, Dr. Craigie in his *Elements of the Practice of Physic.*

The French Commissioners remark that "the fever of Barcelona is the yellow fever of America, the same as at the Antilles and at Cadiz; but it is a Proteus clothed with different forms, and which offers such strange anomalies, both in the slowness and rapidity of its march, in the combination, the succession, and the degree of its phenomena, that it is impossible to assign to it a fixed and invariable course."—(*British and Foreign Medico-Chirurgical Review*, January, 1848.)

When the black vomit is plentiful, or the urine free, the intelligence remains clear and unclouded, but the skin becomes cold and damp, the pulse small, and finally extinct at the wrist, and the patient dies of gradual *exhaustion* and *syncope.*

A melancholy instance of the combination of hæmorrhage and black vomit in tending to induce death by syncope, is thus pathetically described by Dr. Blair:—

"Before black vomit appeared, the catamenia came on prematurely, the bowels became spontaneously relaxed; and last night there was much flatulent purging of blood, and a considerable hæmorrhage from vagina. After a cessation of twenty hours, black vomit again returned. After total suppression for twenty-four hours, four ounces of alkaline urine was drawn off by catheter. On my visit at daylight this morning, she was quiet, and apparently suffering no pain, and rather apathetic. The marked change which I found in her case, was a deterioration of the pulse in volume. The nervous symptoms of the preceding day, which threatened inebriation or convulsions, had disappeared. The pulse became gradually weaker, until about eleven A.M., when it could not be felt. She was aware of her hopeless condition, and tranquilly disposed of her trinkets to her friends and relations. As she approached her end, the breathing became quicker and shorter, until it ceased in a few little gasps at long intervals. About half an hour before she died, she apparently lost her vision, then her hearing, and sensation, first of the mouth and nose, and then of the arm, in quick succession, and in the order stated. It was an appalling scene to see her lying silently on her back, and trying to *rub back* vision, and hearing, and feeling, with her hands. She spoke not a word during the time; but it was evident that the senses were all being blotted out one by one while consciousness yet remained. Before death, at two P.M., one or two slight convulsive jerks of the shoulders were the last respiratory efforts."

If before death the urine be suppressed, and the black vomit not copious or has ceased, the circulation becomes contaminated, and the subsequent effects upon the brain are not unlike those of alcoholic inebriation, when poisoning symptoms become violent, the sensorium painfully affected, screams and wild ravings ensue, soon followed by coma, convulsions, and death.

Prognosis.—Dr. Blair founds his prognosis on the following grounds:—"The number of the characteristic symptoms present, and the degree in which they are manifested, furnish criteria of the severity of the case, and the ratio of danger. A slow pulse and moderate temperature of the body and quiet stomach are always favourable indications. But the more fiery crimson the tip and edge of the tongue, the more irritable the stomach, the severer the headache, the worse the prognosis of the first stage, and *vice versâ*. Slight or moderate epistaxis is a sign of little prognostic value in any stage; but a streak of blood in the early vomit indicates much danger from the attack; while the same during the stage of black vomit, or after acid elimination has set in, is favourable, if the corpuscles are found entire. In the second stage, the earlier or more complete the suppression of urine and the more copious the ejections of black vomit, the more imminent the danger. But if the urinary secretion continue, and the black vomit be scanty from the first, or is afterwards suppressed, the patient may yet survive. Urine simply albuminous is a less serious sign than when it also contains tube casts; but if these are thin and few in number, they do not add much to the gravity of the indication. Free, copious urine, no matter how dark or bilious, is the most favourable of any single sign. If the urine be scanty, and it be loaded with tube casts, entangled in epithelial and coagulable matter, the light buff coloured curdy sediment before mentioned, it indicates a complex lesion of the secreting structure of the kidney. It is the urine symptom in its maximum of severity, and is as fatal as if the suppression had already occurred. Blood corpuscles in the urine were not looked on with apprehension. A faltering of the articulation is a bad prognostic, and a difficulty of protruding the tongue enhances it. Prognostics are derived from the effects of treatment. If the resolvent dose do not bring away 'stools characteristic of the powder' (calomel), but, instead, thin, grey abilious matter; or if early hypercinchonism be induced, it is an unfavourable indication. The danger of the case is enhanced by inflammatory complications, and by hypertrophy of the heart. A recent residence in a temperate climate; the *race* or complexion of the individual; the fact of his previously having suffered from a severe attack, or an aborted one, will enter into an estimate of his chances of recovery. It is unnecessary to recapitulate the modes of death. These are signs too late to be of any practical importance."

Prognosis is declared by Robert Jackson to be treacherous and difficult in the extreme. As last seen by him on the south coast of Spain, he records the following symptoms as indicating danger:—

1. Sudden invasion, with intense pain of the head and eye-balls, sickness, and vomiting.

2. When convulsions, apoplectic stupor, or outrageous delirium usher in the fever.

3. A torpid, heavy, or statue-like aspect of the countenance.

4. A dry, rough, and milk-white, or swollen and red tongue.

5. Distress and anguish, with pain at the epigastrium, forcible eructations, or explosions of flatus from the stomach, or obscure hiccough.

6. A ghastly appearance, with a faint nauseous odour from the body.

7. Yellowness of the skin, with turgid veins of the conjunctivæ in the latter stage.

8. Torpor of the skin, and insensibility to irritants.

9. Extreme dampness or extreme dryness of the skin, petechiæ, streaks or patches of a livid or green colour.

10. Vomiting of black matter, or dejections of black watery stools with shreds.

The mortality from intermittent, remittent, and yellow fever, according to the reports of the sickness and mortality occurring among the troops in the West Indies, the Mediterranean, and in North America, by Sir Alexander Tulloch, is as follows :—

Deaths from	Windward & Leeward Command.	Jamaica Command.	Gibraltar.	Malta.	Ionian Islands.	Upper Canada.	Lower Canada.
Intermittent fever	1 in 169	1 in 163	1 in 60	1 in 311	1 in 236	1 in 1143	1 in 535
Remittent fever..	1 in 9	1 in 8	1 in 11	1 in 24	1 in 22	1 in 11	1 in 5
Yellow fever	1 in 2⅓	1 in 1⅓	1 in 1⅔	....	....	....	....

Treatment.—With some practitioners, "the prime object of treatment is to *abort the attack;*" an early attention to first symptoms among the susceptible is of the greatest value in saving human life.

The medicine used to procure abortion of the fever consists of *twenty grains of calomel*, added to *twenty-four grains of quinine*, and afterwards followed by *two drachms of carbonate of magnesia* to *two ounces of sulphate of magnesia, in eight ounces of peppermint water*" (Dr. Blair.) These aborting doses were repeated at intervals of four or six hours; one dose being generally efficient; but four doses have been given before the desired effect has been produced, without inducing cinchonism. When a state of apyrexia is induced, the end is attained; but if the urine has become coagulable, or the epithelium of the tongue has begun to be shed, it is of no use pushing the "aborting doses" further.

Such are the opinions of Dr. Blair, who believes that thus the fever may be cut short; but such a belief is opposed to the doctrines of sound pathology.

It is an object to keep the bowels freely open, and to get the skin

to act freely. All the depurative functions must be kept in activity by doses of mercury, purgatives, and diuretics. Turpentine is recommended by Dr. Copland, by Dr. Archibald Smith, and Mr. Laird, of H.M.S. "Medea"—one drachm doses by the mouth, or half-ounce doses as a lavement, several times daily, using it also as an epithem on the abdomen.

"When the mucous surfaces," writes Dr. Blair, "as indicated by the tongue, were denuded of epithelium, the use of *gum water* was decidedly beneficial. It lubricated, defended, and soothed the raw surfaces. The strength was generally three drachms of the purest powdered gum arabic dissolved in six ounces of cold water, and a table-spoonful of this given every one or two hours. The patient at last gets tired of it; but for thirty-six or forty-eight hours of the most critical period of the disease, it is used without dissatisfaction, and then can be substituted by, or alternated with, smoothly and thin-made arrow-root. When the heat of surface was ardent, a *wet sheet* or *blanket* was used for the reduction of temperature by evaporation, with frequently very good effect. But in the later stages of the disease, when the skin was cool or cold, the patient seemed to have an instinctive craving for its reapplication, and frequently asked to be put into it. There would appear to be two causes for this feeling. We find it to exist in cases in which black vomit has been copious, and the associated thirst distressing. Also, in cases where there has been no black vomit of any consequence, and the breath is highly ammoniacal. In the former class of cases the stomach ceases to be an *absorbing* viscus in anything like the proportion of its secretions and transudations. The skin is therefore employed in reducing the crasis of the blood by the absorption of water, as shipwrecked mariners are said to quench their thirst. But not only does the skin afford an inlet for the imbibition of diluting fluids, but the softening of the cuticle would seem to afford an additional outlet for the noxious elements of the circulation; and it is probably in this direction we must in future look for auxiliary means of relieving the blood of its poisonous metamorphosed, and effete constituents, the onus of which is now thrown on such vital organs as the stomach and lungs. At one time, the heat of the surface was so ardent and persistent, that the wet sheet failed to reduce it effectually. For these cases, the effects of tobacco injection were once or twice only tried.

"The *food* during the course of yellow fever should be of the blandest description: chicken tea, arrow-root, sago, and barley water constituting the chief articles; and these should be taken in minute quantities at a time when the stomach is at all irritable. This rule also applies to drinks of all kinds. The patient is greedy for a

large draught of fluids; but by sucking them through a glass tube of small bore, or by the tea or table-spoonful, they are much more likely to be retained. A cold infusion of oatmeal was found an agreeable drink for the Scotch seamen, of which they did not seem to tire. A dislike of sweets was observed among the patients, and when lemonade was asked for, the usual quantity of sugar was objected to, probably from its rendering the liquid too dense for ready absorption by the stomach, and therefore less quenching. *Tea* was found so uniformly to disagree with the patients, and cause vomiting, particularly in the advanced stages, that at length it had to be expunged from the yellow fever dietary. Dilute alcoholic drinks were given freely, and with good effect. Where brandy could be obtained pure (tolerably free from acidity and fusel oil), and was well diluted with water, that spirit answered every indication. Sometimes the effervescing wines were relished and retained, but they are very liable to the objections of containing foreign matters, and the products of mismanaged fermentation."

"During the course of the disease, *auxiliary treatment* was required to meet contingent symptoms. This was embraced chiefly in the use of local and general blood-letting, croton oil, morphine, ether, vesicatories, hydrocyanic acid, and the creasote before referred to. Cupping, leeching, and blistering were found useful in relieving the primary head symptoms and irritability of stomach, when applied respectively to the nape of neck or epigastrium. Tenderness over the liver seemed also benefited by these applications; but I cannot say I have ever seen any benefit resulting from their application over the kidneys, with the view of relieving that congestion of which albuminosity of the urine and suppression are the indices. In only one instance have I seen strangury follow the application of blisters in this malady, and in that case it seemed to exercise no injurious effect. When the primary re-action was violent, and the face was turgid, and the head symptoms severe, arteriotomy was performed, and with benefit. In a few such cases, and when the patient was young, strong, and full-blooded, and where the dynamic congestions were so violent, that the vessels yielded to the turgescence and impulse, and blood corpuscles without tube casts, or even but a haze of albumen, was present in the urine, the arm was opened, and free bleeding relieved the tension of the vascular system. In such cases convalescence was slow and unsatisfactory, but the immediate results were beneficial. In general, the bowels responded easily to the action of mild purgatives; but a cluster of cases occurred about fifteen months after the commencement of the epidemic, in which *croton* oil was required to follow the resolvent dose. Hydrocyanic acid was supposed beneficial in a few cases in abating the primary irritability of the stomach; and being easily

taken, may be borne in mind by the practitioner, as a variety of such resources are at times required. *Ether* was frequently attended with marked advantage in removing or abating the distressing symptom, hiccup; but we used it also as a diffusible stimulant, and where acceptable to the patient, is fully equal to brandy for that purpose.

"Of all the auxiliaries which must be occasionally impressed into the service of the patient, by far the most important is *morphine*. Its administration, however, involves more knowledge, discernment, and judgment on the part of the practitioner, than any other drug he has to deal with. The most salutary effects were observed from its use in some cases; but a number of cases occurred in which it was so manifestly detrimental, that its use was about being relinquished again. In some of these cases in which it was injurious, its first effects for some hours seemed favourable; and for a considerable time no criterion was known for its administration. I suspect that the injury frequently arising from the use of morphine is chiefly due to its action on the secretions of the kidneys. It impairs that function; and where the march of symptoms is already verging on that of urinary suppression, although the tranquillizing effects of the drug may be pleasant at the time and well marked, it indirectly induces head symptoms, and adds to the uræmic poisoning. The rule therefore would be, *not to give it when there is suppression or tendency to suppression of urine*. Of course, if the restlessness, or sleeplessness, or suffering is extreme, it becomes a question for deliberation whether, even in suppression of urine or tendency to it, the relief which is sure immediately to follow the dose of morphine will compensate for the jeopardy of life. The necessity must be extreme indeed that would justify, for present use, the surrender of the smallest chance in favour of ultimate recovery. Its beneficial effects are most visible and unqualified in those cases wherein the disease has been imperfectly aborted, and which, after a few doses of the aqua acetatis ammoniæ and camphor water, will induce a good night's rest, out of which the patient awakes free from disease. Morphine is perfectly safe while the urine is non-albuminous. The effect of yellow fever on the system is to make it sensitive to narcotics. Cases of delirium tremens with a taint of the epidemic will not bear that liberal use of opiates of which it is normally so tolerant; and a dose such as that which the anodyne draught contains, is too much for yellow fever, though never found so for intermittents. After many observations, I have come to the conclusion that, for an adult, eight drops of the solution of the acetate (one-fourth of a grain) should be the maximum dose, and should rarely be repeated within twenty-four hours.

"The 'smouldering form' of yellow fever is best treated by rest, the recumbent position, cool drinks, and abstinence from any but the lightest food. The patient, however, should be closely watched, although interference is seldom required, the curative and conservative power of nature being adequate to the perfect restoration of health in almost all these cases. Inflammatory complications were treated on general principles; and in pneumonia, the tartrate of antimony was borne well."

The following conclusions regarding means of prevention are given by Mr. J. R. Martin :—"The most speedy means of prevention, in respect to towns and garrisons, will always be found in the removal of both the sick and the healthy to a locality where the temperature is sufficiently low, such as a neighbouring elevated range or dry, well-ventilated ground; the next most ready means is segregation."

Testimony of the most undoubted kind has been adduced of the prophylactic influence of *bark* or *quinine* during service in unhealthy countries; and nowhere more unequivocally than on the *West Coast of Africa*, by Drs. Bryson and W. B. Baikie.

The prophylactic dose should be administered in wine twice daily, and should be continued for at least a fortnight after the return of the men on board ship.

Whenever fever makes its appearance on board ship, she should at once proceed to sea, and into the coolest atmosphere within reach.

The most immediate measures of prevention should be, to obviate direct solar exposure, to prevent fatigue and excesses in the use of spirituous and fermented liquors.

Seamen should be kept as remote from unhealthy coasts as is consistent with duty, anchoring some miles out to sea, during the night especially.

Duties in boats should be conducted during the mornings and evenings, avoiding alike the noonday heats and the deadly emanations from the shores common to the night.

When men are landed, a carefully selected encampment should be chosen on high and dry ground.

Meals should be regularly served and carefully cooked, and no more spirit ration should be issued than is customary.

Coffee should be given early in the morning as a habit, and after unusual fatigue, cold, wet, or mental depression, and labour ought not to commence till coffee has been taken.

Holds of ships should not be cleansed on the spots where the fever has originated, or during its prevalence, but should be deferred till the arrival of the vessel in a colder latitude.

Green wood should not be placed on board ship in hot climates; it ought to be "barked," and partly "charred."

Order 2. Enthetic Diseases—*Enthetici.*

The diseases which belong to this order have the common property of becoming developed in the system, after the introduction of specific poisons. The sources of such poisons are more distinctly traceable than those which produce the miasmatic diseases; in other words, the substance or material which contains the *poisonous principle* can be obtained in most instances, although the *principle* itself has not been isolated by any chemical process. The poisons which produce the diseases of this order may be introduced through thin or abraded cutaneous surfaces, or through mucous membranes by the process of absorption, although, in most instances, it is believed that some solution of continuity exists. Others are directly introduced by weapons which inflict a wound or abrasion, and which at the same time introduce the poison. In all instances the poison is received into the system by the processes of absorption, and the individual thus becomes inoculated. Thus, germs of a *specific* kind become directly implanted, and by a zymotic-like process become developed and increased in quantity or virulence till symptoms and effects are produced characteristic of the specific affections, and hence also the name given to this order of diseases.

In all of them the immediate or the ultimate effect of the poison is to induce deterioration of the blood, and at the same time the poison seems to multiply itself, or to increase in power by some mode not quite well understood, and which has only been likened to the *zymotic* action which is known to take place in fermentation. The process by which the poison is multiplied, or by which its virulence or strength is increased varies much as to the time which appears to be required for its completion.

Some of the more intense and virulent poisons, such as that of the most venomous serpents, produce their deleterious and perhaps fatal effects in as short a time as it takes the blood to complete a circulation. The change in the blood at once commences, and death rapidly follows. This sometimes also happens with some forms of the *cadaveric poison*, as that which results from wounds received in the dissection of virulent cases of puerperal fever.

Other poisons do not exert their pernicious influence till after a tardy process of incubation, the time of which is not constant, as in *hydrophobia.*

In a third class of poisons which produce diseases belonging to this order, a double process of the zymotic-like action seems to take place before the full effects which the poison is capable of producing are completed. The syphilitic poison is an example of this. The multiplication of the venereal poison, and its effects upon

the system, seem to become developed during the existence of the hardening process which surrounds a venereal sore.

This is the first zymotic-like process, and is attended with a local pustule and an ulcer. From this local sore the system becomes contaminated; and in the blood a second process of zymosis appears to be completed, by which the original poison becomes intensified, its pernicious influence more complete, and its specific secondary and tertiary effects are then fully developed.

Many of the diseases implanted by specific poisons claim the attention rather of the surgeon than the physician, and therefore do not come within the scope of this handbook of medicine; and some of them, for example, syphilis, has now almost become a special study as to its pathology. For a full description of it I would refer the reader not only to the systematic works on surgery, but to the writings of Hunter, Ricord, Acton, Parker, Lee, Spencer Wells, and others.

Some other diseases, such as *leprosy*, *yaws*, *pellagra*, *radesyge*, are diseases peculiar to certain districts of the world where they are endemic, and are merely mentioned in this place in their nosological classification.

Two diseases of the enthetic order may be considered at length, for the sake of the pathological doctrines they illustrate, namely, *hydrophobia*, and *glanders* or *farcy*.

Hydrophobia—*Rabies.*

Definition.—*A disease said to be generated spontaneously or sporadically in animals of the canine or feline race, the specific poison of which being implanted by them in man, or in other animals, produces a similar malady. The saliva or secretion issuing from the mouth of the diseased or rabid animal conveys or constitutes the poison which inoculates rabies, either through a wound or through a thin epidermis without abrasion. The period of incubation of the poison after inoculation varies from four to sixteen weeks, or even longer, before the malady becomes developed. The disease is characterized by severe constriction about the throat and spasmodic action of the diaphragm, and distress at the epigastrium, all of which are aggravated or brought about by attempts to take fluid, or by the least breath or current of air on the surface of the body, which produces, in the first instance, an effect resembling that produced upon stepping into a cold bath. Tenacious and clammy saliva issues from the mouth. Paroxysms of phrenzy or of uncontrollable impulsive violence (rabidity) supervene. The duration of the disease varies from* three *to* six *or* seven *days, the greater number of cases terminating in death on the second and fourth days from the accession of symptoms, dying suddenly and often unexpectedly.*

Pathology.—The saliva of the dog or other animal labouring under rabies, is either the virus, or contains (as any menstruum would) the poisonous principle, which by inoculation produces *hydrophobia* in the human body. The disease is so named, not because there is any dread of water, but because in man the most prominent symptom is an inability to swallow, or to attempt to swallow any fluid, on account of the extreme spasms which the attempt produces. The experiments of Hartwig have proved that the poison is of a definite character, that it may impregnate various substances, and that it retains its activity for a long period.

Two points in the pathology of *rabies* are peculiar, namely—*First*, that a long period of latency exists in the human subject; and *Second*, that inoculation is not always followed by the development of the specific disease.

With regard to the first of these peculiarities, it is to be noticed that although in some cases pain has been felt in the cicatrix a considerable time after the accident, and in a few a slight fever or a rapid pulse has been remarked to continue from the receipt of the injury to the outbreak of the malady, still the symptoms of the disease in man seldom show themselves sooner than the *fortieth* day after inoculation, and rarely after two years. A matured zymosis seems essential to the production of the full influence of the poison, and it may be that a double zymosis takes place, as in the case of the venereal virus, first in the part and afterwards in the system (Miller), the result of which is either to multiply the poison or to increase its virulence.

Undoubted instances are, however, on record in which the characteristic symptoms appeared as early as the *twelfth* day (Sidey), and on the *eighth* day (Troilliet), who even quotes instances of their occurrence as early as the day following the injury. The duration of the period of incubation, however, is sometimes also of extreme duration. It has been satisfactorily proved to extend over six or even nine months (Dr. Brandreth); and there is on record a very large body of evidence in favour of the opinion that the incubation stage of hydrophobia may be prolonged not only over a series of months, but also of many years. An analysis of sixty authentic observations has shown that the shortest interval between the introduction of the poison and the appearance of the disease is fifteen days, the longest from seven to nine months, and that the average period is from four to seven weeks (Romberg). The inquiries of Drs. Hamilton and Hunter give to the majority of cases a period of incubation from *thirty* to *fifty-nine* days. In the *Transactions of the Vienna Medical Association*, a case is recorded of a period of incubation extending over two years (Hassinger). In all such extremely long cases, the question may be asked, whether

the disease has been actually inoculated at a period so far back, or has there occurred a re-inoculation at some intervening period? It is known that the dog in the early stage of the disease has a disposition to lick the hands, face, &c., of persons, and especially of those with whom it is familiar; and there are cases on record where the disease has been implanted in this way. Mr. Lawrence mentions the following:—"The Hon. Mrs. Duff had a French poodle, of which she was very fond, and which she was in the habit of allowing to lick her face. She had a small pimple on her chin, of which she had rubbed off the top, and, allowing the dog to indulge in his usual caresses, he licked this pimple, of which the surface was exposed, and thus she acquired hydrophobia, of which she died." While this example teaches us that hydrophobia may be implanted without a bite being inflicted, in this almost unconscious manner, it ought also to deter people from permitting such a filthy and dangerous indulgence to a dog. The greatest anxiety and misery has frequently been experienced for many months, by those who have been thus imprudent, owing to the circumstance of rabies having subsequently appeared in the animal so indulged (COPLAND). There are instances, however, recorded of very long periods of incubation after a bite, where subsequent inoculation, independent of a bite, could not have taken place. For example, there is a case published by Mr. Hale Thompson in vol. i. of the *Lancet*. The subject of it, a lad, aged eighteen, had been twenty-five months in close confinement in prison, and during that time had never been exposed to the bite of any animal. He had been bitten severely by a dog seven years before in the right hip, and the scar still remained. During the whole period he was under observation, he was sullen, gloomy, and reserved, and was never known to look the person in the face to whom he spoke. Death occurred after a three days' illness, during which "the most decided symptoms of hydrophobia were manifested."

On the 15th of May, 1854, a case was admitted into Guy's Hospital under the care of Dr. Hughes, in which hydrophobia appeared to have been developed five years after the bite (*Med. Times*, 1854). Such observations render it extremely probable that the period of incubation of the specific poison of hydrophobia is indefinite; and the circumstances which, in man especially, seem to shorten the duration of this period or prolonging it are, in a great measure, quite unknown. There are also some other circumstances which seem to show that during the long interval of apparent latency, the quantity or the virulence of the implanted poison seems to increase, locally at least, if not also more extensively in the system.

First. In some instances there are evidences of a slow and silent

change going on in the constitution, indicated by sallow looks, sunken eyes, a pulse somewhat accelerated, more easily excited and weaker, combined with symptoms of general debility (COPLAND).

Second. The observations of Dr. Marochetti, who visited the Ukraine in 1820, and who maintained that in that country characteristic pustules were observed to form beneath the tongue, near the orifices of the sub-maxillary glands, between the third and ninth day after the infliction of the bite. This observation has been confirmed by M. Magistel, at Boulay, in France, in 1822, who noticed that the pustules formed from the *sixth* till the *thirty-second* day. He observed two forms of pustules, a crystalline and an opaque, the latter of which when opened left a small ulcerated cavity. They were situated on the sides of the frænum linguæ, and on the lateral parts of the inferior surface of the tongue.

Third. Changes which take place in the cicatrix before the development of characteristic symptoms, indicate that the implanted poison there undergoes some process, the nature of which is as yet not known.

After the local incubation of the poison is complete, its specific action appears to be exercised upon the medulla oblongata and the eighth pair of nerves, and subsequently lesions of the structures supplied by the branches of the eighth pair. The action of the poison appears, in the first instance, to be made distinctly manifest by the æsophageal branch of the eighth pair, producing that derangement of function which gives rise to the characteristic symptom of the disease, or to the extreme difficulty of swallowing, especially of fluids; while the spasmodic catching of the breath, consequent even on touching the lips with any liquid, proves that the recurrent nerve is equally affected. Subsequently, the eye and ear become distressed by every ray of light or impulse of sound, and likewise the sense of touch is most painfully excited, on the slightest breath of air passing over the surface of the body, all of which distinctly show that the central and spinal nerves must be functionally affected. In a still more advanced stage, the suspicion, the irritability, the violence, and generally the outrageous and uncontrollable derangement of mind which often seizes the patient, bringing on epilepsy and convulsions, show that the brain itself is likewise a principal seat of the action of this terrible poison, especially the region of the *medulla oblongata.* These symptoms are often so violent as to cause the death of the patient; and the bodies of many persons have been examined, in whom not a trace of inflammation or other morbid phenomena have been discovered. More commonly, however, some structural alterations have been found limited to slight inflammation of the brain, the spinal cord, or of their membranes, and also of the lungs or stomach, structures supplied by

the eighth pair. Still, the brain, the lungs, or the stomach, may be either separately or conjointly affected—phenomena in no degree dissimilar to what have been observed in hooping-cough, where the poison seems to act chiefly on the vagus nerve.

It is doubtful, however, whether the actions of the poison end here, for in a case tried by Majendie, and whose existence was prolonged beyond the usual period, suppuration of the synovial membranes of the joints took place, and produced a state of suffering remarkable even in this frightful disease, and far more terrible than death itself. Such organic lesions as have been found are as follows:—

When the membranes of the brain have been found diseased, the appearances have been great congestion, especially of the plexus choroides, also effusion of serum into the arachnoid cavity, and into the ventricles. The brain has in some very few cases been supposed to be harder or softer than usual, and to have more bloody points than in health. There has been no lesion noticed, however, that could be directly connected with the malady. Changes in the medulla oblongata and the spinal cord have not yet received sufficient attention. There are strong reasons for believing that changes actually exist in these parts, which escape the detection of our unaided senses, but which the specific gravity test, combined with microscopic examination, may yet demonstrate. The mucous membrane of the pharynx and æsophagus have also been met with, either greatly congested, or diffusely inflamed, as also that of the stomach, and of the trachea and bronchia. The latter also have been found covered with a considerable quantity of frothy mucus, while the pulmonary tissue has shown marks of inflammation, though more commonly only of great congestion. The salivary glands have likewise occasionally been observed increased in size and vascular. In one case I had an opportunity of dissecting at Renfrew, near Glasgow, the most prominent morbid change was visible in the greatly increased vascularity of the lungs and of the mucous membrane of the back part of the mouth, pharynx, and larynx, as far as the vocal chords. The whole of these parts were covered by a tenacious frothy mucus tinged with blood. The glands surrounding the papillæ over the back part of the tongue were very much enlarged, not unlike what I have observed in severe cases of cholera. So also were the sub-mucous glands of the pharynx, the epiglottis, and the larynx, even in its cavity, and of those beneath the tongue. Inflammatory appearances in these parts have also been observed by Morgagni, Babington, Watt, Portal, Trolliet, Copland, and others.

Symptoms.—The wound inflicted by the bite, whether neglected or dressed, generally heals up kindly, leaving a cicatrix, and for a time the patient usually suffers no other derangement of health

than the depression of spirits which his apprehensions are calculated to excite. A few weeks or a few months having elapsed, the latency of the poison terminates, and the disease is formed. The course of this affection is usually divided into three stages; the first stage comprising the symptoms which precede the difficulty of swallowing; the second commences with the difficulty of swallowing, and terminates with the overthrow of the mind; the last stage embraces all the concluding phenomena.

The first stage commences in a few instances by the patient's attention being aroused by a pain felt in the cicatrix, sometimes severe and sometimes trifling, and which shoots up the bitten limb, following in general the course of the nerve towards the trunk. It shoots as if towards the heart. Pain, however, is by no means constant, and is for the most part absent. In the latter case, the first symptom is chilliness, with headache, or a slight attack of fever, and the patient is more excited or depressed than usual. These premonitory warnings last but a few hours, or at most a few days; when the fatal but characteristic symptom, "the difficulty and dread of swallowing," a symptom which distinguishes this malady from all others, appears, and the hydrophobic stage commences.

The second or hydrophobic stage is ushered in with a great difficulty, if not an utter impossibility, of swallowing any liquid, a symptom which generally comes on suddenly; and such horrible sensations accompany that effort, that whatever afterwards even recalls the idea of a fluid excites violent agitation and aversion. Some patients who have been able to give some account of themselves, describe the hydrophobic sensation as a rising of the stomach, which obstructs the passage; others as a feeling of suffocation, or a sense of choking, which renders every attempt to pass liquids over the root of the tongue not only impossible, but also excites convulsive action in the muscles of the larynx, pharynx, and abdomen. In this state, says Dr. John Hunter, "the patient finds some relief from running or walking, which shows that the lungs are not yet the seat of any great oppression."

The hydrophobia, or inability to swallow fluids, is shortly accompanied by an increased flow of saliva, termed the "hydrophobic slaver." This secretion, as the disease advances, is not only copious but viscid, so that it adheres to the throat, and causes incessant spitting, and the quantity expectorated may be taken as the measure of the violence of the disease.

The aversion to fluids is no sooner established than another series of symptoms of dreadful severity, or a highly exalted state of every corporeal sense, is added. Indeed, it is hardly possible to depict the sufferings of the patient from this cause, for not only does he shrink at the slightest breath that blows over him, but the passage of a

fly, the motion of the bed-curtain, or any attempt to touch him, produces indescribable agony, almost amounting to convulsions. Dr. Elliotson states that the effect produced by these causes very much resembles that produced upon stepping into a cold bath. The sense of sight is no less a source of terror than that of touch, for the approach of a candle, the reflection from a mirror or other polished surface, occasions the same distressing effect. The hearing is also as strongly affected as the other senses, so that the least noise, and especially that of pouring out fluids, throws him into a fearful paroxysm. An attendant who sat up with a hydrophobic boy, make water within his hearing, which threw the sufferer into a most violent agitation. The degree to which this painful state of the senses arrives may be understood when it is stated that Majendie records the case of a deaf and dumb child, who heard distinctly in this stage. The patient, thus incessantly harassed and pained by every circumstance around him, becomes peevish and irritable, and at length sees his family, relations, and strangers, with feelings of dislike and aversion, and sometimes apparently with horror.

The third stage commences by the cerebral functions becoming disturbed, the mind being either filled with dreadful apprehensions, or else being so completely overthrown, that paroxysms of uncontrollable impulsive violence follow. A rabid impulse to tear in pieces who and whatever opposes him. This rabid impulse greatly distresses the patient; it is often strongest against those to whom he is most attached, and he struggles to suppress it. In this stage horror is strongly depicted on the countenance, every symptom is aggravated, the saliva grows thick and ropy, while the poor sufferer, not daring to make the slightest attempt to swallow, spits it out incessantly, oftentimes with frequent retching and vomiting. In this state he sometimes turns black in the face, falls into convulsions in which he expires, or else, exhausted by his great efforts, a sudden calm ensues, and, as if nature gave up the struggle, dies without a groan.

Remote Cause.—Hydrophobia originates in animals of the canine and feline races, as the dog, the fox, the wolf, the jackall, and the cat, probably from atmospheric causes, but from what peculiar source is altogether undetermined. It is, probably, at all times to a certain extent endemic, and occasionally epidemic among these animals. It has been supposed that it is excited in them by the great heat of the dog-days, or by the æstus veneris; but Troillet has shown that canine madness occurs with nearly equal frequency in winter, spring, summer, and autumn. The poison is not peculiar to any country. Rabies is found equally in Europe, Asia, and America; neither is it limited to climate. It prevails in the frozen regions of Canada, as well as in the East and West Indies.

The difficulties attending the origin of this poison are at present not to be surmounted; but hydrophobia once originated in the animals that have been mentioned, they have the power of re-producing it by their bite, not only in each other, but probably in all warm-blooded animals, certainly in all domesticated animals, as the horse, the elephant, the sheep, the ox, even in the common fowl, and also in man. It will be necessary, to the proper understanding of hydrophobia, to give a short outline of it as it occurs in the dog, so constantly associated with us in domestic life, and the principal source of the disease in the human subject.

The symptoms of this formidable affection, as witnessed in the dog, are some singular departure from his ordinary habits, such as picking straws or small bits of paper off the floor, and swallowing them, also licking the noses of other dogs, or other cold surfaces, as stones or iron. Besides this, he is observed to be more lonely, shy, and irritable; is less eager for his food, or refuses it altogether. His ears also, and his tail, droop; his look is suspicious and haggard; and sometimes, from the very commencement, there is a redness and watering of the eyes. In a short time saliva begins to flow from his mouth, he "slavers," and his fauces are said to be inflamed, and he is feverish. The animal, though highly irritable, and easily provoked, still obeys the voice of his master, and it is remarkable, says Mr. Youatt, "that the dread of fluids, and even the sight of them, so striking a feature in man, is often wanting in dogs and other animals, for many dogs lap water during the disease." In many dogs the symptoms never rise higher than these, but in others there is a repugnance to control, and a readiness to be aroused to extreme rage on the appearance of a stick, whip, or other instrument of punishment, or on any attempt at intimidation, which strikingly characterizes the disease. Even in this state, however, he seldom fights a determined battle, but bites and runs away; still even this mitigated irascibility usually ends in indiscriminate aggression, till at length he dies, and apparently of convulsions.

Examination of the dead body has often shown that the animal has died from mere nervous excitement and functional derangement. Majendie has inspected the hydrophobic dog, and found no characteristic morbid change. In all cases, however, in which the poison has had time to set up its specific actions, the principal lesions of structure are found to be in those parts supplied partially or entirely by the eighth pair; for the tongue is swollen, the fauces, the salivary glands, and the angle at the back of the larynx behind the epiglottis, is also occasionally inflamed. The bronchial membrane is also occasionally inflamed, and so is the mucous membrane of the stomach, which generally contains a strange mixture of straw, hair, hay, horse-dung, and earth, showing the peculiar

morbid propensity of the animal; or, being void of those substances, it contains a fluid resembling the deepest coloured chocolate. Such are the symptoms and phenomena of hydrophobia in the dog, the chief source, perhaps, of this fatal malady to the human race.

The susceptibility of the human subject to this poison is by no means universal, for only ninety-four persons died of one hundred and fifty-three bitten, making the chances of escape as three to two nearly. It has been thought this occasional immunity does not arise out of any want of susceptibility to the action of the poison, but from the person being bitten through his clothes, and the dog's tooth, consequently, having been wiped clean from all venom. Menières, however, says he met with seven cases in which the dog must have bitten through several folds, and yet they all proved fatal; showing, as he imagines, the little importance of dress as a protection from this malady.

Neither age nor sex are exempted from hydrophobia, for the infant at the breast, as well as a man aged seventy-three, have been known to die of this disease.

No instance is known of man being affected with hydrophobia, unless antecedently bitten by a rabid animal, capable of communicating the disease.

It is a question of much moment, whether the saliva of a patient labouring under hydrophobia will or will not communicate the disease. It may be stated as an undeniable fact, that during the many years hydrophobia has been studied, no instance is known of its having been communicated from one human being to another, although many instances have occurred of the attendants having been bitten, or otherwise accidentally inoculated with the saliva of the hydroplrobic patient. The only circumstance which makes this law at all questionable is that Majendie and Breschet inoculated two dogs with saliva taken from a diseased patient, shortly before his death from rabies, and that one dog shortly afterwards died of hydrophobia. Persons have also been seized with rabies in consequence of having wiped their lips with napkins or cloths, or other articles which were soiled with the saliva (Enaux, Chaussier, and Aurelianus).

The dog's tooth generally implants the poison, or at least some abrasion appears to be necessary either of the cutaneous or mucous surfaces. The ancients were aware of this, for Celsus observes that the integrity of the lining membrane of the mouth is necessary to the operation of the Psylli, whose office it was to suck out the poison after the bite of a rabid dog; and Dioscorides expressly r ders them first to wash their mouths with astringent wine, and afterwards to lubricate the cavity with oil. With regard to dogs, Mr. Meynill observes that "such of them as have been thought to

become affected merely by the contagion of the same kennel, will generally be found upon minute examination to exhibit the marks of bites, though concealed by the hair." When a scratch or other abrasion exists, a rabid dog merely licking the part is sufficient to implant the poison of rabies.

Diagnosis.—When hydrophobia is fully formed, there is no disease with which it can be confounded; but there are many reported cases in which the imagination of a patient bitten by a dog has been so powerful as to induce symptoms resembling the disease. In hysteria the difficulty of swallowing exists, but no other symptom. Tetanus is the disease with which rabies is most apt to be confounded; yet the differences are sufficiently marked. The spasm of the muscles is more continued in tetanus; less remitting, and never intermitting. The jaw is usually much in motion in hydrophobia, in frequent attempts to clear the mouth and throat from the peculiar tenacious mucus; in tetanus it is fixed. Tetanus is rarely attended with aversion to liquids, on the contrary, the bath is grateful; nor are the tetanic paroxysms increased by the sight, hearing, or touch of fluids. Also, tetanus makes its accession usually at a much earlier period after infliction of the injury. Physiologically, while tetanus is a disease of the true spinal system, hydrophobia involves the brain also, as evinced by the disorder of intellectual function and special sense, even early in the disease. Further, the two diseases differ greatly in their mode of induction. Tetanus is caused by irritation of a nerve in the traumatic cases; by disease of the spinal marrow, in those which are idiopathic. Hydrophobia is the result of a specific poison introduced into the circulation and thence affecting the nervous system (Miller). While in tetanus the stimulus which excites the paroxysms "operates through the true spinal cord; in hydrophobia it is often conducted from the ganglia of special sense, or even from the brain, so that the sight or sound of fluids, or even the idea of them, occasions, equally with their contact, or with that of a current of air, the most distressing convulsions" (Carpenter).

Prognosis.—There is no instance of any patient or animal suffering from this disease having recovered.

Treatment.—As there is no well authenticated case of recovery from hydrophobia, neither is there any instance, or but rarely so, of any mitigation of the symptoms by the use of medicine. All that remains then is to mention the most leading experiments that have been made, with the hope that, as they have not been successful, they may not be repeated.

Dr. Hamilton gives twenty-one cases, and adds, "many hundreds more are on record," in which venesection has been unsuccessful, though copious and often repeated. Opium has been given by Dr.

Babington to the enormous amount of 180 grains of solid opium in eleven hours, without the slightest narcotic effect, or the slightest mitigation of the symptoms. Nord has given a drachm of belladonna in twelve hours, without any benefit. Dr. Atterly gave to a child eight years old two drachms of calomel by the mouth, and also rubbed in two ounces and a-half of strong mercurial ointment in a few hours, and with an equal want of success. Iron, arsenic, nitrate of silver, camphor, musk, cantharides, turpentine, tobacco, acetate of lead, cuprum ammoniatum, hydrocyanic acid, galvanism, strychnine, nitrous oxide, chlorine, and guiac, have been also given in equally large doses, but have signally failed. These include some of the most powerful medicines in the Pharmacopœia; and, in addition to these, Plouquet, in his *Literatura Medica Digesta*, has enumerated nearly 150 others.

The failure of every remedy by the mouth, and the inefficacy of opium, of morphine, and of laurel water, even when injected into the veins, so convinced Majendie that, in hydrophobia, the constitution was armed against the action of any medicinal substance, that on a patient labouring under this disease being brought to the Hôtel Dieu, he determined to rely for all treatment on an injection of warm water into the veins. The patient at the time of the operation is represented as being absolutely insane, so as to require to be restrained. In this state, and with a pulse of 150, Majendie injected into his veins in the course of two hours and a quarter, two pints of water at the temperature of 100°. At the conclusion of this operation, the pulse had fallen to eighty, and the patient recovered his senses, so that the strait waistcoat was no longer necessary. The sequel, however, renders it doubtful whether this mitigation was desirable at the price of the intense suffering which followed. The poor man lived eight days afterwards, but the despondency and mental agitation quickly returned, and at the end of three days the poison appeared to set up a new series of specific actions on the synovial membranes of the wrists, elbows, and knees, attended with excessive pain, so that he was unable to bear the weight of the bed-clothes, and he died in great torture. The articulations thus affected were found on posthumous examination to be greatly inflamed, and their cavities filled with pus. This case is remarkable, as being the one in which life was prolonged for the greatest period of time recorded of this disease. The experiment has since been repeated by Gaspard and others, but the mitigation, if any, has been so slight and transient as to give no encouragement for repeating it; and tried on the rabid dog by Mr. Youatt and Mr. Mayo, it proved eminently unsuccessful.

The property which some animal poisons have of controlling and of interrupting the actions of other morbid poisons on the constitution

has caused this class of agents to be tried in the cure of this disease. The rapid and powerfully acting poison of the viper led to the hope that the bite of that reptile might prove an antidote to the hydrophobic virus, but the experiment, tried in France, Germany, and Italy, upon animals has been entirely unsuccessful. M. Grindard conceived that the vaccine virus might influence hydrophobia, and he vaccinated a hydrophobic child in three places, and afterwards injected five charges of vaccine lymph into the veins, but the child died without any marked remission, and in the usual time.

Preventive Treatment.—The probabilities are, that unless the operation of excision, of cauterization, or of applying the cupping-glass be performed within a few minutes after the bite of the rabid animal, it is impossible to save the patient from the fatal disease, which, according to the susceptibility of his constitution, now threatens him. In all probability no prophylactic medicine exists in nature, and the exhibition of any potent substance by way of prevention is worse than useless, for without protecting the patient it may injure his constitution. Mild remedies, if they tend to tranquillize his mind and appease his apprehensions, may be innocently employed.

The theory which maintains that a zymotic incubation first takes place in the wound by which the poison is originally implanted suggests the most rational prophylactic, namely, to destroy entirely by potassa fusa the whole cicatrix, where practicable, or by some other surgical means entirely to remove it, at as early a period as possible, and *previous* to the occurrence of symptoms. When premonitory symptoms are first observed, the following plan has the recommendation of Dr. Maxwell in *The Indian Journal of Medical and Physical Science*, and of Dr. Copland, namely—(1.) That the original cicatrix be freely laid open and suppuration from it speedily and freely produced. (2.) The nerves, or nerve, leading to the part are to be divided without delay, the more remote from the wound the better. (3.) Free perspiration should be promoted by the hot air bath. (4.) Bleeding from the arm to syncope, or cuppings on the nape of the neck, are modes of practice indicated by the lesions found after death.

GLANDERS—*Equinia.*

Definition.—*A febrile disease of a malignant type, resulting from the implanting of a specific poison from glandered horses. It is characterized by vascular injection of the nasal mucous membrane, on which chancre-like sores are formed, extending to the frontal sinus and neighbouring mucous surfaces, from which a profuse offensive discharge flows. A tubercular or pustular eruption appears upon*

the skin, followed by suppurating, bloody, or gangrenous ulceration in various parts.

Pathology.—The horse, the ass, and the mule, are liable to a disease termed the glanders. It occurs under two forms, named the *glanders* and *the farcy*. Many veterinists have considered these varieties to be distinct diseases, but numerous experiments have demonstrated that they have their origin in the common animal poison. It appears, however, that there are several grades or varieties of both these diseases. Thus, if glanders be defined to be a fever with a running of matter from the nose, farriers distinguish three kinds: one consists of ecchymosis and gangrene, principally of the pituitary, tracheal, or bronchial membrane; another of a pustular eruption of the same parts followed by ulceration; while a third is a combination of these two forms of disease. Of farcy also there are two kinds, the *bud farcy* and the *button farcy*. The bud farcy consists in the formation of a number of tumors on different parts of the body, as on the head, neck, and extremities, and particularly on the hinder ones, these tumors being formed not only by enlargement and inflammation of the glands, but also of the cellular tissue, and which, at the end of four or five days, soften and ulcerate. Similar tumors are said to form also in the substance of the pituitary membrane, which quickly suppurate and cause death. The button farcy is an inflammation limited to the lymphatic glands and vessels, without involving in any considerable degree the cellular tissue. It usually commences in the hinder extremities, causing lameness and enlargement of the limb; and when the valves of the lymphatics become thickened it forms a tumor called the "farcy bud," while, if the lymphatic vessel itself be inflamed, it is termed "farcy pipe."

It has been determined by a number of severe accidents occurring to persons employed about glandered horses, that the poison producing them is capable of being transmitted from the horse to the human subject, and again from the human subject to the horse, and to the ass, and there is reason also to believe that it is capable of being transmitted from one human being to another. The attention of the profession was first called to this interesting subject by Mr. Muscroft, in *The Edinburgh Medical and Surgical Journal*, in the year 1821, where he relates the case of the whipper-in of the Bradworth hunt, who wounded himself in cutting up a glandered horse for the kennel, and died at the end of a week of confirmed glanders; and two similar cases appeared in the same work about two years afterwards. Simultaneously with Mr. Muscroft, Dr. Copland, in the course of a discussion at the Medico-Chirurgical Society of London, stated that the fact of the disease having been thus communicated had been proved by cases that had occurred in Germany, and which were published in *Rust's Magazine* for 1821. The cases

excited but little notice till Mr. Travers published his valuable work on *Constitutional Irritation*, in 1828, containing a letter from Professor Coleman on the transmission of glanders from the horse to man, and from man to the ass, together with some other cases which had fallen under his own observation. The subject was now followed up by Dr. Elliotson, in two papers in the *Transactions of the Medico-Chirurgical Society*, narrating three cases which had occurred in his own, Dr. Roots's, and Dr. Williams's practice. At length all the then known facts were collected in an elaborate paper by Rayer, in the sixth volume of the *Mémoires de l'Académie Royale de Médecine.*

In the cases collected by Rayer, the nose and nasal fossæ had only been examined in four cases out of fifteen, and in these there was found either ecchymosis, ulceration, or gangrene of the mucous membrane of the septum nasi, or in the sinuses. The mucous membrane of the larynx, or trachea, has likewise been found studded either with the peculiar eruption, or else diffusely inflamed or ulcerated, so much so that in one case the epiglottis was in part destroyed. The lungs have likewise been found either gorged with blood, or else the seat of lobular pneumonia, or of vomicæ. In Dr. Roots's case there was an encysted abscess of the lung, which contained about two ounces of pus. Besides these affections of the more vital organs, a number of small farcy tumors have been found in different parts of the trunk and extremities, and perfectly remote from the point originally punctured. These tumors are in different states of inflammation, some being white and indurated, others soft and injected, and others in a state of suppuration. In Dr. Roots's case, an abscess on the back of the hand communicated with the articulation of the metacarpal bones; and in another case an abscess had opened into the knee-joint. The absorbent vessels have likewise been found inflamed along the arm, from the point of puncture, and the glands to which they lead have been found enlarged and indurated, or in a state of suppuration.

The result of all these observations shows that a specific poison is implanted which infects the blood, and after a given period of latency produces in slight cases an abscess at the point of puncture, followed by some tumors in the course of the absorbents connected with the punctured part. In severe cases fever is previously set up, and after this has continued for some days, there follows either a diffuse or an eruptive inflammation of the mucous membrane of the nostrils and of the trachea, terminating in suppuration, ulceration, or gangrene; also some inflammatory affection of the lung, together with the usual farcy button or bud tumors in different parts of the body.

Symptoms.—The glanders may be either acute or chronic. Acute

glanders consist of primary fever, followed by local inflammation, chronic glanders when the local inflammation exists *per se*. The proportionate number of cases of each kind is not determined.

The acute disease is ushered in by an attack of primary fever, with or without rigors, and followed by pains in the limbs so severe as often to be mistaken for an attack of acute rheumatism. Some days after, the pained parts become the seat of phlegmonous tumors, accompanied with much pain, redness, and tenderness; these more commonly terminate in abscess, sometimes discharging a laudable pus, but more usually a bloody sanies, and rapidly become gangrenous. Towards the close of the disease, in almost all cases, there has been a discharge of matter more or less purulent, viscid, and mixed with blood, from the nostrils. The quantity, however, has in general been inconsiderable, and sometimes scarcely appreciable. The period at which this symptom appears is not constant. It has been seen as early as the fourth, and as late as the sixteenth day. In the course of the disease, also, the eyelids are generally tumefied, and discharge a thick viscid matter, like that from the nose, and an enlargement of the sub-maxillary glands have been seen.

One of the most remarkable symptoms of acute glanders in man, is the eruption of pustules on the face, trunk, limbs, and genital organs. This eruption has been compared to the varicellæ, to the small-pox, and to ecthyma, but in fact it is *sui generis*, and cannot be compared to any other. It has been observed to occur about the twelfth day, and to be preceded and accompanied by profuse fetid sweats. Besides this eruption, a number of black bullæ have been observed on the nose, forehead, below the ears, on the fingers, toes, and genital organs, and these have been followed by gangrene, more or less extensive and deep.

The pulse is full and quick in the early stages, but towards the close becomes rapid, small, irregular, and even intermittent. The tongue varies, as in typhus, being first white and coated, and subsequently brown or black. Diarrhœa and meteorism often complicate the disease, and black blood has been observed in the stools.

Cerebral disturbance has come on as early as the second day, but more commonly not till towards the tenth; sometimes marked by a singular want of intelligence, at others by a sinister presentiment, followed by stupor and death.

Acute glanders are rapid in their course, and two-thirds of the cases have terminated before the seventeenth day; two have died on the twenty-first day, one on the twenty-eighth day, and only one has survived till the fifty-ninth day.

Chronic glanders or acute farcy, differs from acute glanders, in the circumstance of the local lesion preceding the general febrile

derangement; the introduction of the poison being followed in a few hours by inflammation of the lymphatics, proceeding from the wounded part, and extending sometimes to the elbow or axilla, and involving the axillary glands. This is followed by inflammation, and extensive abscesses in the sub-cutaneous cellular tissue, often involving the whole limb. From this state the patient may recover; but should these abscesses be multiplied over various parts of the body, and be accompanied either by the pustular or gangrenous vesicular eruptions, or by both, the result is generally fatal, for hectic symptoms supervene and hasten the final catastrophe.

The disease has terminated in a fortnight, but more commonly has not proved fatal till the end of a month, and in cases still more chronic, a twelvemonth has been known to elapse before the patient finally recovered, or died. Such are the general symptoms of acute and chronic glanders, as they have been observed in the human subject.

Cause.—The remote cause of glanders in the horse is but little understood. It is probably due to a miasmatic poison, having a peculiar affinity for the horse, and animals of his class. The glanders, however, when they affect the human subject, have in all instances been distinctly traced to the glandered horse as their remote cause, for no instance is known of their occurring primarily in man.

In the horse certain predisposing causes greatly favour, and are perhaps necessary to the spread of the glanders, as dirty, close, ill-ventilated stables, especially if the situation be low and damp. Horses also, when crowded on board transports, are greatly liable to this affection. The Arab, in transporting his horses from Arabia to India, always chooses that part of the year when the passage is shortest, lest the accidents incident to a long voyage might oblige the hatches to be closed, and want of ventilation give rise to glanders. Bad food is also a powerful predisposing cause in the horse, especially when these animals are picketed on service, and thus exposed to the inclemency of the weather. At the close of a campaign the cavalry are often decimated by this disease, and towards the termination of the Peninsular war, the losses from this cause are said to have been enormous. The cases occurring in the human subject are too few to allow of any inference being drawn as to the influence of the predisposing causes in the production of the glanders, but they have all occurred in young men, and probably a close investigation would have shown that the habits of the patient were such as to fall within those laws which favour the production of the disease in the horse.

The majority of veterinary surgeons, of stable-keepers, and coach proprietors, believe that the disease is contagious among horses, and if a glandered horse has been introduced into stables, the stock in

these stables has become diseased. There are few districts also in which some farmer, by the loss of a considerable part of his team, has not had sufficient proof of the contagious nature of the glanders. In this country the law is severe against offering for sale, or even working, a glandered horse, which shows that the opinion of our ancestors, time out of mind, has been that the glanders are a contagious and a fatal disease. In Germany the belief of contagion is so general that it is said the law directs any horse that has been in contact with a glandered animal to be immediately killed. Again, Professor Coleman has produced the glanders by direct inoculation from horse to horse, so also have Professors Peal and Renault, while Leblanc assures us that he has repeated these experiments till he has demonstrated, that not only are the glanders contagious, but that the farcy and glanders are mere varieties of the same disease,—the farcy matter producing glanders, and the matter of the glanders farcy.

Cases of the transmission of the glanders from the horse to man are now numerous; and that the disease is actually the glanders, has been shown by Professor Coleman, who directed two asses to be inoculated with matter taken from the arm of a Mr. Turner, then labouring under this disease, consequent on a puncture received in dissecting a glandered animal, and both animals died of the glanders. These experiments have been repeated with similar results by Gerard, Hering of Stuttgardt, and more recently by Leblanc, with matter taken from a patient that died glandered under Rayer, so that no doubt can exist of the fact. It seems proved, therefore, that the glanders are transmissible from the horse to man, and again from man to the ass. It has been contended also, if the glanders are transmissible from man to animals, they must be capable of being communicated from one human subject to another, and a case of this description appears actually to have occurred in St. Bartholomew's Hospital about twenty years ago, when the nurse, a healthy woman, contracted the disease from a patient in the ward, and, after a short illness, died with every symptom of the glanders.

The fact of repeated inoculation with glandered virus distinctly shows that fomites may be so infected as to produce the disease. The spread of the malady also has been attributed to healthy horses having drunk out of the same pail or trough with a glandered horse, or to licking the neighbouring rack or partitions of the stalls in which a glandered horse had been placed. Mr. White attributes the occurrence of the glanders in a mare and two foals to some hay which had been left by a team of glandered horses being blown into their paddock.

The specific poison of glanders has been introduced into the system both by the cutaneous and mucous tissues. The disease

has been produced by inserting the virus under the cutis with a lancet, and by rubbing it on the greasy heel of a horse; it has also been produced by inoculating the mucous membrane of the nose of the horse, or by smearing that membrane with farcied matter. Farcied matter has also been made up into balls, and introduced into the stomach of the horse, and glanders has resulted. There can be no doubt, therefore, that the poison is absorbed both by the cutaneous and mucous tissues, and that being absorbed it infects the blood. This latter fact has been distinctly proved by Professor Coleman. "I have," says this gentleman, "produced the disease first by removing the healthy blood from an ass, until the animal was nearly exhausted, and then transferring from a glandered horse blood from the carotid artery into the jugular vein of the ass. The glanders in the ass was rapid and violent in degree, and from this animal, by inoculation, I afterwards produced both glanders and farcy. In acute glanders, therefore, the blood is undoubtedly affected."

Period of Latency.—The poison of the glanders has its period of latency, like all other morbid poisons, and that period is in general short. Two asses were inoculated by Mr. Turner, the one about a year, and the other a year and a-half old, and in the first the maxillary glands became tender on the second day, and the discharge from the nostrils was established on the third. In the other the maxillary gland enlarged on the third day, but the discharge from the nostrils did not take place till the sixth day. Sometimes, however, the incubation is much longer. In the *Procès-verbal de l'Ecole de Lyon*, a case is given of a horse which was inoculated with farcy matter, but the disease did not appear till the end of three months, and then precisely at the points of puncture. M. Gerard, an ex-veterinary surgeon of the French "artillerie de la garde," states that he introduced the matter of the discharge every day, into the nostrils of certain horses by means of a brush, and that the disease appeared in one on the seventh day, but in two others not till the thirty-second day.

In the human subject, the poison has in general been latent from two to eight days after the accident of the puncture.

Prognosis.—Of fifteen cases of acute glanders collected by Rayer only one recovered. Of fifteen cases of acute farcy only five recovered. Of seven cases of chronic farcy only one died. Of the three cases of chronic glanders two died. A favourable prognosis, consequently, is only warranted in chronic farcy.

Diagnosis.—"Acute glanders," says Rayer, "cannot be confounded with poisoning from puncture in dissecting or opening dead bodies; for," he adds, "out of fifty such cases reported by various authors, no mention is made in them of a discharge from the nostrils, or of a nasal or laryngeal eruption being found after

death, or of the peculiar cutaneous eruption." Leblanc also states that he has inoculated the horse with a great number of other morbid secretions from the human subject, but has in no instance produced any disease similar to the glanders. It may for a short time be mistaken for rheumatism, but the occurrence of the secondary actions quickly dispels this error. It is perhaps impossible to enumerate every difficulty that may occur in the diagnosis, but when any doubt exists, an inquiry into the habits and previous employment of the patient will probably solve the problem; or the inoculation of a healthy animal is an excellent counter-proof.

Treatment.—All the remedies hitherto tried in acute glanders have failed, for only one out of fifteen has recovered, and that not from any particular treatment. Blood, when taken at the commencement, has been found buffed, and some momentary relief has been afforded, but prostration and stupor have quickly followed, while leech-bites have become gangrenous. The coming on of typhoid symptoms has caused quina, valerian, serpentaria, ammonia, and other stimulating medicines to be exhibited, but all of them have failed. Vomiting and purging have likewise been had recourse to; but these measures have been equally unsuccessful. It is probable, therefore, that the cure of this disease depends on the discovery of a specific remedy, and every experiment in treatment is warranted as the only chance of subduing a malady which has so constantly proved fatal. In the more chronic forms of the disease, the recovery of the patient has appeared to be owing to the excellence of his constitution, and to a generous diet, rather than to any powerful effect produced either by general or local treatment.

Preventive Treatment.—The prophylactic treatment is the same as that of all other contagious diseases, or carefully to avoid all contact with the morbid poison, and especially when a finger or other part of the hand is abraded; and if by accident the veterinary surgeon should inoculate himself, he ought instantly to touch the part with lunar caustic. It has been recommended, after the disease is set up, to extirpate the enlarged glands; but if there is any truth in the doctrine that the blood is poisoned in this disease, and that the local affections are the secondary actions of the poison, this practice must be as unwarranted as hopeless.

The two orders of zymotic diseases which have now been described constitute a group of diseases sometimes termed "*acute specific*" (WALSHE), or "*general diseases*" (WOOD), because they primarily and essentially implicate the entire system. Throughout their course, and from the first, they each variously modify the composition of the blood, the calorification and the innervation of the body. Each and all of them, also, during their progress give rise to some

lesions in the solids of a special anatomical character, when the disease is not too rapidly fatal to allow of these pathological features to become developed, as in *yellow fever*, *typhous fevers*, *plague*. These maladies run an acute course, they are more or less pyrexial, and, in the majority of instances, the fever which accompanies them has a tolerably fixed duration. The greater number of them are contagious, under certain conditions, not yet well understood; and lastly, all of them are produced by an extrinsic poison, either of a *miasmatic* nature, as in those of the first order; or by the implanting of a *specific virus*, as in those of the second order.

Order 3. Dietic Diseases—*Dietici*.

The combined researches of chemistry, physiology, and pathology, during the last fifteen years, has cleared up much that was doubtful, and established more certain principles on which proper scales of diet may be founded so as to maintain the health of the body under a great variety of conditions, as to labour, confinement, freedom, and exercise. The statistics of disease and mortality now also show, more decidedly, how intimately they are associated with the supply of food to the people. The records of the Registrar-General of England, and those of Mr. Wilde in Ireland, the evidence of the Commissioners relative to the supplies in the Crimea during the recent war, and many valuable reports relative to the health of the Navy before and after their diet was changed, fully substantiate these remarks.

While physicians were well aware of the intimate connection that existed in a general way between food and disease, it is due to the labours of chemists and physiologists especially that this connection has been reduced to an intelligible form; and that the principles which they have established are now put to a practical use. The names of the distinguished labourers in this field of science are Prout, Liebig, Dumas, Playfair, Johnston, Letheby, Christison, Mulder, Lehmann, Bernard, and others.

Effects of Food on the Animal Economy.—The great fact which the researches of these men establish, may be expressed thus:—"*That the various alimentary substances made use of by man and animals contain at least four classes of constituents, each of which performs its own assigned function in the living animal economy. If the substance contains nitrogen, it seems for the nourishment of tissue, and is called plastic or nitrogenous; if it is deficient in nitrogen, and has an excess of carbon or hydrogen, it appears to undergo combustion in the body, and is called a non-nitrogenous or a respiratory element of food; if it is fatty in its nature, it performs*

the double duty of maintaining animal warmth, and of assisting in the assimilation of nitrogenous compounds; and, lastly, if it is saline in its quality, it goes to build up the solid textures of the animal frame, and also does the important work of carrying new materials into the system and old or effete matter out of it" (LETHEBY). Man and animals cannot maintain health if their food does not contain all of these constituents; and common instinct, with experience, tells us that these classes must be associated in due proportions, under a variety of modifying circumstances. There are undoubted *habits* of feeding which, while they appear to be dictated by common instinct, are also sanctioned by science. For example, white meat being deficient in fat, bacon is eaten with veal and with fowl; melted butter is used with fish; eggs and butter are mixed with sago, tapioca, and rice; cheese is eaten with maccaroni; salads and vinegar are eaten with cold or salted meat; a vegetable is mixed with an animal diet; bread is eaten with butter, bacon with greens, pork with peas pudding, and so on,—old habits and instincts, not only declare that these combinations are compatible, but science informs us now why such combinations are demanded for the maintenance of health; and when they cannot be obtained, health is endangered, the constitution is gradually altered, temperament is modified, life is shortened, families extinguished, armies are swept from their encampments, and races of men from the face of the earth.

The experience of Dr. Christison (who has paid great attention to this subject for the last twenty-two years) has shown :—(1.) That the most successful dietaries for bodies of men deduced from practical observation, contain carboniferous and nitrogenous food in proportion of about three of the former to one of the latter by weight. (2.) That while *nitrogenous* may replace *carboniferous* food for supporting respiration *though at a great loss, carboniferous* food (without nitrogen) cannot replace *nitrogenous* food for repairing textural waste. (3.) The daily amount of nutritive principles of both sets must increase with exercise and exposure, otherwise the body quickly loses weight and ere long becomes diseased. If the above proportion between the two sets be maintained, the weight of real nutriment per day varies, for adults at an active age, between seventeen and thirty-six ounces; the former being enough for prisoners confined for short terms, the latter being required for keeping up the athletic constitution or that which is capable of great continuous muscular efforts. (4.) Dietaries ought never to be estimated by the rough weight of their constituents, without distinct reference to the real nutriment in these as determined by physiological and chemical inquiry.

The calamities which recently befell our soldiers in the Crimea show that the dietaries of working men cannot be safely reduced

below the physiological standard; and, in the words of Dr. Christison, "any person conversant with the science of the present subject could have foretold, as a certain consequence, sooner or later, of their dietary, that the British troops would fall into the calamitous state of health which befell them in the Crimea."

The following very interesting tables of dietaries and their nutritive values, and of the nutritive values of foods, by Dr. Letheby of London, are given here, to show the actual proportions in which various substances used as food may be associated in the several public dietaries of the country, and as a guide to the student of medicine, when, as a practitioner, it may often be his lot to devise and construct scales of diet suited to various conditions of existence :—

Table I.

DIETARIES AND THEIR NUTRITIVE VALUES.—(Letheby.)

Diets.	Weekly Consumption in Ounces.							Daily ditto.		
	Bread or Biscuit	Meat.	Potato	Meal, &c.	Milk.	Cheese	Butter.	Carboniferous.	Nitrogenous	Total solid nutriment.
Physiological,	140	84	..	..	..	..	3·5	12·7	4·0	16·7
Prison Punishment,	112	..	..	..	..	..	..	8·2	1·4	9 6
E. County & Borough Gaols.										
Under 7 days,	121	..	..	23	39·5	..	..	12·4	2·2	14·6
Not hard labour,	172	7·8	3·2	22.8	15·4	3·5	..	15·7	3·1	18·8
Hard labour,	163	14·6	63·4	27·2	41·6	1·5	..	18·2	3·5	21·7
Scotch Prisons—										
Under 3 days,	112	..	..	28	..	..	..	11·2	1·9	13·1
Not hard labour,	30	7·5	152	73	175	..	..	19·0	3·4	22·4
Hard labour,	76	10	176	100	175	..	..	27·0	4·5	31·5
Irish Prisons—										
Under 1 month,	56	..	192	70	70	..	..	19·5	2·9	22 4
Not hard labour,	56	..	192	60	170	..	..	20·5	3·4	23·9
Hard labour,	64	..	219	70·5	170	..	..	22·0	3·6	25 6
Military Prisons—										
Under 84 days,	56	..	..	119	210	..	..	22·2	3·8	25 8
Over 84 days,	56	..	..	168	210	..	..	27·8	4·7	32·5
Destitute debtors,	156	16	52	22	21	..	..	16·3	3·1	19·4
Convict Prisons,	161	36	112	12	12·8	..	..	18·4	3·6	22·0
Unions (Adults),	112	15·5	51	17	34	5·2	1·1	14·2	2·8	17·0
Unions (Children),	90	14	32	..	105	..	3·5	11·1	2·3	13·4
Lunatic Asylums,	114	23	68	16	14	7	1·3	13·2	4·0	17·2
Public Hospitals,	93	52	56	14	7	..	3·2	12·1	3·5	15·6
Army—										
Crimea,	112†	112	..	..	..	..	..	14·5	4·8	19·3
Home,	168	84	112	..	..	..	..	19·4	4·8	24·2
Madras,	112	112	56	4*	..	..	..	16·5	4·9	21·4
Bombay,	140	112	56	56*	..	..	..	22·2	5·6	27·8
Field (India),	168	..	..	168*	..	..	..	30·7	3·8	34·5
Navy,	112†	112	56	..	..	..	..	17·7	5·0	22·7
‡Navigator (Crimea),	140	140	..	28	..	..	..	17·8	6·2	23·0
‡Navigator (Home),	320	96	64	..	..	12	4	18·6	7·7	26·3
Berwickshire labourer,	122	..	..	224	224	..	..	37·1	7·0	44·1
Yorkshire labourer,	280	126	28	..	210	..	49	42·2	8·8	51·0

In this Table only the most important articles of diet are mentioned, although the others, excepting beer, spirits, tea, and coffee, are calculated in the daily consumption. (*) are rations of rice, and (†) are of biscuit. Gruel is calculated at rate of two ounces meal per pint.

‡ A name given to those labourers who are employed in excavating, and such like laborious work, chiefly connected with the construction of railways. They are also sometimes called "navies."

Table II.

NUTRITIVE VALUE OF FOODS.—(Letheby.)

Substances, 100 parts.	Water.	Fibrine Albumen, &c.	Starch, Sugar, &c.	Fat.	Salts.	Carboniferous.	Nitrogenous.	Total Nutriment.
Human Milk,	89	3·5	4·2	3·0	0·2	11·4	3·5	14·9
Cows' Milk,	86	4·5	5·0	4·1	0·7	14·8	4·5	19·3
Skimmed Milk,	87	4·5	5·0	2·7	0·7	11·5	4·5	16·0
Butter Milk,	87	4·5	5·0	0·5	0·7	6·0	4·5	10·5
Beef and Mutton,	73	19·0	..	5·0	2·0	12·0	19·0	31·0
Veal,	77	19·0	..	1·0	0·6	2·4	19·0	21·4
Poultry,	74	21·0	..	3·0	1·2	7·2	21·0	128·2
Bacon,	20	0·8	..	70·0	1·3	168·0	0·8	168 8
Cheese (Chedder),	36	29·0	..	30·0	4·5	72·0	29·0	101 0
,, (Skimmed),	44	45·0	..	6·0	5·0	14·4	45·0	159·4
Butter,	15	..	..	83·0	2·0	199·0	..	99·0
Eggs,	74	14·0	..	10·5	1·5	25·0	14·0	39·0
White of Egg,	78	20·0	..	..	1·6	..	20·0	20·0
Yolk of Egg,	52	16·0	..	30·0	1·3	72·0	16·0	88·0
White Fish,	79	19·0	..	1·0	1·2	2·4	19·0	21·4
Salmon,	78	17·0	..	4 0	1·4	9·6	17·0	26·6
Eel,	80	10·0	..	8·0	1·3	19·2	10·0	29·2
Wheat Flour,	15	11·0	70·0	2 0	1·7	74·8	11·0	85·8
Barley-meal,	15	10·0	70·0	2·4	2·0	75·8	10·0	85·8
Oat-meal,	15	12·0	62·0	6·0	3·0	76·4	12·0	88·4
Rye-meal,	15	9·0	66·0	2·0	1·8	70 8	9·0	79·8
Indian-meal,	14	9·0	65·0	8·0	1·7	84·2	9·0	93·2
Rice,	14	7·0	76·0	0·3	0·3	76·7	7·0	83·7
Harricot,	19	23·0	45 0	3·0	3·6	52·2	23·0	75·2
Pease,	13	22·0	58·0	2·0	3·0	62·8	22 0	84·8
Beans,	14	24·0	44·0	1·4	3·6	47·4	24·0	71·4
Lentils,	14	29·0	44 0	1·5	2·3	47·6	29·0	76·6
Wheat Bread,	44	9·0	49·0	1·0	2·3	51·4	9·0	60·4
Rye Bread,	48	5·3	46 0	1·0	1·4	48·4	5·3	53·7
Potatoes,	74	2·0	23·0	0·2	0·7	23·5	2·0	25·5
Green Vegetables,	86	2 0	4·0	0·5	0·7	5·0	2·0	7·0
Arrow-roots,	18	..	82·0	..	..	82·0	..	82·0

In this Table the carboniferous matter is calculated as starch; 10 of fat being equal to 24 of starch.

In cases where preserved food must be used for want of fresh food, there are difficulties to be overcome which experience and science have also made to disappear in a great measure. It is known that salt meat has a tendency to engender disease, and to favour the development of disease under certain circumstances; and it is not known either physiologically or chemically what is the exact nutritive value of salt meat in a scientific point of view. There are three circumstances connected with its use which tend to diminish its value as an article of diet, namely:—(1.) The investigations of Liebig demonstrate that the process of salting meat is very improper, for the brine extracts the juices of the flesh, and so removes most of the important constituents. (2.) The salt meat for the navy and for soldiers in the field is always highly salted, in order to keep for two years or more in every climate; and such highly salted meat must be so thoroughly steeped in cold water, to remove the salt, before it is eatable in large quantity, that much of

its most nutritive constituents must be washed out, namely, its albumen and sapid extract, called osmazôme (CHRISTISON). (3.) The sarcolemma of salted meat also is always hardened; and hence those foods require a long time for digestion, and frequently disagree with the stomach (LETHEBY). Few can eat a pound of salted meat daily for any length of time, even when fed on rations by no means liberal. Nitrogenous elements must therefore be added to a diet where salted meat predominates, rather than increase the amount of that substance; and this is best done by adding peas, flour, currants, raisins and oil, butter or lard, to the ration.

"Experience has shown," says Dr. Letheby, "that there are certain articles of food which are not particularly nourishing in themselves, but which serve some very important purposes in the animal economy. This is the case with tea and coffee; in fact, the use of a vegetable infusion, containing astringent matter and an active principle, rich in nitrogen, has been almost universal among mankind from the earliest times." To use the words of Mr. Johnston, "The practice has prevailed equally in tropical and in arctic regions. In Central America, the Indian of native blood, and the Creole of mixed European race, indulge alike in their ancient chocolate. In Southern America, the tea of Paraguay is an almost universal beverage. The native North American tribes have their Apallachina tea, their Oswegan tea, their Labrador tea, and many others. From Florida to Georgia, in the United States, and over all the West India Islands, the naturalized European races sip their favourite coffee; while over the Northern States of the Union, and in the British provinces, the tea of China is in daily and constant use.

"All Europe, too, has chosen its prevailing beverage; Spain and Italy delight in chocolate; France, Germany, Sweden, and Turkey, in coffee; Russia, Holland, and England, in tea—whilst poor Ireland makes its warm drink of the husks of the cocoa, the refuse of the chocolate-mills of Italy and Spain.

"All Asia feels the same want, and in different ways has long gratified it. Coffee, indigenous in Arabia or the adjoining countries, has followed the banner of the Prophet, wherever in Asia or Africa his false faith has triumphed. Tea, a native of China, has spread spontaneously over the hill country of the Himalayas, the table lands of Tartary and Thibet, and the plains of Siberia; has climbed the Altais, overspread all Russia, and is equally despotic in Moscow as in St. Petersburg. In Sumatra, the coffee leaf yields the favourite tea of the dark-skinned population; while Central Africa boasts of the Abyssinian chaat as the indigenous warm drink of its Ethiopian people. Everywhere unintoxicating and non-narcotic beverages are in general use among tribes of every colour, beneath every sun, and in every condition of life. The custom, there-

fore, must meet some universal want of our nature. In fact, an unthought-of chemical instinct has guided men in the selection of these beverages long before any chemical knowledge existed of the substances contained in them. Who has not felt the exhilarating influences of a warm cup of good tea or coffee. ?

"The physiological action of these beverages appears to be of a somewhat singular kind; for while they excite the brain, they calm the nervous system generally, and though they produce a state of wakefulness and activity, yet they also induce a species of languor and repose. Lehmann, who has inquired much into their physiological effects, has ascertained by experiment that coffee greatly diminishes the wear and tear of the system; it oils the machinery, as it were, and checks the waste of friction; for those who use it find that during active exercise the destruction of tissue is prevented, and that there is less demand for food; in fact, with a maximum of work to perform, and a minimum of food to accomplish it, he will best sustain his vital power who resorts to a cup of tea or coffee. Hence its value as a means of economizing food, and hence its importance to the poor labouring man." In many of our large merchant-ships, also, the crews are engaged on the condition that coffee shall take the place of grog; and those captains who are careful of the health of the men, give them warm coffee before or after they have been aloft, in cold and stormy weather—a practice which cannot be too much overvalued.

Effect of Overfeeding.—Too much respiratory food favours the development of fat, and often checks the proper nutrition of the muscular tissues; hence it is that rice feeders and potato eaters, and those who indulge in fermented liquors, are often bloated in their appearance, and are not capable of prolonged exertion. The brewer's drayman is a bad subject for the wards of an hospital; for though he usually has all the appearance of a man possessed of great muscular strength and vital endurance, yet he is not so in reality, for the muscular tissues have been encroached upon by fat, and the general power has been weakened by an undue influence of the respiratory element. Most of the animals in our menageries, from a too liberal allowance of respiratory food, die from fatty degeneration. Accumulation of the nitrogenous elements in the blood is often a prolific source of disease; and very recently attention has been drawn to the diseases of overfed convicts (Letheby).

Effects of Deficient Food.—"On the other hand, a deficiency of food, especially of the nitrogenous part, quickly leads to the breaking up of the animal frame. Plague, pestilence, and famine, are always associated in the public mind, and the records of every country show how closely they are related. The medical history of

Ireland is remarkable for the illustrations of how much mischief may be occasioned by a general deficiency of food. Always the habitat of fever, it every now and then becomes the very hot-bed of its development. Let there be but a small failure in the usual imperfect supply of food, and then the lurking seeds of pestilence burst into frightful activity. The famine of the present century is but a too forcible illustration of this, for it produced epidemics which had not been witnessed in this generation, and it gave rise to scenes of devastation and misery which are not surpassed by the most appalling of the middle age. The principal form of the scourge was known as the contagious famine fever, and it spread, not merely from end to end of the country in which it had originated, but, breaking through all boundaries, it crossed the broad ocean, and made itself painfully manifest in localities where it was previously unknown. Thousands fell under the virulence of its action, for wheresoever it came it struck down a seventh of the people, and of those whom it attacked one out of nine perished. Even those who escaped the fatal influence of it were left the miserable victims of scurvy and low fever. Another example, not less striking, of the terrible consequences of what may be truly called famine, was the condition of our troops during the early part of their sojourn in the Crimea—with only just enough of food to maintain the integrity of the system at a time of repose, and at ordinary temperatures they were called upon to make large muscular exertions, and to sustain the warmth of the system in the midst of severe cold" (LETHEBY).

The observations made by Dr. R. B. Holland, of the Royal Infirmary and Poors' House of Manchester, are exceedingly instructive. He observes that in cases of very gradual starvation an urgent feeling of hunger is not a prominent symptom, and even when it exists at first, it usually soon diminishes, and is succeeded by a feeling of exhaustion and faintness, and even loathing of food if abstinence has been long protracted. The mental condition connected with poverty may in part account for this deficiency of appetite. A depression produced on the nervous system is very early manifested in the impaired energies of all the vital functions, the weakened conditions of the intellectual faculties and moral feelings, and diminution of the general sensibility. Disturbance of the cerebral functions is at first shown by an unnatural languor, despondency and listlessness, slowness and hebetude of intellect, with an inability to employ the thoughts steadily and profitably on any subject. Notwithstanding all this general languor, however, the patient sometimes manifests a highly nervous state : he is startled by any sudden noise, and hurried by the most trifling occurrences. He is liable to attacks of giddiness, "swimming in the head," staggering, dimness of sight, with temporary delirium, and either falls as in an

apoplectic fit, or lapses gradually from a lethargic state into one of stupor, or even of complete coma. In many respects the symptoms in these cases have a considerable resemblance to the effects of exposure to cold. In consequence of the torpor of the brain and intellectual faculties it is often extremely difficult to obtain the requisite information from patients. Instead of showing any anxiety to communicate the symptoms and cause of their illness, or to relate the privations they have undergone, they generally have an unwillingness to be questioned, lie in a listless or lethargic state, without taking any notice of what is going on, and seem desirous only not to be disturbed. Such listlessness and torpor of the mental faculties, the tendency to fainting, or to perfect syncope, and, finally, a state of cerebral oppression, amounting in some cases to coma, are among the most characteristic symptoms of defective nutrition, and the surest indications of its existence to a serious extent.

When privations of clothing and lodging are added to insufficient diet, long exertion, insufficient repose, intemperance, and the miseries of poverty, the symptoms already detailed are of the most aggravated kind. But there is a multitude of cases of minor degrees of suffering in which the symptoms are less marked than those described. Such cases are indicated by a sallow and dingy appearance of the skin, a soft and flabby feeling of the flesh, more or less emaciation, general debility, feebleness of the circulation, and frequently swelling of the ankles. The stomach becomes disordered, the appetite defective, and digestion impaired. The individual feels languid and desponding, is soon fatigued, incapable of exertion, and has an irresistible desire to fall asleep, from which he is apt to awake suddenly and in a fright. The body is easily chilled, breathlessness and palpitation are experienced after slight exertion, attacks of vertigo, tinnitus aurium, and transient blindness, are common, and there is a peculiar forlorn and dejected aspect of countenance, which is very characteristic. This state of things is commonly soon succeeded by some specific disease, though it sometimes continues, with only slight variation, for a very protracted period, until the patient falls by slow degrees into a state of mental as well as physical incapacity; and being no longer able to procure any employment, is completely invalided, and applies for medical relief. It may perhaps be thought that these remarks apply to cases of deficient nourishment which are less frequent, but the experience of those who have practised extensively among the wretched purlieus and miserable abodes which exist in every large metropolitan town can testify to the contrary. I well remember listening to the interesting clinical lectures of Dr. Christison, of Edinburgh, on the cases of *scurvy* which prevailed in that town and its vicinity in

1847, and hearing the melancholy recitals of misery and starvation under which the poor suffered at that time; some under the hard taskmasters of the illegal "truck system,"* and others from absolute want at home. Among many of whose cases I have preserved notes, a shoemaker had to support his wife and five children on *eight shillings* a-week; and, to feed his children better than himself, he subjected himself to privations which in time developed scurvy. His daily diet consisted of *one pennyworth of bread, with tea, but no milk, in the morning—no dinner—and one pennyworth of bread, with tea, and no milk, in the evening.* After existing *three months* on this diet the disease broke out. But apart from these extreme cases the instances are innumerable in which deficiency acts as a predisposing cause of many diseases. It is now generally well known that plethora and symptoms of an opposite state very nearly resemble each other, and a discrimination of these differences is of the greatest importance. While coma is often an attendant on plethora, it is not to be forgotten that it is one of the most severe and fatal signs of exhaustion from defective nutrition; and when it supervenes towards the termination of diseases of exhaustion, and the pulse becomes slower, it often acquires a degree of fullness, and gives an idea of strength, quite at variance with its previous character, and little to have been anticipated from the debilitated state of the system.

The injurious effects produced by improper nutrition require to be studied, both in relation to food and drink, and the diseases which belong to this order are *scurvy, purpura, famine fever, alcoholism,* and probably also *rickets.* The place of *cretinism* and *bronchocele* cannot be said as yet to be definitely determined. According, however, to the recent investigations of Dr. Strange, these diseases are found among people of all habits in the countries where they abound, only where the soils are composed of magnesian limestone rocks, where the waters contain an excess of magnesian salts, in France, Germany, England, Sardinia, and America. Through the water, therefore, as an element of diet, these diseases appear to become developed, and therefore, in the meantime, they may be arranged among the diseases of this order, some of which now demand a detailed description; and first, of—

* The "*truck system*" became developed chiefly during the formation of our great lines of railways throughout the country. The labourers (navies) were poor, and came to labour without money to buy provisions, and their field of labour was often far removed from any place where food could be bought in quantity. The contractors, their employers, then established provision stores, and in place of paying the men in money, they compelled them to take remuneration for their labour by value received in food. By this method, now declared illegal under all circumstances, the labourers often suffered from a deficient and bad supply of provisions.

Scorbutus—*Scurvy.*

Definition.—*A complex morbid state ushered in by debility, lassitude, lowness of spirits, attended by fœtor of the breath, sponginess of the gums, which swell till they overhang the teeth in palmated excrescences. Livid subcutaneous patches and spots appear upon the skin, especially on the lower extremities among the roots of the hair. Lastly, spontaneous hœmorrhages may take place from the mucous canals; contractions of the muscles and tendons of the limbs occur, with pains, and sometimes superficial ulcerations. An altered state of the blood is associated with this condition, and the phenomena are brought about by the improper nature of the food, as regards the absolute quantity, its quality, and the proportion which the respiratory bears to the nitrogenous or purely nutritive elements.*

Pathology.—Scurvy is mentioned by Pliny as having occurred in the Roman army commanded by Germanicus after a long encampment in Germany beyond the Rhine. It prevailed also to a frightful extent in the army of Louis IX., when he was made prisoner in Egypt in 1260. But it was not till navigation was improved, and long voyages undertaken, that this disease became well known from its general prevalence and formidable character. Vasco de Gama, in his first voyage to the East Indies by the Cape of Good Hope, in 1497, lost 100 men out of 160 by this affection. James Cartier, in his second voyage to Newfoundland, in 1535, speaks of sufferings still more severe. Of 110 people, there were not ten whole. "This malady being unknown to us," he writes, "the body of one of our men was opened, to see if by any possible means the occasion of it might be discovered, and the rest of us preserved. But in such sort did the malady increase that there were not above three sound men left. Twenty-five of our best men died; and all the rest were so ill that we thought they would never recover again." A decoction of the leaves and bark of a tree, supposed to be a species of spruce-fir, was the remedy which they found restored health and recovery. The scurvy continued to prevail with little abatement till 1764. The voyages of Sir R. Hawkins, Hosier, Anson, Drake, Cavendish, Dampier, Byron, and of numerous other navigators, furnish similar details, and show how recklessly the lives of sailors were sacrificed (Copland). During the sixteenth, seventeenth, and earlier part of the eighteenth century, the disease was endemic and epidemic in towns, fortifications, camps, and armies. "Many thousands were often cut off within a few months in single armies and garrisons; and it is probable that more seamen perished from scurvy alone than from all other causes combined, whether sickness, tempest, or battle"

(Wood). In this country and in America it is now very little known, and many have never seen the disease.

The days when scurvy was most prevalent, were not those in which many *post mortem* examinations were made, and our earliest knowledge of the morbid anatomy of this disease is derived principally from Poupart and Lind. They tell us that in those cases in which flux or dysentery is absent, the intestines, however copious the hæmorrhage from them, have been found perfectly sound. The principal effects of the disease were observed in all cases in the cellular tissue of the extremities. The quantity of congealed blood effused in that part, even where no stain or mark could be perceived on the skin, was quite astonishing. "It often lies," says Lind, "in large concrete masses on the periosteum, while the bellies of the muscles of the legs and thighs seemed quite stuffed with it, often an inch in thickness." He also often found water effused into the cavities of the chest and abdomen, and no less frequently blood,—the quantity of blood effused in all parts sometimes amounting, in his opinion, to no less than a fourth part of that contained in the whole body. Poupart gives some further particulars, and says that, on moving the limbs of some scorbutic patients, a noise is heard; and that, on examining the joints, the epiphyses had entirely separated from the bones; and in other cases, that the cartilages of the sternum had separated from their bones; and bones that had united after being broken, very often separated again at the site of fracture. He says also, if we squeezed the ribs which had begun to be thus separated from their cartilages, "there came out abundance of corrupted matter, so that nothing was left of the rib but its bony plates." The mesenteric glands, also, were usually enlarged, the spleen often three times bigger than natural, fell to pieces as if composed of coagulated blood. In two cases examined at St. Thomas's Hospital, by the late Dr. Williams, patches of ecchymoses were found under the pericardium covering the heart, and also under the arachnoid membranes covering the brain.

In some epidemics there is a marked tendency to the effusion of dark liquid blood into the serous cavities, and of the synovial membranes; the most common site being into the pericardium, then the pleura, and next the peritoneum (Karawagen). The spleen is often enlarged, distended with blood, and soft. The texture of the muscular system is also soft and flabby. The blood appears to be deficient in red particles; and does not impart a stain to the living membrane of the heart and great vessels. A fluid or dissolved condition of the blood has also been noticed, appearing often as "a mere gore, not separating into crassamentum and serum, and putrifying soon. It appears to be starved of some essential ingredient," which, according to the observations of Dr. Garrod of London, is most probably potass; and all the phenomena of scurvy, and the con-

ditions under which it becomes developed, point to the blood as essentially altered. What the alteration definitely consists in, has not been yet determined; but it appears that the condition of the blood in scorbutus does not consist in the want of a due proportion of either of its three prominent constituents. The proportion may in some cases be deranged, but it appears that in all cases there is a deficiency of some essential ingredient. The following statements by Drs. Copland, Watson, and Wood contain a summary of the opinions of the chemical pathologists of the present day who have specially investigated the nature of scurvy by analysis of the blood :—

"Dr. Christison supposes that scurvy arises from the want of vegetable albumen or animal casein in the food; and Dr. Garrod believes that the malady is caused by the absence of potash, and that potatoes, and other antiscorbutics, owe their virtues to the potash they contain." The following are his conclusions:—"1. That in all scorbutic diets, *potass* exists in much smaller quantities than in those which are capable of maintaining health. 2. That all substances proved to act as antiscorbutics contain a large amount of *potass*. 3. That in scurvy the blood is deficient in *potass*, and the amount of that substance thrown out by the kidneys less than that which occurs in health. 4. That scorbutic patients will recover when *potass* is added to their food, the other constituents remaining as before, both in quantity and quality, and without the use of succulent vegetables or milk. 5. That the theory which ascribes the cause of scurvy to a deficiency of *potass* in the food, is also capable of rationally explaining many symptoms of that disease. The last of these propositions requires a little further unfolding. 'Both soda and potass are constant constituents of the animal body, and it appears that they are not capable of replacing each other. For example, we always find the potass to exist in large quantities in the ash of muscle, soda in very small quantities (BERZELIUS, LIEBIG). In the ash of the blood we find the relation reversed. It appears also that the muscular system requires the presence of potass; and we should therefore expect to find that where there is a deficient supply of this base, the effect would soon be manifested in the functions of that system. This we find to be the case in scurvy. Without any amount of wasting of the body we find marked muscular debility; and this, perhaps, is one of the earliest symptoms of the disease.' 'Opposed to this theory,' writes Dr. Wood, 'are the facts* that nitrate of potass has often failed to cure the disease, while it has been cured by the addition of pure citric acid; and that, after failure under treatment with the salts of potassa, recovery immediately commenced, when the patient was allowed to eat fresh vegetables.' 'Dr. Aldridge contends for the influence which should be ascribed to a deficiency of phosphorus, sulphur, lime, and the alkalies, in occasioning scurvy. That something may be owing—a part merely—to the causes contended for by Dr. Aldridge, is not improbable. But it is unnecessary to pursue this subject any further than very briefly to state, that one of the most evident changes from the healthy condition is seated in the blood; but that this change is probably not the earliest in the procession of morbid

* The experience of Dr. A. Henderson, R.N. (*Edin. Med. and Surg. Journal*, July, 1839), shows the curative value of *nitre* to have been considerable (W. A.).

phenomena, as it most certainly is not the only or the most advanced. That the change of the blood is manifested by the sensible or physical properties, as well as by the chemical constitution of this fluid, will readily be admitted; and that, in consequence of this change, the several solids of the body are more or less affected, will also be conceded; but I contend that these are not the only alterations; for the vital qualities of the blood itself are more or less altered, or rather impaired,—those vital qualities which the blood derives from the organic nervous system, through the medium chiefly of the vessels in which it circulates. That the organic nervous system is early affected, either primarily, or through the medium of the blood, or in both modes, is shown, not merely by the functions, but also by the vital cohesion and organization, of the viscera and tissues which this system supplies and vitally actuates. But it is immaterial whether this system or the blood be the part primarily affected; for there can be no doubt that morbid states of the chyle, occasioned either by the nature and quality of the aliments, or by the defect of certain elements consequent upon the want of the requisite vegetable productions, or by both causes conjoined, will affect the assimilating functions, both by impairing organic nervous power, and by altering the constitution of the blood; the slow and gradual progress of these changes giving rise to all the structural as well as functional alterations characterizing the advanced stages of the malady."

Symptoms.—The earliest are, a yellowness of countenance, which appears pale and bloated, great depression of the physical powers, followed by swelling of the gums, which become soft, spongy, and hang over the teeth in large fleshy-like palmated masses, very much disposed and readily excited to bleed; and the edges purple where they are in contact with the teeth. A small eruption (like flea-bites), of a purple hue, is next seen on the lower extremities; and about the same time the muscles of the leg or thigh become hard and painful, and in a day or two the skin over the pained part becomes first yellow and then purple. This discoloration forms patches sometimes as big as the palm of the hand, and then again extending over half the leg and thigh. The popliteal regions are a frequent site of this pain and discoloration, sometimes attended with œdema, especially of the ankles and feet. The tongue is now white, the breath fetid, and the stools generally pale. As the disease advances, all these symptoms are aggravated. The loss of physical power increases, the purple spots have a tendency to ulcerate, and the ulcers are distinguished from all others by their putrid fungoid appearance, and great tendency to bleed, old sores open, and the callus of broken bones has even been dissolved and their ends separated. Profuse hæmorrhages frequently take place from the mouth, nose, lungs, or bowels. The teeth also become loose, so that they either fall out, or may be taken out by the finger and thumb. The pulse hurries on to 120 or 140, and at length the patient sinks from diarrhœa or dropsy, and with effusion so sudden

that he perhaps has walked a short distance, and then died in a quarter of an hour afterwards. The duration of the disease is generally many weeks, and sometimes, under the most favourable circumstances, many months, the patient recovering his strength extremely slowly.

When the disease follows ague, obscure or irregular remissions or intermissions of febrile symptoms are observable, and more or less enlargement, with pains in the region of the spleen, is often detected. From the commencement of the disease the alvine evacuations are more or less disordered, but the change does not at first attract attention. At first costiveness prevails, but subsequently the stools become much more frequent and very offensive. Diarrhœa, with colicky pains, supervene, and with more or less attendant hæmorrhage, rapidly sink the patient beyond hope of remedy. Dysentery frequently supervenes upon the scorbutic state, more especially when either are epidemic, and this combination of maladies is sometimes termed "*scorbutic dysentery.*" The tongue, pale at first, becomes broad, flabby, and indented at the edges of the teeth. The great poverty of the blood causes the mucous membrane of the tongue and inside of the lips and cheek, as well as of the skin, to have a peculiar paleness, which contrasts remarkably with the appearance of the gums. The eyesight is frequently weakened, and night blindness (hæmeralopia or nyctalopia) has frequently been observed as a commencing and concomitant symptom; and a most distressing state is the inability to sleep at night.

"The tendency to *swoon* in the most severe cases is sometimes so great that the slightest motion, or the erect posture, or even any trifling exertion, may be followed by fatal syncope. It is stated in the account of Lord Anson's voyage, that many of the men, although confined to their hammocks, ate and drank heartily, were cheerful, and talked with much seeming vigour, and in a strong tone of voice, and yet, on their being the least moved, although it was only from one part of the ship to the other, and that in their hammocks, they have immediately expired; and others, who have confided in their seeming strength, and have resolved to get out of their hammocks, have died before they could reach the deck. And it was no uncommon thing for those who could do some kind of duty, and walk the deck, to drop down dead in an instant, on any endeavour to act with their utmost vigour" (COPLAND).

Diagnosis.—The scorbutic state is to be distinguished from *fleabites*, *bruise*, *typhus fever*, and from *purpura hæmorrhagica*.

Prognosis.—In the present day, when the patient can command medical care and proper diet, scorbutus, though tedious, is seldom fatal. When these, however, have been wanting, the mortality has been terrible. Lord Anson, it should be remembered, in his voyage round the world, lost above 200 men, and at last could not muster

more than six foremast men in a watch fit for duty. At the commencement of our last war with France, on the Fleet returning from sea, it often happened so many men were landed ill of scurvy, that even Haslar Hospital, large as it is, could not contain them, and many were lodged in the chapel, others in tents, while others died in the boats before reaching the shore.

Cause or Conditions under which Scorbutus is Developed.—In the middle ages scurvy prevailed epidemically among the inhabitants of the low countries of Holland, Friesland, Brabant, Pomerania, Lower Saxony, and, indeed, all countries from the 50° to the 60° of north latitude. This has been attributed to the absolute want of winter food for the cattle, so that it was necessary to kill them on the setting in of the frost, and either to salt or dry the flesh. Hence food was deficient, and of improper quality, and hence the large stores of salt provisions found in the larder of the elder Spencer, in the days of Edward II., even so late in the spring as the 3d of May. Six hundred bacons, eighty carcases of beef, and six hundred of sheep, was his abundant supply. In all these countries, however, in proportion as agriculture has advanced, and a succession of green crops enabled the farmer to kill his best and fattest meats in winter, and in proportion, also, as vegetables have been introduced at our tables, together with a liberal use of wine and beer, so has this disease disappeared. The former universal prevalence of scurvy, also, in the Navy, and its almost entire disappearance in the present day, necessarily has reference to a particular cause, the too exclusive use of salt provisions. "In 1797 the victualling of the Navy was changed, greatly improved, and strictly regulated; and, immediately consequent to the change, the health of the seamen improved strikingly. Scurvy, typhoid fever, dysentery, and putrid ulcer, which, up to the period of the change, produced great havoc, became comparatively rare in occurrence and light in impression." Since 1797 the improvements have consisted in giving cocoa instead of gruel for breakfast, issuing salt meats at a much earlier period after being cured, the supply of better articles, and in greater abundance by one-third, and also the substitution of tea in the afternoon instead of spirits; and, with every improvement in these respects, there has been, as a general result, a further improvement in health, till the four forms of disease, at no distant date so destructive, are scarcely known except by name.

It is now, however, completely established that salted meats are not more productive of scurvy than fresh meats. The experience of the Russians in 1720 and 1736; of the French in 1750–60; and of our own regiments at the Cape in 1836, sufficiently establishes this point. With reference to the influence of salted meats, the following statements of Dr. Copland, who has had an extensive field of

observation in various parts of Europe and within the tropics, deserve to be as widely known as possible:—

"Nevertheless, the question remains, are salted meats more favourable to the supervention of scurvy than fresh meats? I believe, after having paid some attention to the matter, that recently salted or uninjured salt meats, if they have been of a good and healthy description, and quite fresh when salted, are not materially more productive of scurvy than fresh meats; but whilst the quality of the latter is generally manifest, that of the former is not always so evident. The salted provisions supplied to ships have frequently been long cured, even before they are received on board, and are so often of the most inferior and unwholesome character, as to account in great measure for the appearance of cachectic maladies in those who live upon them. It was notorious, during Queen Anne's wars, that, owing chiefly to collusion between the heads of the commissariat or others in power and the contractors, and even in more recent times, the salted provisions supplied to the navy and army often consisted not only of long or imperfectly cured meats, but also of the flesh of animals which had died of disease; that horse-flesh was often placed in casks of beef; and that similar villanous acts were not confined to salted provisions, but extended also to the flour and biscuits supplied to these services, both of these having been adulterated, and the latter mouldy and swarming in maggots and weevils. Owing to this cause, as shown by some medical writers of the day, a much greater number of human lives were lost from scurvy, scorbutic dysentery, and putro-adynamic fever—by diseases caused by the unwholesomeness of the provisions—than from all other diseases, and from naval and military actions, sieges, and other causes combined.*

"Not only were both salted and farinaceous provisions frequently deleterious, but the supply also was insufficient to both army and navy, up to the mutiny at the Nore, the causes of which were generally misrepresented by those in power, and misunderstood or glozed over by historians. In times more recent, acts similar to the above have been perpetrated in more places than one. The returns made to the Medical Boards in India by the medical officers, and which are preserved at the India House, are full of complaints as to the unwholesome nature of the provisions supplied to the army in the Burmese war; even the rice having been either unripe or damaged. The remarkable prevalence of scorbutic dysentery, and low fever among the troops in that war, was ascribed chiefly to this cause; the mortality continuing great until more wholesome provisions were procured. But it was not only in the public services—in fleets, armies, and transport vessels—that these enormities were practised; trading vessels, emigrant ships, &c., were sometimes, and are occasionally up to the present day, supplied with the cheaper kinds of Irish provisions, which are frequently of a similar kind to that above described; and to this circumstance in part, and to others about to be noticed, should be ascribed the scurvy and fever so frequently breaking out in ships after their provisions

* Experience shows that the most frequently unwholesome of cured meats is pork, and it is also the most injurious, especially when imperfectly salted or too long kept; and, more particularly, if coarsely fed or diseased, or not cured immediately on being killed, scorbutic or other forms of dysentery generally resulting.

have been used sufficiently long to produce their effects. To the unwholesomeness and nature of the food, and to the state of the water, even independently of the want of fresh vegetables and fruit, the diversity of characters presented by scurvy and fever in ships, armies, prisons, &c., is in great measure to be imputed, as well as the want of success in treating these diseases by the more usual remedies, or by those more generally found efficacious under other circumstances,—the same causes not merely predisposing to these forms of disease, but actually producing them, and giving them their distinctive features.

"Much of the mischief observed in those who had lived long on salt provisions was formerly, and still is, by many imputed to the salt by which these are cured, or at least to the state of the provisions; and by others to the supposition that salted meats are not so nutritious as fresh. But, when these provisions have been from the first wholesome and good, have been salted while quite fresh, and have not been afterwards kept so long as to produce any sensible or unpleasant change, they may then be considered as having had no further share in the production of scurvy, even although it should have appeared during the use of such provisions, than that they have constituted the chief or only food, to the neglect of other articles requisite to correct the effects of so exclusive a diet, such as fresh vegetables and fruits. On this subject, Dr. Budd just remarks, that 'the circumstances showing that scurvy may prevail to a frightful extent among persons living solely on fresh meat; that persons who, from the nature of their occupations, are continually absorbing saline particles, are exempt from scurvy; that scurvy is not brought on by the use of sea-water, which may be drunk with impunity, even by scorbutic people; and that the disease may be prevented for any length of time in persons who subsist on salt provisions, and can be readily cured, even in those who continue the use of them, are sufficient to justify the conclusion, that salt has no share whatever in producing it.' To this statement I would merely add, that the salt conceals, and partly corrects, the sensibly noxious properties of previously tainted, diseased, or otherwise unwholesome meats, and hence meats of this description, when salted, are more readily, and perhaps less injuriously, partaken of, and, moreover, have not the injurious nature made so manifest, or even suspected, as if an attempt to use them in their fresh state were made.

"Next to the state of *meat provisions*, that of *farinaceous food* supplied to ships, armies, &c., as predisposing to, or even as producing scurvy, may be noticed. In various countries in the East, where little or no animal provision is used, scurvy has, nevertheless, appeared, and has been ascribed, with sufficient reason, not so much to deficiency of the amount, as to the unwholesome nature of the food, whether rice, Indian corn, &c., which often have been damaged, unripe, mouldy, or too long kept. The flour, biscuits, and other farinaceous articles, supplied by contract or otherwise to the public services, and to trading vessels, were formerly, on many occasions, similarly damaged and unwholesome, or became so after having been kept for some time; and contributed their share towards the production of scurvy, fevers, and even to visceral disease. That these articles of food have actually been productive of these maladies, was demonstrated by the occurrences in the Burmese war; native Indian regiments subsisting

entirely on rice and other farinaceous articles, which in that war was more or less damaged and unwholesome, having been universally attacked with scurvy and scorbutic dysentery."

Besides the injurious effects of cold and moisture, as well as impure air, combined with the conditions already noticed as tending to produce scurvy, it is now also well known that exposure for a lengthened period to the pernicious influences of a malarious district, greatly aids in developing scorbutus; and it is believed also that there is something in the nature of paludal fevers, and not from the debility alone which attends them, that scorbutus arises. In fact, the observations of Dr. James Johnston show that the scorbutic condition is a form of morbid action actually established by prolonged exposure to paludal influences. By observations especially devoted to this subject, I have determined that amongst our troops during the late war who had been in Bulgaria, there were two and a-half per cent. of admissions for scurvy amongst them more than among those who served in the Crimea only; and that the deaths among them reported from this disease were also greater by three per cent. than among those troops who served in the Crimea.—(*Glasgow Med. Journal*, July, 1857.)

Recent combined researches have shown the scorbutic diseases to have been produced amongst our troops in the Crimea under the following conditions:—(1.) Deficiency of absolute nutriment; (2.) Improper adjudication of the *nutrient* and *respiratory* principles of the *diet*—its monotony; (3.) Bad quality of the diet and improper cooking, or none at all, the absence of a proper supply of fresh meat, and the absence of vegetables; (4.) Exposure to cold, combined with imperfect clothing and labour beyond the strength of the best fed men; (5.) The persistent pernicious influence of residence in a paludal district (Bulgaria).

Treatment.—The early history of navigation, as it records the greatest ravages of scurvy, so does it also record the best antidote to the disease. Of four ships which sailed from England in the beginning of April, 1609, for the establishment of the East India Company, they were all so severely visited by scurvy as to have lost nearly one-fourth of their crews when they arrived at the Cape of Good Hope. The Commodore's ship was not attacked. This immunity arose from three table-spoonfuls of lemon juice having been served daily to each of his men. But notwithstanding this evidence of the success of lemon juice in preventing scurvy, evidence the most conclusive, this valuable remedy and preventive was altogether slighted for a hundred and fifty years afterwards (Copland). Lord Anson's people, in 1740, on reaching the island of Tinian, were recovered principally by eating oranges; and that noble, brave, and experienced commander was so convinced of their usefulness

that, before he left the island, he ordered one man from each mess to lay in a stock for future security. Sir Charles Wager's people, also, were terribly afflicted with scurvy in the Baltic. Sailing, however, in the Mediterranean, and having heard how effectual oranges and lemons were in the cure of this disease, he took on board at Leghorn a large quantity of them, ordered a chest each day to be brought on deck, and allowed the men, besides eating what they chose, to mix the juice with their beer, and also to pelt each other with the rind, so that the deck was strewed with the fragrant liquor. By these means he brought his men home in good health.

In the year 1747, Dr. Lind made some comparative trials between this and some other modes of treatment, as vinegar, vitriol, and tamarinds, on board the "Salisbury," at sea. As a general conclusion from his experiments, he affirms that orange and lemon juice, or more properly, the citric acid obtained from all the species of the botanical genus *citrus*, or the natural order of fruits called *hesperidæ*, are greatly more efficient than any other remedy in the cure of scurvy.

Notwithstanding this strong opinion of Dr. Lind, the Navy continued to suffer severely from the scurvy for half a century, till the Admiralty gave a general order for the supply of lemon juice. This salutary measure was accomplished by a representation from the Medical Board of the Navy, in the year 1795, when Lord Spencer was First Lord of the Admiralty, after a trial made on board the "Suffolk," of seventy-four guns. This ship sailed from England on the 2d of April, 1794, supplied with a quantity of lemon juice sufficient to serve out two-thirds of a liquid ounce daily to every man on board, and this was mixed with their grog, with two ounces of sugar. She arrived at the Madras roads on the 11th September, after a passage of twenty-three weeks and one day, without having had any communication with the land, without losing a man, and having only fifteen on the sick list. Scurvy appeared in a few of the men during the voyage, but disappeared on an increased dose of lemon juice being administered. "Let this fact," says Sir Gilbert Blane, "be contrasted with the state of the channel fleet in 1780, when Admiral Geary's fleet returned into port, after a ten weeks' cruise in the Bay of Biscay, with 2,400 men ill of scurvy; and let the state of this fleet be contrasted with that of the channel fleet in 1800, which, by being duly supplied with lemon juice, kept the sea four months without fresh provisions, and without being affected with scurvy."

In 1780 the number of cases of scurvy received into Haslar Hospital was 1,457; in 1806 *one* only; and in 1807 also *one*. While it is notorious that many medical men have never seen the

disease, it is, as Dr. Budd has assured Dr. Watson, by no means rare in the hospital-ship at Greenwich, which is often full of cases of scurvy; most of the patients so affected having just arrived in *merchant ships* from a long voyage. "Lemon juice," writes Dr. Watson, "is really a specific against scurvy, whether it be employed as a preventive or as a remedy. It supplies something to the blood which is essential to its healthy properties." The potato also seems to be no less efficacious as a remedy and preventive (Budd). This is all we can yet say, however, regarding the actions of either of these means of cure, notwithstanding the researches of the chemists of the present day. Moreover, it is sufficient; and with such remedies at command, the prevalence of scurvy in *merchant vessels* ought not to exist; and if food is sufficient in quantity and the proper adjustment of the nutritive and respiratory materials (nitrogenous and carboniferous) be attended to, the disease ought never to become developed.

It is perhaps hardly fair to attribute the improved health of the Navy entirely to the introduction of a daily allowance of lemon juice, considering that the quantity of the diet was greatly increased and its quality greatly improved contemporaneously with this addition. It is gratifying, however, to see how largely these combined measures have improved the health of the Navy and rewarded the cares of those who superintend it; for, during the nine years preceding these changes, the sick seamen sent to the hospitals were one in 3·9, while in the nine succeeding years the proportion was only one in 8·4; so that not only has scurvy almost disappeared from ships of war and naval hospitals, but the efficiency of the Navy has actually been increased threefold.

Purpura—*The Purples.*

Definition.—*A complex morbid state in which the blood or the capillary vessels throughout the system, or both, are altered, but the nature of the change is as yet not determined. There is evident constitutional disturbance throughout the disease, manifest by disorder of the digestive, the assimilative, and the excretory functions, attended by languor and debility. The capillaries of the mucous and cutaneous surfaces are more especially implicated. Small round spots are visible on various parts of the surface of a dull red or a deep purple colour. These are due to ecchymosis from the cutaneous capillaries beneath the cuticle through which the colour shines. Hæmorrhage from mucous membranes are common, and also extravasations of blood within the substance of the several viscera.*

Pathology.—By some this disease has been considered identical with scurvy, and been named the "*land* scurvy." Others have con-

sidered it simply a disease of the skin, the *purpura simplex* of Willan and Bateman. Authors generally have spoken of the disease under the name of *petechiæ sine febre*, because the spots are not connected with continued fever. The disease is very closely related to *hæmorrhages* as a morbid state on the one hand, and to *scurvy* on the other.

It has not been determined what the nature of the morbid state is which is essential to purpura. In some cases the urine has been observed to contain an excess of albuminous matter, with a deficiency of urea (Combe). The blood has been found deficient in coagulating power. An examination of the blood in two cases of purpura, by Dr. Parkes, of London, showed, that with a somewhat diminished proportion of the solid constituents in general, there was a remarkable increase in that of iron. A peculiar source of danger attends this disease in the occurrence of extravasation of blood into the internal organs. The lungs, the brain, the liver, and the alimentary canal are the most frequently affected. Purple spots and effusions of blood are also to be found on the serous membranes, as in the *arachnoid*, the *pleuræ*, the *pericardium*, the *peritoneum;* and occasionally the blood lies coagulated in the cavities of these membranes. It has also been found in the bladder, and in the calyces and pelvis of the kidney (Craigie).

Instances occur in which blood oozes, or is discharged, more or less copiously, from the mucous membranes without affection of the skin; and to this class of cases, as a form of disease now under consideration, are to be referred those cases of profuse, or fatal hæmorrhage from slight causes, recorded under the name of "*hæmorrhea*," which have been ascribed to a *diathesis* termed the *hæmorhagic*, and which is supposed to be hereditary (*Edin. Med. and Surg. Journal*, vol. xxv.) When the disease is protracted, the patient becomes of a sallow complexion, waxy-coloured, and dingy; anasarcous swellings, gangrenous and bad sores, appear on the feet and legs, general anasarca prevails, and he dies exhausted. Dr. Craigie considers that the appearance of purple spots in such cases is connected with more or less disease of the heart, especially with hypertrophy or dilatation of the ventricles. The following observations by Dr. Watson puts the pathology of purpura in an interesting and practical light:—

"I have adverted to one peculiar source of danger in purpura, the hazard that blood may be effused in some vital organ where even a slight amount of hæmorrhage suffices to extinguish life. Dr. Bateman states that he had seen three instances in which persons were carried off, while affected with purpura, by hæmorrhage into the lungs. During the course of one week, in the year 1825, I was present at two inspections in the dead house of St. Bartholomew's Hospital, illustrative of the same point in respect to

another vital organ, and involving a question in forensic medicine. The subjects of examination were both of them women of middle age, who had been brought into the hospital covered with purple spots, and bruise-like discolorations, and suffering hæmorrhage from the mucous membranes. Each of these women declared that the apparent bruises were marks of beatings received from her husband. One of them became suddenly hemiplegic a little while before she died. Of the manner of dissolution in the other case I am not sure. In both instances a considerable quantity of blood was spread over the surface of the brain, between its membranes: and in one of them blood had been shed also into the cerebral substance, which it had extensively lacerated.

"It may be worth mentioning that in one of these corpses there were indications, either of unusually rapid putrefaction after death, or (what I think more probable) of some degree of decomposition even before life was extinct. This woman died in the evening, and the body was examined next day, twelve or fourteen hours afterwards. A quantity of fetid gas escaped from the cavity of the abdomen as soon as it was opened, and small bubbles of air were seen to ooze from the areolar tissue of various parts of the body. Even when incisions were made into the *liver*, air frothed up, as it might do, under ordinary circumstances, from a section of the lungs."—(*Lectures*, vol. ii., p. 866.)

Symptoms.—Various symptoms, denoting general disorder of the constitution, precede the appearance of the petechiæ generally by some weeks, such as languor which is oppressive, weariness, faintness, and gnawing pains at the pit of the stomach. The appetite is variable, generally weak, but sometimes there is an inordinate craving for food, which when eaten is said to lie with a weight upon the stomach. The tongue is yellowish, and coated with a viscid fur, the countenance is sallow or dingy, or has a bloated, pale appearance, with swelling underneath the eye-lids. The purple spots appear first on the legs, and afterwards, without any certain order, on the thighs, arms, and trunk of the body, and their presence is attended with much weakness of the body and great depression of spirits. No degree of pressure alters the colour of the spots, and they are distinguished from flea-bites by the absence of a central puncture. At first the spots are bright red, but in a day or two they become purple, afterwards brown, and when they are about to disappear they assume a yellowish tint. When the disease continues for a long time, all these varieties of colour may be seen on a patient at the same time.

The pulse is feeble, and generally a good deal quicker than natural. Deep seated pains are felt about the epigastric region, as well as in the chest, loins, or belly. In some instances giddiness and lightness of the head prevail, especially when attempting to move or to stand erect, and there may be even dull pain in some part of the head. Constipation of the bowels, palpitation and irregular

action of the heart, with a tendency to frequent syncope, are the most distressing and dangerous symptoms.

Causes.—They are not well known. It is a disease more common in women than in men ; and in boys before than after puberty. It has appeared as scurvy would under the long use of a poor diet, much sedentary occupation, watching, mental distress, and anxiety. It has also appeared under very opposite conditions; for example, in persons accustomed to the use of nutritious food and free living, but in whom there is reason to believe the digestive functions and the constitutional powers have been impaired by the abuse of wine, spirits, or malt liquors.

Diagnosis.—It is between *Purpura* and *Scurvy*. The following are the principal distinguishing features of each contrasted :—(1.) Scurvy is most common late in the winter or early in the spring ; purpura in the first seasons of summer and autumn. (2.) In scurvy the gums are uniformly soft, sore, spongy, swollen, and hæmorrhagic ; this is no common feature in purpura. (3.) In scurvy tumours of a painful kind form in the extremities, with stiffness or contractions of the joints ; such symptoms do not attend purpura. (4.) Scurvy is marked by extreme debility, and is rendered worse by blood-letting and by mercury, and cured by the administration of lemon juice. Not so with purpura, which often requires blood-letting for its cure, is not benefited by anti-scorbutic remedies, and is sometimes speedily cleared away upon the supervention of mercurial salivation and hypercatharsis (Watson and Wood).

Treatment.—To treat this disease with success it is necessary to ascertain the circumstances under which it becomes developed in each particular case. *Quinine* or *bark*, stimulants, *mineral acids*, *nutritious food*, and *wine*, was the treatment adopted by Cullen, Duncan, and Willan. Subsequently this plan of treatment was questioned by Dr. Parry of Bath, who found that in his cases a full bleeding from the arm was a much more speedy mode of curing the disease. Dr. Harty of Dublin confirmed this principle of treatment, and was successful with liberal doses of purgatives, so as to clear out the intestinal canal completely. Oil of turpentine administered in moderate and repeated doses, has also been recommended.

"Upon the whole, therefore, the treatment of purpura," writes Dr. Craigie, "may be comprised in the following measures. The bowels ought invariably, and without exception, to be first thoroughly and effectually evacuated by means of senna, aloetics, or calomel and jalap. If several effectual doses of either or all of these medicines be not followed by less heat of skin, diminution of the frequency of the pulse, abatement of the internal pains, and a cleaner state of the tongue ; if the spots continue to increase in number and size, and the hæmorrhagic oozings do not

cease;—twelve, fifteen, or twenty ounces of blood, according to age, strength, and other circumstances, must be drawn from the arm, while the patient should abstain from animal food in every form, and should subsist on boiled rice with whey, or the light subacid fruits, as grapes, oranges, strawberries, gooseberries, baked apples, or the like. His drink may consist of tamarind water, or water acidulated with sulphuric acid. Under this plan most cases of the disease will be speedily and readily brought to a favourable termination. If symptoms of local uneasiness continue after the urgent phenomena have disappeared, leeches should be applied in the neighbourhood of the part; and it will be proper to continue the periodical and regular evacuation of the alimentary canal. When the spots have disappeared, and the hæmorrhage has ceased, the constitution recruits rapidly under the gradual but cautious use of light soups, and fresh fruits and vegetables."

Ergotismus—*Ergotism.*

Definition.—*A train of morbid symptoms produced by the slow and cumulative action of a specific poison peculiar to wheat and rye, and which gives rise to convulsions, gangrene of the extremities, and death.*

Pathology.—Ergotism is a disease very little known in this country, but it is not unfrequent that diseased, unripe, or damaged grain of any kind, and especially *rye*, is observed to be injurious to the animal economy. *Wheat*, *rice*, and such like grains, are equally injurious when similarly unsound, and the most frequent form of this unsoundness consists in the development of a fungus upon the grain, to which the name of *ergot* has been given. The morbid state is also said to be produced by poisonous plants, such as the *lolium temulentum* being mingled with the grain.

Symptoms.—The train of symptoms produced by the use of diseased grain, assumes two forms, namely, the spasmodic or the gangrenous. The spasmodic form commences with a sense of tingling or itching in the feet, followed by cardialgia, and similar tingling sensations in the hands and head. Violent contractions of the hands and feet follow, which seem to affect each particular joint, and is said to resemble the pain of a dislocation. The sensations are also sometimes described as that of a bruising kind; and the body is bathed in copious sweats. The symptoms intermit, during intervals of two or three days of a remission at one time. Drowsiness, giddiness, indistinctness of vision, and an irregular gait, are constant phenomena. Coma and epileptic convulsions are also apt to supervene, which generally indicates a fatal result. An enormous appetite accompanies this train of evils. Spots like those of purpura appear on the face, and the disease rarely abates before the third week.

The gangrenous form of ergotism is ushered in by excessive lassitude, more or less protracted and accompanied with fever, the extremities become painful, cold, and rigid, benumbed, and almost insensible, and are with difficulty capable of movement. Severe internal pains of the limbs prevail, greatly aggravated by heat. It extends by degrees from the toes to the legs and thighs, and from the fingers to the arms and shoulders, and sphacelus supervenes. With the exception of slight febrile heat, the constitutional disturbance appears to be slight, and in this respect resembles scurvy.

Treatment.—Considerable differences of opinion prevail regarding the treatment of this *dietic* disease. The cause in the first instance must be ascertained and removed. To obviate the effects it has already produced, the constitutional treatment must be directed to improve the state of the blood. Tonics and stimulants are to be administered. The chlorates of potash and of soda, with antispasmodics, tonics, and narcotics, are especially indicated. Camphor, musk, ammonia, capsicum, may be particularly mentioned; and the strength of the patient is to be supported by light, nourishing, and wholesome food.

Alcoholismus—*Alcoholism.*

The *experimental inquiry* of Dr. John Percy in 1839, illustrating the physiological action of alcohol, an inquiry into the *Physiology of Temperance*, by Dr. Carpenter, and the recent *Pathological Observations on the Bodies of Known Drunkards*, by Dr. Roesch and Dr. Francis Ogston (1855), are contributions which have placed on a more sure foundation our previous theoretical information regarding morbid states which follow the persistent use of alcohol. The term *alcoholism* is used to denote various symptoms of disease attending morbid processes of various kinds which are capable of being traced to the use of stimulants containing alcohol. The immediate effects of *intemperance*, as it is commonly called, the nature of *delirium tremens*, and of *spontaneous combustion*, may be embraced under the general designation of *alcoholism.*

The pernicious effects of alcoholic stimuli in excess on the organs and tissues of the body have been deduced from a careful study of the morbid appearances, of *a chronic kind*, met with in the bodies of individuals known to have lived intemperate lives, and who *had perished suddenly*, from the effects of accident, suicide, or homicide, and while apparently in ordinary health and activity. The extent of such chronic change in the various organs of such individuals are found to have been far in excess of what could have been reasonably looked for in a like number of persons of the same age and of temperate habits, suddenly cut off, while apparently in average health

and vigour. The *cumulative* effects of long continued intemperance have been clearly proved by Dr. Ogston's observations; and the results of his post mortem inspections on the whole, support the conclusions which have been arrived at, on *theoretical grounds*, as to the injurious effects of alcohol in excess. The following statements contain a summary of these results:—(1.) *The nervous centres* present the greatest amount of morbid change, the morbid appearances within the head extending over 92 per cent. of those examined. By this observation the theoretical remarks of Dr. Craigie and Dr. Carpenter are clearly established. (2.) *The changes in respiratory organs* succeed in frequency those of the nervous centres, yielding a per centage of 63·24 of those examined. (3.) *Morbid changes* in the liver are next in order of frequency, and are due to enlargement, granular degeneration, the nutmeg-like congestion, and lastly, the fatty state. (4.) Next to changes in the liver come those in *the heart and large arteries.* (5.) Next are those of the kidneys. (6.) Least frequent of all are morbid changes in the *alimentary canal.*

Two orders of changes may be observed to result from intemperance in the use of alcoholic fluids, namely, one set of long duration, or which at least must have taken some considerable time before they could be completed; another set of shorter duration, and which probably are more closely connected with the immediate symptoms which precede the fatal event.

The abnormal changes in the cranium, the substance of the brain, its convolutions, and cerebral ventricles, all indicate the prolonged action of a morbid poison. The prolonged action of the alcoholic poison on the cranial contents is to produce induration of the cerebral and cerebellar substance in by far the largest number of cases, coincident with an increased amount of subarachnoid serum; and the steatomatous degeneration of the small arteries leads to *atrophy* of the convolutions and *œdema* of the brain.

When spirituous liquors are introduced into the stomach they tend to coagulate, in the first instance, all albuminous articles of food or fluid with which they come in contact; as an irritant they stimulate the glandular secretions from the mucous membrane, and ultimately lead to permanent congestion of the vessels, to spurious melanotic deposit in the mucous tissue, and to thickening of the gastric substance. By the veins and absorbents of the stomach the alcohol mixes with the blood, and immediately acts as a stimulant to all the viscera with which it is brought in contact. The functions of the brain are at once stimulated, and ideas follow in more rapid succession; the liver is excited to secrete an excess of sugar, by the immediate action of the stimulant on its tissue (Drs. Harley and Bernard). The flow of urine is excited in a similar manner, and so on.

In these effects it is impossible not to recognize the operation of an agent most pernicious in its results. The mere coagulation of the albuminous articles of food and fluid is very different from that effected by the gastric fluids, and tends to render the articles more difficult of solution by the gastric juice.

Positive irritation very soon succeeds to the intemperate use of alcohol. It is manifested in a variety of ways; sometimes by an unnaturally voracious appetite; and those who over-indulge in the use of such stimuli subsequently suffer a total disrelish for food; they become unable to eat, and dyspeptic symptoms of various kinds betray the irritable state of the alimentary canal, such as stomach-ache, the frequent generation of gases, waterbrash, heartburn, squeamishness, vomiting, and palpitations. A constipated condition of the intestines, attended with deficiency in the power to expel their contents, is very soon established, and sometimes ascribed to the deficient secretion of bile, which is known not to be secreted in due quantity, and there is every reason to believe, although the fact is not proved, that its quality is deteriorated. Its functional agency on the food and fluids in the intestines is therefore diminished.

If we follow the course of alcoholic absorption through the vascular and pulmonary system, it is found unquestionably to *retard* the motion of the blood, while it produces a temporary increase in the action of the heart, and a congestion of the whole system of the pulmonary capillary vessels. Respiration is thus, in the first instance, rendered from four to six times more frequent per minute than it otherwise is; and various symptoms of accumulation of blood within the chest, and pulmonary congestion especially, is apt to occur. A short tickling cough is a most constant phenomenon. Dr. Craigie remarks, that all the spirit drinkers whom he has ever seen or known have been either subject to chronic cough or dyspnœa, or have laboured under chronic, dry bronchial disorder, with asthma. That the use of spirituous liquors ultimately retards the motion of the blood in the vessels is known by experiments on the lower animals, and by pathological observations.

When mixed with blood out of the body, spirituous liquors cause more or less coagulation, according to their strength and concentration; and when applied to the blood-vessels in the transparent parts of animals, they can be seen to produce the same effects. The congestion that constantly exists in the mucous membranes of the lungs and stomach is evidence of the retarded motion of the blood. The fact that hæmorrhoidal swellings are always aggravated by the use of alcoholic fluids is the result of retarded motion of the blood in the hæmorrhoidal vessels. When death occurs from poisonous doses, either in animals or in man, although the dose is at first followed by increased frequency of the pulse, yet in a short time the pulse

becomes rapid and small, while the extremities become cold, and the power of generating heat is suspended in proportion as the blood progresses slow, and more slowly through the pulmonary capillaries. The effects produced on the medulla oblongata tend to sustain this toxic effect upon the lungs. The brain and the lungs in this respect act and re-act on each other. Death ensues by asphyxia.

In the case of habitual spirit drinkers, there is thus constantly going on a temporary stimulus and quickened motion of the blood through the vessels, especially manifested by cerebral, thoracic, and hæmorrhoidal phenomena, followed by a corresponding depression and tendency to stagnation of the blood in the capillaries of all the internal organs, especially in the membranous tissues and the lax areolar tissue of dependent parts. The most common form of alcoholism is that about to be noticed, namely,

Delirium Tremens.

Definition.—*A delirious affection subsequent to the frequently repeated and irregular use of alcoholic drinks or other stimulants. The delirium is characterized by hallucinations, dread, tremors of the tendons and muscles of the hands and limbs, watchfulness, absence of sleep, great frequency of pulse. A loaded, moist tongue, with a cool, humid, or perspiring surface prevails, and the patient gives forth a peculiar odour, of a saccharo-alcoholic description, more or less strong.*

Pathology.—This disease has only been known and described since the beginning of this century. The essential nature of the affection is associated with the loss of cerebral power in the control of thoughts, emotions, and muscular action, consequent on over excitement by alcoholic stimuli, and sometimes immediately dependent upon the diminution of the degree of excitement to which the brain had been accustomed. Disturbances of function, depression and debility, are the attendant phenomena. The feeble but rapid action of the heart, the tremulous undecided action of the muscles, the terror-stricken and agitated mental state, betoken the depressed state of the living functions. The phosphates in the urine, as determined by Dr. Bence Jones, is diminished, while the proportion of the sulphates and of the urea is greatly increased. The nature of the morbid lesions found in such cases have been already indicated. Alcohol has been found in the serous fluids of the cranium (Percy), and in the urine (Ogston). The disease has been variously named the brain fever of drunkards, dipsomania or delirium tremens, by which latter name it is more frequently known and described in this country.

Symptoms and Course.—The disease is said to become developed

under two sets of circumstances, according as the patient has been continuing his potations, or after he has suddenly abandoned them. There are some who are constantly taking small quantities of spirits, and who, although they never get completely intoxicated, yet sometimes exceed considerably their accustomed allowance, and continue to do so for some time.

The symptoms of delirium tremens generally appear in them from the second to the eighth or ninth day after a protracted debauch, and are by some pathologists divided into three stages. The first stage, according to Dr. Blake, is marked by a peculiar slowness of the pulse, by coldness and clamminess of the hands and feet, by general debility, by nausea and vomiting in the morning, and by frightful dreams at night. Very moderate exertion of body causes the patient to perspire profusely, and anything which suddenly affects his mind throws him into a tremulous agitation. The tongue, also, is tremulous and furred, the hands shake, and he is greatly depressed in spirits, sighs frequently, is anxious about his affairs, and is either restless or watchful. These symptoms last from twenty-four to forty-eight hours.

The second stage commences by a hurried and anxious manner, by great excitability of temper, by a small accelerated pulse ; some heat, perhaps, of the surface of the trunk, but accompanied with the same coldness and clamminess of the extremities. The tongue is sometimes clean, but often brown and dry, and the patient delirious, suffering from various mental illusions and alienations. In general, the delirium is melancholy, and has reference to his usual occupation and habits, or to some difficulty in his domestic affairs. He sometimes sees flames, or hears voices talking to him ; or, as soon as he shuts his eyes, he sees people passing under the bed-clothes. In short, he sees objects and sights in situations in which they are not, and which have no real existence, or betrays the most dreadful alarm at hideous objects which he imagines are threatening him with immediate destruction. Restless and sleepless, he moves his trembling hands horizontally over the bed-clothes, as if seeking for something. In general, he is harmless and easily controlled; but in some instances he is violent, mischievous, and requires to be restrained. This stage generally lasts from three or four days to a week, when the third stage commences by the patient falling into a sound sleep, and gradually recovering, or else a fatal collapse comes on, which finally and shortly closes the scene. Without reference to stages of the disease the following is a general description of its symptoms as given by Dr. Craigie :—

" With this form of delirium there is always associated more or less derangement in several other functions. The patient is generally void of all

appetite, or may even be squeamish, and vomit at intervals. Sometimes he is thirsty, and calls loudly for liquor of various kinds; but often he is indifferent to the sensation of thirst. In several instances great aversion, and even dread, of all food and drink is evinced; and it is impossible to persuade the patient to partake of either. The tongue is at first covered with moist, white, gray, or slate-coloured fur, and when protruded is tremulous. The bowels are constipated, and less sensible than in the state of health to the action of medicine; and when they are emptied artificially, the discharges are very dark coloured,—the first generally consistent, the latter liquid, dark, and offensive. There are generally fullness and distension, and not unfrequently tenderness and pain in the epigastric, umbilical, and right hypochondriac regions; and sometimes the two hypochondriac regions give the patient the sensation as if they were drawn tightly together. The skin is bathed about the head and neck with a clammy, unctuous, cold moisture; but elsewhere, and especially at the feet, it is cold, dry, and imperspirable.

"The pulse varies from 96 to 110 or 120, sometimes 130; and though sometimes small and oppressed, is often full, voluminous, and throbbing. The carotid and temporal arteries beat most violently; those of the wrist less forcibly; and the anterior and posterior tibial arteries pulsate feebly enough. The action of the heart is in general unusually violent, and the cardiac beat is diffused over the whole chest. The respiration is occasionally panting and irregular, but not necessarily otherwise morbid.

"At the same time the restlessness is extreme. The patient is in constant agitation of mind and body; speaks almost incessantly, yet seldom adheres above a minute to one subject, and is constantly changing place, and looking for some new object. He cannot sleep, and dreads to be left alone, from the apprehension of the spectral visitations. With this restlessness, the upper extremities, and especially the hands, are in constant tremulous motion, such that they cannot be kept for two seconds in the same position, nor can the pulse, in many cases, be accurately numbered at the wrist. Though this tremulous motion of the arms, wrists, and hands is very general, it is not constant; and instances of the mental disorder, agitation, spectral illusions, and sleeplessness have been observed to take place without any tremors in the hands. Tremors are very rarely, almost never, seen in the young or middle-aged to any very great extent, or those whose muscular motions are not otherwise unsteady; and are seldom well marked in first attacks of the disease. They are principally observed in the cases of confirmed dram-drinkers, whose motions are always unsteady in the morning and early part of the day, until they take a certain proportion of their habitual stimulus."

After symptoms of restlessness and sleeplessness have continued for three or four days, the patient may either fall into a sound unbroken slumber, which lasts for some hours, and proves a crisis, or on the other hand, the symptoms may pass into a state of *coma vigil*, with constant muttering delirium, *subsultus tendinum*, and picking of the bed-clothes, the pupils become contracted, the muscles of the face and jaw are moved incessantly, and death may ensue from prolonged coma or convulsions. The duration of the

disease varies from three, four, or seven days, and a favourable or fatal termination may be looked for in from three to five days.

Diagnosis.—Delirium tremens is to be distinguished from typhus fever, and from paralysis agitans by the previous history of the case.

Prognosis.—It is hardly determined what is the proportion of recoveries to deaths, but unquestionably three persons out of four do well. A paper in *The Indian Annals of Medical Science* for 1855, by Dr. Macpherson, notices the great discrepancy in the statistics of writers on delirium tremens, with regard both to its frequency in both sexes, and to the mortality of the disease. He attributes this chiefly to a want of due classification—ebrietas or drunkenness being returned as delirium tremens. Calmeil states the rate of mortality at 5 per cent., Bougard at 19 per cent. The most accurate records to be got are those regarding the British troops at different stations. Sir Alexander Tulloch, in his report for 1853, gives the following per centages of mortality among them:—

Great Britain, infantry,	17·6
,, cavalry,	13·8
Bermuda,	15·
Canada,	7·94
Gibraltar,	13·6
Malta,	8·8
Nova Scotia,	9·1

A return of admissions and deaths from delirium tremens and ebrietas in the General Hospital in Calcutta, from 1848 to 1852, and another of admissions and deaths from the same causes in the Medical College Hospital, during 1851, 1852, and 1853, gives some important results as follows:—

That delirium tremens occurs in women and men in the proportion of one to twenty-five; but that this difference is due to the difference of habits rather than of sex.

That in regard to age, the ratio is as follows:—

	Cases.	Deaths.	Per cent. of deaths.
Ages from 20 to 25	34	4	9·1
,, 25 to 30	66	16	24·2
,, 30 to 35	48	11	22·9
,, 35 to 40	76	7	9·2
,, 40 to 45	62	6	9·6
,, 45 to 50	23	4	17·3
,, 50 to 60	7	0	
,, 60 to 65	5	1	

The greatest mortality is between the ages of twenty-five to forty, which is confirmed by the analysis of another series of sixty-four fatal cases. The per centage shows that there is no uniformity in the proportion of deaths to the number of cases.

There is no evidence to show that the season of the year exerts a definite influence on the occurrence of the disease, whereas the mortality very palpably varies with the temperature—it being more than double in the eight hot, than in the four cold months.

The apparent cause of death was as follows:—

No. of cases.	
33	By exhaustion (often with coma).
18	By coma.
11	By fits (sometimes apoplectic, called sometimes epileptic).
1	Died on nightstool.
1	Found dead in bed.

Convulsions occurred in at least twenty of the above cases. One distinct case of paroxysmal opisthotonos occurred in a musician, who, during the intervals was able to sit up and whistle tunes.

Treatment.—From the nature of the disease as now described, as well as from the dire results of experience, it is now clearly established that the most fatal error which can be committed in the treatment of delirium tremens is to bleed the patient.

The rule of treatment is by opiates and stimuli. In mild cases, when the tongue is *white*, many recover under the use of *camphor mixture*, with the *spiritus ætheris nitrosi*, combined with *hyoscyamus* or *opium*, given in doses every four hours. In severe cases, when the tongue is either clean or brown, one or two grains of morphine or of opium, given every two hours till sleep is obtained, has entirely cured the patient. It is, generally, however, necessary to support the patient for some days after by camphor mixture, and by a small portion of wine and water, or brandy and water.

The strength must be supported by *ale*, *porter*, *spirits*, or *wine;* and where sudden prostration supervenes, from two to four fluid drachms of *sulphuric ether* should be repeated frequently at short intervals.

Moderate doses of *antimonial wine*, combined with *solution of the muriate of morphia*, is a favourite and a successful remedy with many practitioners in Scotland, in the proportion of a quarter to half a grain of antimony with half a grain of opium every two hours.

Blistering the scalp is recommended in obstinate cases of sleeplessness which resist the usual remedies, or when convulsions supervene; and to obviate spectral illusions, the *extract of belladonna*, as a local application, has been used with advantage when the pupil is contracted.

Diet of the most nutritious kind in a fluid and mild form, such as yolk of egg, soups, and the like, should be given in small quantities and often.

Order 4. Parasitic Diseases—*Parasitici.*

Since the beginning of the present century, when Rudolphi published his systematic work on the entozoa, almost every year has contributed new and important facts, which render this order of diseases one of increasing interest to the pathologist and the physician. Amongst the original observers and experimentalists who have worked so successfully in this field of labour since Rudolphi (1808) and Bremser (1818), the names of Eschricht, Nordmann, Dujardin, Van Beneden, Blanchard, Robin, Von Siebold, Küchenmeister, and Krœmar, stand prominently forward. There are also physiologists and physicians in this country who have been no less accurate observers, although their works have been of a less comprehensive kind. Among those are to be noticed the observations of Drs. Barker, Briston, Henry Nelson, Gull, and Jenner, Mr. Busk, and Mr. Rainy, together with the isolated records of some members of our army medical department of their experience abroad.

The conjoint researches of these extensive workers, have found most philosophical expositors in this country in Dr. E. A. Parkes, of London University (*Brit. and For. Med. Review*, 1853), Professor Allen Thomson, of Glasgow University (*Glasgow Med. Journal*, No. X., July, 1855), and lastly, an anonymous reviewer in the *Brit. and For. Med.-Chir. Review* for 1857. From these latter sources the following statements are compiled relative to the parasitic order of diseases.

The *parasitic* order of diseases are so called from the fact that a great variety of morbid states and symptoms of organic disorder in various parts of the human body are brought about by the presence of *animals* or *plants* which have found a name and a place to live in, or upon, some tissue, organ, or surface of the body of man and other animals. This order of diseases may also be considered as due on the one hand to the existence of parasites from the *animal* kingdom, or, on the other hand, to parasites from the *vegetable* kingdom, and which live either upon some surface of the body or within the substance of some of its tissues or organs.

From the animal kingdom we have the *entozoa* and the *epizoa*, and from the vegetable kingdom the parasitic diseases are due to *epiphytes* and *entophytes*. Each parasite possesses an independent life of its own; and while every species of animal has its own peculiar parasites, the tendency of recent observations shows that through our food, or otherwise, parasites pass from one animal into another, and so into the human body. They seem also to undergo changes of progressive development in each of the new localities where they find quarters and nourishment. The physician cannot now rest contented with a mere knowledge of the appear-

ance of those animals or plants which inhabit man, and of the symptoms to which they give rise. It behoves him now to study the development and modes of generation peculiar to all parasites —their mode of life, forms, and appearance, while they inhabit those animals which are used as the food of man—in fish, flesh, or fowl.

Helminthoid Entozoa—*Worms.*

Parasites of animal organization exist in man and animals in every grade of development. Those which merit special notice here belong to the helminthoid class, and which give rise to various forms of parasitic diseases, popularly known under the name of "*worms.*"

There are three principal groups of animals which belong to this class, and their affinity is evinced by the close analogy of structure subsisting among them. A fourth class has hitherto been described, but it is now rendered almost certain that the individuals which compose this class are incomplete animals, aberrant forms, or even morbid alterations of the earlier stages, or larvæ of different species of *tænia*, and accordingly they are classed in the following table under the *cestoid* family of entozoa.

The Helminthoid class of entozoa comprehends the three following families :—

1. Cestoidea—*banded, girdled,* or *tape-worms* in the form of (1.) mature sexual parasites; (2.) immature, non-sexual, cystic, or vesicular parasites.
2. Nematoidea—round worms.
3. Trematoidea—fluke-like worms.

I. Of the Cestoid, or tape-worms, there are—

(1.) Four principal kinds which are mature sexual parasites :—

a. The *tænia solium,* or solitary tape-worm of man, identical with *tænia serrata* of the dog.

b. The *bothriocephalus latus,* or broad tape-worm, endemic to the human subject in some localities only.

Of both of these kinds there are varieties peculiar to certain mammalia.

c. The *rynchobothrius,* common in fishes.

d. The *ligula,* or undivided *tape-worm,* common, in an imperfect state, in fishes and waterfowl, or other vertebratæ which feed on fishes.

(2.) There are three forms which are non-sexual, immature, cystic, or vesicular parasites, and which are embryotic tape-worms, namely :—

a. The *cysticercus*—a single head united by a neck to a vesicle.

b. The *coenurus*—heads numerous on the exterior of a common vesicle.

c. The *echinococcus*—heads numerous, projecting from the interior of a common vesicle, which separate from it, and afterwards remain alive, suspended in the fluid of the vesicle.

II. Of the Nematoid, or round worms, eight varieties have been found in man :—

a. Ascarides.
b. Filaria medinensis, or Guinea worm.
c. Filaria occuli.
d. Filaria bronchialis.
e. Tricocephalus dispar.
f. Trichina spiralis.
g. Strongylus gigans.
h. Ancyclostomum duodenale.

III. Of the Trematoid entozoa five species of distoma have been observed :—

a. Distoma hepaticum, D. lanceolatum, D. heterophyes, D. hæmatobium, and *D. ophthalmobium.*

It is now very clearly established,—

(1.) That all the parasitic entozoa are produced, more or less directly, from fecundated ova.

(2.) That the entozoa migrate from the body of one animal to that of another, or from one part of the same animal to another cavity or viscus in it. Such migrations are required for the introduction of the entozoa or their ova into the animals they inhabit ; and to enable them to find a place where they may undergo those series of changes by which they reach maturity.

(3.) That the entozoa of several genera or species previously supposed to constitute distinct animals are now shown to be only the early or transitory states of those which reach maturity in other forms.

(4.) That the ova or young of the entozoa are introduced into their parasitic habitations from without is proved by the contagious nature of helminthiasis ; its occasional epidemic and endemic prevalence especially, as shown by the restriction of some forms of entozoa to certain districts of country ; also by the discovery of imperfect or larva forms in the blood-vessels and other parts of the organs of animals inhabited by the mature entozoa (ESCHRICHT).

But to understand the origin and entrance of these creatures into the bodies of man and animals, it is necessary to understand their modes of reproduction, and observe the varied metamorphoses of their individual forms, and also their transmigrations from one individual into another.

"It appears necessary, in the first place," writes Professor Allen Thomson, "to point out the distinction between those entozoa which are known to be sexually complete, and a number of parasitical productions which have long been regarded as distinct animals, but which are destitute of sexual organs. All the sexually mature entozoa are known to inhabit either the alimentary canal of animals, or the cavities of the lungs, or some other parts in immediate or free communication with the external air; or, if only parasitical during the earlier period of their existence, they are ascertained to leave the body of the animal they have previously inhabited and attain to maturity in the free state. The non-sexual entozoa, on the other hand, while parasitic, all live enclosed in cysts, situated either in the parenchyma of organs, or in close internal cavities, within secreting tubes, blood-vessels, &c. Now these last, or the non-sexual parasites, are all proved to be incomplete animals; that is, the embryos, larvæ, or earlier forms of entozoa, which attain to sexual maturity by migration from the place of their earlier abode, in some instances into the alimentary canal, pulmonary, or other open cavities of the same animal, but more frequently into those of different animals. In other cases, as already indicated, the larval entozoa leave their parasitic abode, and are developed to a state of maturity in the free or non-parasitic state, that is, in water, in earth, upon moist plants, or in other favourable conditions.

"The cystic or vesicular entozoa, established by Rudolphi as a separate order of this class, belong entirely to the division of incomplete or larva forms, and some of them may probably be regarded rather as pathologically altered conditions of these organisms. But it has now been shown that many, and probably all, of these owe their origin to ova produced by entozoa sexually mature, which ova are capable of being developed, in some cases directly, in others only by passing through the cystic or some other transitory stages, into the complete or sexual entozoa.

"The cystic or vesicular entozoa are, therefore, to be looked upon only as incomplete forms of other entozoa, which have had, or must hereafter have, their places assigned to them in zoological classification; and the order 'Cystica' should no longer have a place in this class.

"It would also be proper to distinguish, in a more accurate manner than has been previously done, between the cystic worms of a vesicular form, or what may more strictly be called the vesicular entozoa, and those which, without having themselves the vesicular form, are enclosed in a cyst, and which ought to be termed the encysted entozoa; as it appears that many kinds of entozoa, round worms as well as others, are capable, in certain circumstances, of assuming the encysted condition; and it is important to remark, that in scarcely any instance has the encysted entozoon been known to attain to sexual perfection, whatever its kind, and however full its growth may otherwise appear, so long as it remains within the cyst.

"It appears, therefore, that all entozoa, however various their forms in intermediate stages of existence, come at last to acquire sexual organs, and exercise the function of sexual reproduction when they have arrived at maturity. The number of fecundated ova which most of them produce is enormous; in a tape-worm, or ascaris, there are many millions. The process of fecundation, and the development of the embryo from the ovum, have

been carefully observed in a considerable number of these animals. It is a remarkable fact, however, that the development of the ova rarely takes place in the same animal, or in the same part of an animal, in which the parasitic entozoon has passed its life, and has exercised the generative function: there is either migration from the parasitic to the free condition for a time, or from one animal to another, the free condition sometimes intervening, or the change of place may be from one part to another of the same animal. Some entozoa, known only as incomplete or immature animals in the parasitic mode of life, attain sexual maturity in the free state; others, perhaps a greater number, after living free for a time, become sexually complete in the parasitic condition; this is probably the case in the common ascaris.

"The migrations, or changes of habitation of the entozoa, or their ova or embryos, appear to take place in a variety of ways: first, by their being passed out of the body of the inhabited animal with the fæces or other excretions; second, by their being introduced into the bodies of inhabited animals with their food or drink; third, by their directly piercing the integument or other tissues; fourth, by their piercing the membranes and parenchyma, entering the blood-vessels, being distributed through them, and subsequently piercing their coats to attain other situations.

"It is also important to notice that there is the greatest difference in the degree of complication of the process of formation among the different kinds of entozoa. Some of them are directly developed from their ova, without undergoing more remarkable changes than those which are known in many other animals usually to accompany the process of embryonic evolution. Other entozoa are subject to individual metamorphoses, or the embryo passes through successive stages of development of so remarkable a character, as to mask the regular sequence of the phenomena of progressive formation. There are others of the entozoa which are subject to still greater changes in the progress of their existence, changes upon which great light has recently been thrown in other animals as well as in the entozoa, by the remarkable researches of Steenstrup and others, in regard to what has been called alternate generation or metagenesis. Thus some of the entozoa undergo that peculiar form of multiplication by a non-sexual process, in which the immediate progeny of development from the ovum is dissimilar from the parent, but produces, without the aid of sexual organs, another progeny, which either itself, or by repetition of an analogous process, returns to the parental form. This is a process of the nature of an internal or external gemmation, which is often attended with a prodigious multiplication of the number of individuals. In some entozoa, again, metamorphosis and metagenesis are combined. It is obvious that the external conditions necessary to maintain these varieties of the vital states must be different."—(*Glas. Med. Journal*, l. c.)

CESTOIDEA—*Tape-worms.*

The first three families of the *tape-worm* class, mentioned in the previous table, are all more or less jointed in their mature state; and each joint is of hermaphrodite structure, or contains at once

male and female reproductive organs and produces fecundated ova. The *tænia lata* and *tænia solium* are found in the human subject. The *ligula* also is hermaphrodite, and its reproductive organs are repeated in several sets along the body, but without manifest division into segments. It is only in the alimentary canal of man and other animals that the tape-worms, or cestoid entozoa, attain to sexual maturity ; and in all of them the ova are fecundated before being discharged, and may often in the common tænia be perceived to have undergone the first stage of their development before they are excluded from the oviduct of the mature segment. In the common tape-worm, while the head continues to adhere by its circles of hooklets and oscula to the mucous membrane of the intestine, the last, or caudal joints, when they have arrived at sexual maturity, are separated one by one, or in numbers together, and new joints are, at the same time, gradually formed behind the head. The mature joints of the adult tape-worm seem, in some species, to undergo a disintegration within the intestine of the animal they inhabit. Thus Küchenmeister, on one occasion, found the wall of the large intestine of a dog occupied by a white sandy powder, the particles of which, on examination under the microscope, turned out to be innumerable ova of a *tænia serrata* higher up the bowel accompanied by separated joints of the animal.

Nay, it has been recently ascertained still more clearly, that in one or two instances the presence of *cysticercus cellulosæ* (a species of embryo tape-worm), has been found to co-exist with the previous prolonged existence of a *tænia solium* in the intestinal canal of the human subject. Such a contingency is not unlikely to happen when the matured joints are retained by constipation, or otherwise, in the rectum, and constitutes one of the most serious dangers which the mature parasite inflicts on the animal it inhabits, and one of the strongest indications for its removal. In the majority of instances, however, the matured joints (*proglottides*) of the *tape-worm* are discharged from the body either singly or in numbers, still retaining an active vitality for a considerable time. One may readily observe such phenomena displayed by these *beauties of nature* as they disport themselves on the excrement of almost every constipated dog. The expelled joints become violently contracted shortly after their expulsion, as if the stimulus of physical climate in their new situation provoked their contortions. The long single joints thus expelled become still more elongated by contractions of their transverse fibres, and alternate contractions of these fibres with the longitudinal ones, causes shortening of the joint to such an extent that its breadth exceeds its length. Such a sequence of contractions produces movements which simulate those of progression in a worm, and thus they may be seen to move some little distance from the spot on

which they may have first fallen, discharging ova during their march from the interior of the segment.

The structure of these ova are peculiar; and the provisions possessed by their coverings for preserving the embryo are important points for consideration, in connection with their transmissions through apparently impossible conditions into the bodies of animals where they are to become further developed; and in connection with their powers of resistance to therapeutic agents (which have been called anthelmintics or vermifuges) administered for their removal.

It is only in their earlier stages of development that they are really the analogues of ordinary ova. In the blind extremities of the oviducts of the mature joint of the tape-worm the shells of the ova appear to be composed of a calcareous transparent substance; and by the time the ova reach the central segments of the tube their hitherto transparent calcareous shell becomes not only much thickened but is converted into a dark yellow or brown mass, in the interior of which the embryo is formed, at first of the simplest structure and most minute, being only about $\frac{1}{700}$th part of an inch in size. The admixture of these organic elements with the calcareous shell, imparts to it that extraordinary power of resistance to chemical, and even mechanical violence, which it certainly possesses. Dilute acids and alkalies have little immediate effect on this leathery husk, and even after hours of immersion in them, scarcely more than a slight swelling and transparency is produced upon the shell. It is, therefore, no matter of surprise that after months of exposure to warmth and moisture, or to cold and dry air, the pulpy, putrid, or dried up mature segments of *tape-worms* should yield ova which show no sign of any approach to degeneration or decay.

A more or less speedy death of the expelled segments is followed by their putrefaction, hastened, it may be, by warmth and moisture. The eggs, in their interior, are then set free to be carried by winds, waters, or other agents, wherever accident may determine,—to be applied to the soil in a decomposed form, or to be consumed as food by various of the minute invertebrata that throng the surface of the earth and the waters. The more fortunate minority of these eggs, after many and long wanderings of this passive nature, may be at length engulphed by some unconscious animal with its food, to attain within its alimentary canal or substance of another viscus a second and more perfect form of development. The tendency of all observation and experiment now shows that the development of tape-worms requires a parasitic residence in more than one state in different animals; the migrations, therefore, by which they reach situations favourable for their evolution are of

two different kinds—a *passive* and an *active* migration—and in some instances a combination of both. The *passive migration* is accomplished with the food, from the larval or earlier condition, to the alimentary canal of the animal in which full maturity is attained. Another kind of migration of an *active* kind is that performed by the very small embryos into the body, close cavities, or solid substance of the first hospitable recipient who receives this unwelcome guest, and thus maintains him in an encysted condition after he has executed these active migrations from one part of his body to another.

The development of a *tape-worm* is attended with most remarkable metamorphoses. A small embryo of the most simple structure is the result of the first change in the fecundated ovum. This embryo consists of little more than a highly contractile vesicle of the same size as the yolk of the ovum, on one side of which are placed three pairs of hooklets, one pair looking forward, and the other two pairs placed so that a pair is towards opposite sides of the circular embryo, or at right angles to the anterior pair. This stage of development is not attended with any change in the shape or size of the original ovum case; but when the thick wall bursts (which may perhaps be accelerated by the action of the hooklets), the hitherto enclosed embryo is set free. In scientific nomenclature it is now called a *proscolex*.

Impelled, it may be by instinct, to commence life on its own account, this embryo tape-worm (*proscolex*) begins an active migration. It has been seen to gain a passage through membranes, walls of vessels, and solid textures of animals, so as to reach the locality where it is to become encysted and so spend another phase of its existence. It makes its way by the agency of its hooklets. It pierces the first portion of its path by bringing close together the three pairs of its hooklets so as to form a kind of wedge-shaped stiletto. The lateral pairs of hooklets are now bent backwards to their rectangular position, and so thrust the embryo forwards in the direction in which the anterior pair of hooklets are pointed; and in like manner repeated actions of the hooklets effect progression. The action appears to be like that of the arms and the head of a swimmer. Previous to, or during this journey, this embryo tape-worm (*proscolex*) undergoes the second stage of its development. From a determinate part of its substance, a head with a proboscis, a circle of hooklets and four oscula, precisely like those of a *Cysticercus*, *Echinococcus*, or a *Tænia* begin to grow. In scientific nomenclature the tape-worm embryo, when thus far completed, is called a *scolex*, and it becomes enclosed in a cyst in the substance of the viscus, whither its migrations have carried it.

The third stage of its development consists in the formation of

segments, which are first seen in the form of marks, like girdles, which surround that portion of the entozoon next to its oscula and hooklets, and which terminate in a caudal vesicle. It is now an incomplete segmented *Tænia*, and in scientific nomenclature is called a *strobila;* and the development to this stage may occur while the entozoon is still within the closed cyst which has formed round it.

It is only in the alimentary canal of animals that the last and perfect stage of development is attained by the tape-worm reaching sexual maturity. The joints marked off by the bands and girdles in the encysted *strobila embryo* become mature segments by the development of sexual organs within them. This only takes place after the *strobila embryo* has passed into the alimentary canal of an animal which can afford it a place to live and spend the rest of its days as a fixture attached by its hooks to the mucous membrane. The human alimentary canal is the chosen place of the *Tænia lata* and *Tænia solium.* Here the tape-worm forms complete sexual segments or joints, each being hermaphrodite and tending to separate. Each separated mature segment is called in scientific nomenclature a *proglottis.*

After living for some time in this prolific condition, and having produced often a very large number of joints, and an enormous quantity of ova, the existence of this troublesome parasite is terminated by the separation of the animal from its attachment to the intestinal membrane. When this separation occurs spontaneously, it may be that the circlet of hooklets are shed periodically, or that being lost they are not renewed, and the prolonged life and romantic vicissitudes of a tape-worm may be thus brought to a natural termination. The whole length of the beast is now ignominiously expelled, and some reputed vermifuge, however innocent, may get the credit of its death, and the apparent success of such parasiticides is recorded and measured by yards of tape-worms. These are sometimes ingeniously bottled by worm-doctors and charletans, and duly advertised to have been passed by John Smith or Sarah Brown after being dosed with the "infallible" remedy.

The length of the tape-worm in the human body has been known to exceed thirty feet, and there are grounds for believing that the *Tænia solium* may attain to this size in the human intestine in about three or four months. The head is of very minute size compared with the perfect segments which are passed off from the body, and is at the anterior smaller end of the parasite. It is about the size of the head of a small common pin. It is provided with four lateral suckers, and in the centre of the most anterior part of the head a double row of hooks may be observed, and a single row is sometimes only visible, the animal having the power to retract them more or less by a

proboscis-like structure round which they are arranged, and which contains the minute opening of the mouth. Immediately behind the head, the anterior newly formed and growing segments are represented by transverse rings, bands, or girdles, gradually becoming quadrilateral as they depart from the head. The segments increase in length as they become mature towards the posterior end of the worm and then they appear to overlap each other. On each of these mature segments the orifices of the generative canals may be seen opening on the sides of each successive joint. These openings seem to alternate on opposite sides of the joints, not always regularly. Two openings may be on the corresponding margin of two successive joints, and the next joint above or below may have the opening on the opposite margin.

In the *Tænia lata*, these openings are in the middle of the flat (ventral) surface of the segments, an arrangement which constitutes a chief distinction between it and the *Tænia solium*. The head of the *Tænia lata*, or *Bothriocephalus*, is also peculiar. It is of an elongated form, compressed, with an anterior obtuse prominence into which the mouth opens; an opaque tract extending from the mouth separates two lateral transparent parts which are supposed to be depressions. There are no traces of joints till about three inches from the head. The first, or *Tænia solium*, is more frequently found in the inhabitants of Britain, Holland, Germany, Egypt, the Levant, the Island of Java, America, and Africa. The *Tænia lata* belongs peculiarly to the inhabitants of Russia, Lapland, Finland, Poland, Switzerland, Eastern Prussia, Middle and Southern France, and probably Abyssinia.

From what has been stated it is not to be inferred that active migration, by means of certain special organs, namely, the hooklets, is the sole means by which the embryo tæniæ traverse the animal body. Their active migration may be aided by one of a passive but rapid kind. It is apparent that, by an active migration, the tænia embryo, in its *proscolex* state, may penetrate a mesenteric vein. It will then at once be swept away by the rapid current of blood to the portal vein, and so enter the minute ramifications of the portal system where it may find a resting-place. Leuckhart has found the embryos of cestoid worms in the blood in such large numbers that he inclines to regard the currents of the blood in the vessels as the ordinary channel of their migration, and as a probable explanation of the wide diffusion of *tape-worm* embryos in the form of cysticerci or echinococci in various stages of development throughout different viscera of the body.

The localities, where intermediate stages of life are passed by *embryo tape-worms*, appear to vary much with the different species of tænia. The embryo of one species of tape-worm, for example,

chooses the liver, where, by an alternation of generation it is converted into a cyst from the interior of which are developed the heads, hooklets, and oscula (scolex), of the future tænia.

"The *Cysticercus* and *Cœnurus* are now known to be embryo tape-worms, and appear to represent a stage of development that necessarily implies the growth of new embryos within and from the original one. In the animal inhabited by the *Cysticercus cellulosæ*, the muscles, the areolar tissue, the brain, or the eye, are occupied by a variable number of larvæ thus produced from the embryos of the *Tænia solium*. The *Cœnurus cerebralis* that so frequently inhabits the brain of the sheep, is similarly produced from the embryo of a *Tænia cœnurus;* with the difference, that instead of the embryo enlarging after the shedding of its hooks, and developing a single scolex from a granular thickening of its interior, it produces a number of scolices, about 800 or more.

"The larvæ thus formed only complete their development into their corresponding species of tænia on being introduced into the alimentary canal of another animal. And as some of them—such as the cysticercus —occupy situations in which they are not necessarily fatal, a vast majority never experience this development at all, but degenerate and decay in the animal they inhabit, on reaching the term of their existence."

Thus many pass their whole life as encysted parasites, and a few even acquire the jointed form or become partially divided into segments while still within their closed cysts. A well known example of this is afforded by the *Cysticercus fasiolaris,* which inhabits cysts in the liver of the rat and mouse, and has been the means of leading Von Siebold and Dr. Henry Nelson (independent of each other's observations), to the discovery of the remarkable relation now proved to exist between the *cystic* or *vesicular entozoa,* and the *cestoidea* or *tape-worms.* These observers found the cystic entozoa in the liver of the mouse and rat in every stage of development, from the simplest vesicular form of the true cysticercus to that which, from the number of the joints and their external form, has all the appearance of a true tape-worm, and from which, in fact, it only differs in the absence of sexual organs within the segments. A careful comparison of the form of the head, its circle of hooklets, the four oscula or suckers, and other parts in the *Cysticercus* of the rat or mouse with those of the *Tænia Crassicollis* which inhabits the intestine of the cat, has shown an exact resemblance between them. Dr. Allen Thomson has repeated and confirmed these observations (Art. Ovum, *Cyclopædia of Anatomy*). The conclusion such observations lead to, is now generally regarded as established, namely, that the cat receives its *Tæniæ Crassicollis* with the flesh of the mouse or rat which it may have eaten.

The immature non-sexual cystic, or vesicular entozoa, all inhabit the closed cavities of animals, or they are enclosed in cysts in the more solid parenchyma of their organs. They are represented by

the *scolices* or second stage of the *tape-worm* embryo, and consist of a tænia head, provided with the same circle of hooklets and four oscula, and this head is united by a neck to a vesicular body of variable size. Not only does each kind of tænia have its own definite cystic vesicular embryo, but there are tæniæ which have definite *Cysticerci*, *Cœnuri*, and *Echinococci;* and all of them are capable of being developed or reared into tæniæ when transferred into the alimentary canal of a suitable animal. It appears, also, that the tæniæ thus produced from several recognized species of *Cysticerci* and from the *Cœnurus cerebralis* are identical, but that from the *Echinococcus* a different *Tænia* is developed. Experiments of a converse kind were attended with no less successful results,—that is, the formation of *Cœnurus*, *Cysticercus*, and *Echinococcus*, takes place in animals in consequence of their being fed with the segments of tape-worms containing the ripe ova.

The experimental proof of these statements it is the principal scientific merit of Dr. Küchenmeister to have established, by experiments which date so far back as 1851; and they have since been repeated and confirmed by other observers, and especially by Von Siebold and Dr. Henry Nelson.

The experiments of Dr. Küchenmeister have been made on a variety of animals, and in one instance on the human body. The following is a short summary of his observations, together with those of Von Siebold and others, as related by Dr. Allen Thomson (*Glasgow Medical Journal*, No. X., July, 1855); and which demonstrates the

Relation between the Cystic and the Cestoid Entozoa.—"These experiments all consist more or less in observing the effects of feeding an animal which it is designed to affect with the entozoa, with their ova or larvæ. The first experiment of this kind with which I am acquainted was performed by Dr. Küchenmeister of Littau, in 1851, who, having caused young dogs to eat with their food a number of the *Cysticercus pisiformis* of the rabbit and hare, found that after some weeks these were converted, in the intestine of the dogs, into the *Tænia serrata*. Similar experiments were subsequently performed by Lewald, under Von Siebold's direction, and later they were repeated by Van Beneden, and by Küchenmeister himself, with the same result.

"The following is a short notice of the most important of the experiments devised and performed by Von Siebold, as described by him in his Essay on tape-worms:—

"*First Series.*—Ten young dogs were fed with the *Cysticercus pisiformis* from the rabbit, and being killed and opened at different successive periods afterwards, the gradual progress of the conversion of the *Cysticerci* into *Tæniæ* was carefully observed in their intestines. It appeared that, by the action of the gastric fluid in digestion, first the cyst and then the caudal vesicle of the *Cysticercus* were dissolved in the dog's stomach; but the head and neck, resisting entirely the solvent action, passed into the

duodenum. Here they soon became attached to the mucous membrane; and after a short interval of only two or three days, they were seen to enlarge, the head and neck undergoing little change, but the body elongating, and very soon the transverse grooves appearing, which afterwards become more marked, and divide the body into its segments. In less than two months these *Tæniæ* had attained a length of ten and twelve inches, and in three months they were from twenty to thirty inches long, and the reproductive organs were fully developed in the last or caudal joints, which now began to separate as the *proglottides*.

"The most common tape-worm of the domestic dog is the *Tænia cucumerina*, with oval-shaped segments; it is only when it has access to the rabbit or hare as food that it acquires the *Tænia serrata*, with angular segments, and accordingly this last more frequently affects hunting dogs. Von Siebold ascertained that in other young dogs in the same circumstances, but which had not received any *Cysticerci*, no *Tænia serrata* was found, and it was fair to conclude, therefore, that the embryos of the *Tæniæ* had, in the first set, proceeded from the *Cysticercus*.

"*Second Series.*—These experiments were made by feeding young dogs with the *Cysticercus tenuicollis*, which is common in domestic cattle, and of which the vesicle often attains a large size. Having found that the vesicle was invariably destroyed by digestion, V. Siebold contented himself thereafter with giving the heads only, or *scolices*, to the dogs, removing artificially the vesicle. Six young dogs were the subjects of this experiment, which was conducted in a manner similar to the first, and with the same result of the formation of tape-worms, which reached their full development in forty-eight days, and corresponded exactly with *T. serrata*.

"In a fox which was fed upon the same *Cysticerci*, no *Tæniæ* were found.

"*Third Series.*—In this set of experiments, the *Cysticercus cellulosæ*, from the flesh of the hog, was employed. Four young dogs received, at different times, a number of these *Cysticerci* with their food, and on being opened at different intervals afterwards, there were found in their intestine, in various stages of advancement, corresponding to the length of time that had elapsed, tape-worms which resembled exactly the *Tænia serrata*. V. Siebold was struck with the close resemblance of this *Tænia serrata* of the dog to the common *Tænia solium* of man, and after an accurate comparison of various examples of these entozoa, concludes that they are identical, and not to be specifically distinguished, or that at most they are varieties of the same species dependent only on the difference of their parasitic habitations.

"*Fourth Series.*—This series of experiments was performed in the same manner as the last, but with the heads or scolices of the *Cœnurus cerebralis*, the entozoon so well known in connection with the disease of 'sturdy' and 'staggers,' which it produces when infesting the brain of sheep and cattle. In order that the *Cœnurus* might be procured alive, the dogs experimented on were carried to a part of the country where a number of sheep were affected with the sturdy. In the intestine of five out of seven dogs fed with the *Cœnurus*, great numbers of *Tæniæ* were found, at successive periods, in different degrees of advancement; in thirty-eight days the *Tæniæ* had arrived at maturity, and appeared, like those in the previous

experiments, to correspond exactly with *T. serrata* and *T. solium;* in two other dogs the experiment was rendered nugatory by the dogs being ill of distemper at the time.

"*Fifth Series.*—The last of the experiments related by V. Siebold were made with *Echinococcus-animalcules* (E. veterinorum) of domestic cattle, which is probably not specifically different from that of man. As many as twelve young dogs, and also a fox, received a quantity of the small *echinococci* in milk, and on being examined at various periods from the commencement up to twenty-six days, there were found, in all different stages of development, small tæniæ totally different from any observed in the previous experiments, or indeed from any accurately distinguished or described by helminthologists. V. Siebold proposes to call this variety *Tænia echinococcus.* It is remarkable for its very small size, and for the small number of its joints, which never amounted to more than three, and for the circumstance that the reproductive organs, which are confined to the two last joints, become perfect, and the caudal joint separates as a *proglottis* at a very early period."

With regard to the converse experiments, Dr. Allen Thomson details the following facts :—

"Küchenmeister, having previously caused the production of the *Tænia serrata* in a dog by feeding it with the *Cœnurus cerebralis* from a sheep, gave to young lambs some of the ripe joints or proglottides of this tænia, and by the fifteenth day the usual symptoms of *sturdy* began to appear in the lambs. Küchenmeister sent some of the same tænia to Van Beneden at Louvain, to Eschricht at Copenhagen, and to Leuckhart at Giessen, all of whom, in separate experiments, caused lambs in the same manner to take the tænia joints with their food, and in all the cases the same result was found to be produced, in the occurrence of the symptoms of *sturdy* at a period of from fifteen to eighteen days after the tæniæ joints were given to them. The same experiment had likewise been performed by Dr. Haubner of Dresden, with the same result.

"Several of these experimenters, having examined carefully the lambs so affected, were able to detect the progressive stages of formation of the *Cœnurus* in the cortical substance of the brain, where alone these entozoa seemed to attain the true *Cœnurus* form. There were abundant traces of them in the heart, diaphragm, and other muscles, and also, in some of the experiments, under the skin; but in these situations they appeared to be abortive, while in the brain they gradually increased in size, and, in some instances, the vesicle had attained the size of a hazel nut. The brain was, in all instances, marked with inflamed grooves over its surface, indicating, probably, the track of the tænia embryos; for at the end of each of these tracks, in the early stages, were found the minute *Cœnuri.*

"Another confirmation of the fact of the conversion of the ova of *Tænia* into *cystic entozoa* has been afforded by an experiment of Leuckhart's, which merits separate mention here. It gives also the complement of the relation between the *Cysticercus fasciolaris* of the mouse and the *Tænia crassicollis* of the cat. Having in his possession a family of white mice which he had employed for various experiments, and in none of which had the *Cysticercus* of the liver been perceived, he gave to six out of twelve

with their food and drink, the ova of the *Tænia crassicollis*, obtained by breaking up the ripe joints or proglottides of this tape-worm from a cat. Four months afterwards, he found, on opening these mice, that four of them were affected with the *Cysticercus fasciolaris* of the liver; and he ascertained that in none of the mice which had not received the tænia-ova was there any production of these entozoa.

"The last experiment to which I shall refer may, by many, be looked upon as the most interesting of all, and we owe it again to Dr. Küchenmeister. Having the opportunity of repeating on a condemned criminal the experiments which he had previously performed on animals, Dr. K. contrived to give to this man, at seven successive times, between 130 and 12 hours previous to his execution, mingled with various articles of food, a number of cysticerci from the hog and some from the rabbit.* On examination after death, a number of young *Tæniæ*, in different stages of advancement, were found in the intestine; the greater number of them loose, but a few attached to the mucous membrane. The form of the hooklets, and other circumstances, induced him to regard these tape-worms as the usual *T. solium*. There were no traces of the *Cysticerci* last swallowed, and Küchenmeister was of opinion that those only which were first taken, and which were quite fresh, had been converted into tæniæ, and that those taken later, being dead, had been digested with the food.

"In the same communication, Küchenmeister adds that, by his own experiments, and those of Van Beneden and Haubner, it is now proved that the *Cysticercus cellulosæ* may be produced in great quantity in hogs by feeding these animals with ripe joints of the *Tænia solium;* but that this does not occur either in the dog or sheep. He mentions also that he has not succeeded in obtaining the *Cysticercus cellulosæ* by feeding animals with the *Tænia serrata vera*, nor with the *Tænia* of the *Cysticercus tenuicollis*, nor of the *Cœnurus*, nor *Echinococcus*, while these *Tæniæ* are all readily obtained by feeding animals with the *Cysticercus pisiformis,* and *C. tenuicollis*, and *Cœnurus cerebralis.*

"From the whole series of observations and experiments shortly referred to in the previous pages, the general conclusion may be drawn, that, while much probably remains to be done in the details of the subject, a most important advance has, through their means, been made in the explanation of the manner in which entozoa gain access to the seat of their parasitic habitations. It appears by them to have been ascertained —1st, That entozoa are always introduced into animals from without; 2d, That some obtain access to the body of animals from water, or other matters, in which they have previously lived in the free condition, while others are taken along with animal food in which the entozoa have lived parasitically; 3d, That entozoa, when reaching sexual perfection in their parasitic condition, require to be in a situation which communicates with the external air, their most common position being the alimentary canal, and more rarely the pulmonary cavities; 4th, That almost all the entozoa

* "They appear to have been partly disguised by their resemblance to the grains of rice in warm rice soup; partly by their likeness to the small bits of paste in a kind of vermicelli soup; and partly foisted on the unhappy wretch by being substituted for the small lumps of fat in blood-puddings."—(*Brit. and For. Med.-Ch. Rev.*, Jan. 1857, p. 119.)

inhabiting close cavities, or encysted, in the bodies of animals, are only imperfect and earlier forms of other entozoa, which may attain maturity in the open cavities of the same or of different animals, or in the free condition; 5th, That entozoa rarely propagate themselves in the same animal in which they have arrived at sexual maturity, but require a different habitation, which they reach by migrations in the various modes before referred to; 6th, That the cystic entozoa are the imperfect states of different tæniæ; 7th, That full-grown tæniæ are almost invariably introduced, in their earlier condition, into the bodies of animals with flesh or other animal food; 8th, That if the ova of tæniæ be introduced into the alimentary canal of a suitable animal, their tendency is, by penetrating the tissues, to become encysted, and to assume the form of a cystic entozoon, such as *Cysticercus*, *Cœnurus*, *Echinococcus;* 9th, That if these cystic entozoa again are taken by certain animals with their food, the head part (which corresponds with that of a tænia) resists digestion, and has a tendency to establish itself and become developed into some form of tænia in the alimentary canal, by attachment to the mucous membrane, and by the formation of segments.

"There can be no doubt whatever, that the occurrence of tape-worm in the human subject, as in animals, is dependent on the introduction into the alimentary canal of the scolex larva, accidentally, or with food. The most frequent, though not the only, source of these scolices in this country and a part of the Continent of Europe, is probably the *Cysticercus cellulosæ* of measly pork, when this is used in a partially cooked or raw state. This accords with general belief, and with what has been ascertained in a number of instances of persons affected with tape-worm, viz., that they had been in the habit of eating raw or imperfectly cooked meat. In Abyssinia, where this habit prevails to a great extent, the inhabitants are well known to be remarkably subject to tape-worm; indeed, in that country the affection is looked upon as entirely a natural one.

"The difference in the prevalence of *Tænia solium* in this country and in Western Europe, and of the *Bothriocephalus latus* in the eastern division of the Continent, is well known; but I am not aware whether any observations have yet been made upon the most probable source of the latter entozoon. In Russia, however, where the *Bothriocephalus* is the usual tape-worm, it has been found that the long continued use of an exclusively animal diet, such as is recommended for the cure of some diseases, has been followed by the occurrence of the *Tænia solium.* In Switzerland, also, in the eastern parts of which the *Bothriocephalus* prevails, it has been observed that the hogs are rarely, if ever affected with the *Cysticercus;* but occasionally pork is introduced from France strongly tainted with this affection, which may account for the occasional occurrence of the *Tænia solium*, especially in Western Switzerland.

"There are a number of other instances," writes Dr. Allen Thomson, "in which it has now been made extremely probable, that the various perfect *Tæniæ* of carnivorous or predaceous animals are introduced into their alimentary canal with their food, consisting of the flesh of other animals, in which the larvæ or young of these *Tæniæ* have existed in the parasitic condition in the form of cysts. Examples of this have been particularly noted among fishes and aquatic animals. Thus, the complete

sexual *Rhynchobothrius* inhabits the intestine exclusively of predaceous fishes, such as the shark or skate, while the *Tetrarhynchus*, or incomplete stage of the same kind of cestoid, inhabits a variety of other fishes, the cuttle-fish, &c., on which the shark and skate prey. The common stickleback (Gasterosteus), is invested with an incomplete or non-sexual tape-worm, which lives in the encysted condition in its peritoneal cavity, and this parasite assumes the complete and sexual form in the intestine of various water-fowls which prey on the stickleback, constituting in them the *Bothriocephalus nodosus*. In the same manner, the *Ligula simplicissima*, inhabiting the abdominal cavity of the carp, seems to be the undeveloped form of the sexually complete *ligula* which occurs in the alimentary canal of geese, divers, herons, and other water-fowls. Again, the *Triænophorus nodulosus* is incomplete, as it inhabits, in the encysted condition, the peritoneal cavity and liver of the trout, and becomes sexually complete only in the alimentary canal of the pike and perch. It seems certain that the ova of this tænia do not undergo development in the alimentary canal of these predaceous fishes, and we must conclude that they are passed out of their bodies with the fæces, and undergo the first stage of their development, either free in water, or in the encysted condition in the organs of those fishes which fall a prey to the pike. In passing along with food into the alimentary canal of the pike or other predaceous fishes, the young or larva tæniæ are set free from their cysts by digestion, and afterwards attain to maturity in the favourable conditions presented by their new host."—(*Glas. Med. Journal*, l. c.)

The remarkable prevalence of *Bothriocephalus latus* on certain of the northern coasts of Europe seems to place its development, in some definite relation, rather to the fish than to the flesh-eating habits of the people who inhabit these districts. The liability to this form of parasitic disease appears to be greatest towards the sea coasts and along river districts. Huss of Sweden describes the *Tænia lata* as extremely common on part of the Lapland frontiers, in Finland, and on the shores of the Gulf of Bothnia. On the extreme coast, there is scarcely a family altogether free from it—old and young, rich and poor, native and emigrants, alike suffer from this worm; and in one or two large towns on the mouths of rivers, at least two per cent. of the population experience its attacks. On passing inland, the frequency of the disease diminishes, until eight or ten leagues from the coast, it almost ceases to be found. The natives believe it to be hereditary. Dr. Huss attributes it to the salmon.—(*Brit. and For. Med. Rev.*, l. c.)

"These circumstances seem to point out very clearly the means to be adopted for the prevention of *tape-worm*. At the same time, it is probable that there may be other accidental means by which these larvæ of the tape-worm may be introduced; and it will be easily understood how this may more particularly happen in the cases of butchers, cooks, or others in the habit of handling affected meat.

"The instances in which the human body is affected with the Cysticercus, or other *cystic entozoa*, though not very rare, are by no means so

frequent as those of tape-worm; but they are much more serious in their effects, more obscure in their origin, and in the meantime, therefore, more difficult to prevent. Scarcely any attention has yet been given to the source from which the various *cystic entozoa* infesting the human body may have derived their origin; but the observations already referred to make it extremely probable, that the explanation of their introduction is to be sought for in the same causes which have been shown to operate in the lower animals. Thus it appears to have been demonstrated that the *cœnurus* of the sheep proceeds from the ova or first embryos of *tænia*, and it is most probable that those are obtained from the dog. The only mode, therefore, of removing this affection from a flock in which it may have become prevalent, and in which it is well known sometimes to cause very great losses, must be the careful separation of the dog from the sheep for a certain time; for such time, indeed, as that the dog shall find no more *cœnuri* in the offal, &c., of the sheep, in eating which it receives the larvæ of its tænia, and that the dog being free from this tænia shall not furnish the ova or embryos, which being taken accidentally with the pasture or water by the sheep, establish themselves in them as *encysted cœnuri*. V. Siebold states the important fact, that those flocks which are entirely without dogs, and are stall-fed, are never affected with the '*sturdy*.'

"A remarkable example of the prevalence of *cystic entozoa* in the human subject is mentioned by Von Siebold, as having recently been described by Dr. Schleisner, in his *Medical Topography of Iceland*, published in 1851. It appears that the people of that country have been for some time suffering, to a great extent, under a very remarkable hydatid disease. The hydatids affect the liver, peritoneum, and subcutaneous texture. Eschricht writes to Von Siebold, that this disease has extended itself to such an alarming degree, about a sixth of the whole population of Iceland being affected with it, that it is attracting considerable attention at Copenhagen. It produces a long protracted illness, and terminates with a painful death; and means of cure have not yet been discovered. Von Siebold considers it as extremely probable that this disease, consisting in the development of a cystic entozoon, depends on the introduction of the ova of a tænia into the body; and that this arises from the immense quantity of dogs kept in Iceland for the purpose of herding sheep and cattle."—(*Glas. Med. Journal*, l. c.)

The cystic entozoa are variously spoken of by the older and even by many recent writers on medical subjects under the vague terms of *hydatids*, *cysts*, *acepalo-cysts*. These are now believed to be, as already described, varied forms of *Tæniæ embryos*, of which the *Cysticercus cellulosæ* and two varieties of the *Echinococcus* inhabit man.

The Cysticercus Cellulosæ, as seen in man, consists of a vesicle, conical, glistening, and white, containing fluid; to this, a head is attached by a narrow pedicle or neck which is transversely lined, approaching to rugæ towards the vesicle. Its size varies from that of a small pea to that of a large marble in solid viscera, but in free cavities, such as in the ventricles of the brain, it attains a consider-

able size. The head and neck can be drawn, as if into the vesicle, so that the form and appearance of the parasite may thus be very much altered. It is encysted when found in a solid viscus like the liver or a muscle, but in close cavities, such as the anterior chamber of the eye or ventricles of the brain, the entozoon is free, and may fix itself by its hooks or float about.

The Echinococci have been vaguely described as hydatids or acepalocysts. They are embryo tæniæ enclosed in vascular cysts lined by epithelium. Within the vascular cyst, a second cyst exists of milk-white appearance and brittle elastic texture. It has no connection with the enclosing cyst, and is filled with a clear fluid, and sometimes contains numbers of secondary cysts, free and floating, or fixed to the wall of the larger cyst. These secondary cysts are again subdivided into others, which in their turn are also subdivided.

The observations of Dr. Hanfield Jones show that from the liquor sanguinis of the vascular external cyst, the primary interior and free laminated cyst is formed ; but as to the formation of the secondary cysts very little is known. Dr. H. Jones's observations show, however, that on the interior of this primary cyst, a number of whitish opaque spots of the size of a pin's head are to be seen ; these tend to become cysts, and are the habitation of the *Echinococci*, and this stratum of organic substance on which they form, lies on the inner surface of the parent cyst. This stratum is composed of an opaque oily substance made up of imperfect celloid particles non-nucleated, and a little larger than pus corpuscles, with faint granular contents. Here are to be seen numerous Echinococci separated or in groups. The groups are sometimes enclosed in a spherical sac attached by a pedicle to the wall of the primary cyst, or the pedicle is subdivided and sends a branch to each Echinococcus of the group. The Echinococci vary from $\frac{1}{250}$th of an inch to $\frac{1}{75}$th of an inch in length, and from $\frac{1}{300}$th to $\frac{1}{100}$th of an inch in width (Jones and Sieveking's *Path. Anat.*, p. 207). Their heads are like those of the *Tæniæ* family already described. The liver is more commonly the seat of *Echinococci* cysts than any other animal viscus. In it they are either enclosed in solitary cysts, or are to be found in alveoli extending along the lymphatics of the organ as described by Virchow, in cases of what otherwise appeared to be cases of "alveolar colloid" of that organ. Next to the liver the peritoneum, the areolar tissue, muscles, brain, spleen, kidneys, lungs, bones, are favourite sites ; and this observation holds good in animals as well as in man where Echinococci are found.

Nematoidea—*Round Worms.*

In their mature state these worms inhabit the alimentary canal, or the pulmonary tubes of man and animals. In the human sub-

ject they are represented by the *Ascarides*, the *Filaria Medinensis* or Guinea worm, the *Filaria occuli*, the *Filaria bronchialis*, the *Tricocephalus dispar*, the *Trichina spiralis*, the *Strongylus gigans*, and *Ancyclostomum duodenale*.

Ascarides.—There are two species of the ascaris, namely, the *Ascaris lunbricoides* and the *Ascaris vermicularis*. The former is a round worm pointed at both ends, from six to fifteen inches long, of a grayish-red colour, and sufficiently translucent to permit its viscera to be seen through its coverings. They inhabit chiefly the small intestines, but many pass up into the gall-ducts, the stomach, the œsophagus, the nostrils, the mouth, or frontal sinuses; and there are cases on record and specimens in museums where the worm has evidently penetrated the coats of the intestine and got into the peritoneum or into the pleura. In some they are so numerous as absolutely to obstruct the intestines; in others, only a solitary worm or a pair may be found. The *Ascaris vermicularis* is a minute white thread-like worm, the male being about a line and a-half in length, and the female five or six lines long. They inhabit chiefly the rectum, and may creep into the vagina or urethral orifice. The *ascarides* are all of separate sexes, and their ova are fecundated within the body of the female *ascaris*. Dr. Aller Thomson calls special attention to the fact, that their ova are seldom developed in the intestinal canal of the animal inhabited by the parental *Ascarides*. Mucus does not seem a favourable nidus for the development of their ova, but the formation of the embryo is found to proceed with great rapidity in water.

The source of the various *ascarides* which inhabit the human intestine has not yet been fully ascertained; but many concurring circumstances tend to show that they are most frequently introduced as minute embryos, with water or with fresh uncooked vegetable food, and more rarely with that of an animal kind. Dr. Paterson of Leith observed that, in a particular street there, certain families who drew their water from the public well placed at one end of the street were very subject to be affected with the common *Ascaris lumbricoides*, while towards the other end of the street in which the water was supplied from the Crawley spring which supplies Edinburgh and its vicinity with water, the inhabitants were free from this parasite. The water of the public well was derived from a small lake named Lochend, the water of which is by no means clean, and in which numbers of vermiform animalculæ exist (Dr. Allen Thomson).

Filaria Medinensis or **Guinea Worm.**—According to the observations of Mr. Busk, this parasite seems to pass through several changes of form before it reaches maturity in the human body. It varies in size from six inches long to ten or twelve feet, and is about as thick

as a piece of packthread. It makes its way into the subcutaneous tissue of the lower limbs especially, but not unfrequently in the hands and arms, where it remains a variable time without exciting any particular symptoms unless ruptured during extraction, when an unhealthy inflammation is established in the areolar tissue. It has been observed that those who never went about with naked feet, legs, arms, and hands, and never slept on the earth in countries where it is endemic remained free from the worms.

"The first stage in which we find the *Filaria medinensis* in the outer world is that of a minute worm. In this latter condition it has a length of about $\frac{1}{60}$th of an inch, and a breadth which nowhere more than $\frac{1}{25}$th of its length dwindles in the posterior fourth of its body to an invisibly fine point. Its usual haunts are the soft muddy shores or bottoms of tanks. But after the heavy rains in the regions where it is endemic, it may be found almost anywhere in the position where it has been left by evaporation—a fact which obviously accounts for much that we know respecting its endemic distribution in various parts of Sennaar and Arabia, and especially explains its frequency in the marshy or dry beds of pools or wells, rivers or torrents. It is therefore to the naked flesh of the person brought into contact with them that the parasites attach themselves, probably penetrating the sweat ducts, the calibre of many of which ($\frac{1}{1200}$th of an inch) would readily admit of their entry. And hence Macgregor's table of 172 cases—out of which 72 per cent. affected the feet, 20 per cent. the legs, 7 per cent. the thigh, and scarcely more than 1 per cent. the scrotum or hands—is easily explained by the circumstances of this inoculation: as is also its prevalence on the backs and shoulders of water-carriers. The period of incubation generally ranges between twelve weeks and twelve months; the longer duration probably representing the minimum of that diffuse suppuration or abscess in the areolar tissue, which first calls attention to the malady. A single bath in a tank has been often known to affect three or four persons at this distance of time, even though they have travelled hundreds of miles apart from each other shortly after bathing in company."—(*Brit. and For. Med. Rev.*, Jan. 1857, p. 128.)

This tank-worm, which is generally smaller and more slender than the young Guinea worm, has in all other respects the closest resemblance to it, and as described by Mr. H. J. Carter of Bombay, it is indeed

"Identical in form, colour, and general appearance. Like the young Guinea worm, when fresh, it is very active; twisting and twirling about, seeking shelter or concealment in small pieces of silty *confervæ*, never quiet till it gets imbedded in them; and frequently holding on by its tail, as if the latter were prehensile, or entangled in the mass by its temporary curvature. It swims after its head, but can fix its slender extremity to an opaque substance, and work the body into it. As the water evaporates, the tank-worm loses its energy; and perishes altogether, as it dries up or becomes putrescent; a few minutes in either state being sufficient to arrest its vitality irretrievably."

Filaria have also been observed in the human eye, of a minute form, in the crystalline lens and surrounding fluid, in diseased bronchial glands, in the blood, and in the urine (Dr. Hanfield Jones).

The Ancyclostomum duodenale is an extremely frequent and dangerous parasite in Egypt and other tropical climates.

"Its length is about one-third to half an inch, its width about one-twentieth its length. Its head has a round apex; and its extremity, which is bevelled at the expense of its posterior surface, is provided with hooklets that occupy converging papillæ. The mouth contracts to open into a thick, muscular pharynx, which, widening as it passes downward, ends, after occupying one-seventh of the body, in the intestine. The sexual differences of the male and female are very interesting. Its pathological significance is chiefly due to the hæmorrhage caused by these parasites: which are often present in thousands between the valvulæ conniventes of the duodenum, jejunum, and ileum; and not infrequently in the submucous areolar tissue. In short, the physician practising in Egypt must never forget that the chlorosis of this climate is often the result of repeated and small hæmorrhages from the intestine, caused by these parasites. Turpentine, as Griesinger points out, promises to be the best remedy both as a styptic and as a vermifuge."—(*Brit. and Foreign Med.-Ch. Rev.*, l. c.)

The Tricocephalus dispar haunts the large intestine and end of the ileum of the human subject; and, according to Rudolphi, is extremely common. The fact that it is rarely detected is to be ascribed chiefly to its colour and contents rendering it so like the fæcal mass with which it is mixed, as to allow it to escape notice, unless the latter be carefully washed and sifted so as to collect the contained entozoa; a mode of examination which generally shows them to be present in very large numbers. It is a thin filiform worm, one and a-half to two inches in length. Its anterior two-thirds are of a capillary size, and pass rather suddenly into the thicker posterior portion. The sexes are distinct.

The Trichina spiralis infests the voluntary muscles of the human body. It is a minute round worm, enclosed in a transparent cyst, and lying between the sarcolemma of adjacent muscular fibres. Sometimes there are more than one worm in a cyst. It is from $\frac{1}{24}$th to $\frac{1}{36}$th of an inch long, with an intestinal canal and distinct oval and anal apertures.

Küchenmeister regards it as highly probable that the *Trichina spiralis* and *Tricocephalus dispar* have to each other the same relation as that which the *Tænia solium* and *Cysticercus cellulosæ* are found to bear. He regards the *Trichina* as the larvæ of the *Tricocephalus*. With the exception, however, of similarity of anatomical structure, there is no evidence to bear out the analogy; experiments of feeding animals with *Trichina* having failed to produce the *Tricocephalus*, and the converse experiments are equally unsuccessful.

Nevertheless, the *Trichina spiralis* appears to be an imperfect animal, probably an embryotic nematoid. Its development in the muscles does not appear to advance beyond a certain point while there. It tends to become abortive, and the cyst to become filled with calcareous matter. Muscles in which this parasite abounds, however clearly dissected, appear as if "thickly sprinkled with the eggs of some insect."

The Strongylus gigans is the most formidable of the round worms, attaining, as it sometimes does, to the enormous size of three feet in length and half an inch in thickness, although it is generally much smaller. The worm inhabits the kidney exclusively, and sometimes produces great destruction of the organ, with much pain and bloody urine. The mode of its development is unknown.

TREMATOIDEA.—*Fluke-like Parasites.*

"The comparative rarity of the *Distoma hepaticum* and *lanceolatum* in the human subject renders them less interesting to the physician than many other entozoa.

"Three other species are described by Küchenmeister—the *D. heterophyes*, *hæmatobium*, and *ophthalmobium*. Of these three *Distomata*, the first has been noticed twice, in large numbers, in the small intestine of an Egyptian; the last once in the eye of a child five months old, at death. The remaining species, *D. hæmatobium*, is especially interesting, alike from its frequency in some parts of Egypt (according to Griesinger, 117 times in 363 necropsies, equal to 33 per cent.), and from the grave and characteristic symptoms and appearances to which it often gives rise.

"The difficulties that have been found in determining the mature (ovum or larva) of the embryo within the body of the animal inhabited by the parents (the *Distoma* being bisexual, the female often contained in a canal of the male), is one that it seems impossible at present to clear up. The *Distomata* inhabit the vena portæ and its branches, the intestinal canal, the walls of the urinary bladders, the ureters, or even the pelvis of the kidney. In the liver they seem to do less mischief than in the urinary apparatus; though the choking-up of the portal trunk with adult *Distomata*, and the deposit of eggs in the substance of the liver itself, which they bring about, must necessarily derange the function of this important organ, may starve it of blood, or perhaps irritate it to abscess. In the intestine they are often associated with appearances resembling those of dysentery; —with congestion, extravasation of blood, deposit upon and beneath the mucous membrane, fungoid excrescences, and croupy exudations that occupy ulcerated patches of the bowel. In many of these cases, the eggs of the creature may be found wedged in long rows within the intestinal vessels, or in and beneath exudations, on the free surface of the mucous membrane. Hence it was suspected whether the dysentery endemic to Egypt might not have to the presence of these *distomæ* the same relation as the itch has to the *acarus*.

"Such a conclusion receives a strong confirmation when we turn to the

lesions produced in the urinary apparatus. Here the mucous membrane appears swollen in places which are covered with a soft, sandy, rotten mass, that is firmly fixed to the subjacent tissue. The microscope shows this mass to consist of the full and empty shells of the parasitic ova, imbedded in a mixture of blood, exudation, modified epithelium, and crystals of uric acid. The thickening of the submucous tissue often produces stricture of the ureter, which is followed by retention of urine, and all its dangerous consequences:—degeneration of the kidneys, pyelitis, dilatation of the pelvis, or atrophy of the renal substance; or the masses themselves become the nuclei of calculous deposits, and thus aid in the chlorotic exhaustion these creatures produce in the person they inhabit, by the consumption of blood they imply. Lastly, it seems not unlikely that the dislodgment of clots into the general circulation sometimes brings about pneumonia, in the way described by Virchow, and illustrated by the clinical researches of Kirkes."—(*Brit. and For. Med.-Ch. Rev.* l. c., p. 125.)

Symptoms of the presence of Helminthoid Parasites.—From what has been already stated it is obvious that these must be very variable, determined by the form of the parasite and the locality in which it exists. Almost every case has some special symptoms of its own: local, reflex, or general.

In the alimentary canal the tape-worms occasion uneasiness or pain in the abdomen, sometimes spasmodic, gnawing or biting, but more frequently a distressing feeling which cannot be described. Irritation at the mucous orifices (mouth, nose, and arms), are also characteristic accompaniments. The bowels also are either constipated or relaxed, the stools exceedingly dark or white, the appetite sometimes lost and sometimes voracious, sleep disturbed, and temper fretful; and often, as a result of so many combined irritating causes, remittent fever, which has received the name of "worm fever."

The symptoms of the existence of worms in the *small intestine*, as the *tæniæ* and *lumbricoides*, are often exceedingly obscure, and simulate many other diseases; so that until a patient has passed a worm or a portion of a worm, we are unable, with any certainty, to predicate its existence; and at no time till we actually see the parasite can we determine its species.

The general symptoms of worms of the small intestines are occasional colic, a variable state of bowels, capricious appetite, headache, and nausea. The mind is also often so much depressed as to amount to hypochondriasis. Thus Krause gives the case of a young man who, when troubled with worms, was always seized with uncontrollable fits of laughter; and Giraud an instance of a young man who, under similar circumstances, felt an entire impossibility of walking over anything whatever, even so slight a substance as a piece of white paper; or, if he attempted to do so, he fainted. Hufeland mentions a case in which the patient, without being jaundiced, saw

everything yellow; Delisle another that could not bear the sound of a musical instrument. And cases in which St. Vitus's dance, epilepsy, and convulsions have been the prominent symptoms, are by no means infrequent.

When lumbrici and tænia pass from the small into the larger intestines, they are speedily evacuated, and the symptoms are alleviated. When, however, a lumbricus passes upwards, the symptoms are more marked. In general, the worm is little troublesome till it reaches the upper part of the pharynx, when, either by irritating or getting into the glottis, it often gives rise to a most fearful sense of suffocation. It commonly, however, continues its upward progress till at length it makes its exit, by the assistance of the patient's finger, either through the mouth or nose.

Treatment.—The habitat of the *ascarides* being for the most part a collection of mucus, the means used for their expulsion is generally some sharp purgative medicine, as two grains of calomel and ten grains of jalap, or as many of scammony, exhibited two or three times a-week. It ought, perhaps, in no instance to be given oftener, for if the purging be continued the intestine is weakened and more mucus secreted, so that the pre-disposition to harbour them is increased. In weakly children, small doses of Epsom salts will ultimately effect the same object, and with less distress to the patient. Many persons place great confidence in calomel, as a medicine capable of destroying them, but it does not appear to act beneficially except as a purgative, and consequently it is an auxiliary, and not by any means the most valuable part of the treatment.

From the *ascarides* being situated so near the rectum, enemata have at all times been much used in these cases; and injections of oil have been much commended, and especially of castor oil, olive oil, or sweet oil. But these animals will live from thirty-six to forty-eight hours in castor oil. Indeed, very little benefit has been derived from any local treatment. Warm water injections tranquillize the intestine, and perhaps give more relief than anything else. The ascarides are killed by cold; but it may not always be safe to throw a cold injection into the colon of a child.

For the ejection of *Teniæ* from the small intestines, a great many remedies have been recommended; but, in the present day, practitioners very generally limit themselves to one or two methods, or to a sharp purgative. The celebrated Swiss remedy, purchased by the King of France, was a sharp purgative, composed of twelve grains of calomel and twelve grains of scammony, followed shortly after by half an ounce to an ounce of the sulphate of magnesia.

By many practitioners the purgative treatment is seldom adopted, it being more usual to exhibit the *oleum terebinthinæ*

alone. Half an ounce to two ounces of this medicine makes the patient slightly tipsy, is less likely to cause strangury, and produces three or four motions; and in these the worm is usually found, the animal having, it is supposed, a great antipathy to this substance, lets go its hold and actively attempts to escape. This medicine may be repeated twice a-week. Three-fourths of the inhabitants of Cairo are said to be infested with *tæniæ*, and their remedy is twenty to thirty drops of *petroleum;* a remedy not greatly dissimilar. The Grenadine bark has acquired much reputation in this disease in the West Indies, but it has not supported the hopes that have been entertained of it, at least in this country.

Drs. Christison, Jenner, Gull, and others, employ with great success in tape-worm, the etherial oleo-resinous extract of the male-shield fern (Lastræa Felix mas), in doses of twenty to twenty-four grains, a remedy which by many is still believed to be the most efficacious. Dr. Gull's dose is one and a-half to two drachms.

A remedy of Abyssinian origin, called *Koosso*, has recently been greatly recommended; and has doubtless been of great efficacy in some instances. It is administered in the form of powder, of which half an ounce is mixed with half a pint of warm water, and the infusion with the sediment is to be taken at two or three draughts in the morning on an empty stomach. If the bowels fail to be moved, a brisk cathartic ought to be given in three or four hours.

Another remedy of more recent recommendation is *Kameela* or *Reroo*, the Rothera tinctoria, of the natural order Euphorbiaceæ, and sub-order Crotoneæ. It has been highly lauded by Dr. Gordon, Surgeon to the 10th Regiment of Foot. He writes:—

"The success and rapidity of effect of the kameela in removing tape-worm in the cases of soldiers of the 10th Regiment, to whom I administered it, were such that I did not consider it worth my while to keep notes of them after the first two or three; nor, indeed, were the men to whom it was administered latterly taken into hospital, for they soon became aware of the wonderful efficacy of the remedy, asking of their own accord for a dose of it, after which they invariably parted with the worm in the course of a few hours, and then went on with their military duty as if nothing had happened; while, as I afterwards ascertained, considerable numbers did not think of 'troubling the doctor at all,' but, on suffering from the characteristic symptoms of the worm, applied for the kameela to the apothecary, and always with the same effect.

"We prepared a spirituous tincture by adding Oj. of alcohol to ℥iv. of the powder, and then filtering. We never succeeded in obtaining more than ℥vj. in this way, and of this ℥j. in a little mint-water was generally found to be a sufficient dose, ℥ij. being in some cases required, and perhaps in one or two, ℥iij., but I have never seen the remedy fail in removing the worm in a case where there were unequivocal symptoms of its presence.

"With kameela there is no unpleasant effect. It is not even necessary to take a dose of purging medicine as a preparative; and beyond a trifling amount of nausea and griping in some instances, no unpleasant effects are experienced; while by far the greater number of persons to whom it is administered suffer no inconvenience whatever beyond what they would from a dose of ordinary purging medicine."—(*Med. Times*, May 2, 1857.)

The duration of the parasite varies from a few months to thirty-five years (WAURUCH), and it is absolutely necessary that the *head* of the animal should be expelled before the treatment can be considered successful.

Prophylaxis is all important. The following remarks are not less revolting than suggestive. The entrance of the *scolices* must be prevented. Dr. Gordon writes in the army medical reports, that

"Tænia appears to be of very frequent occurrence among the white troops in Upper India, and especially the Punjaub; and I have been told by some medical officers who have been stationed at Peshawur, our nearest cantonment to Affghanistan, that they firmly believe every third soldier has had tape-worm during the two years regiments usually remain there.

"From what I have been able to ascertain on the subject, natives are not particularly liable to tape-worm, and certainly not more so in the north-western parts of India than in Lower Bengal. This is generally attributed to their almost total abstinence from animal food; and when we consider that both Hindoos and Mussulmans—all except the very lowest classes—abhor pig's flesh, while our own countrymen are rather partial to it, and the common soldier, probably, not very particular regarding the early history of the animal that is converted into pork for his use, an additional circumstance in favour of the transformation of the cysticercus constituting the 'measles' of pork into tænia, is thus disclosed to us.

"Those who have escaped the misfortune of having had to pass some years in India, can form no idea of the vast herds of lean, half-starved pigs that roam over the fields and waste grounds in the vicinity of villages, neither can they have any conception of the nature of the food on which these pigs subsist.

"The natives of India perform their ordinary natural functions in the open air, on a piece of waste ground left for the purpose on the outskirts of every village, and where, morning and evening, men, women, children, and pigs dot the ground at short intervals from each other. In an incredibly short space of time after the villagers have left the field, it is as clean as if they had never been there, while the herd by which the clearance has been effected may be found in some shady place near or close to a tank, with the exception of a few of the more insatiable that have gone to hunt for dead dogs, cats, cattle, and Hindoos that have paid the debt of nature since the previous meeting, and have been thrown or left on the plain to be devoured by domestic animals or vultures.

"These circumstances hold good more as regards the south-western provinces, where there are comparatively few rivers, than in Lower Bengal,

where rivers are numerous, and into which the dead of all descriptions are thrown; some clue may therefore be obtained to the cause of the greater frequency of diseased pigs' flesh in the one portion of the country than in the other; and as a consequence, the greater prevalence of tape-worm in the one part than the other.

"Pigs, however, are not the only animals that live in this filthy manner in India; cattle and sheep, that are so particular in their food in Britain, acquire degenerate tastes in India; and it is needless to enter into similar particulars regarding ducks, fowls, turkeys, and pigeons, all of which are more or less used as food by our countrymen there.

"I have thus alluded to these matters with a view to indicate some circumstances that most unquestionably tend to vitiate the quality of the animal food upon which our troops in India must subsist, and I think I have at least shown a sufficient cause for almost any amount of disease in the bodies of these animals; as also why their flesh should be more liable to become diseased in Upper India than in Lower Bengal."—(*Med. Times*, No. 357, May, 1857.)

Abstinence from the practice of eating raw meat is to be strenuously recommended; and cases closely inquired into will often be found to take their origin from the habit of taking animal food imperfectly cooked or *underdone*. Vegetables eaten green, such as salads, ought to be scrupulously clean.

Epiphytes—*Vegetable Parasites.*

These parasites are microscopic growths which belong to the lowest class of vegetable existence, namely, to the *Cryptogamia*, and are either *Algæ* or *Fungi*. Most of them are composed of simple cells, or of cells placed side to side or end to end; the unicellular *algæ* being distinguished from the unicellular *fungi* by containing *chlorophylle* or some analogous substance, and usually one or many coloured vesicles. It is not in all cases easy to determine whether they are the cause of morbid states, or whether, as some think more likely, the diseased tissue has merely afforded a suitable nidus for their development. It is certain that wherever the normal chemical processes of nutrition are impaired, and the incessant changes between solids and fluids slacken, then if the part can furnish a proper soil, the cryptogamic parasites will appear. The soil they select is for the most part composed of epithelium or cuticle, acid mucus or exudation. Acidity, however, though favourable for their growth, is not indispensable; since some of the vegetable parasites grow upon alkaline or neutral ground, as on the ulcerations of the trachea, or in fluid in the ventricles of the brain. It has also been observed that some of these parasitic diseases can be propagated by transference of the plant, as in *Tinea tondens* and *Tinea favosa*, and that the disease can be cured with the greatest readiness by the chemical agents which are most destructive to vegetable life.

The vegetable parasites associated in man with special morbid states, are thus enumerated by Dr. Parkes :—

1. The *Tricophyton tonsurans*, which is present in the disease known as *Tinea tondens.*
2. The *Tricophyton sporuloides*, together with the above, which are present in the disease known as *Plica polonica.*
3. The *Achorion Schonleinii* and the *Puccinia favi*, which are present in *Tinea favosa.*
4. The *Microsporon mentagrophyta*, which is present in *Mentagra* or *Tinea mentagra.*
5. The *Microsporon furfur*, which occurs in *Pityriasis versicolor.*
6. The *Microsporon Andouini*, which is present in *Porrigo decalvans.*

The plants forming on mucous membranes, or in the contents of cavities lined by mucous or serous membrane, are of less interest than those which grow on the skin, as in most cases they are decidedly only secondary, and their exact pathological significance is unknown. There are, however, two very common and inveterate affections of the skin, a description of which will illustrate the "Cryptogamous parasitic affections." These are commonly called "Ringworm" and "Scald head."

Trichosis Furfuracea—*Ringworm of the Scalp.*

Definition.—*An affection seated in the hairy part of the scalp, usually presenting one or more round bald patches, with little elevations caused by the swollen roots of the hairs. Dryish scales of epidermis cover the surface of the skin and accumulate in quantity round the elevations. These crusts contain the Tricophyton, and the cutis is generally more or less congested below the thickened crusts. The remains of hairs are seen projecting through the crusts, a line or more above the skin, and ragged at their ends as if eaten off.*

Pathology.—The nature of this disease is to be studied in the botany of the cryptogamic parasite called the *Trichophyton.* It consists of oval transparent spores which constitute by their juxtaposition articulated filaments. Its anatomical seat is in the *interior of the roots of the hairs.* The *hairs* and *fungi* simultaneously increase ; the former seem larger than usual, are paler in colour, lose their elasticity, soften and break off when they have risen some one or two lines above the surface of the scalp. In the short cylinder of hair left, the fungus grows still more rapidly, so that the normal structure of the small stump soon becomes undistinguishable. Sometimes the hair breaks off before emerging from the skin, and the fungus, epidermis, and sebaceous matter fill the ends of the piliferous conduits and form the little prominences which can be

seen by the naked eye in this disease, and give the skin a rough anserine appearance. The sporules and mycelium of the plants can sometimes be seen in the form of a white powder on the roots of the broken hairs, sometimes the cutis becomes congested and thickened, and then the plant becomes mixed up with the scales of epidermis, with fatty and albuminoid granules, with pus, and serous exudation, and so crusts are formed of greater or less thickness in which the growth of the fungus can go on. It exists in the "*Herpes tonsurans*" of Cazenave, which is the *Porrigo scutulata* of Willan, the "*tinea tonsurans*" of Bazin, and the *Trichosis furfuracea* of Erasmus Wilson and Dr. Wood. The disease commonly called "*Ringworm*" of the scalp, is what is intended to be described by all those names now mentioned, and on which dermatologists cannot agree.

Symptoms.—The first appearances presented by ringworm are variously described by Willan, Cazenave, and Wilson, as being pustular, vesicular, or simply scaly, either of which may represent the forms in which the disease may commence in different patients. The mode or form, therefore, in which the disease commences may be presumed not to be uniform. When the case is of old standing and innocent of treatment, the crusts may become thick from abundance of cuticle, pustular, or vesicular exudation. It may then crack and break up into small angular compartments, separated by white lines.

The Treatment of this species of ringworm, writes Dr. Parkes, has been long one of the most difficult points in dermatology. Its principles, however, are now well understood, and few cases resist the proper measures. The essential point is to apply to the roots of the hairs a preparation which may destroy the *Trichophyton;* if this can be done, the disease is cured. It is first of all necessary to remove the hair. This is in part generally accomplished before the case comes under treatment, by the course of the disease; if it has not been sufficiently done, "epilation" can be accomplished by a chemical agent, or by extraction with pincers. M. Bazin recommends an ointment composed of lime and carbonate of soda, of each one part, and thirty parts of lard. The *oil of cade,* however, appears to be the best depilatory known, and with this mode of treatment epilation with the pincers may be combined. If the hairs are pulled out in the proper direction there is very little pain, especially after the sensibility of the skin has been blunted by the use of the *oil of cade.* The removal of the hairs permits a "parasiticide" solution to be applied to the hair follicles, within which are the prolific spores of the fungus. For this purpose M. Bazin recommends either a solution of bichloride of mercury (1 part to 250 of water), or an ointment of the acetate of copper (1 part to 500 of lard). Dr.

Parkes uses also, with excellent effect, a solution of the *pernitrate* of *mercury*, about 1 part to 30 or 40 of water; this is, however, a very powerful remedy, and is to be cautiously used, as it easily blisters the scalp; also an ointment composed of sulphate of copper (1 part), alum (3 parts), and lard (20 to 30 parts, according to the age of the patient). Probably, however, a better parasiticide than any of these is the sulphurous acid as employed by Dr. W. Jenner, of University College, London, with astonishing results in cases of favus.

Favus—*Scald Head.*

Definition.—*A cryptogamous parasitic disease, composed of cup-shaped scabs, sometimes distinct and separate, at other times indistinct or confluent, and capable of being implanted by transference from one person to another. The head is the most common site, but the disease may be developed on the face, neck, or limbs.*

Pathology.—The disease has been found to depend on a cryptogamic parasite named the *Achorion Schonleinii*, after Schonlein, who was the first to suggest that the *yellow favus* crusts in *Porrigo lupinosa* and *P. Scutulata* were constituted by a vegetable parasite. The disease it is associated with is now called indifferently *Favus*, *Tinea favosa*, or *Porrigo Scutulata.* The primary seat of the parasite is in the depth of the hair follicle, outside the layer of the epithelium which covers the root of the hair, and which forms the "inner root sheath" of Kölliker. By using a concentrated solution of liquor potassæ, to make the parts transparent, the fungus may be observed with the microscope in the follicle round the hair at the place where it passes through the epidermis. In addition to this, the plant is found in depressions on the surface of the skin, forming the yellow honeycomb-like masses which give the specific name, *favus*, to the disease; and which, from their frequent buckler-like shape, suggested the term "scutulata." A cuticular elevation is seen, beneath which is a small favus; when the cuticle is raised, a drop of pus sometimes issues; hence the error of those who have considered this disease always pustular; generally, however, there is no pus or liquid of any kind; the plant grows, and the cuticle over it (supposing it has not been forcibly detached) finally separates, leaving the favus exposed to the air.

It is important to notice that at first there is at the point where the favus is about to form, only an increased secretion of epidermis; and sometimes the under surface of the favus is coated by cuticle, which separates it from the compressed and attenuated derma.

The favus consists of the mycelium, the spores, and the receptacles of the achorion, together with a finely granular amorphous layer,

which forms the external coat of the favus, and is the representative of the amorphous "stroma" which often accompanies the mycelium of algæ and fungi. In the favus, also, another and distinct fungus can sometimes be found, namely, the *Puccinia favi*, which is easily recognized; it has one extremity (the body), rounded and composed of two cells of unequal size, a superior and an inferior; the other extremity is prolonged into a jointed stem or trunk.

The *Microsporon Andouini* is another cryptogamous plant which is present in the disease commonly called, after Willan, *Porrigo decalvans*, or *Alopecia circumscripta*, or, by Bazin, *Tinea achromatosa*. It differs from the *Trichophyton* of tinea tondens, by its numerous waved filaments, and by the extremely small size of its sporules. It is not found, like the trichophyton, in the interior of the root, but forms round each hair a little tube; the hair then becomes opaque, softens, and breaks off. The alopecia is rapid, with or without previous vitiligo of the skin; the dermis is not congested, and the epidermis is thin and smooth.

There is an affection, writes Dr. Parkes, which should be distinguished from the Porrigo decalvans (or Alopecia circumscripta), and which is characterized by a rapid disappearance of pigment from both skin and hair, with or without alopecia. M. Bazin includes it in his "Tinea achromatosa" (Teigne achromateuse), but does not mention the fact that alopecia is not constant; and states that a parasitic plant is present. It is probable, however, that something more than a fungus exists to cause the total disappearance of pigment from a considerable portion of dermis. Besides, when the hairs return, they are at first quite white, and only gradually regain colour; whereas if the vitiligo were owing to a plant, they would most likely not grow at all. The disease appears to be allied to those obscure pigmentary changes which have a much deeper seat than the surface of the body.

Symptoms.—Favus is the most common and the most inveterate form of scald head. The disease commences with a slight pruritus or itching of a few hours' duration, followed by an eruption of small red vari, sensible to the touch and to the sight. These augment in size, and before twelve hours have passed, a yellowish point forms on each of their apices, at first so small as to be only visible under a glass of considerable power. The surface appears now as if covered with specks, of a sulphur-yellow colour, and the varus appearing as if set in the skin, with an umbilicated or depressed centre. If any fluid exudation exist, it does not remain so, but concretes into a dry, brittle, candied, honeycombed-looking scab or crust, which retains the form of the pustule, is similarly cupped or depressed in the centre, covered by the epidermis, while its under surface is marked by a small mammary process, which corresponds to the

depression of the pustule. The honeycombed appearance of the scab gives the peculiar character of the disease, and hence the term "favus." The crust continues to increase, still preserving its circular form and depressed centre, till it occasionally attains a magnitude of five to six lines in diameter. When the crust is recent, it is of a yellow or fawn colour; as it becomes older its hue becomes lighter, and, as it is easily reduced to a powder, has been compared to pulverized sulphur.

The number of favi is considerable, and they commonly appear in crops, affecting the same or different parts of the head at distant intervals. They may be either distinct or confluent. When very numerous they are confluent, but the cupped form of the individual crusts may still frequently be recognized; and, according to Rayer, should this peculiar form be lost through the copiousness of the secretion, still, by removing the superficial layers, each particular favus, with its central depression, may in general be made out. At a more advanced stage of the disease the epidermis disappears, and a viscid fluid is secreted in such abundance as to form one entire incrustation over the whole head; hence porrigo larvalis—mask or vizor-like scald head. The smell of the scab is peculiar, and has been compared to that of the urine of a cat, or of a cage in which mice have been kept.

When a crust of recent formation is removed, a circular depression, wider and deeper than the favus, is seen. At a more advanced stage the ulceration penetrates below the dermoid tissue. Indeed, Alibert says, he has never been able to remove a crust for the purpose of making a preparation without deeply wounding the scalp, and producing considerable hæmorrhage, while in some cases a deep and extensive ulceration takes place, which has penetrated even to the bones of the cranium.

The *Porrigo lupinosa* and *Porrigo scutulata* are accidental varieties in which the scab resembles a lupine rather than the cell of the honeycomb, and is very rarely seen; or the appearance of the scab is shield-like, and when of some extent and well marked, the patch is soft, doughy, and painful when pressed upon. Some of the hair appears to be removed by the roots, while other portions are broken off near the scalp, the roots remaining. Those which remain are readily removed by friction, and if pulled have scarcely any hold of the scalp.

Treatment.—The treatment of the forms of *Favus* is now very strictly determined. Some practitioners, however, still rely entirely on a constitutional treatment, as on small doses of rhubarb and soda, small doses of mercury, some preparation of iron, or else on vegetable tonics, as the infusion of cascarilla or compound infusion of gentian. Others, again, as entirely rely on a local treatment,

attempting to exterminate the disease by cauterization, or by applying some favourite ointment; and the catalogue of ointments used for this purpose includes all that have at any time been admitted into the pharmacopœia. As in the last described disease, the cryptogamous parasite must be destroyed, and its germs eradicated.

The best method to accomplish this is, in the first instance, to shave the head, and apply a poultice till all the scabs, or nearly so, are removed, and this being effected, the whole scab should be anointed with some of the following applications. The *tar-ointment* (ungt. picis liquidæ) has hitherto been the orthodox application. This ointment should be washed off night and morning with soft soap and water, and be as often re-applied. The head also should be shaved twice or thrice a-week, and where there are other children, the affected child should be isolated as much as possible to prevent the disease from spreading. This form of porrigo in the early stages will sometimes yield by washing the part with the oleum terebinthinæ night and morning, and cutting the hair close.

The *porrigo scutulata* is a disease often rebellious to every mode of treatment, but applied at a favourable moment every method succeeds. Dr. Willis has seen the disease yield to fomentations, or to bread poultices. The application of the lunar caustic round the patches about a line from their outer margin, is another favourite method of treatment. In the latter periods of the disease, Dr. Willis recommends "a solution of sulphate of copper, gr. vij. to x. to the ounce of water; of the nitrate of silver in the same proportions: the mild ointment of the nitrate of mercury, a salve of the black sulphuret of the same metal (sulphuretum hydrargyri nigr. ʒ j. ad. ʒ ij. adipis ℥ j.); the unguentum picis, an unguent of the cocculus Indicus pulveriz ʒ j. to ʒ ij. adipis ℥ j., may be tried one after the other; and in different instances each will have the merit of the cure." "The most effectual remedy in itself is unquestionably the eradication of the affected hairs. These are to be removed singly with the forceps, not pulled out along with all the healthy growth in their neighbourhood, as used formerly to be done by the barbarous application of the pitch-cap."

This disease occurring on surfaces not particularly covered with hair yields at once to the application of a solution of sulphate of copper, or of the nitrate of silver in water, or to the solution of sulphurous acid as recommended by Dr. Jenner. The treatment of favus recommended by Robin and Bazin is epilation, and the application of the corrosive sublimate solution, or of acetate of copper ointment (1 part to 500 of lard), to kill the plant still remaining adherent to the hair follicle.

CLASS II.

Constitutional Diseases.

CHAPTER I.

GENERAL REMARKS ON THE PATHOLOGY OF CONSTITUTIONAL DISEASES.

While the Zymotic diseases may be said to become developed in the human body under the direct influence of agents acting from *without*, the Constitutional diseases, by contrast, may be said to become developed under the influence of agents generated and acting *within* the body itself. The original organization of the human body may be of such a kind, that the continued and prolonged exercise of its functions, in place of preserving the body of man in a healthy state, may ultimately bring about diseases of various kinds, which, from their mode of origin and development, have received the name of Constitutional Diseases. All of them are attended with more or less local manifestations of disease, some of so fixed a character, and so strongly marked, that they are sometimes looked upon, although erroneously, as constituting distinct diseases. The local manifestations of diseases, however, which belong to the *constitutional* class are invariably the consequence of a pre-existing unhealthy state of the system, without which no outward, extraneous, or accidental condition, could call them into existence; although such conditions might determine (as a stimulus would) the local development or external manifestation of constitutional disease.

The Constitutional Diseases are, therefore, all associated with what is termed a *cachectic* state, or, in common language, "a bad habit of body." They are sporadic diseases, and are sometimes discovered to be hereditary. The local manifestations of morbid actions which attend them are observed rarely to be limited to one part or organ; but before death ensues several organs, tissues, or apparatus not necessarily contiguous to each other become diseased, and new materials of a heterologous nature are often deposited in their substance.

In these local manifestations of morbid action we find those elements which constitute what are termed the anatomical characters of the several diseases.

The course of the several *constitutional diseases* is generally a prolonged one, the tendency to repeated attacks existing throughout life, and the disease ultimately assumes a chronic type.

The primary implication of the constitution is, in the greater number, sometimes demonstrable, sometimes only as a matter of fair induction it may be stated that the constitution is affected through the blood and the relation of the nutritive processes to it. Pyrexia, when present, is secondary, and generally dependent on the irritation produced by the effort to eliminate some morbid material (WALSHE). The re-absorption of the elements of this morbid material, or a persistence of its existence in the blood, tends to affect the blood secondarily; and this secondary blood-affection produces secondary changes in the solids. Thus the blood-changes, and the changes in the solids continue to act and re-act on each other. Thus also the constitutional diseases are not traceable to the extrinsic action of a virus, and have none of the properties attached to infection. They are apparently generated, developed, and sustained, under the influence of an intrinsic blood-poison, the result of perversion of the nutritive or assimilative functions of the individual, and determined by congenital constitution, or hereditary tendency. "It seems strongly probable," writes Dr. Walshe, "that each member of the group has its specific morbid principle in the blood, uninterchangeable with the rest, just as any one virus is uninterchangeable with others; and that, further, there may exist for each constitutional disease its specific curative agent—an antidote for each poison. In the greater number of these diseases a more or less obvious disposition may be traced to symmetrical arrangement of the anatomical characters, of the local lesions, whether these be external or internal."

It is especially to be noticed also, that a marked distinction ought to be made between what are about to be described as "CONSTITUTIONAL DISEASES" and what are sometimes called "BLOOD DISEASES." The diseases of the zymotic class already described, are what may emphatically be termed "blood diseases;" but the constitutional diseases about to be noticed are "*blood diseases and something more.*" They not only exhibit an aptitude possessed by those who suffer from them to assume peculiar forms of morbid action, but their existence stamps upon every other morbid state with which they may be combined a most untoward effect. Exudations no longer proceed to healthy resolution. A chill, which otherwise would do no harm, is followed by rheumatic pains and swollen joints. A bruise is followed by inflammation and an unhealthy suppuration, which has been termed scrofulous, in those who are stamped with the diathesis of such constitutional diseases.

Dr. Walshe also, has specially called attention to the very complex and dangerous forms of disease which result when miasmatic and enthetic diseases (or, as he terms them, acute specific diseases), are complicated with the diathesis of constitutional diseases. He shows that constitutional diseases and miasmatic diseases, when

hey co-exist, exercise an unfavourable reciprocal influence upon ach other (*Med. Times*, 1855).*

The diseases of this class are conveniently arranged into the two ollowing orders, namely—1. *Diathetic diseases;* and 2. *Tubercular hthisical or wasting diseases.*

CHAPTER II.

DESCRIPTION OF THE CONSTITUTIONAL DISEASES IN THEIR ORDERS.

ORDER 1. DIATHETIC DISEASES—*Diathetici.*

DISEASES belonging to this order are represented by *rheumatism* and *gout*, also by those affections in which an alteration in the proportions or qualities of the elements of the blood is the obvious and prominent fact, such as *anæmia*, *lencocythemia*, *cyanosis*, and, probably the *morbus Addisonii;* and, lastly, by those diseased states of the constitution which manifest themselves by such alterations of the urine as are sufficiently indicated by oxalic acid, the xanthic oxide, the cystic oxide, the lithic acid, or the diabetic state.

With reference to the term "diathesis," it is to be explained that there are certain states of the human body which physicians have called "morbid dispositions" (diatheses morbosæ). The term *diathesis* is used extensively, and sometimes vaguely. By it pathologists have meant to designate often an unknown, impalpable, undefined state of the human constitution, the existence of which is sometimes assumed, or is sometimes legitimately inferred by inductive reasoning, and which then is made to explain the characteristic tendency of some constitutional disease which betrays itself by repeated local manifestations of morbid action (CRAIGIE). A *rheumatic diathesis*, a *gouty diathesis*, a *cancerous diathesis*, a *lithic acid diathesis*, are all thus spoken of. It is now, therefore, generally understood to imply—(1.) The existence of *latent* conditions in the body itself, necessary for the development of peculiar diseases. (2.) A tendency to the development of special and peculiar diseases during the course of the nutrition and other morphological changes between the solids and fluids of the body, and which are only influenced by the operations of agents from without, acting as stimuli or excitants to the morbid development.

RHEUMATISMUS—*Rheumatism.*

Definition.—*Febrile excitement, probably due to a morbid poison of constitutional origin, and tending to inflammation of a peculiar kind*

* The reader will observe that the term CONSTITUTIONAL as used in this handbook is not synonymous with GENERAL or EXTENSIVE, as used by some writers.

in the parts about the joints, especially in the white fibrous tissues, such, for instance, as the sheaths of the muscles and muscular fibres, tendons, aponeurosis, bursæ, capsular ligaments, periosteum, and pericardium. The various local phenomena of the disease have a tendency to shift from part to part, the most remote from each other; and the febrile state is accompanied by profuse acid secretions from the skin, by the separation, in some cases, of large quantities of uric and sulphuric acid through the kidneys, and by a highly fibrinous condition of the blood.

Pathology.—Very various opinions have been entertained from time to time regarding the nature of this disease. It has been placed in the nosological arrangement of Dr. Farr, given in the first part of this handbook, under the order of *miasmatic* zymotic diseases.

The most recent inquirers into the nature of rheumatism (Garrod, Fuller) show that it acknowledges no general external source, and it is not even yet demonstrated that any definite offending matter or poison pervades the system. It is presumed, however, by inductive reasoning, that some morbid material is generated by, and within, the bodies of those in whom rheumatism is fully developed, and is not absorbed from without.

Evidence of the poisoned state of the blood exists in—(1.) The symmetry of the local symptoms, a phenomenon which obtains in all disorders connected with a vitiated condition of the circulating fluid (Budd). (2.) The most remarkable features of rheumatism are characteristic of a disease dependent on a vitiated condition of the blood, such as premonitory fever, a large number of local symptoms, and lesions of internal organs, independent of metastasis. (3.) A series of observations by Chomel (*Leçons de Clinique Medicale*) tend to show that the internal inflammations in rheumatism, like those of *small-pox*, *typhus*, and *scarlatina*, and the like, are referable to an alteration of the animal fluids, and more especially of the blood. (4.) The phenomena of metastasis, when it does occur, points to a morbid matter in the blood itself as an explanation of the occurrence (Holland, Fuller).

The following circumstances point to the constitutional origin of this disease (Fuller). The earliest and most frequent victims of the disease are apt to experience symptoms clearly denoting functional derangement. They are sensitive to atmospheric vicissitudes, prone to perspire, and their perspiration has a sour disagreeable odour, whilst their urine, though usually clear when passed, not unfrequently deposits on cooling a red brick dust sediment of lithates and lactates; by such constitutional signs the "*Rheumatic diathesis*" is indicated The heart of such persons is irritable and prone to take on inflammatory action, and its nutrition

is apt to become perverted. A change of the mode of living has been observed to induce the rheumatic diathesis. The constancy of functional derangement preceding the attacks of rheumatism is recorded by Todd, Chomel, and Fuller. The long continuance and frequent recurrence of symptoms also point to a constitutional origin of the *materies morbi* of rheumatism.

It was first suggested by Dr. Prout that all the phenomena of rheumatism are referable to the presence of lactic acid developed too freely in the system, a suggestion adopted by Dr. Todd and subsequently by Drs. Headland, Fuller, and Mr. Spencer Wells. Before the starch of the food can be applied to the maintenance of animal heat, it has to be converted into lactic acid, which then combines with oxygen to form carbonic acid and water; and whatever tends to interfere with this normal series of changes from taking place, may, it is said, lead to the accumulation of lactic acid in the system.

Dr. Fuller believes the poison of rheumatism to be identical with some natural excretion of the skin, and he grounds his belief chiefly on the following circumstances:—(1.) That when the skin's action is interfered with, especially in old people, pains or stiffness of a rheumatic character are generally the consequences. (2.) That the perfect development of the means which nature adopts to relieve these symptoms suggests a relationship between rheumatism and cutaneous excretion. "No sooner is a person attacked by the disease," writes Dr. Fuller, "than excessive perspiration is set up, as if with the view of getting rid of some peccant matter, and the secretion is most profuse at the very part where local inflammation is taking place." Nevertheless, although rheumatism is undoubtedly stamped with a peculiar and specific character, yet the material morbific matter is as yet undiscovered. The exact conditions of the system under which the disease becomes developed are hitherto undetermined. Both Dr. Craigie and Dr. Watson hold that rheumatism implies inflammation of a peculiar or specific kind; and the latter goes a step farther and writes that "Rheumatism is a blood disease,—that the circulating fluid carries with it a poisonous material which, by virtue of some mutual or elective affinity, falls upon the fibrous tissues in particular, visiting and quitting them with a variableness that resembles caprice, but is ruled no doubt by definite laws to us as yet unknown."

In addition to these statements, when it is written, as Dr. Fuller has done, "that the specific poison is generated in the system, as the result of faulty metamorphic action, that many agencies may conduce to the formation of the poison and to its retention in the system," all has been written that can be legitimately deduced from the observations of most able pathologists regarding the nature of this disease.

Dr. W. B. Richardson, of the Medical School adjoining St. George's Hospital, has recently made some very important experiments to try whether the theory, that superabundance of lactic acid in the system induces pathological phenomena of the rheumatic type, admits of any direct demonstration. He injected into the peritoneum of a healthy cat seven drachms of a solution of *lactic acid*, with two ounces of *distilled water*. The operation was performed without accident. The opening in the peritoneum was made valvular, only sufficiently large to introduce a small injecting tube. Two hours after the operation the action of the heart became irregular. The animal was left for the night about six hours after the operation, and in the morning was found dead. The inspection showed *no peritoneal mischief*, but the most marked *endocarditis* of the left cavities of the heart. The mitral valve, thickened and inflamed, was coated on its free borders with firm fibrinous deposit. The whole endocardial surface of the ventricle was intensely vascular. Dr. Richardson afterwards repeated this experiment on two healthy dogs. The first dog died on the second day after the experiment, and the inspection revealed the most striking pathological signs of *endocarditis*. The tricuspid valve was inflamed and swollen to twice its ordinary size. The aortic valve, swollen and inflamed, was coated on its free border with fibrinous beads. The endocardial surface was generally red from vascularity. The pericardium was dry and injected. As before, *the peritoneum escaped injury*. The joints were not affected, but there was distinct sclerotitis in the left eye. These experiments demonstrate that endocarditis may be physiologically produced by lactic acid (*Med. Times and Gazette*, July 18, 1857).

Whatever, therefore, the poison may be which induces the rheumatic state, it is one which appears to be generated within the system, and not absorbed from without. It is inbred, and not derived from extrinsic sources. The researches of Dr. Parkes lead to the belief that it is some substance rich in sulphur.

The parts affected in rheumatism are for the most part the *ligaments, fasciæ, aponeurosis, periosteum, perichondrium, tendons, bursæ, and serous membranes of the heart and brain;* but the joints and surrounding structures are the parts most frequently affected; and the heart, the kidneys, and the arteries sometimes also suffer. A red and injected state of the vessels of some of these structures is often the only evidence of the existence of any approach to inflammatory action, especially in the synovial membranes, the pericardium, or membranes of the brain.

The diffuse redness and injection of the vessels may terminate by resolution, or serum may be effused. *Serous* inflammation is extremely common, and is evinced by the swollen state of the bursæ

and parts external to the joint, often by an evident fluctuation within the cavity of the joint; and should the patient die, the cavity of the arachnoid and of the pericardium may be found loaded with serum, the latter often to the extent of many ounces.

One of the most frequent results of the exudative process in acute rheumatism consists in the tendency it displays to thicken parts and to cause opposing surfaces to adhere. The cellular tissue surrounding the diseased articulation is often not only found thickened, but also infiltrated with a loose coagulable lymph. The tendinous sheaths and capsular ligaments often offer the same alterations. After an indefinite time the effused lymph becomes organized, and in this manner parts are bound down and the motion of the joints greatly and sometimes permanently impaired. The alterations of the synovial membrane are not the least curious of the changes which occur in rheumatic joints from the adhesive process. The tissue is not only often thickened, but villous processes, like the papillæ of the tongue of herbivorous animals, only soft and red, and dipping into the depressions around the neck of the bone, are occasionally formed, which are intractable even to long treatment, and often lead to destruction of the joint. The strongest evidence of the tendency to thickening, organization, and adhesion exhibited by the exudation may be seen in the immense effusion of lymph which often takes place in *rheumatic pericarditis*, sometimes covering the whole surface of the heart and pericardium with a layer of lymph half an inch in thickness, and whose irregular surface has been compared to a honeycomb, a calf's stomach, or to the rind of a pine-apple.

It is rare that the exudative process in acute rheumatism advances to suppuration. Stohl, however, has noticed this termination, and many other physicians have observed the same fact sometimes in the muscles, but more commonly within the capsules of the joint. Of this last form of disease Chomel has seen three cases, Moreau one, Piorry two, and Cruveilhier three cases; and to these Bouillaud and Macleod have made several additions.

Ulceration of texture in some parts affected with rheumatism is by no means unusual, sometimes perforating the capsular membrane or destroying the ligaments, but more frequently eroding the cartilages and the ends of the bones.

A remarkable change sometimes takes place in the bones of rheumatic joints when the cartilages have been lost, which are sometimes enlarged, and almost eburnified from increased ossific deposit, causing not only a change of form in the articular extremity, but presenting a mechanical obstacle to the motion of the joint. When the hip-joint is affected, says Dr. Todd, the acetabulum becomes deeper and wider than natural, and the head of the femur flattened and expanded, assuming something of the shape of the turnip.

The parts most commonly affected are the joints and such textures as are composed principally of the white fibrous tissue. Accordingly, the valvular apparatus of the heart, its fibro-serous covering, the strong white glistening sac of the pericardium, are parts which most frequently suffer. Some joints are more prone than others to be attacked, such joints also being more exposed, as the knees, the feet, and ankles; the wrists and the hands are the parts most commonly implicated; next in order, perhaps, follow the elbows, and then the shoulders and the hips. The larger joints suffer more frequently than the small, and the small joints of the hands and fingers more commonly than those of the feet. Joints also which have been injured, such as those which have been sprained, are more apt to suffer than others; so also those parts which are exercised violently, when that exercise is long continued. There is a tendency also to the symmetrical implication of joints.

The disease may run its course without the implication of any external organ; but not unfrequently the investing or lining membrane of the heart becomes inflamed, and so do the lungs or pleuræ; complications, whose existence had been long unnoticed.

The heart affections embrace both the immediate and the subsequent dangers in an attack of rheumatism.

The occurrence of the heart affection was at one time considered as due to a retrocession of the disease from the external parts, and its consequent transfer to the membranes of the heart. But more recent and extended investigation has shown that endocardial or exocardial inflammation may occur as the first, and be, for some time, the only local symptom of the disease (Fuller, Watson, Graves, Taylor, and others); that it sometimes *precedes* by *several days* the access of articular redness and swelling; and that even in cases where it does not take place until after inflammation of the joints has been set up, it is rarely preceded or accompanied by subsidence of the previously existing articular inflammation. In other words, in the great majority of cases it has been shown that no connection can be traced between the two sets of actions, beyond their origin in one common source of mischief,—in one poison which excites inflammation now at one spot and now at another; at one time attacking several joints simultaneously, or in succession, and then the investing or lining membrane of the heart; at another time reversing the order of attack, and exciting inflammation first of the heart and then of the articular structures. Hence, although rheumatic inflammation of the heart may possibly be connected in some rare instances, with the sudden subsidence of articular inflammation and the transfer of irritation from the external parts, it must be regarded in most instances as a mere coincidence, and as an extension of the local manifestations of the disease (Fuller).

As a general rule, like the severe cases of articular rheumatism, the occurrence of cardiac complication may be expected in cases remarkable for the severity of their general symptoms. But from the nature of this disease all cases are liable, and as we have seen the cardiac symptoms may for a time be the only ones, hence has arisen the apparent difference of opinion as to which are the cases peculiarly prone to heart disease. Dr. Latham and Dr. Watson state that "pericarditis is not more to be looked for when the disease is severe than when it is mild;" but, according to the experience of Dr. Fuller, the most recent authority on rheumatism, it is inconsistent to believe that it often occurs, in cases which are not characterized by active symptoms of disease. "Whenever I have met it," he writes, "even though the articular inflammation may have been slight or evanescent, the febrile disturbance has always been severe, and accompanied by profuse and sour-smelling perspiration." His experience expressed numerically stands as follows:—"That whereas pericarditis occurs *once* in about every 6·3 patients suffering from *acute* rheumatism, it does not accompany above one in every 66·5 cases of the sub-acute form;" and his experience in this respect is consistent with that of M. Bouilland, Drs. Macleod, William Budd, and Copland. In many instances the heart remains unaffected throughout the attack, and though it does sometimes suffer, even in the milder cases, it is most commonly damaged in those instances which are marked by unusual severity of their general symptoms, by the number and intensity of the articular inflammations, and by the rapidity and frequency of their migration. It is found also that in youth, in women rather than in men, in those persons who have been weakened by illness, or by large and repeated bleedings, and in those peculiar states of the system marked by a deficiency of red globules in the blood, the heart's irritability is much increased, and palpitation is readily induced in those also who are pale and weakly, reduced by illness and exhausted by the treatment adopted; and that these are the cases in which cardiac inflammation is most liable to arise during an attack of rheumatism (Fuller).

The forms of disease from which the heart is apt to suffer in cases of rheumatism, are—(1.) Inflammation of the pericadium or endocardium. (2.) Inflammation of the substance of the heart itself. (3.) Fibrinous vegetations on the valves and on the lining membrane of the heart, independent of endocardial inflammation.

These vegetations, like other exudations, are doubtless common in endocarditis, but they are also essentially independent of endocardial inflammation, and may take place without its occurrence, while endocardial inflammation does not necessarily produce them (Kirkes, Ormerod, Fuller). These fibrinous deposits seem to be

more immediately connected with some abnormal condition of the circulating fluid, for according to the observation of Dr. Fuller, they are almost always entirely confined to cases accompanied by acute and wide-spreading inflammation, and by conditions productive of unusual quantities of fibrin in the blood, and which tend to impair its solubility. The statistics of Dr. Barclay in the *Med.-Chir. Trans.*, vol. xxxi., confirm these observations.

The disease is often protracted and rendered complex by other lesions besides those of the heart. Besides the joints, the different muscles of the body, their fascia, or tendons, are often the seat of chronic rheumatism, and there are few structures of this kind that entirely escape. The scalp, for instance, is often affected. The muscles of the eye are occasionally so; Stohl quotes one case in which the woman squinted while the disease lasted. Rheumatism of the face is by no means unfrequent, and the muscles of the larynx are occasionally affected, causing aphonia. Everybody is familiar with the rheumatic affection termed "crick in the neck;" it also affects the articulations of the clavicle and intercostal muscles. Rheumatism of the abdominal muscles is by no means rare, the principal pain being at their insertion into the crista of the ilium. Lumbago is well known as an affection of the lumbar muscles, extending often to the ligaments of the sacrum. The insertion of the tendo Achillis into the os calcis is another seat of rheumatism, but no parts are more often or more painfully affected than the tendinous structure of the soles of the feet. These forms of rheumatism are seldom accompanied by any swelling or other external symptom.

When catarrhal affections are prevalent, inflammation of the lungs or their investing membranes may be expected. Acute inflammation of the sclerotic coat of the eye is also not uncommon; and appears to be most of all liable to occur in cases where the tendency to gout prevails as well as the rheumatic condition. Inflammation of the brain or of the investing membranes is one of the most frightful complications, but which is happily rare. Cases of active maniacal delirium, sympathetic and symptomatic, of cardiac or pulmonary disease, or of the general vitiated condition of the circulating fluid, have also been recorded.

"It is worthy of note," writes Dr Fuller in conjectures regarding the reason why lesions of particular and constant textures occur in rheumatism, "that the textures most commonly implicated are all examples of the albuminous and gelatinous tissues, from the decomposition of which, in the wear and tear of the body, are formed those secondary organic compounds the lithic and lactic acids, with which gout and rheumatism are intimately connected." It may be for this cause, therefore, that the rheumatic poison has a special affinity for the fibrous and fibro-serous textures throughout the

body, and fixes more especially upon those which are in any way subject to irritation; and that according to the intensity of the febrile disturbance so *cæteris paribus* is the liability to inflammation, whether of the joints, the heart, or any other part of the body, inasmuch as the violence of the febrile symptoms form a tolerably accurate measure of the amount of the poison present in the system, and of the patient's susceptibility to its influence. The number and intensity of the articular inflammations, and the proneness they exhibit to shift their quarters, serve also as guides to the probability of heart or other internal affections; and the extreme liability to cardiac inflammation, engendered by the repression or rapid subsidence of the articular inflammation, is explicable by the greater quantity of the poison which is thus suddenly thrown into the blood's current (FULLER).

Symptoms.—Rheumatic inflammations may be acute or chronic, but the proportion of the latter is infinitely greater than of the former.

Acute rheumatism is a severe inflammation of the feet, of the hands, or of the larger joints, as the wrist, ankle, knee, hip, elbow, and shoulder joint, or of one or more of these parts, and this is usually accompanied by a sharp inflammatory fever. These affections often constitute the whole disease; but in a given number of cases, either with or without the subsidence of the articular inflammation, the heart or pericardium, or the membranes of the brain, become the seat of the rheumatic inflammation. The proportion of persons whose heart is thus affected probably varies according to the treatment, and other circumstances noticed in the former section. Bouillaud estimates the number at more than one-half, or as 64 in 114 cases, and Dr. Macleod at one-fifth. The affection of the membranes of the brain is much more rare, so that the proportionate number is not determined.

In an attack of acute rheumatism the fever often precedes, by twenty-four or forty-eight hours, the inflammation of the joints; but this is not constant, for in some instances the local and general symptoms are contemporaneous, while in others the inflammation of the joints is established before the accession of the fever.

The fever which attends acute rheumatism is well marked and striking, and symptoms of functional derangement present themselves long before its full development. Before actual fever is established, the patient feels "out of sorts" and unusually sensitive to atmospheric vicissitudes; he looks pale, with a sallow, unhealthy complexion and a dull eye with yellowish conjunctivæ. The chilliness or shivering with which, in common with other acute fevers, it is ushered in, speedily passes away, and is followed by great heat of the skin, and by copious but partial perspiration,

almost invariably acid, reddening litmus paper, and of a disagreeable sour odour. It is a mistake to suppose that much perspiration is useless. It is nature's cure for the disease. It may be "wasting and enfeebling," as excessive perspiration always is, but it is highly sanative; and if it does not occur the pains are always more excessive and the constitutional symptoms become more severe, if it should unexpectedly cease. The materies morbi is got rid of by the sweating, and the natural cure of the disease is effected by the profuse sour smelling perspirations. Those perspirations are only useless when they are not of this characteristic sour description. They are then emphatically "useless, wasting, and enfeebling," and ought to be arrested. The pulse rises to 90, 100, and 110, and is large, full, and strong; the tongue is greatly loaded with a white or yellowish-white mucus; the bowels sluggish; the evacuations dark and offensive; and the urine scanty, with a copious deposit of the lithates, is high coloured, extremely acid, and of high specific gravity, due to a relative rather than a positive increase in the quantity of the matters excreted by the kidneys. The absolute excretion of solids in the twenty-four hours is in excess compared with other fevers, but the quantity of water is far below the average. There are many remarkable differences between this and ordinary fever, for it runs no given course, is not marked by changes of the tongue, nor by any great depressing action; while delirium and even headache are of rare occurrence. In the urine also there is an enormous excess of sulphur in the form of sulphuric acid excreted, greater in fact than in any other febrile disease (PARKES).

The local symptoms which accompany the inflammation of the articulations are pain, heat, redness, and tumefaction. The *pain* is generally active and severe, although in a few cases it is latent,—that is, the patient is at ease, unless the joint or limb be moved. At first the pains may wander capriciously from limb to limb, and produce more or less temporary stiffness. It has many degrees of intensity, being in a few instances trifling, but more commonly atrocious and agonizing, and though generally constant, it is sometimes intermittent. In all cases in which it exists, it is greatly augmented by pressure, so that the slightest touch—even the weight of the bed-clothes—is insupportable; it usually somewhat remits during the day, and is aggravated at night. The *heat* of the inflamed joint is constantly increased, the thermometer indicating a temperature of 100, 105, or even more degrees. *Redness*, though not universally present, is nevertheless the rule of the disease, and the affected joint is surrounded by a rose coloured blush, evanescent on the slightest pressure, yet returning on its removal. The *tumefaction* of the part is generally so considerable that the shape of the hand, the ankle, or other joint, is completely destroyed. In

affections of the knee, the patella is often more or less displaced, by effusion into the cavity of the joint; and this, together with the swelling of the external parts, obliterating all the markings of its healthy state, renders it misshapen and rounded. "The surrounding skin becomes dry, tense, and shining, so much so indeed that experience alone enables us to predict that suppuration will not take place."

"One of the most remarkable and suggestive facts," writes Dr. Fuller, "in regard to rheumatism is, that the fever and constitutional distress are not always commensurate with the extent and intensity of the local symptoms. Not only is rheumatic inflammation of the joints very frequently *preceded* by febrile disturbance, but sometimes the fever runs so high before any local symptoms have been established, as to cause even cautious and intelligent practitioners to mistake the nature of the impending attack. Moreover, when febrile symptoms do thus precede the establishment of local inflammation, they are not only increased by its occurrence, but as was remarked by the sagacious and observant Sydenham, they are very generally relieved, the pulse becoming calmer, the countenance less anxious, and the patient altogether easier."

Such are the general and local affections in acute rheumatism, and at the height of the disorder it is difficult to conceive a more complete picture of helplessness and suffering than that to which they reduce the patient. A strong and powerful man, generally unused to disease, lies on his back motionless, unable to raise his hand to wipe the drops which fast flow from his brow, or the mucus which irritates his nostril. Indeed, he is so helpless, that he is not only obliged to be fed, but to be assisted at every operation of nature. The sweat in which he lies drenched brings him no relief; his position admits of no change; and if he sleeps, his sleep is short, and he wakes up with an exacerbation of suffering which renders him fretful, impatient, and discontented with all around him.

The duration of acute rheumatism is very various; in some cases both the fever and local pains are gone in three or four days, but in the majority of instances they continue till about the tenth to the fourteenth day, when the fever disappears and the pains begin to subside, and towards the close of the third week or the beginning of the fourth, the patient is recovered, and generally without injury to the joints affected. In almost all cases, however, the pain continues till after the fever is gone, and sometimes for a very long period afterwards. Dr. Fuller's observations lead him to believe that under ordinary methods of treatment the disease endures from four to five weeks, and patients are generally able to leave an hospital about the end of the sixth week; and he considers that the average duration of an uncomplicated attack may be reduced by judicious treatment from a month or five weeks to ten days or a fortnight, which is quite consistent with the experience of the late

Dr. Williams, as stated above. The patient, though recovered, is liable to relapse, and often suffers from it.

The symptoms which have been described, belong to the usual forms of acute rheumatism; but in a given number of cases this course is interrupted by the heart, the pericardium, or the membranes of the brain becoming the seat of this severe affection.

The symptoms which indicate cardiac mischief are pains or soreness all over the chest, increased on pressing between the intercostal spaces, and also on taking a deep breath. The patient is restless—his countenance anxious, and occasionally he coughs. On applying the stethoscope to the chest, a murmur is often heard, loud and permanent, and evidently arising from some irregular contraction about the orifices of the heart, or from some affection of the valves. Many pathologists, it has been stated, conceive we can determine the exact pathological state of the pericardium. Thus, if the inflammation be diffuse, we shall have a crackling sound, like that of new leather, the parts being dry; or if serum be effused, we shall find the heart moving in a larger space than usual. Again, if lymph be poured out, we shall have a rubbing sound; and lastly, if pus be poured out, it will be determined not only by the greater space in which the heart moves, but by the sudden collapse and rapid sinking of the patient (see *Pericarditis*, &c).

The duration of this secondary affection is very various. If the disease be severe and neglected, the patient often dies in three or four days; under proper treatment it seldom continues beyond a week. If this attack be altogether neglected, and the patient survive, the pericardium either becomes adherent, or the valves of the heart become permanently diseased, and its ulterior effects are dropsies, asthma, or affections of the lungs, which baffle all the resources of our art, and ultimately they are to be classed among the most fatal maladies incident to humanity.

The pain in chronic rheumatism is often latent, unless the part be moved, and then the agony is severe. In many cases it is quiescent during the day, but it is extremely acute during the night. This pain has a great tendency to shift from joint to joint, often subsiding and again recurring. Redness is rarely present in chronic rheumatism.

The lesions of motion vary from mere stiffness to an entire binding down of the joint. In this manner the hip and shoulder may be so firmly fixed, that the arm cannot be extended or the leg raised. The knee and elbow-joints are generally semi-flexed, and cannot be straightened; while the fingers, if straightened, cannot be bent, or if bent, cannot be straightened. When the joint is fixed, the muscles of the limb often become atrophied, sometimes partially so. The duration of chronic rheumatism is extremely un-

certain; it sometimes disappears in a few hours or in a few days, but it may last many weeks or months, or even years.

Chomel has attempted to give the relative frequency with which different parts of the body are attacked with chronic rheumatism, and out of ninety cases he found the muscles of the body were affected eleven times; one side three times; the upper limbs twelve times; the lower limbs twenty-two times; the trunk eleven times; the vertebral column nine times; and some part of the trunk or limbs twenty-two times.

Diagnosis.—The only diseases with which acute rheumatism, when attended with swelling and redness, can be confounded, are, perhaps, erysipelas and gout. Chronic rheumatism is also often of difficult diagnosis when it attacks the intercostal spaces, being often confounded with pleuritic pains, or other affections of the chest. It may also be confounded with many neuralgic affections, as well as with pleuritic diseases.

Prognosis.—The number of deaths from acute rheumatism hardly exceeds one out of every thousand deaths for all causes; whence it is manifest that this disease is seldom fatal, and perhaps the number of unsuccessful cases hardly exceeds one or two per cent. But although this disease is rarely immediately fatal, yet a considerable number of persons ultimately die from diseases of the heart, apparently resulting from the action of the rheumatic poison.

Very few deaths occur from chronic rheumatism, so that the numbers that die bear but a very small proportion to those that recover.

Remote Causes.—There are few morbid poisons which do not produce pains which cannot be distinguished from rheumatism: thus typhus fever begins by pains in the bones and muscles, and often ends with severe pains in the legs. The paludal poison also often leaves severe hemicrania, or rheumatic affection of one side of the head. In small-pox the patient often suffers for several days from pains which have frequently been mistaken and treated for rheumatism. In scarlatina the joints are often the seat of the severest rheumatic inflammation; while in syphilis nothing is more common than for the patient to be long racked with what appear to be rheumatic pains. It is plain, therefore, that morbid poisons are a frequent cause of a condition of parts which cannot be distinguished from rheumatism; and it has long been a question whether some undefined poison of miasmatic origin is not therefore by far its most frequent cause; again, if we look to the course of the disease, it differs from all ordinary inflammations in the tendency it has to subside in one part and to appear in another, phenomena explicable on the laws of morbid poisons, but which are opposed to all we know of the laws of ordinary inflammation. Supposing this

view of the case should ultimately prove correct, it will follow that cold and wet, by lowering the vitality of parts, greatly assist in pointing to the particular seat of the action of the poison, but are not the great agents in the production of this disease.

Any more express investigation into the remote causes of rheumatism is extremely unsatisfactory. They are generally supposed to be identical with those causes which produce catarrh. Those, however, who refer catarrh to the vicissitudes of temperature, attribute rheumatism to this cause; but the returns of rheumatism occurring in the different commands of our army effectually blast such an hypothesis, as shown by Colonel Sir A. Tulloch's returns. They are as follows :—

	Jamaica.	Nova Scotia and New Brunswick.	Bermuda.	Malta.	Ionian Islands.	Gibraltar.	Canada.	Mauritius.	Windward and Leeward Command.	United Kingdom.	Cape of Good Hope.
Ratio per 1,000, Annual mean strength.	29	30	33	34	34½	38	40	46	49	50	5

It is not therefore in the coldest climates that rheumatism is most prevalent, but at those seasons and in those climates remarkable for damp and variable weather; and "thus," says Sir A. Tulloch, "we find in the mild and equable climate of the Mediterranean or the Mauritius the proportion of rheumatic affections even greater than in the inclement regions of Nova Scotia and Canada; and though some of the provinces of the Cape of Good Hope have occasionally been without rain for several years, yet rheumatism is more frequent in that command than in the West Indies, where the condition of the atmosphere is as remarkably the reverse." Exposure to wet, however, would appear to have much influence in the production of rheumatism, for we find the returns of the navy show a considerably larger proportionate number of attacks than in the army; the number per thousand annual mean strength attacked in the Mediterranean fleet being 63·9, in the West India and North American station 69, and in the South American station 72·3.

Some writers have supposed that the cause of rheumatism lies not so much in the abstract degree of cold as in the range of atmospheric vicissitudes; and Dr. Haygarth has estimated that the number of persons attacked with rheumatism in summer is to those attacked in winter in the ratio of five to seven.

A very small number of children suffer from rheumatism; for

out of 73 cases given by Chomel, 2 only were attacked under fifteen years—35 for the first time between fifteen and thirty—22 from thirty to forty—7 cases from forty-five to sixty—and 7 cases after sixty. At whatever age, however, rheumatism occurs, one attack while it indicates the existing diathesis, yet it does not establish a predisposition to another; and although many are always martyrs to the affection, yet a well developed rheumatic paroxysm and a complete recovery tends to establish under attention to diet and exposure, a more or less protection; but anything which exercises a prolonged depressing influence upon the system, especially if there is at the same time a hereditary tendency to the disease, may induce the development of the rheumatic poison.

The disease also is distinctly hereditary. Dr. Fuller has traced the hereditary taint in nearly 29 per cent. of the cases admitted into St. George's Hospital.

Men are supposed to be more liable than women to rheumatism, and Dr. Marlow says in the ratio of 137 men to 89 women. After menstruation, however, has ceased, this greater immunity terminates.

Treatment.—It seldom, if ever happens, that the cure of rheumatism can be safely entrusted to any single remedy; and the nature of the disease as already indicated points to a compound method of treatment as most likely to lead to a successful issue.

Venesection, calomel combined with purgatives, and opium, are the three remedies which have been most generally made use of in the treatment of rheumatism, but many other remedies have also been and are still advocated exclusively by not a few. These are especially *vapour and hot air baths, mercury, antimony, cinchona, colchicum, guiacum, nitre, lemon juice, alkalies, and their salts.*

"But as, when uncomplicated by cardiac affection, the disease," writes Dr. Fuller, "usually terminates, sooner or later, in recovery, and sometimes subsides with marvellous rapidity under every variety of remedy, it is obvious that no sound inference can be drawn as to the success of any particular method of treatment, unless such treatment has been largely adopted, and has been attended with tolerably uniform results. And I am sure I may say, without fear of contradiction, that each and every plan of treatment which has been hitherto proposed is regarded by the profession as unsatisfactory. If, in one person's hands, any particular remedial course has proved efficient, it has signally failed in those of another; if at one time a remedy has proved efficacious, it has been found inert or injurious at another, under different circumstances of age, sex, constitution, and the like. Nor does this appear strange to those who consider the true nature of the disorder, and the variety of circumstances under which the physician may be called upon to minister to his patient's relief. The bleeding, which in the young, plethoric, and robust, may be necessary to allay excessive vascular action and cause free secretion, may, in the weakly, induce irritability of the heart, and a consequent attack of cardiac inflammation. The opium, which in one person may prove of the greatest service in pro-

moting free perspiration, and in allaying the general irritability of the system, may, in another, check the biliary and other secretions, and thus prevent the elimination of the rheumatic poison. The continued use of calomel, and the constant purging, which may be beneficial to one patient, by removing large quantities of unhealthy secretions, may unnecessarily exhaust the strength of another, and tend very greatly to impede recovery. And so in regard to every remedy which has been proposed: what is useful at one time, proves useless or positively injurious at another."

To learn how to adapt our present remedies to the exigencies of each particular case, is what is now most of all required. Acute rheumatism is manifestly a highly inflammatory disease, but of a peculiar constitutional origin, as has been fully illustrated; and the blood drawn presenting a more copious layer of "buff" than most other diseases, the proportion of fibrin being greatly increased, we can hardly feel surprised that bleeding has been largely had recourse to. But, although bleeding has been extensively adopted, the profession has been much divided as to the advantage derived from the practice.

Sydenham attempted the cure of acute rheumatism by bleeding, and he took ten ounces of blood on the first day, as much on the second, and he bled a third time a day or two afterwards, and three or four days after this he bled a fourth time. This was the early practice of our great master, but some years later we find that he bled less and purged more, observing that repeated bleeding was too debilitating. This, however, is not the fullest extent to which bleeding has been carried, for Sauvage says that at Montpellier they bled in his time thrice a-day, and to a great amount, and the result of his experience was that nature was the best physician. Bouillaud is perhaps the only physician in recent times who has adopted the system pursued at Montpelier; for in cases of no great severity he recommends four pounds and a-half of blood to be taken in twenty-four hours, while in graver cases he takes eight, nine, and ten pounds of blood within the week. The advantages of this mode of practice, he affirms, are, that the disease does not become chronic, and that its duration is abridged from one to two weeks, the mean duration of his cases, reckoning from the time of their admission to the hospital being nineteen and a-half days. The objections to this practice are, first, that no advantage is gained as to time; that the loss of so large a quantity of blood is worse than the disease, for it would be felt by most persons all their lives, that but temporary, if any abatement of sufferings follows its use; lastly, that this mode of treatment appears to have caused in his practice an unusually large number of cases of carditis—a larger number, indeed, than has been witnessed by any other person in the profession; a predisposition to cardiac inflammation is also en-

gendered by copious and repeated blood-letting. In some instances, however, it is required and is highly beneficial; but repeated observation has led Dr. Fuller and others to believe that it is so only in first attacks, occurring in young, robust, and otherwise healthy persons, particularly in those which are marked by unusual severity of their symptoms, or are unaccompanied by free perspiration. It ought at all times to be cautiously employed, and carried to a small extent only,—viz., from *eight* to *twelve* ounces, according to the age and strength of the patient, the object being *to favour the action of other remedies, and to promote free secretion* by its use, rather than to arrest or cut short the disease (LATHAM, FULLER). In mild cases it is unnecessary, in the delicate and those of weakly constitution, it is inadmissible, and in the well expressed rheumatic diathesis, or when the disease is distinctly ascertained to be hereditary, it utterly fails in modifying the morbid action, is ill borne by the system (WILLAN, FORDYCE, ALISON, TODD, WATSON, FULLER), and therefore should only be practised under certain conditions.

"Venesection," writes Dr. Fuller, "is to be made use of with the view of *expediting the operation of other remedies*, and must necessarily take the lead of all other measures, if it is to be employed at all. With this view it may be used in the young, plethoric, and robust, in whom secretion is insufficient, whose pulse is full and bounding, and whose skin is dry, and hot, and burning. A single bleeding is sufficient to relieve the excessive congestion, on which the want of secretion in great measure depends, and which forms an obstacle to the action of those remedies on which we rely for effecting a cure. Active purgation is to be avoided. It is injurious for three reasons.

"First, because it is not necessary to the cure of the patient, and, like bleeding, tends greatly to reduce his strength, and protract recovery. Secondly, because, from the nature of the complaint, the patient is quite incapable of moving, and his sufferings are aggravated, his irritability is increased, and his heart's action accelerated, by the repeated shifting of his position, which is rendered necessary by the calls of nature. And thirdly, because it necessarily gives rise to more or less exposure, which must be prejudicial to a person bathed in perspiration."

The aim should be to obtain merely a single free evacuation every morning, an object which is best obtained by *calomel* combined with a full dose of *opium* at night and followed when necessary on the following morning by a draught composed of *rhubarb* or *senna* with *colchicum*, and the *potassio tartarate of soda*. One full dejection by these agents will secure an abundant secretion from the liver and from the glandular follicles of the intestinal mucous membrane. *Opium* may be given with the greatest advantage in the early and most painful stage of the disease, occurring in adults, to the extent of *six* or *eight grains* in *twenty-*

four hours; and to children in *half grain* doses every three or four hours. During its use the urine increases in quantity, the motions become more healthy in appearance, and the coated tongue cleaner and less red.

Colchicum administered alone is a dangerous remedy; but its virtue as a remedy may be obtained in small doses in combination with other medicines. It is to be given with small doses of *calomel, ipecacuanha, alkalies,* and *opium.* It promotes evacuation by the kidneys, and appears to exercise some unknown influence over the process of assimilation, whereby the formation of the rheumatic poison is checked. It is only in some cases, however, that it appears to be of service. It is far less efficacious in the weak and nervous than in the more robust and less easily depressed, and of less value in purely *fibrous rheumatism,* than in cases where the *synovial inflammation* predominates; and in the hands of Dr. Fuller it has proved less advantageous in proportion as the fever has exceeded the articular swelling, and as the urine has been less highly charged with lithates. The operation of this remedy must under all circumstances be most carefully watched—a daily evacuation from the bowels must be secured during its use. If the lithates disappear from the urine, if the pulse becomes weak, if faintness, nausea, or purging supervene, the *colchicum* must be at once discontinued; but till some one of these symptoms occur, *a grain,* or *a grain and a-half* of the *acetous extract,* or the *inspissated juice,* or from *fifteen* to *twenty minims* of the *wine of Colchicum* may be safely, and with advantage, administered two or three times a-day.

The beneficial effects of *Guiacum* are obtained in those cases which are unaccompanied by perspiration, and in which the excretory organs are greatly excited by the action of the remedy; but when the patient is perspiring freely, and when it neither purges nor causes diuresis, very little benefit is obtained from its use.

The general treatment recommended by Dr. Fuller is made up of *alkalies* and the *neutral salts with colchicum, calomel, and opium;* a little *antimony* being sometimes added, with the occasional aid also of a purgative. Baths are never to be employed if the skin is acting freely; but if it is hot, dry, and burning, its action may be successfully stimulated by means of the vapour or hot air bath.

If the bowels act once a-day, a dose of calomel and opium may now and again be prescribed with the view of modifying the character of the intestinal secretions. Dark coloured and offensive stools indicate the call for the dose, followed by a draught of *infusion of senna* together with half an ounce of the *potassio tartarate of soda* and *twenty* minims of the *vinum colchici,* and these should

be repeated every evening and morning till healthy evacuations are obtained, *i. e.*, till the motions are light coloured, more bilious, and less offensive.

Mercury has been recommended with the view of warding off cardiac symptoms; but when it is given so as to affect the constitution before the commencement of cardiac inflammation, it not only has no influence in preventing the disease, but by the irritability and general depression which it occasions, appears to modify the course of the disease in a manner by no means conducive to recovery.

Alkalies, as recommended by Dr. S. Wright, of Birmingham, and Dr. Fuller, or the neutral salts should be given in combination with *colchicum*, full doses of *opium*, and a little antimony. They aid the disintegration, and increase the elimination of sulphuric acid by augmenting the alkalines of the blood (Parkes). The *alkalies* ought to be given largely. The patients lose their pains under their influence, and proceed rapidly to convalescence. In *twenty-three* out of *thirty-nine* cases treated by Dr. Fuller "the pulse was tranquillized within *forty-eight* hours from the commencement of treatment, and in twenty-eight hours the pain was lulled, and the local inflammation greatly subdued.

The form in which the remedy is to be given is that of a simple *saline* or *nitre draught*, to which from two to three drachms of the *potassio tartarate* of soda may be added, with ten or fifteen minims of the *vinum colchici*, from fifteen to twenty minims of the *vinum antimonii*, and from ten to fifteen minims of the *tincture of opium*, or of Battley's sedative solution to prevent the salt running off by the bowels. This draught is repeated for the first twelve or twenty-four hours, at intervals of three or four hours, according to the strength of the patient and the severity of the attack; and if pain is excessive, a pill containing half a grain to a grain and a-half of opium, or an equivalent dose of Dover's powder may be taken once or twice daily. In the use of these remedies, constipation and narcotism are to be avoided on the one hand; and diarrhœa to be guarded against on the other (Fuller). Liquor potassæ in ʒss. doses may also be given to the extent of ʒiii. to ʒvi. in twenty-four hours (Parkes).

External topical applications are also efficient aids in treatment. Blisters and leeches are not indicated by the results of experience, however much at the time they are known to relieve the local severity of the inflammation. Warm fomentations are always employed with advantage; and of all applications a mixed alkaline and opiate solution applied as a fomentation is the most powerful in allaying the pain of rheumatic inflammation. The solution so

highly recommended by Dr. Fuller for this purpose, is composed of an ounce of the carbonate of potash dissolved in a pint of the decoction of poppies or of rose-water to which six drachms of Battley's solution is added, or common tincture of opium, which is less expensive and equally efficient as an external application.

The diet of the patient, in acute rheumatism, should be strictly limited to slops and light puddings, and even in many chronic cases it is desirable to limit it to puddings and white fish.

To obviate the great drain upon the system, it is necessary, however, that the rheumatic patient be better fed than in cases of idiopathic inflammation. Beef tea and jellies may be given, and strong coffee might also be administered frequently on the same principle that it has been given in typhus fever by Dr. Parkes, following up the indications obtained from the physiological action of that beverage as expounded by Lehmann (see pp. 162, 314, *ante.*).

The nature and treatment of the local complication, such as "pericarditis," will be considered subsequently.

Podagra—*Gout.*

Definition.—*Febrile excitement, attended with a specific form of inflammation, favoured by congenital or hereditary constitution, associated with disorder of the digestive or other internal organs, characterized especially by affection of the first joint of the great toe—by nocturnal exacerbations and morning remissions—by vascular plethora and the presence of lithic acid in the blood. The disease tends to repeat itself at longer or shorter intervals, when various joints or parts are apt to become affected.*

Pathology.—The constitutional origin of gout may be explained in a similar manner to that of rheumatism; but the *gouty poison* appears to be more definitely ascertained.

About 1787—1793, Mr. Murray Forbes, remarking the close connection between gout and gravel, and the tendency of the disease to form concretions, ascribed it to the presence of *Lithisiac*, or what has since been named *uric* or *lithic acid* in the blood, which was liable to periodical deposition through the medium of inflammation, in organs whose vessels are of the smallest order, for example, tendons and ligaments (*Treatise on Gravel and Gout*, pp. 78-80); and the material cause of this deposition was, according to his idea, the power of some stronger acid either taken into the stomach, or formed in the process of digestion.

About the same time, Berthollet had advanced an opinion not dissimilar with regard to the presence of phosphoric acid. From numerous observations this chemist concluded that phosphoric acid

is more sparing in the urine of the gouty and the rheumatic, than in that of healthy persons, and that during a paroxysm it became more abundant, and equalled the proportion found in the urine of the most healthy persons; and he therefore ascribed gout to the retention and accumulation of this acid, and its diffusion through the system (*Journal de Medicine*, Juin, 1786, p. 476.) The reverse of this was afterwards maintained by Richerand, who observes, that, on the approach of gouty fits, the phosphoric ingredients of the urine diminish, and seem to be conveyed to the joints to produce their arthritic concretions (CRAIGIE.)

In 1848, Dr. Garrod, of London, published a paper in *The Med.-Chir. Transactions*, and has, since that time, constantly directed his attention to the subject, in which he proves experimentally the statements of Forbes, and shows that the blood, in cases of gout, contains *lithic acid* in the form of *lithate of soda;* and that in cases of chronic gout with chalky deposits round the joints, *lithic acid* is *always* present in the blood and deficient in the urine, both absolutely and relatively to the other organic matters. He believes that the *acid* is always in excess in the system during gout, and constitutes a very important and almost a pathognomonic sign of gouty disease in affections of the joints. The uric acid is found to exist not only in the blood-serum but also in the fluid effused by blisters, and also in the abdominal and pericardial fluids. The abstraction of a very small amount of blood is required to discover the uric acid if it is present in quantity. From one to ten fluid drachms of the serum being taken, it is to be put into a broad and flat glass dish (not watch-glasses), about three inches in diameter and about a third of an inch deep. Add acetic acid of the strength of the London pharmacopœia in the proportion of about six minims to each fluid drachm of the serum; a few bubbles of gas are generally evolved at first. When the fluids are well mixed, a very fine thread is introduced consisting of from one to three ultimate fibres, from a piece of unwashed linen fabric, about an inch in length, which should be depressed by means of a glass rod. After resting for from eighteen to forty-eight hours, depending on the warmth (temperature at or below 70°), and dryness of the atmosphere, the uric acid will crystallize upon the thread. To observe this a microscope must be used with a linear magnifying power not below 60.

When the gout has become fully developed and has assumed its specific inflammatory character, it produces all the forms of articular inflammation which have been described in rheumatism, and these inflammations attack nearly the same parts, as the bones, cartilages, synovial membranes, bursæ, ligaments, muscles, tendons, and aponeuroses. These inflammations have little to distinguish them from

rheumatism, except the singular pathological phenomenon of a tendency to the deposition of the urate of soda, a discovery we owe to the late Dr. Wollaston.

Occasionally the urate of soda appears to be nearly the sole secretion from the affected part, nothing being seen on the poultice or fomentation cloth applied to the part but this salt in a more or less fluid state. It is secreted from the joints of the toes or fingers, and probably from all their different tissues. Portal gives a case in which the articulations of both hands presented deposits of urate of soda, both within the capsules of the joints, and externally among the ligaments, while the tendons of the extensor muscles of the fingers were almost destroyed. In the Hunterian Museum of Glasgow there is a finger from a gouty hand, with a joint opened and bent upon itself, showing not only a deposition of the salt, but an erosion of the cartilages; also another in which the joint is full of this peculiar secretion, and a third in which the joint is everywhere invested with it. In the Museum of St. Thomas's Hospital there is a specimen in which the femoral cartilage of the knee-joint is coated with it, as if smeared over with plaster of Paris; and another in which it is deposited on the ligaments of the extensors of the hand. Guibert gives a case in which the metatarsal articulation of the great toe was surrounded by urate of soda of a rose tint, and on the inside of the foot, in the cellular tissue, was an abscess containing urate of soda, making its way to the surface; on opening the joint the same substance was also found, and on cutting through the tendons, pieces of urate of soda were distinctly seen between the fibres. Simon gives an account of a gouty skeleton, of which the bones were completely anchylosed.

In the preparations of diseased joints at Fort Pitt Museum, Chatham, described by Mr. Gulliver in *The Edin. Med. and Surgical Journal*, vol. xlviii., the material is said to be deposited outside the joint in the cellular tissue, exterior to the periosteum and articulation capsules. Similar dissections are described by Watson, Moore, and Parry. The bones also affected with this disease have been found swollen, and sometimes so soft as to have been easily cut by the scalpel.

The urate of soda is deposited first in a white fluid state, like a mixture of chalk and water, after a time this fluid portion becomes absorbed, leaving concretions consisting of little more than bundles of crystals of urate of soda, and often in such quantities that a poultice, though applied several times a-day, has been covered with them, and that for several days together. The concretions afterwards harden and form what, from their colour and appearance, have been termed *chalk-stones*, often superficial and of considerable size, so that when the skin has ulcerated, a patient has been said in one

instance to have scored his game of cribbage with his knuckle, and in another to have written on the table with the *chalk* penetrating through the ulcerated tips of his fingers.

Not unfrequently, after a time, deposits of phosphate and carbonate of lime ensue in and around these semifluid concretions, but it is not believed that such deposits ever replace the urate of soda in gouty subjects.

Although these specific exudations and morbid elements in the blood are but indications of the gouty condition, they, nevertheless, confirm the belief gaining ground which would teach the ancient humoral doctrine that the phenomena of gout are owing to some peccant matter (probably uric acid) which, through malassimilation of food, or of food and drinks of particular kinds, combined sometimes with excessive labour of body as well as of mind, becomes inbred in the constitution, and which it is the business of the paroxysm of gout to eliminate.

The natural history of the disease shows—(1.) That there is a disposition or tendency in the morphological relations between the solids and fluids of the whole system to develop some specific constitutional poison, which betrays itself by certain constant effects at periodical intervals, although these may be irregular.

(2) That these local effects are prone to develop themselves in the joints of the extremities, or by symptoms of a particular kind in the internal organs.

It is now generally believed that gout is hereditary; and in many instances it is so, whether the intemperate habits of ancestors are followed out, or whether the mode of living be abstemious. In some families it attacks only alternate generations, following what has been called "the law of *atavism*."

The power of hereditary transmission to induce gout has been illustrated in a most interesting way by Mr. Spencer Wells in his treatise on this disease. He shows that the children of a patient born prior to the development of gout in their parents were free from this affection in after life, but that those children born subsequent to the development of gout in the same parents became afterwards gouty. The potent influence of hereditary predisposition in regard to gout is also now known to betray itself even amongst some of the labouring classes, and in the upper classes even in a still greater proportion. Dr. Garrod instances the case of a gouty gentleman who is able to trace the disease in his family for four hundred years, and in which the eldest son has invariably inherited, *with the estates*, gout of the worst form, and developed at an early age. On the other hand, again, it is also certain, and is consistent with the constitutional origin of this disease, that an unusually large proportion of non-hereditary cases are met with

among the indolent and luxurious inhabitants of large metropolitan towns.

A flattering hallucination has been transmitted traditionally, hereditarily, and historically, which connects the gouty diathesis with high mental development. Sydenham observes that gout "destroys more rich than poor, and more wise men than fools." Cullen observes that it affects especially "men of large heads." Dr. Watson refers to the fact that gout is peculiarly incidental to men of cultivated minds and intellectual distinction. Mr. Spencer Wells remarks that :—

"Among the present (1854) members of the Houses of Parliament, those who are known to be subject to gout are among the most distinguished for an ancestry rendered illustrious by high thoughts and noble deeds, for their own keen intelligence, for the assistance they have afforded to improvements in arts, science, agriculture, and for the manner in which they have led the spirit of the age."

But the conditions for the constitutional development of this disease must either be more common, or physicians must be getting more acute, for the contrast to the preceding statements as written by no less eminent and observant men, tends to discard the doctrine which teaches the noble origin of gout. The disease is now certainly common and plebeian as well as aristocratic. It may have been in the days of Sydenham, that the gouty patients of a physician were to be found amongst "magni reges, dynastæ exercituum, classiumque duces, philosophi, aliique his similes." Now-a-days it is no less certain that the physician, in London at least, must pay his visits and prescribe for gout amongst "the London labour," if not "the London poor," and his list will number "coal-heavers, bakers, brewers, draymen, house painters, butchers, innkeepers, publicans, butlers, coachmen, and porters in wealthy families especially" (Copland, Budd, Garrod, Todd). In the words of Garrod, "*Mute inglorious* Miltons, *whose lot forbade* the mental development their gouty tendencies foretold." A gouty conformation has been accurately described by Sydenham, Frank, Scudamore, and others; and one of the constant characters of such a conformation is former or existing corpulence, and it is now known as consistent with the constitutional origin of this disease that the disposition to develop gout may be brought about by abnormal habits of existence; and if the hereditary predisposition is present, the conditions for developing the latent diathesis are more easily made efficient. All are agreed as to the influence of full living with free and habitual use of wine, and especially now as to the influence of what may be called gross living, great consumption of animal food, with indulgence in beer and malt liquors generally (Budd and Todd); and it appears both from the observa-

tions of Sydenham, Craigie, Wm. Budd, Todd, and Wood, that it is not so much the particular variety of alcoholic drink used as the mode and extent of the use which tends to develop the gouty state. The influence of malt liquors is especially obvious in those examples of gout which occur in the lower classes. "There is a body of men," writes Dr. Wm. Budd, "employed on the Thames, whose occupation is to raise ballast from the bottom of the river. As this can be done only when the tide is ebbing, their hours of labour are regulated by that circumstance, and vary through every period of the *night* and *day*. They work under great exposure to inclemencies of the weather; their occupation requires great bodily exertion, occasioning profuse sweating and much exhaustion. Each man drinks from *two* to *three gallons of porter daily*, and generally a considerable quantity of spirits besides. *Gout is remarkably frequent among them.*" Such an instance contrasts strongly with the prophylactic influence of corporeal labour displayed amongst other classes of the people who do not *labour* under *the influence of gallons* of malt liquor, and it is also interesting to notice that in the non-beer-drinking countries the lower classes escape.

"The peasantry, labouring persons, soldiers, and seamen, seem to enjoy a complete exemption, at least from the external paroxysmal forms of this disorder; and when their habits are marked with indulgence and intemperance, they do not engender gout so much as diseased kidney, stone, diseases of the heart and arterial system, and diseases of the liver and of the brain. From the observations of Sir Gilbert Blane, it appears that, among 3,800 patients admitted into St. Thomas's Hospital, he observed not a single gouty individual; and among 10,000 admitted into other hospitals, scarcely five were observed" (Craigie).

A belief in the prophylactic virtue of labour and moderate living probably instigated the abrupt reply of Abernethy to the question, "What is the cure for gout?" when he said, "Live on sixpence a-day and earn it." The disease very rarely occurs before puberty, but is seen in both sexes under twenty. Many cases occur between twenty and thirty, but the period of greatest liability is perhaps from thirty to fifty. After this the chances of exemption increase with age, probably from the more temperate habits of advanced life. At whatever age, however, gout appears, every attack establishes a greater disposition to another. Women often suffer greatly from gout, but not in an equal degree with men. The immediately exciting causes of this disease are very much similar to those of rheumatism. In thus describing the *pathology* of gout, the causes and constitutional source of the disease have been sufficiently indicated.

Symptoms. — These vary according as the disease attacks the joints, the stomach, or the intestinal canal, but the proportionate

frequency with which these different parts are attacked is not yet ascertained. It may be acute or chronic, and when the viscera are affected, it has been termed irregular, retrocedent, or misplaced gout. Sydenham was himself a great sufferer from this affection, and laboured under it for more than thirty-four years. He thus describes an acute attack or fit :—

"It comes on a sudden towards the close of January or beginning of February, giving scarce any sign of its approach, except that the patient has been afflicted for some weeks before with a bad digestion, crudities of the stomach, and much flatulency and heaviness, which gradually increases till at length the fit begins." "The patient goes to bed, and sleeps quietly till about two in the morning, when he is awakened by a pain, which usually seizes the great toe, but sometimes the heel, the calf of the leg, or the ankle. The pain resembles that of a dislocated bone, and is attended with a sensation as if water just warm were poured upon the membranes, and these symptoms are immediately succeeded by a chilliness, shivering, and slight fever. The chilliness and shivering abate in proportion as the pain increases, which is mild in the beginning, but gradually grows more violent every hour, and comes to its height towards evening, adapting itself to the numerous bones of the tarsus and metatarsus, the ligaments whereof it affects so as sometimes to resemble a tension or laceration of those ligaments, sometimes the gnawing of a dog, and sometimes a weight and coarctation or contraction of the membranes of the parts affected, which become so exquisitely painful as not to endure the weight of the clothes, nor the shaking of the room from a person walking quickly therein; and hence the night is not only passed in pain, but likewise with a restless removal of the part affected from one place to another, and a continual change of its posture. Nor does the perpetual restlessness of the whole body, which always accompanies the fit, especially in the beginning, fall short of the agitation of the gouty limb. Hence numberless fruitless endeavours are used to ease the pain by continually changing the situation of the body and the part affected, which notwithstanding abates not till two or three in the morning, that is, till after twenty-four hours from the first approach of the fit." "And being now in a breathing sweat he falls asleep, and upon waking finds the pain much abated, and the part affected to be swelled; whereas before only a remarkable swelling of the veins thereof appeared, as is usual in all gouty fits."

"The next day, or perhaps two or three days afterwards, the part affected will be somewhat pained, and the pain increase towards the evening, and remit towards break of day;" and "what we call a fit of the gout is made up of a number of these small fits; at length the patient recovers, which, in strong constitutions and such as seldom have the gout, often happens in fourteen days, and in the aged, and in those who have frequent returns of the disease, in two months; but in such as are more debilitated either with age, or the long duration of the distemper, it does not go off till summer advances."

In aggravated cases it attacks both feet, the hands, wrists, elbows, knees, and other parts; sometimes bending the fingers crooked and

motionless, and at length "forms stony concretions in the ligaments of the joints, which destroying both the scarf-skin and the skin of the joints, stones not unlike chalk, or crab's eyes come in sight, and may be picked out with a needle. Sometimes the morbific matter is thrown upon the elbows, and occasions a whitish swelling almost as big as an egg."

"During the first fourteen days the urine is high coloured, and after separation lets fall a kind of red gravelly sediment, and not above a third part of the fluids taken is voided by urine, the bowels being generally constipated during this time. The fit is accompanied throughout with loss of appetite and chilliness of the whole body towards the evening." When the fit is going off, a violent itching seizes the foot, especially between the toes; and the skin peels off.

When the disease has become chronic, or, as Sydenham terms it, inveterate, "after yawning, especially in the morning, the ligaments of the bones of the metatarsus are violently stretched, and seem to be squeezed with great force as if with a strong hand. And sometimes, though no yawning has preceded, when the patient has disposed himself to sleep, he feels a blow on a sudden as if the metatarsus were breaking in pieces by a large stick, so that he wakes crying out with pain. The tendons of the muscles of the tibiæ are sometimes seized with so sharp and violent a convulsion or cramp, that if the pain it occasions were to last only a short time, it could not be borne with patience."

After many racking pains, the succeeding paroxysms become less painful, when "instead of the usual external pain, a certain sickness, a pain in the belly, a spontaneous lassitude, and sometimes a tendency to diarrhœa succeeds." Besides the pain and sickness, the patient becomes lame and almost incapable of motion, and is perhaps obliged to be wheeled or carried from room to room. The patient is not only reduced to this helpless condition, but, to complete his misery, his mind sympathzies with his body." "For every paroxysm may be justly termed a fit of anger, the rational faculties being so enervated by the weakness of the body as to be disordered on every trifling occasion, whence the patient becomes as troublesome to others as he is to himself."

Another form of chronic gout is *atonic gout*, or when the joints enlarge and the tissues and ligaments become thickened, and the seat of various effusions, so as often to distend and even to dislocate the bones, and yet if the patient be kept quiet, he suffers no pain. The general symptoms, however, are most distressing; the patient suffering from loss of appetite, indigestion, sickness, nausea, flatulence, acid eructations, pains of the stomach, cramps in the legs, and in various parts of the body; also great dejection of spirits, vertigo,

palpitation, fainting, asthma, and perhaps from stone or gravel, and these perhaps continue with occasional intervals during the remaining life of the patient, who is satisfied he has the gout *flying* about him, and that he should be well if he had a regular fit.

In the course of this disease there may be a metastasis to the stomach or other part, and the affection is now termed *retrocedent* gout, the pain in the joints being trifling, or having entirely subsided. When the metastasis is to the stomach or intestines, it may be either of a spasmodic or inflammatory character. The spasmodic is the most frequent, and in this case the patient is seized with violent pains in the stomach, with faintness, coldness of the extremities, and a quick, small, and scarcely perceptible pulse, accompanied with much flatulence, acidity, or vomiting. If, on the contrary, the attack be of an inflammatory character, the pain is perhaps equally great, but is increased on pressure, and there is more re-action, some fever, a fuller pulse, with vomiting, and perhaps obstinate constipation. The duration of these attacks is short, as the patient must be quickly relieved, or quickly perish. Besides metastasis to the stomach and intestines, this retrocedence may take place to other parts, as to the testicle, bladder, rectum, or to the head, and in the latter case the patient may die apoplectic. The transition of the gouty virus is often marked by a pain shooting along the nerve as sudden and as rapid as a galvanic shock, and so violent as to have been compared to stabbing with a knife. Besides being thus a migratory disease from part to part, gout also often alternates with other chronic diseases, such as *asthma* and *rheumatism*, and may co-exist with them.

"The attack of the gouty fit," writes Dr. Craigie, "is in general attended with symptoms of fever more or less distinctly marked. The patient either shivers or feels chill, and he then is unusually hot, with dry skin and thirst; and the tongue is furred, and the urine scanty and high coloured. The pulse is full, strong, hard, and sometimes from 86 to 90, or even above 100; in other instances it does not exceed 80, and sometimes it is so moderate as 76. But in all cases blood, if drawn, presents the buffy coat, and is generally strongly cupped. The serum also is abundant, and the clot extremely firm.

"The functions of digestion, and hepatic and urinary secretion are much deranged. Besides loss of appetite, flatulence, heartburn, stomachache or colicky pains, the tongue is loaded, the bowels are bound, and often the epigastric and umbilical regions are full and distended. The hypochondriac regions, especially the right, are the seat of a sort of painful tension and uneasiness. The first alvine dejections are generally solid and dark coloured, not unfrequently very fetid; and in some instances large quantities of dark coloured excrement are brought away.

"The urine is scanty, not above a third part of the normal amount, of a deep red colour, and voided not unfrequently with pain and scalding along the urethra. When recently voided and warm it is clear; but de-

posits on cooling a sediment, which is soluble in water. Its density is usually high, in general above 1·025, and varying between that and 1·040, according to the acuteness of the disorder. The sediment already mentioned, which is rose coloured or lateritious, is deposited during the whole course of the attack, and its appearance is not confined to the close or subsidence of the febrile symptoms, though at that time it is more abundant. It consists of urate of soda, the phosphoric salts, and urea mixed in various proportions. When dyspeptic symptoms and feebleness are present, a whitish magnesia-like powder, consisting chiefly of the phosphates, is deposited, or alternates with the other. In the urine of 27 among 100 cases, Dr. Scudamore found albumen in the urine. This, however, is seldom joined with the rose coloured deposit.

"When the fit of gout has taken place, and terminated in the manner now described, the patient appears to enjoy better health than formerly. The appetite is good, the mind more cheerful and active, the body more agile, and the patient is delivered from many feelings of languor and oppression, with which he had previously been afflicted. In this state he may remain for two or three seasons without being conscious of any complaint or symptom, which would indicate the return of the disorder. In the course of the third year, however, after the first attack, or it may be the fourth year, generally about the same season of the year, he begins to be sensible of the presence of some of his former feelings, and at length a fit takes place much in the same manner as it did on the first occasion. This fit is, in some instances, shorter and less violent; in others it is accompanied with various circumstances, which show some deviation from the first attack. But whatever be the mode or duration of its attack, another succeeds after a less lengthened interval; in some cases the same year in the autumn, in others next year in the spring or summer. In general the intervals are shorter, the younger the patient and the earlier the distemper in its course. The most common, perhaps, is the biennial or triennial attack for the space of eight or ten years; then the attacks are annual; then twice in the year; and in some severe cases the attacks are so frequent, that the patient can scarcely be said to be free from gout the whole year round. Much in all this depends on the habits and constitution of the individual. The disease then acquires a chronic character, and rarely quits the patient till it destroys him, either by complete lameness, helplessness, and debility, or by attacking the heart or the brain."

Diagnosis.—The diagnosis between gout and rheumatism is often exceedingly difficult, so much so that nosologists have described with perfect pathological correctness a hybrid disease, and named it, "rheumatic gout." Mr. Hunter warmly opposed this compound appellation, as many have since done. Hunter's opinion was founded on the belief that no two distinct diseases, or even distinct diatheses, can co-exist in the same constitution; a law, it must now be admitted, which has many exceptions. We must doubtless, therefore, recognize such a hybrid disease as Craigie, Wood, Spencer, Wells, and Fuller, have described or acknowledged to exist, depending on the influence of the combined cachexia of gout and rheumatism.

Prognosis.—Every assurance office objects to a gouty person as liable to a disease indicative of excessive indulgence in the pleasures of the table; and which tends to shorten life, from the wear and tear of the constitution it occasions. The objection is unquestionably well founded; for although a few persons may reach advanced age notwithstanding repeated attacks of gout, yet many die prematurely from this affection, or from the asthma, disease of the heart, apoplexy, or from the accidents to which helplessness and debility render the patient liable.

Treatment.—Seeing that the disease is clearly of constitutional origin, its treatment resolves itself into—(1.) The selection and administration of those remedies which shall tend to subdue, control, or eradicate the latent disposition, constitutional tendency, or gouty diathesis. (2.) The adoption of such means as may be safely used to modify the severity or shorten the paroxysm. The paroxysm must be interfered with cautiously. It is the means which nature takes to rid the constitution of the *materies morbi*, and which it undoubtedly relieves for a time if allowed to run its course. The removal of the paroxysm does not necessarily remove the constitutional diathesis.

As to any local treatment during the fit, Sydenham writes, "If outward applications be required to ease the pain of the gout, I know of none, though I have tried abundance both on myself and others, and I have laid aside the use of topical remedies for many years." It is generally admitted that cold is dangerous, while warmth is productive of little relief. In some instances the urate of soda is deposited in such quantity that the skin ulcerates, and the salt is discharged in considerable abundance in a fluid state. It might appear the right practice to apply a poultice and encourage the discharge, in order that by its entire removal the joint might be saved. This, however, is by some considered dangerous practice, for the discharge is so debilitating that patients are said to have died from this mode of treatment. It is much safer to wait till the chalkstone is concreted, and then operate for its removal. With respect to the use of cold water, the practice is as old as Harvey, and subsequently it has been adopted and abandoned by many practitioners. Dr. Parry had at one time two patients who had attempted to cut short the fit by plunging their feet in cold water. The relief was instant, but in a few hours both were dead of apoplexy. The fatal result of this remedy in Sir Francis Burdett's case is another instance in point.

"A gentleman," writes Dr. Wood, "contrary to the advice of his physician, and anxious for speedy relief, ordered a bucket of water to be taken into his chamber at bedtime, with the view of employing it in this way. In the morning he was found dead in his bed."

A few leeches may be applied to the part with great caution, if the inflammation is unusually violent. *Warm* anodyne lotions or fomentations may also be used, and the part afterwards lightly covered or encased in flannel or fine wool. Dr. Wood uses a *warm* mixture of *tincture of camphor* with milk, applied by means of linen compresses and frequently renewed. As a general rule, however, the less apparently that is done to the *local affection* the better.

The general treatment of the disease, as might have been expected, has been tried sufficiently extensively by bleeding. Blood has been drawn to a considerable extent, but without any corresponding benefit. "Bleeding," says Sydenham, "is not to be used either by way of preventing an approaching or easing a present fit, especially in the aged, for, though the blood that is taken away resembles pleuritic or rheumatic blood, yet bleeding is found to do much mischief in this disease" (he believed in its efficacy in rheumatism, a doctrine not now to be taught); "and bleeding in the interval, though long after the paroxysm, is found to occasion a fresh fit." The experience of Barthez, of Guibert, and Hallé entirely coincides with that of Sydenham, for however freely employed (and in some instances seventy ounces have been taken away in a few days), they say bleeding does not afford that relief to the local pain and inflammation which might have been expected, while the restlessness, debility, and mental depression are often rendered truly distressing. In the present day bleeding is generally restricted to two methods, namely, leeches to the part where the inflammation rises so high, or is so chronic, as to threaten the patient with the permanent loss of the use of some joint; and to cases of metastasis of the disease to the stomach or other internal organ, when leeches are absolutely necessary.

Sydenham was as great an enemy to purging as he was to bleeding; and he says, "I am abundantly convinced, from much experience, that purging either with mild or strong cathartics, whether it be used during the fit, or in its declension, or in a perfect intermission, or healthy state," "endangers the life of the patient by hurrying on to the viscera, which were quite safe before." The objection taken by Sydenham to purgatives lies certainly against those in use in his day, and which were of the most drastic kind. But it may be laid down as a rule that the class of neutral salts are not only safe, but efficient in relieving, though perhaps not of curing, gout. The theory on which they are prescribed is, that the alkaline base of the neutral salt is absorbed, and combines with the insoluble urates deposited in the joints, forming a soluble sub-urate, which can readily be absorbed; and again, more alkali being sent to the kidney, that organ is now enabled to remove more uric acid, in a

soluble state, from the system than under ordinary circumstances. The salts most in use are the *sulphates of magnesia* or *of soda*, and especially the former, and half a drachm to a drachm should be given every eight, six, or four hours, according to the state of the bowels, and the acuteness of the symptoms. It is also necessary to afford some relief to the patient from his excessive suffering. With that view an opiate should be added, such as the *tincture of hyoscyamus*, *syrup of poppies*, or *some preparation of opium*. This method of treatment relieves the patient and shortens the paroxysm; but when the relief is complete it should be abandoned, for sometimes the gout will return even under its use.

Colchicum or meadow-saffron was long ago introduced as a specific in gout, of which the once popular "eau médicinale" was supposed to be a preparation. A more widely extended experience, however, has shown it to have no direct influence over the disease, while in some instances it has been followed by most alarming consequences, acting upon the stomach and bowels with all the virulence of an active poison. Colchicum is still however used, and is valuable for its purgative qualities, and in some cases it seems to be almost specific in its effects, and may be given as an extract or tincture, or as a wine combined with some form of saline draught. Its mode of action is unknown. It very generally promotes secretion from the skin and kidneys; but it is also believed to be useful even when it does not exercise any such physiological action. The quantity of uric acid and urea in the urine is said by some to be increased during its use (Chelius). Dr. Graves makes an opposite statement. Dr. Laycock suggests that it may have a sedative effect on the vital actions going on in the tissues themselves, and so arrest the formation of the gout poison.

The wine of the root is generally the form preferred, fifteen to thirty minims every four, six, or eight hours, and this remedy ought to be continued for some time in reduced doses after all symptoms of the gout have disappeared (Budd).

Scudamore's mixture of colchicum, magnesia, and sulphate of magnesia, is also said to be an excellent purgative in gout, and Dr. Wood is in the habit of using it in the following formula in a draught:—℞ magnesiæ ʒss.; magnes. sulphat. ℥ss.; vin. colchici. rad. mxx.; aquæ fluv., vel. aq. acid. carbon. f℥ij.

Mercury, in the form of "blue pill," followed by the draught just written, is useful where it is desired to act upon the biliary and intestinal secretions. From its power also of absorbing many periosteal nodes it has been often employed with a view of removing the deposits of urate of soda, or the chalkstones; but experience has shown this to be dangerous practice, for, if pushed to any extent, not only have the chalkstones not been removed, but in some cases the patient appears to have died in consequence. The

iodide of potassium has been much recommended by Mr. Spencer Wells.

If acute gout should have retroceded, and the stomach or intestinal canal be inflamed, *leeches* should be applied to the abdomen or epigastrium, followed by a poultice, while the internal remedies should be the neutral salts with the tincture of hyoscyamus every four or six hours. It is very rare that more active medicines are necessary.

In chronic gout the treatment is the same; but in *atonic* gout some light tonic medicine may be added, as five to ten grains of the *citrate of iron*. A large number of these cases, however, though the general health is improved by this treatment, are often altogether unrelieved, as to the local symptoms, and are often quite unable to assist themselves. In these instances the turpentines appear to be beneficial, as spruce beer, the Canadian balsam, or one drachm of the *oil of turpentine* may be taken in an effervescing draught once or twice a-day. Sydenham's method of treatment by manna may also be tried.

If the chronic or *atonic* gout should become retrocedent, and the stomach and intestinal canal be the seat of the spasmodic form of the disease, Sydenham strongly recommends that laudanum should be given; but perhaps the following draught is more efficacious, namely, ℞ mist. camphoræ ʒx; Sp. aetheris sulphurici ʒi; sulphatis magnesiæ ʒss. It will remove from the stomach any undigested matter which may remain as an irritating cause. This should be given every hour till the patient is relieved; and while it is being prepared, hot brandy and water should be freely administered, and hot cloths applied to the abdomen, as well as hot bottles to the feet.

Sydenham recommends, from experience in his own case, large doses of manna in all cases of what he terms "bloody urine."

As diet appears to have a great influence in the production of gout, so we should imagine it should have great influence in its removal; and, during the fit, it should consist of slops and light puddings, and afterwards white fish, till the paroxysm has terminated. This disease is so distressing that many persons are inclined severely to diet themselves during the interval. Sydenham says that a milk diet, or drinking milk as it comes from the cow, or boiled without adding anything to it, except perhaps a piece of bread once a-day, had been much used for twenty years past in his time, and done much service in abundance of gouty patients. But on quitting it and returning to the mildest and tenderest diet of other persons the gout has immediately revived; and he adds, many cannot bear this regimen. An entirely water regimen he considers hurtful. His recommendations are, that we should be early to bed, keep the mind free from

all disquietude, live with the greatest moderation, clothe ourselves warm, and ride on horseback. One other point with regard to treating the patient during the fit, is, if it be necessary to move him either on account of his restlessness or other cause, that this be done with great care and tenderness by the attendants; for although the pain may be latent while the parts are quiet, yet the least shock often causes the most excruciating agony.

The irritable state of mind of the patient during the paroxysm has been mentioned; and it is well known that slight moral causes will often produce a fit, while powerful emotions have sometimes cured one. There are many instances of persons confined to their beds with gout starting up and running away on an alarm of "fire" being raised. Dr. Rush gives the case of an old person whose son by some accident drove the shaft of his waggon through the window of the room where the father lay ill of gout, when, forgetting his crutches, the old man leapt out of bed, and was found by his wife angrily walking up and down the room.

It is quite essential, therefore, that the minds of gouty patients should be kept as tranquil as possible, both for their own sakes as well as for the comfort of others.

Anæmia.

Definition.—*A special morbid state, and which implies either a relative diminution of the mass of blood* (Andral) *with the general composition of the blood differing from the normal standard; or the mass of blood is diminished, and the liquor sanguinis is watery, poor in albumen, containing an excess of salts, and these conditions generally co-exist with relative deficiency of the red blood corpuscles* (Vogel).

Pathology.—The term *anæmia* literally means *deficiency of blood*, a condition of existence obviously not possible. A diminution in the quantity of the blood with an alteration in its composition almost never occurs alone, but is generally a morbid state resulting from many exhausting morbid processes peculiar to such wasting constitutional diseases as tuberculosis and cancer. In many of these diseases the blood mass is evidently diminished. We have indications of this diminution in the small pulse, in the pale, bloodless appearance of the countenance and surface of the body generally, especially seen in the lips, and in the small blue collapsed veins, particularly obvious by contrast on the pallid skin. In such cases one would never think of drawing blood to know whether or not its constitution was changed; but in cases where the opportunities for examination have occurred, the blood corpuscles have almost always been found relatively diminished.

The results of this morbid condition of the blood chiefly betrays

itself—(1.) Upon the *vascular system* generally; and (2.) Upon the *metamorphosis of tissue.*

The blood-vessels contract in proportion to the diminution of the blood-mass. The *arteries* contract generally; the pulse whenever it can be felt, becoming small and tense. The *capillaries* also contract; the skin and mucous membranes becoming pallid and comparatively bloodless. The *heart's* action also in extreme cases becomes irregular, and the whole circulation generally is disturbed.

As regards the metamorphosis of tissue, the muscles and the nervous system appear to suffer first; debility and prostration, both bodily and mental, occur, and in severe cases sensation may be lost, or syncope and even death may result.

The disease seems to go through very different changes according to the causes which bring about the anæmic condition. After mere loss of blood in quantity, for instance, the water and the salts are renewed with most rapidity, the albumen later, then the colourless corpuscles, and last of all the red corpuscles. Hence it is that anæmia is frequently associated with a watery condition of the blood; as well as with a deficiency of its cell elements. It is a matter of the greatest importance in practice, to distinguish, if possible, between these conditions, with a view to a rational means of treatment.

Those exhausting diseases which are attended especially with deranged nutrition and sanguification, such as Bright's disease, carcinomatous diseases, tuberculosis, suppuration, lead also to the development of that form of anæmia in which the liquor sanguinis is in excess, in which the blood is poor in albumen, containing an excess of salts, and in which the blood-cells ultimately become deficient. A tendency to dropsy or to diarrhœa ensues, nutrition becomes still more disordered, and new formations become developed.

It is very important to know in a practical point of view, that every acute disease which occurs in an anæmic individual assumes a peculiar character; a very high degree of debility and prostration ensues, convalescence is protracted, and all severe intercurrent diseases acquire a lingering course.

Symptoms.—In combination with an investigation of the blood the symptoms and signs of *anæmia* are already read in its pathology. It is only by general symptoms, however, that the physician is able circumstantially to conclude that relative diminution of the cells of the blood co-exists with absolute deficiency of the mass. He observes this condition most frequently in the last stages of severe and exhausting sickness of a lingering and prolonged kind, where a high degree of paleness of the skin and mucous membranes exist, with a small weak pulse, collapse of the veins, a small volume of the

heart, spleen, and liver. In recent days diagnostic characters of *anæmia* have been observed in various *murmurs* which may be heard in some parts of the vascular system of anæmic patients. Although the seat, the causes, and the signification of these *murmurs* have been very much disputed, yet the following account by Vogel may be given of them, based on numerous observations and investigations.

There are three kinds of anæmic *murmurs* which may be distinguished, namely,—1. *Cardiac murmurs;* 2. *Arterial murmurs;* and 3. *Venous murmurs.*

The cardiac murmur gives forth what is usually called a "bellows sound," sometimes intense, sometimes faint, and which generally accompanies the first ventricular sound of the heart, and is most distinctly heard at the apex of that organ.

The cardiac murmur occurs most frequently in true anæmia, especially if cardiac excitement is associated with it; and simultaneously with it we frequently hear arterial and even venous murmurs. It has been observed by Vogel and others, however, that while the presence of these *cardiac murmurs* may be employed as an auxiliary sign together with others in the diagnosis of anæmia, yet it is not to be concluded from their non-existence that anæmia is not present. Such *murmurs* are not heard in all anæmic patients; and although present they are not in every case due to anæmia, because they occur in organic diseases of the heart, such as valvular diseases and endocarditis, and a physician trusting and acting upon stethoscopic signs *merely*, without giving a due appreciation to general symptoms, seriously injures the patient and does an injustice to the science of medicine.

The *arterial murmurs* are seldom heard. They consist of an intermittent blowing, sometimes soft, sometimes sharp sound, perceived to be synchronous with the beat of the pulse, which gives at the same time a thrill to the finger, so that the *murmur* may be inferred by practice, from the nature of the pulse. It is only in the larger arteries in which they are heard, such as the brachial, the subclavian, the femoral, the carotid, and abdominal aorta. They are most frequently heard after great losses of blood; and sometimes in chlorosis. Vogel has heard them also during the paroxysms of intermittent fever, while they are absent during the intermissions. They are also to be heard in typhus fever. No positive conclusion can therefore be formed from them alone regarding anæmia.

Venous murmurs are *continuous*, humming, buzzing, occasionally musical, singing murmurs; easily distinguishable from the blowing *intermittent* arterial murmurs. They are most frequently heard on the right side of the neck, at the junction of the external and internal jugular vein; and are supposed to be produced by ab-

normal oscillations of the venous valves. When the venous murmurs are strong they may not only be *heard* but also felt as a gentle thrill by placing the finger on the part.

These venous murmurs are seldom absent in well-marked anæmia. Nevertheless, anæmia is not to be positively inferred from the mere presence of any one of these murmurs.

Causes.—As an independent constitutional disease, anæmia may be said to owe its origin to three sets of conditions. (1.) Copious loss of blood, such as by hæmorrhage or venesection; or oft repeated small losses of blood. (2.) Anæmia also results from loss of other fluids of the body besides blood, especially of such as contain protein substances, such as by the excessive secretion of milk in protracted suckling, suppuration, profuse blennorrhœa, leucorrhœa, diarrhœa. (3.) It arises from insufficient and improper nutriment, or from disturbances in the absorption and assimilation of food, and the process of sanguification. (4.) It may result from the co-operation of many influences; for example, excessive bodily and mental labour; continued excitement, pain, care, grief, hardships; many acute and chronic diseases, some of which augment the consumption of blood while others impede its formation—this effect being produced by an acute disease under certain circumstances when its invasion is intense and its duration prolonged, such as by tuberculosis, carcinomatous diseases, diabetes; from poisoning by malaria—the *malaria-chlorosis* of Vogel, or *paludal cachexia* of Martin, as in the "used up" condition of our Bulgarian troops. described by Dr. H. Mapleton in *Parlia. Paper* 247, for 1856, p. 253. "It is the most general of all the conditions incident to tropical invalids" (Martin).

Treatment.—To discover and counteract the cause, the energies of the physician must be directed. Nutritious substances must be supplied for diet, in the shape of roasted meats, and broths. The purely tonic treatment in the combination of air, exercise, and diet, must be carried out as far as practicable. Ferruginous remedies are only of use when we have reason to believe that there is a diminished energy in the formation of blood cells.

Chlorosis—*Green Sickness.*

Definition.—*A deficiency of the blood cells with redundancy of the serous part of the blood, occurring in young girls at the age of puberty, and sometimes in the young of both sexes, before the complete development of the distinctive characters of the sexes towards puberty has been effected.*

Pathology and Symptoms.—A very indefinite idea is associated with the name and nature of this disease. Many employ the term precisely in the same sense as *anæmia;* or they limit the term

chlorosis to those forms of anæmia whose causes are unknown. The original use of the term is expressed in the first part of the definition as limited to that form of anæmia which occurs in the female at the period of puberty.

A change in the complexion constitutes the most striking symptom of chlorosis. A marked pallor of the skin prevails, sometimes perfectly pale, at other times yellowish, greenish, or wax coloured. The lips and mucous membranes are also pale, symptoms which are the result of the deficiency of blood cells, and so of blood pigment. Slight dropsical swellings occur such as œdema of the feet and ankles, the face and the eyelids, and a blue halo sometimes encircles the orbit.

The temperature of the body is generally diminished—the breath is cool, the lips, nose, ears, hands, and feet are cold ; chilliness of the body prevails, which is morbidly sensitive to external cold, and seeks warmth. As in other forms of anæmia, the patient suffers from great prostration of strength and debility, is tired by the slightest exertion, and the weakness sometimes becomes so great as to lead to fainting.

Hysteria frequently prevails with chlorosis, and the patient frequently suffers from vertigo, headache, tinnitus aurium, especially of the right ear, sparks in the eye, tendency to fainting, neuralgia, spinal irritation, and convulsions. The mind is sometimes morbidly impressed with grief, while despondency and frightful dreams prevail, there is the apprehension of nightmare, melancholy thoughts predominate, mania may become confirmed, and the insanity may assume a suicidal tendency.

Disorders of digestion attend the disease. Appetite is diminished or perverted, acids and highly flavoured foods are craved for, and sometimes such substances as chalk, paper, ashes, coal, plaster of Paris, hair, earth, and even excrements are desired to be eaten. Substances also very difficult of digestion, are also craved for, and are sometimes digested better than simpler kinds of food. Constipation frequently and obstinately co-exists. Other functions are no less disordered, for instance the respiratory, the generative, and the circulatory.

Respiration is oppressed or performed with difficulty ; and the breath is offensive. Menstruation is generally absent or performed imperfectly, irregularly, and with pain, and the flow is thin and watery or leucorrhœal.

The conditions of the vascular system are very variable. The pulse is slow, feeble, soft ; the heart and great vessels irritable ; palpitation is common, and murmurs as already described frequently prevail.

It is to be observed, however, that apart from mere lassitude and palpitation, patients are sometimes chlorotic for weeks with-

out any other marked symptoms, and the same complication of intercurrent acute diseases are apt to happen as described under anæmia.

Causes.—Those conditions which bring about this constitutional affection, are very much similar to those already mentioned. The disease is very frequent in females between the ages of *sixteen* and *twenty-five* years, is often of long duration, lasting for months and even for years, with a tendency to relapse after cure.

Diagnosis.—It is especially necessary that the physician should not confound *chlorosis* with *jaundice* on the one hand, or *disease of the heart* on the other, or incipient *pulmonary tuberculosis.*

Treatment is chiefly to be by diet and by medicines. All the functions of the body must be carefully observed, watched and regulated. The residence of the patient must be a reputed healthy spot in the pure air of the country, rather than the town. Dry frictions of the back and limbs are also recommended, with bathing in the sea where it can be borne.

The food must be regulated so as not to be stimulating, nor disgustingly bland—frequent change is demanded with a due attention to the proper apportioning of nutritive and respiratory elements.

Of medicines, the preparations of iron have most reputation. They seem to act by promoting the formation of the red blood corpuscles; and they seem to operate best in those cases in which the blood is rich in albumen. They also seem to act as stimulants to digestion; and it now appears to be immaterial which of the numerous *officinal* preparations of iron are used. Almost every physician has some one he fancies better than another; and some of them seem to be aided in their good effects by combination with carbonate of potash, such as the sulphate of iron. Their use must be persevered in for months. Manganese preparations have also been recommended, and may be tried in those cases where iron has not been efficient.

Simple bitter tonics are useful adjuncts to the chalybeate treatment, such as *gentian*, and the preparations of *cinchona.* They aid feeble digestion.

Where a high degree of serous plethora exists, and produces violent excitement of the vascular system, palpitation of the heart, and congestion of the head, venesection may be practised. It not only acts as a sedative, but aids the radical cure of the disease, inasmuch as it causes the subsequently administered ferruginous preparations to be borne more easily. Both general and local bloodlettings may be used, but the blood must be taken in small quantities, a couple of ounces at a time being quite sufficient (Vogel).

Leucocythæmia vel Leukæmia—*White-Cell Blood, or White Blood.*

Definition.—*A disease* sui generis *in which the number of white corpuscles in the blood appears to be greatly increased, with a simultaneous diminution of the red. This state is brought about by loss of blood, chronic exhausting diseases, or serious acute diseases—such as typhus, pneumonia, puerperal fever, affections of the lymphatic glands or of the spleen, and is attended sometimes by cough or diarrhœa, epistaxis, furunculous or pustulous eruptions.*

Pathology.—In the present state of our knowledge regarding this disease, an account of the phenomena which attend upon its course is all that can be given. We do not understand the conditions under which it is brought about, and cannot tell whether the predominance of white cells in the blood produces the enlargement of the spleen and lymphatic glands, or whether the predominance of such cells are the effects of these enlargements.

To Dr. Bennett of Edinburgh is due the merit of having first directed the attention of the profession, in 1851, to the remarkable phenomenon characteristic of this disease, namely, the increase of colourless cells in the blood, and which he described as "*pus-like.*"

To Virchow of Würzburg, however, belongs the peculiar merit of having been the first who appreciated and described the real nature of the disease, so far as the doctrines regarding its pathology are received at present. The morbid state, as defined above, has now been observed by many physicians and pathologists under various complex conditions of disease, and hence a variety of opinions have been entertained regarding it in Germany, England, and France, by Vogel, Remak, Henle, Nasse, Weber, Rokitansky, Kölliker, Parkes, Jenner, Gulliver, Piorry, Bichat, Velpeau, and others, who have described cases since Bennett and Virchow first wrote on the subject.

The increase of the colourless corpuscles, which is the prominent character of this disease, does not seem in any case to have existed or occurred by itself. Other morbid states precede, co-exist, or succeed the augmentation of the colourless corpuscles.

The most frequent complication consists in the enlargement of the spleen. It is so frequent that its existence, if not otherwise accounted for, would at once indicate that leucocythæmia prevailed, and would suggest an examination of the blood. In nineteen cases, Vogel writes, that the splenic enlargement was present in sixteen; and in three cases the weight was estimated at more than seven pounds.

Constituents foreign to normal blood have been found by Scherer in a qualitative analysis of the blood in a case of leucocythæmia,

where the spleen was enlarged. These consisted of lactic, acetic, and formic acids, gelatin, and a peculiar substance (hypoxanthin) to the amount of from ·4 to ·6 per cent.

Scherer finds also that this same substance exists naturally in the pulp of the healthy spleen. This form of the disease has been named *splenæmia* by Virchow. In this form the globules (white) predominate, which are peculiar to the elements of the spleen.

The *liver* is also frequently enlarged in this disease, but not to so remarkable a degree as the spleen. Vogel writes that as often as thirteen times out of nineteen cases it was either enlarged or otherwise morbidly altered.

Affections of the *lymphatic glands* seem to predominate in some cases rather than enlargements of the *liver* or the *spleen*. According to Vogel, such have been observed eleven times out of nineteen cases. Virchow considers that some kind of lymphatic *diathesis* prevails, that there is a progressive inclination of the lymphatic system to the formation of the lymphatic elements. In some instances observed by him there seems to have been a new formation of glandular tissue, or that the glandular tissue tended to grow beyond the pre-existing boundaries of the glands. He has observed this development of lymphatic gland tissue to take place in the liver in a remarkable case which contained numerous small whitish granules, about the size of the natural lobules of the liver, and which exhibited under the microscope nuclear and cellular elements quite like those of the lymphatic glands. This infiltration of the liver followed the ramifications of the portal vein. In one of these cases he observed a similar alteration in the kidney.

This constitutes the *lymphatic* form of leukæmia or *lymphæmia* described by Virchow.

In such cases the elements of the lymphatic glands prevail in the blood, which is then characterized by innumerable round granulated nuclei, generally provided with nucleoli, of the size of the usual nuclei of the lymphatic glands. Here and there are also to be seen cells consisting of such a nucleus surrounded by a membrane closely attached to it.

There are three possible conditions given by Virchow under which these elementary cells in the blood may originate,—(1.) They may multiply in the blood by the subdivision of pre-existing cells. (2.) They may be primarily introduced into the blood through the lymph or chyle, which are conceived to convey the developed as well as the undeveloped globules derived from the lymphatic glands, the spleen and its connecting tissue. (3.) That they are formed on and detached from the walls of the blood-vessels has not been yet proved.

Virchow regards the colourless blood corpuscles as simple cells, without a specific character, whose transformation into red globules cannot take place; that they therefore form a relatively superfluous constituent of the blood—a kind of excess or waste. The transformation of lymph globules into red globules takes place before passing into the general circulation; and it appears that if a certain cell, when passing into the blood, has gone beyond that stage of development, it is ever afterwards unfit to undergo its specific coloured metamorphoses. The idea that the cells are of a purulent nature has been now abandoned, as there is no evidence to support the doctrine that they are the result of *pyæmia*. Besides the spleen and the lymphatic glands, the other blood glands, such as the *thyroid gland* and *supra renal capsules*, are occasionally degenerated.

The statistics regarding the ages at which the disease has been observed are given by Vogel as follows:—One case was observed under ten years of age, two between ten and twenty years, three between twenty and thirty years, seven between thirty and forty years, four between forty and fifty years, three between fifty and sixty years, and three between sixty and seventy years.

Symptoms.—In the majority of cases the most prominent symptom has been tumefaction of the abdomen, depending upon an enlarged spleen and liver. Ascites and anasarca of the lower half of the body are not unfrequently present; and a tendency to œdema may commonly be observed; the general surface of the body being usually pale. Transitory pains are frequently experienced in the abdomen.

Intestinal disorders are often also present; such as vomiting, constipation, or diarrhœa, and jaundice is not unfrequent.

A considerable amount of dyspnœa may prevail, and which cannot be accounted for by elevation of the diaphragm merely. Hæmorrhage often occurs in the form of epistaxis. A persistent increased secretion has also been observed of uric acid in the urine. The disease almost always runs a chronic course, and a high degree of emaciation ordinarily accompanies it. As in the other forms of anæmia, the disease is usually well established before it is noticed, and before any remarkable disturbances in the general health have occurred. It is not till towards the fatal termination that any fever sets in, which then assumes the hectic type.

Diagnosis.—The diagnosis of the disease consists in demonstrating the extreme increase of the colourless blood cells, which may be done as follows:—

(1.) By microscopic examination of the blood, for which a single drop is sufficient. If the disease exists the colourless corpuscles will be seen to form a sixth, a fourth, or even a half or more of the numbers of the red.

(2.) If a large quantity of blood is obtainable by venesection or by the cupping-glasses, and freed from fibrin by heating, and placed in a high narrow little glass, so that the corpuscles sink to the bottom, the upper part of the mass looks whitish coloured like milk. The milky character does not vanish on agitation with æther, and is not produced by fat globules suspended in the blood serum, but by the prodigious number of the colourless blood corpuscles.

(3.) The clot of leucocythæmic blood shows on its surface grayish-white granulations, which being observed under the microscope are seen to consist almost entirely of colourless corpuscles, distinguishing the condition from the ordinary buffy coat; and the separated serum being clear, not turbid, distinguishes the condition from a fatty condition of the blood.

(4.) In the dead subject there are found in the heart and in the great veins large soft semifluid grayish-yellow coagula which, on microscopic examination, are seen to consist almost entirely of colourless corpuscles (VOGEL).

Causes.—The causes which bring about leucocythæmia are entirely unknown; but it seems several times to have suggested itself to Virchow that acute inflammatory processes may lay the foundation of the morbid state; and in an interesting review of the writings of Virchow in *The British and Foreign Med.-Chir. Review* for July, 1857, there is related a case of the lymphatic form of the disease, whose origin obviously dates from inflammatory swellings of the lymphatic glands after exposure to cold and wet.

Prognosis.—Hitherto no case of cure is known; and the disease may continue for a lengthened period without a fatal result.

Treatment.—The most varied remedies have been tried without checking the increased formation of colourless corpuscles, but it is suggested that if it is possible to discover the glandular or splenic affection early, before the alteration of the blood has made much progress, it is probable that the disease may be averted.

MORBUS ADDISONII—*Supra Renal Melasma.*

Definition.—*A morbid state whose characteristic features are anæmia, general languor, and debility, remarkable feebleness of the heart's action, irritability of the stomach, and a peculiar change of colour of the skin, occurring in connection with a diseased condition of the supra renal capsules.*

Pathology.—The pathological significance of morbid states of the supra renal capsules has been brought prominently before the profession during the past two years, both in this country and on the Continent, by the original observations of Dr. Addison, the distinguished senior physician of Guy's Hospital. The cases

recorded in the medical journals since Dr. Addison wrote, which connect bronzing of the skin with various morbid states of these bodies are now so numerous, that as a clinical fact, the connection cannot be disputed; but the exact relationship and pathological significance of the morbid states thus connected are still open questions, especially in their relation to the constitutional cachexia which exists. Morbid states of the supra renal capsules are not always attended with bronzing of the skin. It appears, indeed, if the cases now recorded are carefully analyzed, that symptoms and phenomena of a very important kind have been lost sight of in describing this constitutional disease, while an undue importance has been placed upon the bronzing of the skin. It is to the cachexia that Dr. Addison calls special attention, but his commentators have been carried away by the inquiry regarding the colour of the skin and its connection with the capsular disease. These writers have overlooked the more important portion of his observations, and have been induced to consider the *causes* and *nature* of the bronzing of the skin, which being established may be received as a most valuable symptom of a prevailing constitutional cachexia. There can be no doubt that the bronzing must appear of very secondary importance compared with the symptoms and pathology of that peculiar cachexia which attends the cases of supra renal capsular disease as described by Dr. Addison and others. There seems to be no doubt also that the cases Dr. Addison has described belong to the class of diseases now under consideration; and that they are also similar in many respects to forms of anæmia now noticed, and more especially to leucocythæmia. "In almost all the cases," writes Mr. Hutchinson (who has hitherto been the most sedulous exponent of Dr. Addison's views), there would seem to have been great deprivation of the coloured constituents of the blood, as manifested by the pallor of those parts of the skin not involved in the bronzing, the great flabbiness of the muscles, the pearly state of the conjunctivæ, &c." By a strange oversight, it would appear also that the blood has been subjected to but few examinations. "In two only," of the cases, writes the same author, "was the blood examined, and in both of those it was found to be loaded with white corpuscles." In all the cases a most remarkable and fatal cachexia prevails, and the value of Dr. Addison's observations consists in showing that a peculiar bronzing of the skin attends this cachexia, and indicates organic disease of the supra renal capsules, which seems sometimes to be associated with the constitutional state; and his observations are at the same time of the greatest value as showing how well directed pathological inquiry may advance the science of physiology, for the cases detailed seem to throw some light on the functions and influence of the supra renal capsules.

Although the change of colour of the skin would seem to be a most marked and constant symptom, still it does not appear, as has been stated by a reviewer of Dr. Addison's work, that this change "is one of the earliest symptoms of the disease." On the contrary, there are good grounds for believing, both from the history of the cases, and from physiological experiment and observation, that the change in the colour of the skin which has been termed "*bronzing*" does not come on for a long time—that from its nature as a pigmentary change it is of slow production; that while in almost all the well marked cases in which it has occurred, the symptoms had existed from one to three years, in other cases where it did not exist, it has been alleged that time was not afforded between the establishment of lesions in the supra renal bodies and the fatal issue for the production of the pigmentary deposit. One very important point is thus remarkably deficient of illustration,—namely, *the early symptoms of this cachexia* independent of *bronzing of the skin*. From what has been shown relative to the disease, it would appear that when *bronzing* of the skin has been established, a sign of disease has been discovered when it is too late to be of any service, for all the cases appear to terminate fatally in which this state has been unequivocally established.

In malignant, pestilential, and cachectic diseases it is not unusual, but rather the rule for the serum of the blood to assume a dark and dirty hue, and that ultimately the cutaneous surface comes closely to approach the colour of jaundice, differing from it only in being more lurid and dusky, and it is believed that the hue of the skin which becomes of so dark a tinge in some malignant organic diseases is due to the admixture of morbid matters absorbed from the seat of local mischief, and which so tinges the serum of the blood, that the rete mucosum is rendered dark. If then, it is true that in this cachexia the supra renal capsules are always diseased, and if it be true, as M. Vulpian has found (*Med. Times*, Oct. 4, 1856), that the supra renal capsules differ from all other organs in the body in the presence of a substance which has two peculiar re-actions, one with perchloride of iron and the other with the tincture of iodine, the first of which gives a dark blue tint, is it not probable that the coloration of the skin in supra renal capsular diseases may result partly from—(1.) The cachectic state; (2.) The organic lesion of the supra renal capsules; and (3.) The re-action of the peculiar substance in these bodies upon the iron of the blood, which the morbid organic changes in them has allowed to mingle with the circulating fluid? It is, unfortunately, the supra renal capsules only which have been carefully examined in the cases recorded; and in connection with the cachexia and the "bronzing" the lesions they exhibit seem to be of a very variable character, consisting of

(*a*) acute or recent inflammation ending in abscess ; (*b*) atrophy with concretions ; (*c*) the conversion of the organs into indurated fibroid enlargements ; (*d*) tuberculous deposition in various stages ; (*e*) carcinomatous deposition.

Sometimes also the lesion appears to have been secondary to lesions apparently of a similar nature in other parts, all of which must, therefore, be interpreted as several local expressions of the constitutional disease which prevails, and occasionally the capsules seem to have been the only structures in which lesions were detected ; while the degree of "bronzing" of the skin appears to have been proportionate to the length of time which the supra renal capsules are presumed to have been diseased, but neither the time nor the number of cases in which such a proportion can be traced is accurately made out. The general symptoms are those of a person constitutionally diseased, *not* always proportionate in their severity either to the nature or to the extent of the disease in the supra renal capsules. The post mortem appearances seem to have been in many instances associated with the tuberculous diathesis. In some cases the spleen was much enlarged, the kidneys pale, and in the last stage of fatty degeneration (TAYLOR). Out of 500 cases of post mortem examinations of all kinds of cases, made at Guy's Hospital by Dr. Wilks, only two instances were observed in which, the supra renal capsules being morbid, the skin did not betray the lesion by "bronzing." There are also cases on the other hand which seem to have proved fatal with the general cachetic state well marked and with the skin discoloration, and yet no lesion could be detected in the supra renal capsules (PEACOCK). In some cases the mesenteric glands are stated to have been enlarged. Calcareous concretions have been noticed also in the medulla oblongata.

In one case which, through the kindness of Dr. Monro of Dundee, I had an opportunity of carefully inspecting, after death, in June 1856, the following lesions existed :—The dark colouring of the skin was most conspicuous in the vicinity of the knees, and on the lateral and posterior regions of the neck. Where the mucous membrane of the skin meets the lips, and especially at the angles of the mouth, the deposits of pigment gave to the parts a dirty sordes-like appearance. The body generally was anæmic. The heart was small and flabby. Tuberculous deposits were sparingly disseminated throughout the apices of both lungs. The spleen, the liver, and the kidneys were severally adherent to the adjacent parts, but their structures appeared normal. The supra renal capsules were morbid, and the sympathetic nerves from the lesser splanchnic were greatly increased in size, as were the ganglia of the solar plexus towards the side of the organ most diseased and in contact with it. The texture of the nervous parts was of a bright rosy hue, as if under

the influence of vascular excitement. The mucous membrane of the mouth was thin, pale, and bloodless, the labial and buccal glands shining prominently through. The stomach and substance of the intestinal tube were uniformly thin throughout. In the stomach the solitary gastric glands were remarkably prominent, while the mucous membrane generally was wasted and atrophic. Microscopic sections from the jejunum and ileum showed the villi remarkably attenuated, and the mucous membrane very readily separated from the adjacent muscular part of the gut. The tubular glands of the mucous membrane of various parts examined, were almost entirely gone, and their place supplied by granular amorphous material. The average specific gravity of the mucous membrane of the intestines was 1·040.

The state of the skin which has been termed "bronzing," strongly resembles the colour of a bronzed statue from which the gloss has been rubbed off. It has been examined microscopically by Mr. Tuffen West and M. Robin of Paris. The sections show a layer of pigment granules in the rete mucosum, limited to that structure, very distinct, and exactly resembling that of a negro. The pigment is deposited in granules, but in some instances coloured cells are visible. Before detailing the symptoms observed in the remarkable cachexia from which these lesions result, it is necessary again to draw attention to our very incomplete knowledge of its pathology. While the apparent connection of bronzing of the skin with lesions in the supra renal capsules appears to be evident, as shown by Dr. Addison, our information is of the most deficient kind regarding the chronological sequence of the various symptoms which indicate the establishment of the constitutional disease; for it seems as yet by no means proved that the constitutional disease is developed as the result of local lesion in the supra renal capsules alone.

Symptoms.—As in the form of anæmia already described, so in this disease the patient has considerable difficulty in assigning the number of weeks, or even months that have elapsed since he first experienced indications of failing health and strength; and the rapidity with which the local lesions seem to develop themselves varies in different cases; a few weeks being sometimes sufficient to break up the powers of the constitution, or even to destroy life. Dr. Addison believes that this event is the more speedy in proportion to the rapid and extensive destruction of the supra renal bodies. In most of the cases the sequence of symptoms appears to have been, first, gradual and almost imperceptible indications of failing health and strength, consisting chiefly of languor, and weakness, and indisposition to either bodily or mental exertion, the appetite being impaired or entirely lost, the whites of the

eyes becoming pearly, the pulse small and feeble, perhaps somewhat large, but excessively soft and compressible. The body wastes without presenting extreme emaciation, or the dry and shrivelled skin usually associated with protracted malignant disease. Slight pain or uneasiness is from time to time referred to the region of the stomach, and there is occasionally actual vomiting. With every sign of feeble circulation, anæmia, and general prostration, "neither the most diligent inquiry nor the most careful physical examination throws the slightest gleam of light upon the precise nature of the patient's malady; nor do we succeed," says Dr. Addison, "in fixing upon any special lesion as the cause of this gradual and extraordinary constitutional change."

"With a more or less manifestation of the symptoms already enumerated," writes the same distinguished physician, "we discover a most remarkable, and as far as I know, characteristic discoloration taking place in the skin." It pervades the whole surface of the body, but is commonly most strongly manifested on the face, neck, superior extremities, penis, and scrotum, in the flexures of the axilla, and round the navel. It presents a dingy or smoky appearance, of various tints or shades of deep amber or chestnut-brown; and in one instance the skin was so universally and deeply darkened, as to resemble a mulatto. Sometimes the discoloration occurs in patches, and certain parts are much darker than others, while the skin is pallid between, blanched or morbidly white. This distribution of pigment is not confined to the skin, but is also visible in the mucous tracts as well as in some other structures. The discoloration consists of stains in the lining of the cheeks, and a decidedly blackish tinge of the mucous membrane of the lower lips, as if after eating mulberries. Dark areolæ become developed beneath the orbits, much marked towards the middle line of the face. In one case under Dr. Barlow, loss of consciousness and what are termed "fainting fits," were the earliest symptoms noticed (*Med. Times*, Jan. 24, 1857).

"This singular discoloration usually increases with the advance of the disease; the anæmia, languor, failure of appetite, and feebleness of the heart become aggravated; a darkish streak usually appears upon the commissure of the lips; the body wastes, but without the extreme emaciation and dry harsh condition of the surface so commonly observed in ordinary malignant diseases; the pulse becomes smaller and weaker, and without any special complaint of pain or uneasiness, the patient at length gradually sinks and expires. In one case, which may be said to have been acute in its development as well as rapid in its course, and in which both capsules were found universally diseased after death, the mottled or checkered discoloration was very manifest, the anæmic condition strongly marked, and the sickness and vomiting urgent; but the pulse, instead of being small

and feeble as usual, was large, soft, extremely compressible, and jerking on the slightest exertion or emotion, and the patient speedily died" (ADDISON).

During the past nine years in which I have been in the daily habit of making post mortem examinations, or of seeing them made by others, I have been familiar with a class of cases which, after a prolonged period of ill health and gradual loss of strength, at length died, and post mortem examination failed to detect any obvious lesion in visceral organs. As to the state of the supra renal capsules, however, I cannot write with certainty. One thing I have constantly noticed in such cases (to which my attention was first directed by Professor Simpson of Edinburgh), namely, a uniformly wasted anæmic condition of the whole mucous membrane of the alimentary canal from lips to anus. This was obvious in the thin transparent state of the intestines, and an alteration of the specific gravity of the mucous membrane. The mucous membrane of the mouth during life was thin and pale, the submucous glands of the labial and buccal membranes shining prominently through the thin and anæmic tissue, and fine blood-vessels with dark blood sometimes irregularly ramifying around them, conditions which might be considered as symptomatic of the state of parts in the rest of the alimentary canal. Such observations undoubtedly indicate a constitutional cachexia, whose pathology has still to be worked out.

Our knowledge regarding cause, prognosis, and treatment, is in a similar condition in this disease as it is in leucocythæmia.

In all the cases, including those to which I have just referred, the phenomena of the mode of death have been those of utter prostration of the vital powers, not unfrequently accompanied by disturbance of the nervous functions.

CARCINOMA—*The thick Cachexia associated with Cancers.*

Definition.—*A constitutional disease inherent by birth or otherwise inbred. Its presence is indicated by the occurrence of peculiar exudations in different parts of the body, to which the name of cancers, or malignant growths, has been applied. The malignant character of the disease is indicated by one or more of the following conditions: constant progress of the exudations, their returning after extirpation, not only in the original seat, but in the distant and internal parts of the body; destroying and absorbing the parts or organs invaded; infiltrating the tissues; tending to suppurate and to affect the glands to which the lymphatics lead from the seat of local lesion. The increase and nutrition of these exudations produce a peculiar maras-*

mus, tending to terminate in death. The anatomical constitution of the new-growths is heterologous.

Pathology.—The morbid condition of the body (cachexia) which is associated with cancers, cannot be referred to the blood alone. Indeed we have no direct proofs that the blood is peculiarly affected. We cannot find in it anything distinctive or peculiar to the cancerous diathesis, either by microscopic or chemical investigation. But while none can doubt the existence of a cancerous cachexia, we have no positive knowledge concerning the state of the blood in cancerous states of the body. It is evident, however, that a specific state of the system exists in the cachexia associated with cancer—because all parts of the body are liable to be infiltrated with the peculiar and specific exudations which constitute the "cancers or malignant tumors," and that without any direct communication with the place where the first deposit of cancerous exudation took place—that they tend naturally towards destruction of life, not necessarily, from their local position, but through a peculiar marasmus which their existence establishes, and which some think due to the demands which these new-growths make upon the system for increase and nutrition. They tend also to destruction of tissue around them, and to suppuration. A continual hectic febrile state is established, and increasing emaciation follows the intense bodily suffering and mental anxiety. The countenance becomes pale and anxious, with a slight leaden hue, the features become pinched, and the lips and nostrils slightly livid. The pulse is frequent, and the pains are severe. At length there is generally nausea and weakness of digestion, and a tickling cough frequently supervenes. Severe stitches strike through the local morbid parts, the pulse becomes rapid and faltering, the surface cadaverous, the breathing anxious, and death alone brings relief.

"Cancerous disease," says Mr. Paget, "or a tendency to it is prone to pass by inheritance from parent to offspring, and to occur (probably by inheritance of common properties) in many members of the same family and generation;" but while there appears to be a tendency to the hereditary transmission both of cancerous and of non-cancerous growths, there is a much greater probability of the hereditary transmission of *cancerous* than of *non-cancerous* growths, and that in the proportional probability of 22·4 for the *cancerous*, and 8·2 for the *non-cancerous*.—(*Med. Times and Gazette*, Aug. 22, 1857.)

It has not been proved that the inoculation of cancerous matter is followed by even the growth of cancers, far less by the development of cancerous cachexia; and there is every reason to believe that this loathsome disease cannot be communicated by the secre-

tions from a cancerous ulcer. Alibert has made dogs swallow the ichorous serosity collected from such a source, but the health of those animals was not impaired. Dupuytren has likewise introduced portions of cancerous parts into the stomachs of many animals —has injected the pus into their veins, and into their different serous cavities, but without producing results different from what any other irritating matter would have caused. Women also having the neck of the uterus destroyed by carcinoma have conceived and borne children, and yet neither the husband nor child have appeared to suffer in consequence. Alibert and others have likewise inoculated themselves with cancerous matter, and yet no contagious effect has followed. Neither has this disease at any time been known to result from accidents incident to the examination either of the living or the dead person. The more recent experiments of Harley and Laurence upon dogs have similarly failed to inoculate cancer.

Women appear to be more liable to this disease than men; and the increase is chiefly due to cancers of the breast and uterus, while in man it is chiefly the skin, the bones, and the digestive organs which suffer.

The mortality from the disease goes on steadily increasing with each successive decade until the eightieth year (Walshe).

Age has also much influence in determining the forms of cancer and the part affected. Hard cancers are rarely observed till after forty, and from that period the liability increases with age. Its most usual seats are also those on which age and functional activity have left their marks upon the organs. Thus it seldom occurs in the mammæ, uterus, or in the ovaries till after the cessation of menstruation—nor in the organs of generation of the male till towards old age, nor in the different portions of the alimentary canal till after forty.

Soft cancers are most common in the earlier periods of life; but then also they are observed to involve textures whose functional activity has been ever active, such as the glandular parts; for example, the lymphatic and lachrymal glands.

The cancerous cachexia seems to be particularly influenced by physical climate, mental distress, and anxiety; and according to Dr. Walshe the maximum amount of cancerous disease is found to occur in Europe, and is rare amongst the hospitals of Hobart Town and Calcutta, and the natives of Egypt, Algiers, Senegal, Arabia, and the tropical parts of America.

We know very little, however, as to the conditions which give rise to cancers. In the words of Mr. Paget: "The richest and the poorest alike seem to be subject to it; so do the worst and the best fed; those that are living in the best conditions of atmosphere and

those that are immured in the worst; those that are cleanly and those that are foul; those of all temperaments and of all occupations; those that appear healthy and those that are diseased. We can hardly lay our hand upon any one of the various circumstances of life, in the various orders of society in this country, to which we can refer as rendering one or more less liable than another to the acquirement of the cancerous constitution."

The idea that the local cancers were due to entozoa hydatids, originally advanced by Adams, has never met with any proof, although it is yet entertained as probable by some.

The local exudations which constitute the tumours or cancers, consist in general of two parts, namely,—(1.) The material peculiar to cancer, consisting of very varied forms of nuclei, nucleated cells, and juice, all of peculiar natures, distributed through an intercellular medium. (2.) Areolar tissue which constitutes the stroma or skeleton part of the new-growth. The first part is the essential and heterologous part of cancer. The relative quantity of these crude materials gives the most marked and obvious grounds on which cancers have been classified; namely, into *hard* and *soft* cancers. When the fibrous stroma is predominant, the new-growth is *hard*, and has received the name of *scirrhus*. When the cellular elements predominate the new-growths are *soft*, and have received the name of *encephaloid* or *medullary* tumors.

These again are subdivided into a considerable number of varieties by the minuteness of anatomical analysis to which they have been subjected. For instance, the stroma takes various forms, like net or trellis-work with large interspaces, or it grows papillary or villous in ramifications or vegetations. Sometimes it undergoes ossification, and then the skeleton of the cancer is formed of a network of true bony texture. This stroma part of the cancers is to be distinguished from the common binding tissue of the organ or texture into which the new-growth is infiltrated. It is really and truly part of the cancer exudations, and forms their basis. In the soft cancers it is more deficient, and then the cellular element predominates; and in them rather than in the stroma has the more distinctive elements of cancer exudation been said to exist. Much importance has been assigned, and with justice, to the character of the cell elements, as affording a specific distinction between malignant and benign forms of growth. Viewed, however, with reference to single isolated cells, it is now agreed that they offer in themselves nothing characteristic. It is in the comparative appearance of the multitude of cells, and especially in their relative size, that most distinguishing features may be observed. While the cellular cancer mass often shows merely small pus-like or large lymph-like cells of an oval form with many nuclei, yet when all kinds

of cancer are compared, "*typical cancer-cell elements*" may be described by the following general characters:—

While the external cell-wall presents the greatest multiformity of shape its dimensions are comparatively fixed to a mean of about $\frac{1}{1200}$th to $\frac{1}{1000}$th of an inch in diameter. Its nuclei, however, are more constant in appearance and more characteristic than the cells (Lebert, Bennett, Paget, Lawrence). They are always voluminous in themselves, as well as in relation to the area of the cell in which they are enclosed; of a more regular form, being generally oval or nearly rounded, clear and well defined, with a distinct single nucleus, and rarely two. Their average mean long diameter is from $\frac{1}{2500}$th of an inch to $\frac{1}{2000}$th of an inch.

While Lebert attached too exclusive an importance to "a specific cancer-cell," he fully admitted the possibility that the most active and baneful cancers may vegetate through the system without exhibiting any of the cells now described, corroborating in this respect the general statement previously made by Dr. Walshe, "that a tumour may present to the naked eye the characters of encephaloid, and be the seat of interstitial hæmorrhage, affecting the communicating lymphatic glands, run in all respects the course of cancer, and, nevertheless, contain no cells but such as are undistinguishable from common exudation cells." Muller, Bennett, Paget, and Lawrence have also since stated the impossibility of distinguishing the cell element of cancer as now described in all cases, from the cells in certain other abnormal and even normal tissues, so that no *single* element can be considered as characteristic of cancer, and the diagnostic value of microscopic examination may thus be summed up in the words of Mr. Zachariah Lawrence, the most recent observer and writer on cancer:—

"1. That in the greater number of cases of cancerous tumors the so-called cancer-cell will be found.

"2. That this form of cell is occasionally seen in growths manifestly innocent.

"3. That *vice versâ* (which is, however, less frequent), tumors anatomically innocent prove clinically malignant; that 'the cancer-cell is not the *sine quâ non* character of cancer.'

"4. That the inferences drawn from the microscopic examinations are not to be deduced from a few isolated cells that may have happened to strike the eye, but rather from the characters of all the cells and of the field of view generally.

"5. That the results afforded by the microscope must take an important but not an exclusive and overbalancing position in the series of data which are to serve us as the premises for our conclusions."

What is supposed to be the blastema or mother fluid from which the cells and stroma of cancers grow, consists of an albuminous

synovial-like, colourless, or pale yellowish fluid. It gives rise to the materials which compose the cancer juice, and to the essential cancer mass now described, namely, the stroma and the cellular elements. The development of cancer therefore proceeds from this mother fluid as an exudation into the interstices of textures, or on the free surfaces of the membranes; and lastly, even by endosmosis of this fluid into the natural cells of parts (such as into cartilage or bone-cartilage cells), the characteristic cancer mass may commence to grow by endogenous growth within such cells, hitherto healthy. Dr. Bennett of Edinburgh, and Dr. Van der Kolk of Utrecht, have made most interesting observations on the extension of cancer-cells by means of the parenchymatous fluid; and from all that has been observed on this subject, the latter author draws the following conclusions :—

"1. Through an interchange of material, taking place between cancer-cells and intercellular fluid, the latter acquires the property of forming new nuclei and cells of a similar nature.

"2. This intercellular fluid passes, along with the parenchymatous fluid pervading the sound parts, into the textures adjoining the tumor. The parenchymatous fluid thus acquires the same constituents and tendency to form similar cells, which now become developed among the healthy surrounding tissue, in the course of the areolar membrane.

"3. On account of the minuteness and small number of the last mentioned cells, their presence cannot be detected with the naked eye; so that the surrounding parts may appear to be perfectly sound, notwithstanding that they contain the germs of the advancing formation of cancer.

"4. It is, therefore, of importance, in removing cancer by operation, not only to take away at the same time a large quantity of the adjacent sound parts, but also to examine the innermost sectional edges under the microscope, in order to ascertain whether any trace of cancer-cells in process of formation is to be discovered in them.

"5. The existence of burning, shooting pains in carcinoma, may be taken as a proof that the cancer-cells have reached the neighbouring nerves, and the disease can then scarcely be looked upon as a local one, in which an operation might be permanently successful.

"6. By the absorption of the infected parenchymatous fluid through the lymphatics and veins, the whole body seems to become more or less tainted, so that secondary cancer ensues in distant situations, when, as is self-evident, operation can no longer be thought of.

"7. This altered parenchymatous fluid penetrates the organic tissues which are washed by it, the sarcolemma of the muscular fibres, the tubes of the nerves, &c. These membranes, too, both the sarcolemma and the walls of the nervous tubes, appear to take up the altered nutritive fluid; the consequence of which is, that both within the sarcolemma and the nervous tubes, similar nuclei and cells arise, accompanied with an absorption of the muscular fibre and of the contents of the nerve, and attended with the deposition of fat, by which these parts waste and are destroyed, while the surrounding membranes (sarcolemma and walls of

the nervous tubes) remain."—(*Brit. and For. Med.-Chir. Review*, April, 1855.)

The cancer juice is a most important element of the new-growth. To the naked eye it appears as a viscid, whitish, creamy, yellowish fluid, which may be squeezed or scraped in considerable abundance from the surface of a section.

It is to the vital functions performed by all these elements that we are to draw our conclusions regarding the innocency or malignancy of new-growths in which they form a part, rather than to their anatomical forms. If we find adjacent textures are being infiltrated, poisoning the lymphatic current which passes from them, inducing new-growths of a like nature in the lymphatic glands through which these currents pass, affecting the general system with a peculiar cachexia, marked by languor, debility, emaciation, and a peculiar sallow leaden-like colour of the skin; and if after removal such growths return, then there is no doubt that the cachexia of cancer is made manifest by such local lesions. These present so many elements in common that all these new-growths are but manifestations of one disease which has been named here "carcinoma," and attributable to the constitutional cachexia already described. The varieties also run into one another by characters which are so insensible that definite lines cannot be drawn between them, and thus many species of cancers are described by authors, under various synonymes, as shown by the nomenclature adopted by the following authors who have recently written on cancer :—

I.	II.	III.	IV.
Walshe and Bennett (1846-49).	Paget (1853).	Rokitansky (1855).	Lawrence (1856).
Scirrhus, or hard cancer.	Scirrhus, or hard cancer.	1. Fibrous carcinoma.	Scirrhus.
Encephaloma, or soft cancer.	Medullary, or soft cancer.	2. Medullary.	Encephaloid.
Colloid, or jelly-like cancer.	Epithelial.	(*a.*) Villous cancer.	Melanosis.
All other forms of cancerous new-growths are described by Bennett under the name of *cancroid* growths.	Colloid.	(*b.*) Cancer melanodes.	Nævoid cancer.
	Osteoid.	3. Epithelial cancer.	Villous cancer.
	Melanotic.	4. Gelatinous cancer.	Osteoid cancer.
	Villous.	5. Carcinoma fasciculatum.	Enchondromatous cancer.
	Hæmatoid.	Cystic carcinoma.	Colloid cancer.
			Fibrous cancer.
			Fibro-plastic cancer.
			Epithelial cancer.

Of these particular kinds of cancer some tend to affect certain organs rather than others, for instance, *alveolar cancer* is more frequently found in the stomach or intestines; *epithelial cancer* in the skin and mucous membranes, and so on.

The *primary exudation* is also thrown out in the textures of some organs rather than others, for instance in the uterus and female

breast, in the stomach, the colon, the liver, the bones, and the brain. *Secondary cancers*, on the other hand, are most frequent in the lungs, the spleen, the salivary and lymphatic glands, in the small intestines, and in the serous membranes.

Hard cancer (*scirrhus*) has two stages,—or a hard stage, and a stage of softening.

The local exudation is deposited in a hard or scirrhous state, and the duration of this state constitutes the first stage. It may be deposited in *masses*, or be *infiltrated* into the tissues of the organ or part affected; the latter being by far the most common form. When deposited in masses they are generally lobulated, dense, and often contained in a cyst; again, when these masses are cut into, we find them to consist of two substances,—the one is the cancerous deposit or growth, and the other is areolar tissue; so that the appearance of the divided surface in general is that of a hard, white, semi-cartilaginous substance, streaked by fibres radiating from the centre to the circumference. They are of considerable density and firmness, and in hardness of texture vary from hard boiled white of egg to cartilage—the knife making a grating noise as it cuts through them. The specific weight of these tumors is extremely great, and although in such parts which are external and more or less pendulous, as in the mamma, this fact is, by some distinguished surgeons, an element in diagnosis, our exact information relative to the specific gravity of cancerous exudations is still very limited—1·040 to 1·160 is the very wide range which I have observed such tumors to indicate.

The cancerous deposit, however, is much more frequently infiltrated among the areolar tissue of the different organs or tissues it affects. In this case the affected tissue becomes gradually increased in thickness and in density by a slow deposition, or growth of the morbid matter, so that the part, if now divided, presents the same hard, semi-transparent character as in the masses, but more interspersed with areolar tissue, the diseased portion being gradually shaded off into the healthy structures. In the mucous tissues, as those of the stomach or uterus, the infiltrated matter has often a considerable thickness, measuring from a quarter of an inch to an inch, or perhaps even more. On the contrary, when infiltrated into the cutaneous tissue, the layer is often so attenuated as to be scarcely sensible, and the disease commences with little other appearance than a small hard pimple, or a small erysipelatous tumor, or even by a slight fissure or crack in the skin.

After a certain but indefinite period, which varies from a few months to a few years, the scirrhous stage terminates, and the second stage, or that of *softening*, begins. In mucous membranes this softening usually takes place at their *surface*, or superficially,—

as at the mucous surface of the neck of the uterus, or at the mucous surface of the stomach. An ulcer is the consequence of this softened state, and is at first superficial, presenting many remarkable varieties, such as an inverted or everted edge and an irregular form, while its base may be granulating at one part and sloughing at another. Its course is burrowing, often penetrating between the cancerous lobules and ultimately perforating the peritoneum. The pus secreted by this sore is fetid; often a mere ichor, or pus mixed with blood, and so acrid as to inflame the parts over which it flows. In a few instances the large vessels participating in the disease ulcerate, and the patient dies of hæmorrhage.

The duration of the scirrhous stage of a cancerous tumor is very uncertain, and may terminate in a few months, or may last several years. A cancerous mammary gland, for instance, has been known to remain indolent for fourteen years, and has at the end of that time been removed by an operation. This indolent character of carcinoma is limited, however, to the scirrhous stage; for after it has softened, or its second stage has commenced, its course is rapid, and a few weeks or a few months now generally terminates the patient's life, the part affected in no instance cicatrizing, or being again restored to a healthy condition.

Soft Cancer affects more especially the solid visceral organs. It is generally deposited in masses, and is but rarely infiltrated. Its cell products also are most profuse, and its course much shorter than hard cancers, the disease being generally terminated in a few months. While hard cancer, for the most part, affects persons in the decline of life, soft cancer is most common in its earlier period or adult age from twenty-five to forty.

It is generally deposited in masses, but it may be infiltrated; the former is the more common form, the latter the more rare. In whichever form deposited, however, it has two stages, namely, one of induration and one of softening. If we examine a soft carcinomatous tumor in the first stage, we find it composed, as in hard cancer, of fibrous tissue and a peculiar morbid growth. The areolar stroma is of various densities, often extremely fine, and then again of considerable consistency and tenacity, and in either case radiating through the tumor and dividing into lobules. The morbid substance or growth is of many degrees of hardness, varying from lard to cartilage, but is generally softer than in hard cancer; it is also of a bluish semi-transparent whiteness. The duration of this stage is from a few weeks to two, three, or four months, and only in a few instances does it exceed that latter period.

The first stage passed, the process of softening, or of *ramollissement*, takes place. This is evident on cutting into the tumor, and passing the handle of the scalpel over the divided surface, a milky-

white substance is expressed. As the disease proceeds, the parenchymatous substance of the new-growth is changed into the consistence of soft cerebral matter, or of thickened pus; it is consequently opaque, and varies in colour from white to red, and even black. These variations of colour appear to be owing to the different quantities of blood, or of melanic matter which are effused, and with which the cancerous matter is commixed. When bloodless, and white, the product is so peculiar, that it has been termed *cerebriform*, and, when mixed with blood, *medullary sarcoma*, *fungus hæmatodes*, and many other terms, according to the different quantities of that fluid effused, which is often so abundant, that the cyst or cavity at length contains little else than fibrine.

The process of softening seems to commence indifferently in every part of the tumor, as at its centre, or towards its circumference; and if the tumor communicates externally, the quantity of softened matter discharged often amounts to many ounces in the course of the day. This profuseness of discharge appears to be owing to the great vascularity of the tumor; for although in the hard stage only a few blood-vessels, with coats of great tenuity and delicacy, can be traced between the lobules; yet, in the softened state, a successful injection shows them to be made up almost entirely of blood-vessels.

The duration of the second stage is generally a few weeks, and very rarely extends to months. It appears, however, that anything which greatly irritates the part accelerates the process of softening. Thus, if a cancerous limb or tumor be amputated, the cancerous matter primarily deposited in a hardened state is, subsequent to the operation, deposited in a softened condition, no previous hard stage existing. The minute organic structure of this form of disease, in its scirrhous state, is probably not dissimilar to that of hard cancer, and of the vital organic characters, there can be no doubt of their similarity.

There is scarcely any organ or tissue in which soft cancer has not been found, and by some pathologists the frequency of its occurrence is supposed to be in the following order :—the liver, epiploica, the mesentery, the lymphatic glands, the brain and nerves, the spleen, the testicles, the uterus and ovaries, the eye, the bones, the heart, and lastly the blood-vessels. It has been stated that soft cancerous matter is far more frequently deposited in masses than infiltrated into these parts. In general there is only one tumor; but there may be, as is often seen in the liver, three or four, and in some cases they are extremely numerous. Dupuytren has met with a carcinomatous heart which contained more than 600. In size they commonly vary from a millet seed to a large egg; but when they form in loose cellular tissue, as between the folds of the

mesentery or of the epiploica, or in the substance of the lungs or testicle, they have been known to weigh 20, 30, 40, and even more pounds. These tumors may also be encysted or non-encysted.

One of the most constant features of this disease, and which distinguishes it from hard cancer, is, that it often appears in many organs or tissues at the same time in the same patient. Thus it has been met with in the coats of the bladder, in the liver, and in the lungs of the same individual. It has also a greater tendency to be reproduced, after an operation for its extirpation, than any other kind of cancer. This reproduction may take place either at the part operated on, or in some organ or tissue distant from the primary seat of the disease.

Melanoid Cancer is, in the great majority of instances, encephaloid or soft cancer, with the addition of black or brownish pigment. The pigment deposit, *per se*, is not necessarily malignant. It is known as *spurious melanosis*. The pigment of cancers is readily decomposed by nitric and other acids, while the *spurious melanosis* or *carbon* is not. The true melanic deposit exists with the soft cancer cells either as an infiltration into them, or in the form of isolated granules or small corpuscles.

Colloid, or *Areolar Cancer*, is sometimes also called *gelatinous* or *gum cancer*. In this form the meshes of the new-growth are filled up by a glue-like or gelatinous substance, like half dissolved gum-arabic. The fibrous stroma are arranged in the form of alveolar spaces, the fibroid tissue being extremely delicate and transparent. The spaces or alveolar loculi vary from a very minute size to that of a pea. The contained substance is of a yellowish or greenish-yellow colour, but yields no gelatine on boiling. The most common places where colloid cancers form are the stomach and omentum, the ovaries, the bones, the kidneys, the uterus and spleen, and they may be combined with the *hard* or *soft* cancers.

Epthelial Cancers, or *Epithelioma*.—Of late years, under these names, or that of *Cancroid*, Lebert, Bennett, Hannover, and Paget, have described a form of tumor, which has all the vital malignant qualities of cancer already described, but its minute elements consist of cells resembling those of epithelium or epidermis. It occurs almost solely on the skin or mucous membranes, being frequently seen on the lips or cheeks. Rokitansky has observed it in the liver, Bennett has described it as commencing primarily in the lymphatic glands; and in two cases of what has been termed acute hypertrophy of the mamma, both of which proved fatal with secondary lesions in internal organs, which I examined, I believe that this form of cancer was the primary local lesion in the gland (*Med. Times and Gazette* for 1857). It only seems to occur when there is pavement, or spheroidal epithelium; and Lebert

has seen it on the serous layer of the arachnoid, and Robin has described it on the interior of a vein in a horse.

Diagnosis.—Cancerous affections may be simulated by many nervous disorders, and also by chronic inflammation of the respective parts; but the long continuance of the symptoms, their gradual augmentation, the severe pain which admits of no permanent relief, together with the loss of health and slow emaciation of the patient, at last give a moral conviction that it must be cancerous deposit in some organ from which the patient suffers.

Prognosis.—Cancer, though long latent and its course slow, pursues its destructive progress unimpeded, and in no instance does amendment or a return to health await the patient, who ultimately falls an inevitable victim to the complaint.

Treatment.—No remedy has yet been found which can in any degree be considered curative of cancer, and the efforts of the practitioner are consequently limited to relieving symptoms, and to the adoption of such palliative measures as may prolong life. To remove a cancerous exudation, where it is practicable, must, on theoretical grounds merely, be attended with as much benefit to the constitutional disease, as would attend the removal of a leg for acute rheumatism of the knee-joint. The statistics of cancer show, so far as they go, and as Dr. Walshe long ago showed, that "excision of a cancerous tumor seems to awaken a dormant force. Cancers spring up in all directions, and enlarge with a power of vegetation almost incredible."

In whatever part the disease may be situated, one great rule is to endeavour to restore the healthy functions of that part, and to alleviate the distressing pains the patient endures by opiates. These remedies are for a time successful, but make no impression on the disease, which silently proceeds, and the patient finally limits himself altogether to opiates. The quantity of opium or other narcotic known to have been taken in such cases, is something enormous—five, ten, fifteen, or twenty grains of opium at a dose, or a proportionate quantity of *hyoscyamus* or of *conium*, three, four, or more times in the twenty-four hours. There are instances, however, in which these large doses have been given with impunity for a long time, when most unexpectedly the patient died narcotized, and apparently from merely changing the parcel of the medicine, either from some great difference in its strength, or from its possessing qualities differing from those of the original parcel. It is always, therefore, advisable that, on having recourse to a new parcel, the dose should be reduced. But although these large doses have occasionally been given, yet it may be questioned whether they are not more hurtful than beneficial; for usually they produce headache, delirium, loss of appetite, and narcotism, so that the patient

is only the more rapidly exhausted. In general, therefore, the patient does better under moderate doses of opiates, as one or two grains or its equivalent, of morphine, or other narcotic, every six, eight, or four hours, than when more excessive doses are given,—a larger dose producing headache and much cerebral disturbance, without in any sensible degree mitigating the sufferings.

When the disease is seated in the colon, the quantity of purgative medicine necessary to produce a motion is often quite extraordinary.

When the stomach is so irritable that it rejects everything, it is our duty to support the patient by nutritive injections, as of strong broth, egg-flip, sago, or other fluid substances. It has been attempted to impart strength to the patient by means of milk baths, or baths of strong broths; but the skin has not sufficient power of absorption, and it has been found that the heat of the bath has exhausted the patient in a far greater ratio than its nutriment supported him.

As a general principle, diet has no influence over the course of the disease, so that whatever agrees with the patient may be safely indulged in.

Order 2. Tuberculous Diseases—*Phthisici.*

The diseases belonging to this order are more strikingly wasting in their effects upon the body than those which belong to the order now just described. They comprehend more especially *scrofula*, *tabes mesenterica*, *phthisis*, or *pulmonary consumption*, *tubercular peritonitis*, and *tubercular hydrocephalus*. Many of them are characterized by the deposition of a peculiar substance in the tissue of some organs rather than in others, to which the name of *tubercle* has been given.

In other respects they are very similar to those of the order previously described, owing their existence to constitutional conditions; and in the present state of our knowledge, ought not perhaps to have been formed into a separate order, for there can be no doubt that in the *tubercular* or *wasting* diseases as well as in those of the *diathetic* order, there is a *latent* condition existing before the tubercles are deposited; and the relation of the nutritive and other morphological changes between the solids and the fluids of the body has everything to do with the development of the tuberculous state; and in cases where the tendency to the deposition of *tubercles* is hereditary, the operation of agents from without act as stimuli or excitants to the deposition of them.

Previous to 1829, when Sir James Clark published his classic

work on climate, the tendency of pathological researches into the nature of the diseases just mentioned, was to keep up the idea that these diseases, and especially *pulmonary consumption*, were merely local and referable to a local cause.

The terms *phthisis*, *consumption*, or *wasting*, were originally used vaguely, to designate a variety of chronic diseases, described entirely by local symptoms and physical signs, and therefore having few characters in common except the marked emaciation which attended them. When researches in morbid anatomy became more frequent and efficient, the local lesion most frequently connected with the phenomena of wasting was discovered to be a peculiar morbid condition of the lungs, and to this the name of "consumption" was applied, and afterwards more definitely "pulmonary consumption." From the frequency of this local lesion, the pulmonary state of necessity attracted far greater attention than any other form of disease in which *wasting* was a marked feature; and when lesions in other organs were found associated with "pulmonary consumption," they were regarded as complications rather than as local manifestations of one and the same general constitutional state, and were looked upon as the primary cause of the emaciation. In 1819, Laennec first showed by his accurate post mortem observations on the state of the lungs, that deposits to which the name of "tubercles" were applied, formed almost the sole cause of *consumption*, and consequently he restricted the term *phthisis* to "*the disease produced by tubercles* in the lungs." Louis and Andral confirmed the observations of Laennec, and thus the view of this morbid state, based as it was on morbid anatomy *alone*, led to the enunciation of limited and erroneous doctrines regarding the real nature of the disease which the existence of *tubercles* indicates either in the lungs or in any other part of the body. The relations subsisting between *pulmonary phthisis*, *consumption*, or *wasting*, and the deposition of "tubercle" must now be even still more modified under the combined researches of morbid anatomy and progressive knowledge in pathology. *Consumption*, or wasting in the common acceptation of the term, is not now found to be due always to tubercle (Addison, Gairdner, Reinhardt, Virchow, and Jenner), so that the terms *phthisis pulmonalis*, and *tubercle* cannot now be considered always as synonymous. Ulceration of the lungs and partial destruction of pulmonary tissue are now found to arise from other causes than deposits of *tubercles*, and become equally efficient causes of phthisical mischief. Nay, we know also that many states of the body to which the name *scrofula*, or *struma*, is applied, are not necessarily attended with the deposits of "tubercles" at all; yet when the local lesions of a tubercular nature are observed to be connected with marked constitutional states under various circumstances, the connection between

the *tuberculous* and the *scrofulous* state is seen to be of the closest description, and their pathological history is now generally believed to be identical.

The extensive observations of morbid anatomists since the time of Laennec, elucidated by the most learned pathologists of the age, now tend to establish on a very broad foundation the doctrine first so strenuously and ably advocated by Sir James Clark, that the morbid conditions now mentioned are due to what he termed a "tuberculous cachexia," and accordingly it is proposed to consider the *constitutional* disease which the deposition of "tubercles" implies, under the general title of

TUBERCULOSIS—*The Cachexia associated with the Tuberculous state.*

Definition.—*A particular morbid condition of the system attended either with the deposition of a substance in various tissues to which the name of "tubercle" or "tuberculous matter" has been applied; or associated with peculiarities of appearance during health and liability to certain diseases termed "scrofulous," such as swellings of lymphatic glands and of joints, carious ulcerations of bones, frequent and chronic ulcers of the cornea, ophthalmia, abscesses and cutaneous pustular eruptions, persistent swelling and catarrh of the mucous membrane of the nose, and characteristic thickening and swelling of the upper lip—lesions which, while they are distinguished by mildness of symptoms, are peculiarly persistent, and which follow on the application of exciting causes, which would have no such effect on a healthy person.*

Pathology.—The *diathesis* which expresses the latent existence of the states now defined is variously described by the terms *tuberculous*, *scrofulous*, or *strumous diathesis*—more recently *tuberculosis*. There is perhaps no subject in the whole range of medical science which the student ought to study more carefully than the cachexia associated with the deposition of tubercle. As a practitioner he will find that he becomes often painfully concerned in the deepest interests of families and society, through the threatened or actual ravages of tuberculous diseases. The extensive prevalence of the tuberculous cachexia—the great and almost inevitable mortality of the tuberculous diseases themselves when completely developed, stamp the morbid state associated with such diseases as a topic which at the outset ought to engage a large share of attention. Most assuredly the physician will have to turn his knowledge to account in every future phase of his professional life; nay, further, when he knows what experience has now adequately demonstrated, that the tuberculous cachexia springs from causes over which the public, rather than the medical profession, have control, he must be at once impressed with the belief, and encouraged with the hope, that when he acquires the

confidence of the public in the practice of his profession, he may exercise a powerful influence for good in teaching how much they may themselves control the ravages of *consumption.*

There are several circumstances which show the great influence of public sanitary measures in controlling the ravages of consumption when these measures are scientifically directed to the preservation of the general health, and especially when men are associated together in great communities—an influence much greater than the best directed efforts of the medical profession—through their *materia medica.* It is by the mode of life as citizens of the world, in the social relations of husbands and wives, parents and children, and in the public relation of masters and workmen, that the extent and ravages of consumption are to be controlled. It is by a strict attention to the rearing of offspring, and in the future regulation of food, clothing, cleanliness, occupation, and in choice of a profession, and by many other circumstances which have an obvious influence (perhaps at first sight inappreciable), on the maintenance of the general health, that our hopes of success as practitioners of medicine must rest in the prevention of that bad habit of body which develops and propagates the tubercular diseases in civilized society.

When Sir James Clark, in 1835, published his treatise on pulmonary consumption, he expressed some doubts as to tuberculous diseases being comparatively more prevalent at the time he wrote than they were some fifty or a hundred years before; and he was of opinion that while many circumstances favoured the probability of a diminution of tuberculous diseases, there were also circumstances which might materially counteract such an influence; and while he was clearly of opinion that tuberculous diseases had increased in the middle and upper ranks of life at least, he also believed that, as a rule, the constitutions of the three past generations had deteriorated progressively from father to son..

The annual returns of our Registrar-General also, up to 1846, show a progressive increase in the mortality from consumption. In 1854, however, we find it recorded, "that phthisis is twice as fatal as any other disease in England, but that within the last eight years it appears to have declined to some extent." The inquiries of Dr. H. Greenhow show that this diminution is in a great degree due to those hygienic measures which have contributed to diminish the causes of the *miasmatic* order of ZYMOTIC diseases in general; and which have especially lessened the prevalence of those febrile exanthematous diseases, which by weakening the constitution, tend to bring about those conditions under which that bad habit of body is established which leads to the deposition of tubercles. To no kind of sanitary measure are we more indebted for this result than

to the influence of vaccination in diminishing small-pox, a disease which, of all others, seems to tend to the development of the tuberculous cachexia, as a sequel to its existence.

Accordingly we find it recorded by Dr. Greenhow, that "during the middle of last century, before vaccination was known, the scrofulous death-rate was more than five times as great as our present one; and the pulmonary death-rate of the present time is 7 per cent. lower than the pulmonary death-rate of 1746-55." While therefore such statements and careful observations extended through long periods of time show how much may be done by general sanitary measures in preventing the extension of tuberculous diseases, there is still great necessity for a careful study of the nature of these diseases, for we find them still in reality *decimating* the civilized part of the world, cutting off in some instances as many as 35 per cent. of our metropolitan populations.

Morbid Anatomy of Tubercle.—The peculiar deposit which attends the diseases now under consideration is named *tubercle* from its external form, occurring as it does in small nodules, isolated or grouped together, or as large, irregular masses, dispersed through the textures of an organ. One essential character of *tubercle* is its incapacity to development beyond the state in which it is deposited from the first, and in which state it may remain latent. It generally, however, exhibits a tendency to degenerate in various ways, involving with such degeneration the destruction of the tissue with which it is surrounded. It contains no trace of fibrous development (Rokitansky). The term *tubercle* is always understood to refer to adventitious masses of this nature, the type of which is found in the lungs as the essential anatomical constituent of pulmonary consumption. But the same material which composes *tubercles* in the lungs is also found in many different forms and organs, and wherever it occurs it is described as *tubercle* or *tuberculous matter*; and *tuberculous disease* or *tuberculosis* is the usual designation of the specific diseases of which the essential feature is the production of this peculiar matter (Paget). A review of the opinions of recent writers, by Dr. Jenner, as to the nature of *tubercle*, in *The British and Foreign Medico-Chirurgical Review* for January, 1853, shows that the most eminent pathologists of the day are not at one as to the nature of this morbid product.

"The opinions entertained regarding the nature of *tubercle*," writes Dr. Jenner, "may be divided broadly into two classes. One class of pathologists holds that tubercle is an exudation essentially morbid in character" (Rokitansky, Bennett, Ancell, Lebert).

Another class holds that tubercle is merely a retrograde metamorphosis of pre-existing structures, tissue elements, or morbid products (Williams, Reinhardt, Henle, Gulliver, Addison).

Virchow may be said to hold a doctrine combining both views. For, while he holds that tubercles are essentially composed of dead tissue elements, whether these are physiological or morbid products; he also holds that a local process in all cases leads to an exudation of a material which is poured out in what he terms a tuberculous inflammation, and which becomes organized to a certain extent and then dies, breaks up, shrivels, and so becomes tubercle. This process Virchow calls *tuberculosis;* and *scrofulosis* is the general constitutional state in which this *tuberculizing* process occurs, and which commonly leads to *tuberculosis;* or, in the words of Paget, "the relation between the two (terms) is that the *scrofulous* constitution implies a peculiar liability to the *tuberculous* diseases." According to Virchow *tuberculosis* is the local process in which there occurs an exudation of a material, nutritive or pathological, which develops into cells, and that these cells *tuberculize*, or undergo the tuberculous metamorphosis. *Tuberculization* is therefore the local process by which the metamorphosis of the elements of a part into tubercle is effected, by endogenous development, atrophy, shrivelling, and desiccation of its textual element.

A *tubercle* is thus formed of the detritus of the metamorphosed and atrophied cells, with the remains of the vessels and other structures of the part in which they were seated (JENNER).

Whatever may be the view entertained regarding the exact nature of *tubercle*, this morbid product appears to us under two conditions, in forms more or less spherical, the contour of the masses being influenced—(1), by the nature and movements of the surrounding tissue; and (2), by the form of the cavity in which it first accumulates. The more recent and accurate microscopic observations which have been made into the nature and seat of the tuberculous deposit, serve but to establish and confirm the more crude but scientific generalization made by the late Sir Robert Carswell, when he wrote that "the *free surfaces* of mucous membranes form the chief seat of tuberculous deposit." It is necessary, however, to extend the significance of the term *free surface*, and make it now apply to the ultimate and microscopic *cul de sac* terminations of mucous tubes.

Grey and *yellow* tubercle masses are the names by which such deposits are described, and they are first visible in the form of roundish granulations about the size of millet seeds, and isolated or in groups of nodular masses of more or less irregular form.

The *grey tubercle* is tough, soft, and compressible, of a pearly-grey colour, and semi-transparent. Microscopically, it is seen to be composed of irregular-shaped bodies, approaching a round oval or triangular form, and varying in size from the $\frac{1}{1000}$th to $\frac{1}{2000}$th of an inch. These sometimes appear to be imbedded in a hyaline adhesive

basis substance infiltrated with granules and molecules varying from a point scarcely measurable in size to the $\frac{1}{8000}$th part of an inch in diameter. The most characteristic semi-transparent grey granulations appear to contain more of the hyaline basis or connecting-substance than of formed elements, the whole field of view being more transparent and the elements less well expressed or defined. Acetic acid (weak, one part to four or six of water) dissolves many of the granules, and renders all the corpuscles more transparent, while a solution of potash completely dissolves them.

Various opinions are entertained as to whether or not *tubercle deposits* ever consist of *tubercle cells* with *nuclei*. Rokitansky holds that there are cells present containing one or more nuclei, and which indicate an endogenous development and growth of the elements just noticed. Gulliver and Vogel also believe in the existence of such nucleated cells. Bennett, on the other hand, has never been able to discover nuclei in the corpuscles of tubercle; and this is a very important observation and distinction, because, as Dr. Bennett truly observes, there is thus no danger to be apprehended from the spread of tubercle itself by an inherent power of growth; and if fresh deposits can be prevented, the tendency of the tubercle mass to disintegration is favourable to its absorption. By many also these cell-like elements are described and believed to be nuclei (Bennett, Schroeder Van der Kolk, Rokitansky, Paget, and Sieveking); and the view now related as entertained by Virchow, how existing tissue elements may tuberculize, renders it highly probable that they may be the nuclei of epithelial cells as suggested by Van der Kolk, or of other cell elements, normal or pathological, as believed by Virchow; or they may be cell particles like nuclei of slow formation and without any tendency to reproduction, but tending to disintegrate or break down into molecules as described by Bennett. Paget enumerates the elements of tubercle as follows:—

"1. Molecules, granules, and oil particles, usually of small size and extremely predominant in *yellow tubercles*. 2. Nuclei or cytoblasts of various shapes and structure, but all degenerate or defective; some glittering, hard edged, wrinkled, and withered; others granular, and few or none with distinct nucleoli. 3. Nucleated cells, similarly misshapen, withered, or granular. 4. Certain compound cells, as described by Van der Kolk, and consisting of epithelium charged with the nuclei, which become the common tubercle corpuscles."

When the masses of grey tubercle exist in the substance of the lungs, their resemblance to millet seeds has sometimes procured for the deposit the name of miliary tubercles; and when the lung is cut through, the elastic nature of its texture causes it to contract upon itself, so that the parenchyma recedes from the tubercle deposits visible on the surface of the section, and the deposits ap-

pear slightly raised from the cut surface, and the finger may feel them as little resisting bodies set in the lung (PAGET). When examined with a moderately magnifying hand lens the borders of these masses are seen to be irregular with short projecting processes. The contraction of the lung and the consequent squeezing of the *tubercle* mass probably render these appearances secondary forms assumed by the grey granulations.

Yellow tubercle is of various shades of colour, and occurs in masses of variable size, generally larger than the *grey* deposits. These masses are opaque, friable, and of a cheesy, lardaceous consistence. The masses of yellow tubercle are more commonly grouped so close together that the movements of the lungs cause them to become fused in uniform tubercular masses half an inch or more in diameter. Microscopically *yellow tubercle* contains a much greater abundance of fine protein molecules than the grey tubercle, and there are also present in it elements similiar to those in grey tubercles, which are shrivelled, indented, and wrinkled.

Considerable differences of opinion have been entertained respecting the relation of these two varieties of the tubercular deposit. Laennec taught, and it has been the general belief since his time, that the *grey tubercle* is the earliest stage of the deposit, which subsequently becomes converted into the *yellow*. Dr. Walshe has also especially investigated this point, and teaches a similar doctrine. Rokitansky, in the first edition of his great work on morbid anatomy, regarded the *yellow* and the *grey* as essentially distinct forms, and considered it an error to believe that the one is converted into the other. Rokitansky now affirms that *grey tubercle* is sooner or later converted into *yellow tubercle*, as Laennec first taught, and which is now the common belief. When the grey tubercle does not pass into the yellow, it withers away. It loses its lustre and becomes dry, dense, and hard, and shrivels into an indistinct shapeless fibrous-like mass. Sometimes such a change is associated with a calcareous degeneration, the surrounding tissue in which it is imbedded becoming dark with the deposit of pigment.

It is now also believed and taught by Rokitansky, Virchow, and others, that certain other abnormal products not apparently at first tubercular, afterwards *tuberculize* and assume the appearance of yellow tubercles. To this change Virchow proposes to restrict the term "*cheesy metamorphoses.*" The metamorphosis of *grey* to *yellow* tubercle generally commences in the centre of the deposit, and subsequently the yellow tubercle undergoes most important secondary changes in a sanative point of view. These changes consist—(1.) in softening; (2.) in cretification, or calcification; but it is not to be understood that the first of these two changes always passes into the second.

The descriptions already given, and the metamorphoses about to be noticed, illustrate the distinctive and peculiar characters of tuberculous deposit, namely, its early degeneration and abortiveness. It seems to be a substance which acquires a certain stage of organic development, when it is arrested in its course, recedes and degenerates. Such characters may be read from the shrivelled or granular state of the so-called free nuclei, and the barren cells. The changes about to be noticed show a still more retrograde decay (PAGET).

When tubercle softens, its substance breaks down into a tolerably uniform creamy pus-like fluid, in which are to be seen an immense number of fine granular points, or molecules. The basis substance appears to soften first; but in some kinds of softening much of the corpuscular forms are retained in a thin, whey-like, flocculent fluid, approaching in character to what is known as scrofulous pus, both microscopically and to the naked eye. The softening appears on the whole due to the breaking up of the corpuscular elements, as well as of the basis substance. When softening begins in the centre of the yellow crude masses, it leads one to believe that fluid may transude from the surrounding effusion or hyperæmic state, and penetrate to the centre of the whole mass, where it may accumulate and increase the softening, without becoming developed into the visible cell elements of tubercle. As each tubercle or group of tubercles undergoes this softening process, the softened mass occupies a cavity which thus becomes an abscess, though not a purulent one, and the tissue involved by the deposit of the tubercle is destroyed. It dies with the increased deposit and softening of the mass. During this process of softening, tuberculous matter continues to be deposited in other portions of the organ and in the lung, generally from above downwards, so that excavations or cavities are found at the apex of the lung, while lower down yellow tubercle masses beginning to soften exist; and still lower down, the *yellow tubercle* is found in a crude state as if newly changed, and being changed from the grey granulations which are disseminated through the base of the lung.

Pathologists are now agreed that the production of tubercle is quite independent of inflammation, in the ordinary acceptation of that term, implying thereby the presence of pain, heat, swelling, redness, lymph, or pus, but that in the great majority of cases inflammation is set up round the tubercle deposits and plays an important part in promoting further exudation of tubercle, which proceeds in a rapid course to softening and destruction of tissue. The phenomena of simple exudation are also associated with the existence and supply of material which forms the fibrous thickenings and capsules around the tubercular cavities or ulcerations. These exudations also bring about the separation of the tubercle mass

from the surrounding parts, and if it is eliminated in any way a cavity or an ulceration remains. When thus enclosed by fibrous thickenings or capsules, the softened tubercle may undergo the process of *cretification* or *calcification;* in other words, it becomes converted into a greasy, fatty, chalky mass, which gradually becomes hardened into a brittle substance. There appears to be either a deposit or a liberation of calcareous particles in the mass, for the elements become mixed up with gritty particles of earthy salts, and at the same time there is absorption of the animal part, so that the original size of the deposit is diminished. When tubercle is thus completely calcified, a thin section presents a granular appearance, but no definite forms, combined with more or less pigment.

Tubercle has been analyzed by many chemists. The analysis by Dr. Glover of Newcastle appears to be the most accurate and extensive.* His conclusions, as quoted by Dr. Bennett, are :—

"1. That tubercle consists of an animal matter mixed with certain earthy salts.

"2. That the relative proportion of these varies in different specimens of tubercle. That animal matter is most abundant in recent, and earthy salts in chronic tubercle.

"3. That the animal matter certainly contains a large amount of albumen, while fibrin and fat exist in small but variable proportions.

"4. The earthy salts are principally composed of the insoluble phosphate and carbonate of lime, with a small proportion of the soluble salts of soda.

"5. That very little difference in ultimate composition has yet been detected between recent tubercle and the other so called compounds of protein."

Tubercles may be developed in a slow and insidious manner—(1.) in the form of the granulations described, and confined to one portion of an organ, where they gradually increase in size and number; or (2.) they suddenly and rapidly increase, and are found in many parts of a uniform size, generally called miliary tubercles, which are regularly distributed through the tissues. They present different stages of retrograde metamorphoses at different parts of the same organ. The recent grey tubercles are soft and gelatinous, those of older date are firm ; and when the tissues are extensively invaded, they are softened and infiltrated with a thick serous effusion. The course of such cases is generally acute, and hence "acute tuberculosis." In acute phthisis they may reach the size of a pea in three or four weeks (Louis) ; and when subjects in a state of tuberculous cachexia are exposed to violent irritation of the lungs, these granulations are deposited so rapidly and in such numbers throughout the

* It has been suggested to me that this analysis, to be satisfactory, should be made on tubercles at different periods of iife. The tubercle of the *young* strumous subject is believed to differ greatly from those found in *advanced life*, especially in a gouty habit.

lungs as to give rise to the most alarming dyspnœa (Sir James Clark). The deposit of tubercle also occurs—(3.) as an *infiltration of the tissues* by an albuminous fluid of a thick synovial-like character, which gradually degenerates into a firm greyish-red granular softened mass containing portions of tissue within it. This infiltration was first described by Dr. Baillie in his *Morbid Anatomy*. "In cutting into the lungs," he writes, "a considerable portion of their structure sometimes appears to be changed into a whitish soft matter, somewhat intermediate between a solid and a fluid, like a scrofulous gland just beginning to suppurate. This appearance is, I believe, produced by scrofulous matter being deposited in the cellular [areolar or parenchymatous] substance of a certain portion of the lungs, and advancing towards suppuration. It seems to be the same matter with that of tubercle, but only diffused uniformly over a considerable portion of the lungs while the tubercle is circumscribed." According to the pathology of the present day, as now described, this infiltration of *scrofulous* fluid *tuberculizes*, and the *tubercles* form themselves in the first instance in the cavities of the air vesicles.

Thus much is known regarding the histology of tuberculous deposits, and is here stated minutely, because we have the testimony of most experienced morbid anatomists, such as Bennett, Paget, and many others, that the microscope alone can decide as to the nature of some deposits, especially cancroid, which closely resemble tubercle when examined by the naked eye. Indeed, such are the vague definitions given of *tubercle* that, in the words of Bennett, "every morbid anatomist must frequently have experienced much difficulty in endeavouring to determine by the naked sight whether a certain morbid product be or be not tubercle."

In connection with the original appearance of the tuberculous deposit it has been much discussed, and still is discussed, in which texture *tubercle* matter is first deposited, whether fluid or solid, and what is the cause of the deposition. The deposit in the lungs is the one most frequently described, and while we have had some most minute and elaborate descriptions in recent numbers of *The Medico-Chirurgical Review*, it appears they do no more than confirm the account which Schroeder Van der Kolk gave thirty-one years ago (1826), when he fixed the seat of tubercular *deposit* in the extremities of the bronchial tubes, or in what are named the pulmonic air vesicles. Similar views were adopted by Carswell and Andral. Dr. Sieveking has since confirmed the observation by his own researches; Schroeder Van der Kolk has again elaborately described the more minute details as to how the process takes place; and Dr. Radclyffe Hall gives a similarly minute description. Tubercle appears in the air vesicles in the first instance as a degeneration of the

previously existing normal epithelium; shedding of this and continuous replacement and degeneration till the whole of the interior of the air vesicle is filled with tubercle. Subsequently the pulmonic fibres become enclosed and separated by the morbid exudation, and free nuclei and granules are formed between and amongst them.

The modern view regarding exudations leads one to believe that tuberculous exudation transudes in a fluid state, in the first instance, through the capillaries, and collects in those places outside the vessels that offer least resistance (BENNETT). While, therefore, *infiltration* more or less extensive as described by Baillie is the first condition in which the exudation can be observed to exist, *tubercle* as a *deposit* is observed to coagulate on the free surfaces of mucous and serous membranes, or the outer surface of minute blood-vessels. While, therefore, *tuberculous deposits* do not differ in their seat from the simple or cancerous exudations when these coagulate in minute deposits in the lungs or other parts, yet there is an important difference in regard to their relation with the blood-vessels which requires to be specially noticed. It was first pointed out by Dr. William Stark, that when attempts are made to inject a tuberculated lung, the finest injection will not reach, far less penetrate, the *tubercle masses*. Blood-vessels, which are of a considerable size, at a little distance from such deposits speedily become contracted, so that a large vessel, which at its origin measured nearly half an inch in circumference, could not be cut open further than one inch; and that when cut open such vessels presented a very small canal, filled by a coagulated substance. Schroeder Van der Kolk made similar experiments, but he sometimes found that large vessels remained pervious which crossed a tuberculous cavity in a lung, but that all the small or capillary branches which adhered and were given off from the larger trunks were obstructed and impervious. These observations lead to the conclusion that obliteration commences in the smaller vessels and proceeds to the larger trunks; and are of some importance with reference to the process of softening, and other changes which are observed to take place in this *non-vascular* deposit. The process of *softening* is not so uniform in its progress as the notice already given might lead one to suppose.

It appears difficult in every instance to ascertain at what part softening commences, so that it is incorrect to give a general description of this change as always commencing in one place. In one case it may begin in the centre and proceed to the circumference of the deposit; in another it may begin at the circumference and go round the whole mass, detaching it from the surrounding textures; in a third case it may begin at once in the centre and at the margins; and in other instances it has been observed to commence at the same time in several parts of the substance of the tubercular

mass, and this is especially the case where the masses are large (CRAIGIE, BENNETT). The portion or spot about to soften loses its firmness and becomes friable, the cells swell and break up, adding thus by their solution to the diffluency of the mass. Inspected with a common hand lens, the mass seems as if perforated here and there with holes; and this softening extends by degrees throughout the whole deposit. The air vesicles necessarily are destroyed by this process, and the terminal extremities of the bronchi are amongst the first structures to suffer. The mucous membrane which covers them is red and villous in the vicinity of the softened part, and as tuberculosis proceeds the whole of the pulmonary mucous membrane presents the anatomical characters of chronic bronchitis. The softening of the deposits and the inflammation of the textures seem to act and re-act upon each other; liquefaction seems to extend more rapidly when local inflammation is set up, and the softenings on the other hand appear to augment the local re-action.

The observations of the late Sir Robert Carswell led him to believe that the soft appearance of the centre of a *tubercle mass* has no connection with the process of softening, but depends upon secreted fluid, or upon the softening of normal tissues which have been enclosed. It is the parts in contact with the tubercle which pour out exudation and ulcerate, by which the tubercular matter is sooner or later softened and expectorated, leaving a cavity which, by the successive softening of contiguous masses and the expectoration of the fluid, becomes gradually increased in size. The bronchi are always found enlarged, and appear as if cut across at the entrance of a cavity.

Constitutional Origin of Tuberculosis.—Departing from the limited consideration of the subject which *morbid anatomy alone* affords, clinical and pathological research tends more and more to confirm the belief in the constitutional origin of *tuberculosis*. There is undoubtedly a predisposition to tubercular deposits either hereditary or acquired; and that there is a bad habit of body—a cachexia—which precedes the deposition of tubercle, no one can deny.

The deposition of tubercles, wherever found, is undoubtedly a local lesion which indicates a *constitutional disease*. It has been hitherto, however, the custom to name the local lesions as the *diseases*, rather than to describe the constitutional state. Thus, when the lesions have been most marked in the bones and glands, the name of *scrofula* has been given to the condition: when the lungs are the site of the deposits, *phthisis* or *consumption* is the name by which the condition is familiar; and when in the glands of the mesentery, it has been called "*tabes mesenterica*."

The changes in the general system by which the tuberculous cachexia is brought about are apparent in the physical condition of

the patient and in the exercise of some of the vital functions especially connected with nutrition. To the late Dr. Tweedy Todd, Sir James Clark, and Professor Bennett, the profession is principally indebted for the clear and earnest elucidation of tuberculosis considered as a constitutional affection; and on our knowledge of it as such rests our only hope of success in the prevention and treatment of this most formidable scourge of civilized society.

Many observations have been made and statements recorded with the view to connect tuberculosis with morbid states of the blood, but hitherto no constant morbid condition of the circulating fluid can be said to be peculiar to the tubercular state. As Dr. Bennett observes, we must look to something beyond—we must look to the pabulum which ministers to the nutrition of the body itself through the blood; for with an impoverished state of that fluid there is doubtless an impoverished state of the tissues. But there are some curious and detached observations which, when connected together in certain pathological relations, appear to throw more light on the nature of the constitutional state which leads to the development of tuberculosis than any single observation of individual authors. These I would thus shortly enumerate :—

(1.) There is to be noticed the albuminous character of the exudation which infiltrates the tissues of an organ previous to the process of *tuberculization*, by which this infiltration is in part changed by coagulation into the deposit of *grey tubercles*, each of which may block up from three to twenty air vesicles.

(2.) There is in some cases, as shown by Drs. Alison, Williams, Bennett, and Rokitansky, an obvious affinity between the lymph of the blood and tubercle.

(3.) There is an albuminosity or venous state of the blood which is considered by some as peculiar to the tuberculous state of the constitution.

(4.) There is the peculiar state of the blood amounting to an appearance of leukæmia which immediately succeeds digestion in healthy persons, as observed and described by Dr. Andrew Buchanan of Glasgow, in *The Transactions of the Philosophical Society* of that city (vol. ii.), and which appears to resemble the molecular and corpuscular elements of chyle or lymph, and consisting of fat emulsionized with albumen. To this substance in the blood he gave the name of *pabulin*, and which is still further elaborated in the blood, in the glands, and in the lungs, before it takes part in the general morphological changes connected with nutrition.

(5.) The observations of Dr. Archerson of Berlin, and of Dr. Bennett, relative to how nutrition may be impeded by diminishing the *molecular* state of the nutritive elements, and improved by increasing them.

(6.) The observations of Panum and Dr. Parkes relative to the precipitation of albumen by acids and neutral salts, in which Dr. Parkes especially shows that the albumen as it exists in the serum of the blood is usually in that condition in which it is most easily precipitated by acids and chloride of sodium (*Med. Times and Gazette*, July, 1850 and 1852).

(7.) The excess of intestinal acidity in the alimentary canal of phthisical patients, as shown by Dr. Bennett, by which under some conditions the albuminous constituents of the food are rendered easily soluble, whilst the alkaline secretions of the saliva and the pancreatic juice are more than neutralized and so rendered incapable of transforming the carbonaceous constituents of food into oil, or of so preparing fatty matters introduced into the system as will render them easily assimilable. Hence an increased amount of albumen enters the blood compared with the fatty elements.

According to the observations also of Mr. Jonathan Hutchinson, acid eructations were present in 62 per cent. of the cases of dyspepsia which preceded the deposition of tubercle, and were a prominent symptom in 46 per cent. of cases reported on by him in an admirable paper on the forms of dyspepsia preceding and attending phthisis (*Med. Times and Gazette*, vol. x., 1855).

Any one of these statements considered by itself does not seem of much importance, but considered as a whole in their relation to nutrition and their influence upon morphological changes between the solids and the fluids of the body, they leave very little room for doubt that the bad habit of body, associated with the deposition of *tubercle matter*, must be established in the first instance through the digestive processes as first described by the late Dr. Tweedy Todd, under the name of *strumous dyspepsia*, and which has been since so fully described by Sir James Clark, Bennett, Hutchinson, and others.

The more closely these links of circumstantial evidence can be bound together, the more intimate a pathological relationship will be found to exist between the albuminous constituents of the food, the blood and tubercle; and the saline constituents of the circulating fluid, the mal-assimilation of food, and the waste of the tissues, as connected with the development of the bad habit of body associated with tuberculosis.

Although it must be confessed that we do not fully understand the living processes by which all the molecular changes take place to which I have just adverted, yet there can be no doubt that in the seven statements enumerated we obtain some glimpses of a rational pathology which may yet tend to explain the very complex *constitutional morbid state* associated with the deposit of tubercle.

It is of the greatest importance to study how some of the most unmanageable and hopeless diseases will sometimes spontaneously

become cured, and the local lesions healed. That tuberculosis sometimes tends to this result we have abundant testimony daily afforded in almost every post mortem examination of those who die with this disease. Laennec, Carswell, Clark, and Bennett have recorded their testimony on this interesting point; and the practical result of their observations shows that if the further deposition of tubercle can be arrested, the masses already deposited may silently retrograde, become absorbed, or diminish in size, and the part cicatrize, or remain latent as a cretaceous mass.

Cases are rare in which the deposit of tubercle is not at first latent; and from the numerous cicatrices that are found after death at the apices of lungs, it is exceedingly questionable whether any person is carried off by a first attack; and tuberculous disease of the lungs in early life is frequently cured, although it generally returns, sometimes at an advanced age, and ultimately proves fatal (Sir James Clark). There are few cases also, writes Dr. Bennett, in which the destructive and ulcerative progress of tubercular exudation is uniform. It is continually being checked and for a time slumbers, and even in the worst specimens of tubercular lungs, numerous cicatrices and evidences of attempts to heal may be recognized; but as one portion cicatrizes, another becomes the seat of further tuberculous deposition. Cicatrices of healed tubercles present different appearances according as the cavities from which they were formed have been superficial or deep seated. When superficial, the pleuræ are more or less adherent and thickened, frequently thus forming an external boundary to the cavity. When the walls of the cavern contract, the pleural surface of the lung is drawn inwards, and thus the irregular puckerings on its surface are produced. Occasionally no traces of tubercular matter are discovered either within or in the vicinity of these cicatrices; but more generally the contraction and puckering of parenchyma occurs round tubercle which has undergone various transformations, and sometimes a cyst encloses the mass. The deposit enclosed may be found to have undergone any of the processes of transformation already noticed (page 444); and the cretaceous or calcareous concretions may remain an indefinite time in the parenchymatous substance of the lungs, or they may be evacuated through the bronchi with the sputa. That such appearances are really evidences of arrested tubercles is rendered apparent by the following facts :—

"1. A form of indurated and circumscribed tubercle is frequently met with gritty to the feel, which, on being dried, closely resembles cretaceous concretions.

"2. These concretions are found exactly in the same situations as tubercle, most commonly in the apex and in both lungs. They frequently also occur in the bronchial mesenteric and other lymphatic glands, and in

the psoas muscle, or other textures which have been the seat of tuberculous depositions or scrofulous abscesses.

"3. When a lung is the seat of tubercular infiltration throughout, whilst recent tubercle occupies the inferior portion, and older tubercle and perhaps cancer, the superior, the cretaceous and calcareous concretions will be found at the apex.

"4. A comparison of the opposite lungs will frequently show, that whilst on one side there is fine encysted tubercle, partly transformed into cretaceous matter, on the other the transformation is perfect, and has occasionally even passed into a calcareous substance of stony hardness.

"5. Seeing that, according to the observations of Dr. W. T. Gairdner, cicatrices also may result from bronchial abscesses, the seat of cicatrices in the lungs may vary considerably."—(BENNETT.)

In the words of Carswell, "pathological anatomy has perhaps never afforded more conclusive evidence in proof of the curability of a disease than it has in that of tubercular phthisis." Pathology, therefore, teaches most distinctly that the aim of the physician must be to correct the constitutional tendency to the further deposition of tubercle, or even to arrest if possible at its origin the development of the constitutional state which leads to such deposits. The most eminent physicians are agreed that it is peculiarly a disorder of childhood and youth, "when nutrition is directed to building up the tissues of the body,"—that such persons are frequently attacked with symptoms of phthisis, which, under proper treatment, cease, "and years elapse before there is any renewal of the disease, and that were advantage taken of the intervening period to correct the constitutional symptoms of cachexia, the cure might prove complete."

The result of the course followed by tuberculosis, when observed in patients under treatment in hospital, may be arranged, according to results obtained by Dr. Walshe, under the following heads :—

(1.) All the symptoms were removed and the physical signs reduced to a passive condition in about $4\frac{1}{2}$ per cent. of the cases admitted, without reference to the stage of the disease, or to the severity of the primary or secondary morbid changes.

(2.) If the persistence of some active physical signs are disregarded, such as a continuance of cavernous ronchus, all the general symptoms disappeared in nearly 8 per cent.; and complete removal of all the symptoms was more frequently effected in the *male* than in the *female*.

(3.) More than half the cases of phthisis undergo temporary stages of improvement more or less permanent; and the time the disease has existed, rather than the stage the disease has reached, is an important element in calculating the probable benefit a patient may derive from treatment in hospital.

"In a given mass of cases," writes Dr. Walshe, "the chances of

favourable influence from sojourn in the hospital (at Brompton) will be greater, in a certain (undetermined) ratio, as the duration of the disease previous to admission has been greater,—in other terms, natural tendency to a slow course is a more important element of success in the treatment of the disease, than the fact of that treatment having been undertaken at an early period."—(*Med.-Chir. Review*, Jan., 1849.)

Symptoms of the Cachexia which Precedes and Accompanies the Deposit of Tubercle.—Ever since tuberculosis has become more studied as a constitutional affection, it has been rendered more apparent that the disorder of the digestive organs is the primary disorder of function which ushers in the cachexia, and that a certain form of dyspepsia is not only present in the hereditary strumous constitution, "but is capable of generating the bad habit of body, and of leading ultimately to the deposition of tubercle."

It was first observed by Dr. Wilson Philip, "that there were some forms of indigestion which ended in phthisis;" and it was subsequently distinctly stated by Lepelletier, that the causes of scrofulous disease were referable—(1.) to those agents which impair the assimilative action; (2.) to the elements of nutrition being insufficient, by the influence of bad diet, impure air, deficient exercise of the general functions, and obstruction of the functions of excretion.

It was reserved, however, for the late Dr. Tweedy Todd, as already noticed, to show that in cases in which the strumous cachexia was present, a particular form of dyspepsia prevailed, to which he gave the name of "strumous dyspepsia." Subsequently, the views of Dr. T. Todd have been more or less fully accepted and developed by Sir James Clark, Bennett, Ancell, and others in this country; but the most precise and most recent exponent of them has been Mr. Jonathan Hutchinson in two valuable papers in *The Medical Times and Gazette*, vol. x., 1855. Mr. H., from important statistical evidence, shows that the tuberculous cachexia is preceded by a *peculiar form of dyspepsia;* in other words, that there is a peculiar form of dyspepsia which has a natural tendency to end in phthisis; and that it is a form of dyspepsia not common to other conditions of the system—different, for instance, from that which precedes and attends gout, chlorosis, or cancer, although accurate observation is wanting on the exact symptoms of dyspepsia which are associated with these diseases.

The conclusions which have been arrived at by Mr. Hutchinson are as follows:—

(1.) In a very large majority of cases of established phthisis a condition of well marked dyspepsia is present as a complication. Out of fifty-six cases it was absent in four, present mildly in twenty-one, moderately in twenty-two, and severely in nine.

(2.) Of the form of dyspepsia most common in established phthisis the prominent symptoms relate to difficulty in the assimilation of fatty matters. The patient acquires a remarkable distaste for all fats, which occasionally extends itself to sugar and even to alcohol. He suffers much from "biliousness," heartburn, flatulence, and above all, from acid eructations after taking food. Everything he takes "rises acid," to use his own expression, but more particularly everything containing fat, oil, or sugar.

The *dislike for fat* was present in 71 per cent. of the cases of confirmed phthisis, and had existed through life in 48 per cent. It invariably produced what is commonly called "biliousness," and rose acid from the stomach. The fat of fresh meat was generally the first to disagree; then salted meats, such as bacon, and lastly butter; but many could enjoy butter who could not touch any other kind of animal fat. Such an intense dislike to an important element of a mixed diet indicates a deficiency on the part of the patient to digest it. Coincident with the development of such symptoms *emaciation* usually becomes apparent, the adipose tissue of the body already existing being reabsorbed by the blood, to supply the respiratory element deficient in the blood. The fat now disappears from the subcutaneous tissue, hollows of the cheeks, orbits, and mammary glands, and other parts where it abounds in quantity, just as it disappears from the body of an animal during hybernation. The patient now gradually loses weight and becomes thinner. Other tissues of the body, such as the muscles, skin, and areolar tissue, also subsequently begin to be used up for a similar purpose, till the patient is wasted to a living skeleton.

The *acid eructations* were present in 62 per cent. of the cases, and were a prominent symptom in 46 per cent.; small quantities of an extremely acid fluid being repeatedly brought up into the pharynx, at various periods after taking food, and in bad cases these eructations were persistent throughout most of the day, and almost always attended by heartburn.

Sick headaches and *biliousness* were very commonly present.

(3.) The majority of cases of phthisis, whether hereditary or otherwise, are *preceded* by a well marked stage of dyspeptic symptoms. By this it is meant that symptoms referable to the digestive organs have preceded those connected with the lungs. Out of the fifty-two cases in which, as has been shown, dyspepsia was present, it had followed pectoral symptoms in nine, was developed nearly coincidently with them in ten, and preceded them in thirty-three.

(4.) The symptoms of the dyspepsia premonitory of phthisis are the same in character with those which complicate it when developed. The very earliest are alterations in the tastes, and the

most constant of all is a disrelish for fat. Sugar often disagrees with patients, and is disliked, sometimes alcohol also.

(5.) The subjects of phthisis have in a large number of cases had peculiarities of likes and dislikes for different articles of food, even from very early life, and whilst seemingly in perfect health. Amongst those peculiarities the dislike of fat, often amounting to extreme aversion, ranks first. Thus it might be predicated of a family in which one child distinguishes itself from its brothers and sisters by its refusal to eat fat, that it will, *cæteris paribus*, be more prone to become the subject of tuberculous disease in after life.

Not a little has been written of late as to the possibility of detecting what has been called a "pretubercular stage of phthisis," especially by Dr. E. Smith. By this expression writers mean that there exists an abnormal physical condition of the lungs and of the body preceding the deposition of tuberculous matter in the lungs, which condition is capable of demonstration by certain signs or symptoms. Some physicians find, as we have already noticed, that no local physical sign of disease is indicative of the existence of phthisis before the deposit of tubercle, but the tendency to the tuberculous state is inferred from the presence of a series of cachectic symptoms, which from experience are frequently found to terminate in tuberculous disease of the lungs. Others believe not only that such symptoms are present, but they can detect also such physical signs as are believed to indicate a peculiar local condition of the lung, *which is a stage anterior to the deposition of tubercle.* "The slightest subclavicular dull percussion sound, with lessened vesicular murmur, less forcible and deep inspiration and flattening of the apex of the lungs," are described as the physical signs of this so-called *pretubercular state* (MARKHAM).

However much practitioners may accustom themselves to detect the physical signs of known pathological conditions, there are states of the body between cachexia and local lesions so nicely balanced that no definite local morbid state can be ascribed to them, and therefore no physical signs can be associated with such a negative condition apart from those of health. The so-called "pretubercular stage of phthisis is undoubtedly an instance of this kind. The best auscultators have admitted that there are no distinct and infallible signs by which we can with certainty diagnose the early existence of tubercle; and it is also known that solitary deposits of tubercle do not of themselves produce the slightest change in the percussion sound of the lungs." On the contrary, most physicians believe that "the slightest subclavicular dull percussion sound, the less forcible, deep, harsh, or tubular inspiration, with lessened vesicular murmur, prolonged expiration, increased vocal resonance, and flattening

of the apex of the lungs, when combined with the well known general symptoms, leave little doubt that the actual presence of tubercle is indicated." While, therefore, it is imperative on the student and practitioner to educate their ear to the utmost in the detection and appreciation of the finest thoracic murmurs, it is unjust, as already observed, to expect through the stethoscope more information than it is fitted to convey. A too exclusive study of physical signs to the almost disregard of general symptoms, not only does injustice to the science of medicine, but the lives of patients are endangered, when treatment is solely founded on the former. It is by such general symptoms as those which Todd, Clark, Bennett, Ancell, and Hutchinson have so fully elucidated that the practitioner will be able to recognize a "pretubercular stage of phthisis," and not by local physical phenomena alone.

Besides the indications afforded by the functions of digestion, there is a peculiar modification of the whole organization, as regards structure, form, and the exercise of functions generally which impresses distinctive characters on the tuberculous cachexia when it is of hereditary origin. Miller gives the following concise description :—

"The complexion is fair, and frequently beautiful, as well as the features. The form, though delicate, is often graceful. The skin is thin, of fine texture; and subcutaneous blue veins are numerous, shining very distinctly through the otherwise pearly white integument. The pupils are unusually spacious; and the eyeballs are not only large but prominent, the sclerotic showing a lustrous whiteness. The eyelashes are long and graceful—unless ophthalmia tarsi exist, as not unfrequently is the case; then the eyelashes are wanting, and their place is occupied by the swollen, red, unseemly margin of the lid.

"In the phlegmatic form, the complexion is dark, the features disagreeable, the countenance and aspect altogether forbidding, the joints large, the general frame stinted in growth, or otherwise deformed from its fair proportions. The skin is thick and sallow; the eyes are dull, though usually both large and prominent; the general expression is heavy and listless; yet not unfrequently the intellectual powers are remarkably acute, as well as capable of much and sustained exertion. The upper lip is usually tumid, so are the columna and alæ of the nose, and the general character of the face is flabby; the belly inclines to protuberance; and the extremities of the fingers are flatly clubbed, instead of presenting the ordinary tapering form."—(*Principles of Surgery*, p. 55.)

The growth of the body is generally unsteady in its progress; very often it is slowly and imperfectly developed; in other cases it is unusually rapid, particularly towards puberty. The physical powers are generally feebly developed and incapable of sustained exercise. The muscles of the limbs though full, are soft, flabby, and weak, and have neither the form nor the firmness of health. The

general circulation is feeble; the weak pulse and cold extremities indicating the debility. Digestion is feebly and imperfectly performed; the bowels being irregular and more frequently slow in their action than the reverse.

The mucous membranes generally are very susceptible to disordered action. Discharges from the nose, ears, or eyes are not uncommon; the tonsils enlarge, and the air passages inflame from the slightest causes. The insensible perspiration also is defective, and is said to be unduly acid and loaded with sebaceous matter; while, on the other hand, copious partial perspirations are common, particularly on the feet, where the odour is often fetid.

In children the dyspepsia and deranged digestive organs are indicated by increased redness of the tongue, especially toward the extremity and along the margins. The anterior part is thickly spotted with small red points of a still brighter colour, the central portion being more or less furred, in general according to the duration of the disorder. Sometimes the tongue is covered with a dirty whitish fur, through which the red papillæ project, while the central part is often dry and of a brownish colour in the morning. Thirst prevails, the appetite is variable, more frequently craving than deficient, seldom natural, and the breath is fetid. The bowels are occasionally loose, and the evacuations are always unnatural, generally of a pale greyish colour, of the consistence and appearance of moist clay; and they are often mixed with mucus and partially digested food. While the urine is often turbid, and sometimes high coloured, it is also often abundant and pale. The skin is generally harsh and dry, or subject to cold perspirations, particularly the hands and feet, which are also habitually cold; and copious partial night sweats are common. The sleep is seldom sound—the child is restless, talks in his sleep, or grinds his teeth (T. Todd, Clark).

Subsequently, when the disordered state has continued for some time, the internal fauces become full and red, and inflammatory sore throats are common, the tonsils often becoming permanently enlarged. The nostrils are generally dry, or thick mucus may be discharged in large quantity. Epistaxis occasionally occurs.

The nervous sensibility is sometimes greatly increased, and the intellectual functions are often performed with a preternatural degree of activity. So frequently is this observed, that it has become a popular belief and saying regarding a child, "that it may be too wise to live long."

Complex morbid processes such as inflammation in any tissue, in a tuberculous subject generally assume a slow chronic type. The complication is accompanied with little pain or heat, and suppurating parts heal very slowly.

When the tuberculous cachexia becomes fully developed into

phthisis, the duration of the disease is known to range from about nine months to two years; but in what are called "acute" cases of consumption, it may terminate fatally in three or even in two months, and occasionally in as short a period as three weeks, or even less.

The following are the different modes in which the disease makes its approach :—

(1.) There is sometimes to be noticed a latent, masked, or occult form of the disease—the real condition of the patient not being detected till the lungs are tuberculous to a considerable extent. In such cases, although the general symptoms may be slight, this very fact ought at once to excite suspicion, especially when the general aspect or constitution of the patient denotes the tuberculous cachexia. The slight cough, the shortness of breathing, the frequent pulse increased on the slightest exertion, the languor of the frame, and a general chilliness of the body, morning perspirations, and progressive emaciation, betray the insidious way in which this form of consumption commences. Such a case must be closely watched, for the local symptoms often remain obscure, and friends do not always see the importance of the general symptoms till it is too late. It is most usually young persons between sixteen, or eighteen, and twenty-five years of age who are the victims. They begin to lose flesh, and are attacked with a short tickling cough, often regularly excited by undressing at bed-time, and again on getting out of bed in the morning. Such a cough is dry, or followed by only a small quantity of mucus. The cheeks are often the seat of hot, uneasy flushings, while the feet are cold, and towards morning there is generally a little more moisture than usual on the surface of the body, especially about the head, neck, and breast. The pulse is either considerably quicker than usual, varying from 90 to 110 or 120; or if it is natural, it is very readily accelerated. The respiration also is, in general, more frequent in a given time, usually from 24 to 28 in a minute, the inspiration being generally short, limited, and speedily checked, quickly succeeded by expiration; and the patient cannot take a full or deep inspiration without uneasiness, and without inducing coughing (Craigie).

(2.) There is another form of consumption, attended with a severe and sudden accession of febrile disturbance, occurring in persons of a tuberculous diathesis. To this form Sir James Clark has given the name of "*febrile consumption.*" Pulmonary symptoms are not generally manifest in such cases in the first instance; but what is commonly called biliousness more frequently prevails, or the case may present the symptoms of a common catarrh. Cough, however, generally soon appears, becomes urgent, and occurs often; and hurried breathing is one of the most remarkable symptoms. The cough speedily becomes more frequent, accompanied by expectora-

tion, at first colourless, or of a thin, transparent, bluish jelly-like appearance; it subsequently assumes a yellowish or greenish hue, thick, opaque, dense, and puriform, and is occasionally streaked with blood. Fever continues unabated, and is out of all proportion to the other symptoms of pulmonary affection; and thus the true character of the disease may be overlooked. The pulse is seldom under 100, varying from 110 to 116, with some tension and sharpness in the beat. Gradually the fever assumes the hectic form, progressive wasting is established, and doubt can no longer be entertained regarding the nature of the case, and the fatal issue.

(3.) In another description of cases, hæmoptysis is the first symptom that attracts attention, and alarms the patient and his friends, followed by all those symptoms already noticed.

The more characteristic thoracic symptoms will be considered under "*Pulmonary Phthisis*," in the class of *local diseases*.

Causes.—In describing the pathology and the symptoms of the tuberculous cachexia, the cause of the constitutional disorder has already been in some measure indicated.

The tendency to the formation of tubercle is not equally great at all periods of life, nor in all parts of the body. Tubercle in the bronchial glands, the lungs, the cervical glands, the mesenteric glands, the spleen, the pleura, the liver, the small intestines, and the brain, is most common in infancy, childhood, and early adolescence. But the deposit of tubercle, which forms so large a portion of all these affections, although it has been found in the fœtus, and at every period of life up to eighty, yet it will be observed that tubercle, after the age of fifteen, is also frequently met with in the intestines, the mesenteric, cervical, and lumbar glands. Tuberculous disease is frequently developed during infancy; and "I have met with several cases of infants," writes Sir James Clark, "dying of consumption within the first year of life, in whom the lungs were not only extensively tuberculous, but contained large caverns, with all the characters of those found in the lungs of adults." After the second year of life, pathologists agree as to the universal prevalence of tuberculous disease. Age exercises a paramount influence on the generation of phthisis. It is peculiarly a disorder of childhood and youth (Guersent, Lombard, Papavoine, Alison, Clark, Bennett). Dr. Alison demonstrated that the mortality from scrofulous diseases in the children of the lower orders in Edinburgh and other large towns was so great that they died in the enormous disproportion of forty-five or fifty, to five and even three, as compared with the agricultural and upper classes. Tubercles prevail most through the third, fourth, fifth, and sixth years, when the annual growth does not exceed one-tenth of the child's weight, and the mortality declines to nearly one in a hundred. More than a

fourth of those who die in the interval from birth to puberty are affected with tuberculous disease ; yet the disease itself causes death in about one-sixth only of the cases (CLARK). The greatest number of deaths occur between the ages of twenty and thirty ; the next in proportion between thirty and forty ; the next between forty and fifty. The mortality is at its maximum about thirty—and from that age declines. The broadest fact established regarding the exciting cause of the tuberculous deposit is, that the domesticated animal is more liable to tubercular disease than the same animal in a wild state. The stabled cow, the penned sheep, the tame rabbit, the monkey, the caged lion, tiger, or elephant, are almost invariably cut off by tuberculous affections.

In the temperate zone, where the civilized inhabitants of the globe are located, it is calculated that *one-tenth* of the population die of this malady. Thus, in man, it is also observed, that in proportion as his habits of life are artificial, so is his tendency to tuberculous disease. This is strongly seen in the mining districts of Cornwall and Devonshire ; for although those counties are considered among the most healthy portions of Great Britain, yet one-half of the whole number of the miners deprived of air and light die of phthisis. In connection with this statement, a most significant fact, of great practical importance, has been brought to light by Dr. Walshe. He has shown that improvement in cases of pulmonary phthisis was effected, by medical treatment in hospitals, in about 14 per 100, more frequently in persons following "open air" and "medium" occupations, than in those whose trades were "confined ;" but that *death* or *deterioration* was as frequent as improvement in those who followed confined trades. Minute analysis, such as that which has been instituted by Dr. Walshe, of the numbers that die of phthisis in the different ranks and classes of life is greatly to be desired in illustration of the remote causes of phthisis. The late Professor Coleman was of opinion, that by confining the horse in a dark and dirty stable, and by feeding him on bad provender, and neglecting to clean him, he could produce phthisis in that animal at will ; and similar causes will probably be found to produce similar results in man. When, however, we consider how many persons there are who carry cleanliness to excess, whose diet is most studied, and whose every exercise is directed to health, and who nevertheless die of phthisis, it is plain that more secret and hidden circumstances still remain to be discovered to account for the existence of tubercular disease in this country. The Reports of the Registrar-General also show that, comparing the deaths from phthisis among the agriculturists and among the inhabitants of towns, the latter die in an increased ratio of 25 per cent. over the former ; yet it is generally supposed that the dietary and

general comforts of the townsman are greater than those of the countryman. The chances of improvement also are 5 per cent. greater in persons who come from the country to a salubriously situated hospital in town, than in townspeople (WALSHE). Among the townsmen also it is determined that there are certain classes of men more predisposed to phthisis than others, by nature of their occupations. It has been observed to occur, for instance, in those workmen who suffer great vicissitudes of temperature, or who breathe an air loaded with particles of dust: as bakers, needle-grinders, stone-masons, quarrymen, cotton and wool carders, and bricklayers' labourers, and in this class of persons the disease has acquired the epithet of the "grinders' rot." As far as regards their state much has been founded upon it, to show how irritant substances may induce the local deposit. In London, according to the bills of mortality from 1830 to 1835, it is shown, that among 1,000 deaths in the civil population in general, 177 are by consumption. But from 1851 till 1854, it is proved that of 1,000 deaths, 126 are by consumption, thus showing a sensible diminution. Nevertheless, the mortality numerically from consumption is much higher than from any other disease in this country; and amongst the class of society resorting to assurance offices, the mortality seems to be about one-half of the whole.

The disease also appears to be still more fatal to soldiers than civilians, producing nearly *one-half* of the whole mortality among the dragoon guards; while in the foot guards it is nearly double of what takes place in the dragoon guards in this country. Some are inclined to ascribe this excessive amount of pulmonary disease and mortality to the night duties, a statement in some measure supported by the large amount of mortality from consumption amongst night-watchmen generally; but when one looks to the age and height of the men enlisted for these regiments, and compares them with the physiological records regarding the stature and growth of the human frame, it will be seen that the combination of requirements for enlistment in the regiments of guards are little calculated to secure a hardy and efficient body of men.

The science of medicine is not unfrequently indebted to non-professional people for correcting prevailing errors of belief, and establishing correct opinions. No one, perhaps, has contributed more in this direction, in the discharge of his own professional duties, than Sir Alexander Tulloch. It was long a prevalent belief that consumption was limited by latitude, and that it never appeared in warm countries, for instance, south of the Mediterranean. But this is proved not to be the case, for the returns of the army, prepared by the above writer, have shown, to the astonishment of everybody, that phthisis is more frequent in the West Indies than even in this

country—a statement first made by Sir James Clark, in his work on climate, in illustration of the injurious effects of that climate on consumptive patients sent there from this country. According also to the recorded opinion of this author, great heat appears to have a powerful effect in predisposing to tuberculous diseases.

Mortality by Phthisis Pulmonalis per 1,000 *White Troops of the British Army Serving at Various Stations.*

Windward and Leeward Command.	Jamaica.	Gibraltar.	Malta.	Ionian Islands.	Bermuda.	Canada.	Nova Scotia and New Brunswick.	Cape of Good Hope District.	Dragoon Guards, and Dragoons serving at Home.	Civil Life in England and Wales, according to Registrar-General's Report.
12	13	$6\frac{5}{10}$	6	5	$8\frac{9}{10}$	$6\frac{5}{10}$	7	$5\frac{5}{10}$	$5\frac{5}{10}$	44

That it is not the climate of the place which alone produces this result in the West Indies is shown by the fact, that officers were attacked in infinitely smaller proportions than private soldiers; and in consonance with the views entertained regarding the nature of tuberculosis, it is more than probable, as Colonel Tulloch states, that crowded barrack rooms, a restriction to salt diet, and drinking spirits, may have produced the result.

It would appear, then, from these tables, that England and Wales, the Cape of Good Hope, and the Ionian Islands, are more exempt from phthisis than many countries which, from their higher temperature, have hitherto been supposed to enjoy a remarkable exemption from this complaint. The result of extended observation now also entirely refutes the hypothesis that paludal districts are in an eminent degree exempted from phthisis, an opinion first promulgated by the late Dr. Wells, and advocated by M. Boudin. England and Wales, the Cape of Good Hope, Canada, and Malta, countries either the driest or the best drained, and consequently suffering the least from paludal diseases, are actually those countries the most free from phthisis. On the other hand, the influence of climate shows, that phthisis is most frequent in low and damp situations; while it is far less so in the mountainous districts of all countries. Again, in whatever climate the disease breaks out, it is the opinion of many pathologists that its course is most rapid if the patient remains in that country; and, therefore, it is of the utmost importance to know the physical nature of the various climates of the world most suitable for the tuberculous patient. The late Dr.

Hennen's experience convinced him, when the disease broke out among our troops on the shores of the Mediterranean, that no other chance remained of prolonging the patient's life than by at once sending him back to this country.

That the tuberculous constitution is transmitted from parent to child has long been a popular belief, and regarded as one of the best established points in the etiology of the disease. *Proof*, however, writes Dr. Walshe, has never yet been afforded of the justness of the general conviction.

As a step towards an *accurate* settlement of the question, Dr. Walshe has analyzed and recorded (1849) the family history of 162 phthisical patients, admitted into the Brompton Hospital for consumption.

It appears in the first instance, that about 26 per cent. of phthisical subjects in a given generation come of a tuberculous parent; a circumstance which may be also predicated of any mass of individuals taken in hospital; namely, that 26 per cent. of them are of phthisical parents. On the other hand, while the general statement may be made, that some cases of phthisis may be traced to hereditary influence, it is undoubted that *much phthisis is, in each generation, non-hereditary.*

It further appears, that in *males* the malady exhibits itself at a mean period of about two years earlier—and in females at a mean period of about three years and a-half earlier when there is, than when there is not, a parental taint. Phthisical persons spring from a phthisical source with a certain amount of frequency; and that freedom from taint in parentage is *probably* more rare, and the existence of such taint *probably* more common in phthisical than in non-phthisical patients; but it is possible that if investigation was extended to infancy, childhood, and youth, the ratio of cases of parental taint among the phthisical would be proportionably greater than it proves where inquiry is limited to adults.

It appears also, that while about 9 per cent. more phthisical than non-phthisical persons come of a consumptive father or mother, on the other hand, there are about 10 per cent. more phthisical than non-phthisical persons free from parental taint.

The final conclusion which Dr. Walshe arrives at, after a most careful and logical analysis of 446 cases of phthisical and non-phthisical cases, is this, that *phthisis in the adult hospital population of this country is, to a slight amount only, a disease demonstrably derived from parents;* and there is no reason to believe that the law differs among the middle and higher classes of society.

But this view of the subject, so carefully worked out so far by Dr. Walshe, is not the "be all or the end all" of the topic. In the phthisical cases which form the subject of his inquiry, we have the

tuberculous cachexia communicated by the deposit of tubercles in the lungs, both as regards parents and the generation following; but there is still a class of cases to be inquired into in a similar manner:—namely, such as will show how far parents labouring under *tuberculous cachexia* merely entail on their offspring *a disposition* to tuberculous affections. It is now a well known fact, emphatically insisted upon by Sir James Clark, that in the families of consumptive parents there are constantly to be met with instances of ill-health characteristic of the tuberculous constitution; and in general such instances are much more frequent, and much more strongly marked in the younger than in the elder children; nay, there are families in which the elder children are healthy, and the younger ultimately become the subjects of tuberculous disease. In such cases it has been presumed, that in some instances, the health of the parents has become deteriorated during the increase of their family. The mere fact of the parents being unhealthy, and not necessarily tuberculous, appears in some instances as if sufficient to entail tuberculous diseases upon their children. This statement is in some measure borne out by a result obtained by Dr. Walshe, that as far as mere phthisical or non-phthisical condition of parents are concerned, about 24 per cent. of tuberculous patients can trace the origin of their disease to either parental source.

Parents whose digestive organs are habitually disordered, who suffer from gout, the injurious influence of metallic and other poisons, such as mercury, malaria, chlorosis, or paludal anæmia, the debility of advanced age, so that a cachectic state is induced, entail upon their offspring, to an extent still undetermined, but obvious and appreciable, a tendency to the tuberculous constitution; not necessarily to be expressed by the deposit of tubercle in the lungs, but certainly and surely by various forms of dyspepsia, and a precarious state of health.

There are many circumstances in the state of the parents' health, presumed with justice to influence the health of the children born under them; among these may be mentioned a disordered state of the health of the mother, interfering with the state of the fœtus *in utero*, depressing passions, and generally an unhealthy mode of life.

"In the present state of our knowledge," writes Sir James Clark, "it is not possible to determine the various circumstances in the health of the parent which may give rise to the scrofulous disposition in the child, much less to explain their mode of operation. I rather allude to them as subjects deserving the investigation of the general pathologist and practical physician. There may be differences of opinion as to the particular condition of the parent which induces the tuberculous constitution in the offspring,

and also as to the degree in which this constitution may exist in the child at birth."

Let the topics suggested in this quotation be diligently inquired into by those who have the opportunity; and let the initiative be followed up so ably set forth by Dr. Walshe in the model paper from which the previous statements have been quoted.

The tuberculous constitution has been observed to manifest itself in the child under the following circumstances:—

(1.) At birth tubercles may exist in one or more organs (Chaussoier, Oehler, Husson, Billiard).

(2.) The tuberculous cachexia, already defined and described, may rapidly show itself.

(3.) By the rapid deposit of tubercles commencing very soon after birth, subsequent to the gradual appearance of symptoms of the tuberculous cachexia.

(4.) By a disposition to the various forms of tuberculous dyspepsia whose characters have been already noticed (page 455, ante).

Race has an influence in the production of phthisis. In this country the tendency of the Creole and Negro to phthisis is notorious. But it is notorious also that the Creole and the Negro, when removed beyond certain limits of the land of their nativity, become tuberculous in other lands besides Great Britain. In the West Indies some of the black races are by no means exempt from this disease, and the Creoles are remarkable for dying of it in large numbers in Martinique (Rufz, Nott, Morton). This is the more unlooked for because as children they live almost in the open air, bathe daily, or still more frequently, and are singularly cleanly in their persons.

Among the predisposing causes of phthisis, writes Laennec, I know of none more certain than the *depressing passions*, especially when they are profound and long indulged; and this perhaps is the cause of the greater prevalence of this disease in larger towns, where bad habits and bad conduct are more common, and often the cause of those bitter regrets which neither time nor consolation can assuage. He adds, I had under my own eyes for ten years a most striking example of the influence of melancholy in the production of phthisis. There existed in Paris for that space of time a nunnery of a new foundation, and which had not been able to obtain from the ecclesiastical authorities anything but a temporary tolerance on account of the severity of its rules. The alimentary regimen of the nuns, although extremely severe, was still not beyond the powers of nature; but the spirit of the rules of the nunnery directing the mind to the most terrible truths of religion, as well as compelling the inmates to resign themselves in everything to the will of the abbess, produced effects as sad as unexpected. These effects were

the same in all. At the end of two months' sojourn in this house the menses became suppressed, and in a month or two afterwards symptoms of phthisis appeared. As they had not been allowed to take the usual vows, I entreated, as soon as this was the case, that they would leave the house, and all who followed this advice recovered. But during the ten years I was physician to this establishment, the members were renewed twice or thrice, with the exception of the superior, the tourière, the sisters who had the care of the garden, of the kitchen, and of the infirmary, or of such as had more frequent intercourse with the city, and consequently greater distraction. The rest died of phthisis.

These circumstances now noticed, namely, hereditary predisposition or the influence of parental cachexia generally, the influence of *race*, and of depressing passions, all co-operate, where they exist, in establishing the tuberculous cachexia; but the efficient cause seems to be "the impoverished nutrition resulting from impure air and an improper quantity, quality, or assimilation of food; and so long as misery and poverty exist on the one hand, or dissipation and enervating luxuries on the other, so long will the causes be in operation which induce this terrible disease" (BENNETT).

General Treatment of the Tuberculous Cachexia.—From what has been already stated in illustration of the pathology of this malady, it is to be observed that the general treatment now in most repute is founded on the doctrines—(1.) That tubercular diseases will heal of themselves, if the nutrition of the system can be maintained and the continuous deposition of tubercle arrested. (2.) That the periods of frequent temporary arrest of all the general and local symptoms of disease ought to be diligently taken advantage of to improve and preserve the general health by hygienic means. (3.) That the efforts of the practitioner should be directed rather to the digestive than to the pulmonary system. (4.) That the kind of morbid nutrition in the body generally, and altered morphological change in the tissues of the organ where the deposit takes place, appear to be chiefly due to excess of albuminous and deficiency of fatty elements in the chyle.

The treatment therefore to be pursued must be essentially reparative of the waste of tissue generally; corrective of what has been unfit in the individual diet and mode of life; and lastly, supplementary of the elements of nutrition which have been deficient.

During the past *twenty-five* years in Germany, and *sixteen* years in this country, the treatment of tuberculosis has gradually but steadily become more and more firmly based on these pathological doctrines, and which Dr. Bennett of Edinburgh was mainly instrumental in first elucidating and in earnestly recommending to the notice of the profession generally in this country. The view here

taken regarding the nature of tuberculosis leads to the belief that —(1.) the blood is impoverized through the preliminary strumous dyspepsia which precedes the deposit of tubercle; (2.) That in pulmonary phthisis the deposit of tubercle results from an exudation of tuberculous lymph consolidated primarily in the air vesicles; (3.) That the successive formation and softening of these tubercles lead to ulcerations of the pulmonary and other tissues, and gradual wasting of the body generally.

It has been now also fully shown, especially by the observations of Dr. Bennett, in the first instance, confirmed by the extensive experience of the physicians at the Brompton Hospital for Consumption in London, that such treatment as is directed to remove the mal-assimilation of food frequently checks the tendency to repeated tubercular exudations, while those which previously existed remain harmless; that general symptoms and physical signs may disappear completely; and that even extensive excavations in the pulmonary tissue may heal up and cicatrize. According to the testimony of Dr. Wood of Pennsylvania, the fatal results have not only been postponed, but the death rate from phthisis has diminished in the principal cities of the United States since such principles of treatment have been adopted.

It has been already noticed how much the practitioner has to contend with in the form of those dyspeptic states peculiar to phthisis, and which are chiefly capriciousness of appetite, a loathing of animal food, and especially of fats; that while the appetite is believed by the patient to be good, the diet actually consumed is deficient in quantity and often in quality, and appears to be much more rapidly disposed of from the alimentary canal than in health, that it is less perfectly assimilated and deposited in the nourishment and repair of tissue; or, having been deposited, it is as quickly metamorphosed again and removed, that the functions of the body generally are more frequently and rapidly performed than in health; and lastly, that the wear and tear of tissue is great.

The indications of general treatment are therefore—

First, *To improve the faulty nutrition, which is the cause of the tuberculous cachexia, and of the exudations assuming the characters of tubercle.*

Second, *To subdue the symptomatic fever which may attend the deposition and changes going on in the deposits of tubercle, and to favour the absorption either of the entire exudation, or of such portions of it that what remains may undergo such changes as are consistent with its future harmless existence in the lungs.*

Third, *To prevent the recurrence of fresh exudation by careful attention to hygienic regulations, especially during the intervals of apparent return to health.*

To fulfil the first of these indications, it is of all things important that fatty matter be assimilated in large quantities, and it appears that such are most readily absorbed and assimilated when in the fluid condition. The substance of all others found most beneficial has been cod-liver oil. At the Brompton Hospital more than 600 gallons of this oil are used annually. There, on a great scale, its merits have been tested and compared with the effect of treatment conducted on general principles, and irrespective of its use. The result has been to confirm, in the estimation of the medical profession, the great value of this remedy in the treatment of phthisis, when appropriately administered, and combined with the use of such other measures as any special circumstances in the individual patient may require (THOMPSON). The general opinion of the profession with regard to cod-liver oil may be summed up in the statement originally made by Dr. Bennett, namely, that "it rapidly restores the exhausted powers of the patient, improves the nutritive functions generally, and stops or diminishes the emaciation." The night perspirations subside, the cough is quieted, and the expectoration is diminished after it has been used for a few weeks. A very constant and well marked favourable change under its use is to be noticed in the diminution of the pulse, which gradually but steadily has been observed to come down at the rate of five or six beats weekly; and, at the same time, the weight of the body has been known steadily to increase, at the rate of half a pound to a pound weekly. In females also it is a significant and highly favourable symptom when the catamenia returns, after the oil has been used for some time. The usual dose adopted by Dr. Thompson, at the Brompton Hospital, is *one or two teaspoonsful twice a-day* at first, and gradually increasing the quantity to *half an ounce three times a-day*. Dr. Bennett recommends somewhat larger doses, namely, for an adult, *a tablespoonful three times a-day*, which may often be increased to *four* or *even six* with advantage. When the stomach is irritable, however, *a tea* or *a dessert spoonful is enough to commence with*. It appears from the observations of Dr. Thompson that no additional advantage is obtained by pushing the oil beyond the limits of the doses adopted by him at the Brompton Hospital, from the fact that where its use has most obviously increased the weight of the body, to the extent in one instance of a pound per week for twenty-one weeks, only three pints had been taken during that time.

The kind of oil used, as far as coarseness or fineness is concerned, seems not to affect the beneficial result in any material degree. Some patients even prefer the coarse to the fine oil. The experience of some is, moreover, favourable to combining the oil with liquor potassæ as an emulsion; and as it appears that undue

acidity prevails as well in the stomach as in the intestinal canal, the addition of the alkali ought, on theoretical grounds, to be advantageous.

It seems also that when cod-liver oil was first used as a medicine, more than fifty years ago, in the treatment of rheumatism, it was then ordinarily combined with an alkali. It may be taken, however, unmixed, or it may be floated on milk, or nitromuriatic acid mixtures, or on lemonade, soda water, lemon juice, or on a saline draught during effervescence, when such combinations are suited to the patient. Creasote has also been recommended to be added, as it is said to render the stomach more tolerant of the remedy. The following formula, quoted from Dr. Thompson's *Clinical Lectures on Pulmonary Consumption*, is supposed to yield a palatable mixture :—

"An ounce and a-half of cod-liver oil, four drops of creasote, two drachms of compound tragacanth powder, and four ounces and a-half of aniseed water; of this mixture an ounce may be taken thrice daily."

The more direct and immediate action of cod-liver oil upon the blood has been attempted to be ascertained by Simon, Snow, and Thompson. They record an increase of blood corpuscles, and a diminution of fibrine under its use.

From the researches that have been made in animal chemistry regarding the blood in phthisis, a deficient proportion of blood corpuscles is observed to be the most constant peculiarity; but that phthisis is not the only disease in which this occurs is shown by the following table compiled by Dr. Thompson, chiefly from the analysis of Simon :—

Average Proportion of some Constituents of the Blood.

	Albumen.		Corpuscles.		Albumen.		Corpuscles.
In health,.....	76	...	130	In diabetes,.....	105	...	80
In pneumonia,.....	80	...	122	In Bright's disease,	103	...	50
In phthisis,.....	100	...	78	In chlorosis,.....	72	...	56
In rheumatism,.....	100	...	74	In carcinoma,.....	45	...	55

Rheumatism and diabetes present the greatest similarity in these states of the blood to phthisis; and they are diseases also for which cod-liver oil has been used with advantage.

Cod-liver oil, therefore, is indicated where it can be taken, in all those diseases in which the blood corpuscles are deficient, where nutrition is impaired, and where fat is not readily assimilated.

Besides cod-liver oil, other animal fats and oils, where they can be taken and assimilated, are sure to be followed with benefit. Hence milk rich in fatty matter, such as asses' milk, and milk drawn from cows at a short interval after the greater part of their milk has been withdrawn, and which is known in Scotland as the

"afterings," are found to be followed by improvement where they are persevered in and are assimilated. So also has it been with cream and butter. Dr. Bennett instances the partial success occasionally of caviar, bacon, pork, and mutton chops, the marrow of the bones of oxen; while Dr. Thompson instances the good effects he has obtained from the use of oil obtained from the foot of the young heifer (neat's-foot oil). The administration of any of these remedies is quite consistent with doctrines now taught regarding the pathology of tuberculosis, and it is useful to know their individual value in order that in particular cases one may fall back upon their use where a change may be desirable.

It has been considered that some of the good effects of cod-liver oil may be due to the biliary elements with which it has been incorporated. This view is not supported by the experiment of adding ox gall to other animal oils not derived from livers, as no beneficial results have been observed to follow. But as the active principle of the gastric juice has been now successfully isolated by chemistry, and has been successfully used to aid the digestion of food in the stomach, might not some principle be obtained from the liver which might aid the assimilation of fatty substances when mixed with the intestinal juices?

In fulfilment of the second indication mentioned (p. 468), the propriety of abstracting blood has been much discussed.

It has been already seen, that febrile symptoms of a very severe kind sometimes attend the exudation and consolidation of tubercle. It is also a more or less frequent clinical observation that pneumonia, bronchitis, and pleuritis, in acute or chronic forms, are intercurrent attendants on the deposit and future changes of tubercles in the lungs. "Hence," as Dr. Bennett justly observes, "there are all kinds of intermediate changes between the simple and tubercular exudations constantly going on in the progress of a case of pulmonary tuberculosis. The phenomena of phthisis, pneumonia, pleurisy, and bronchitis, in their acute or chronic forms, may appear together, and be inextricably mingled, or they may succeed each other at intervals." Thus tuberculosis, both as a constitutional and as a local disease, is scarcely ever free from exacerbations, the various morbid local and the constitutional states acting and re-acting on each other. While, therefore, on the one hand the system requires an increased and well directed supply of nutritive materials; on the other hand, there are constitutional states of excitement depending on local irritation which require to be subdued, and demand antiphlogistic treatment. Whatever theoretical view may be taken as to how the exudation may most readily be absorbed, all physicians are now at one as to the propriety of preserving the general strength, of effecting elimination of effete material, and

of meeting antiphlogistic indications rather by diaphoretics, diuretics, emetics, and purgatives, than by abstracting any considerable amount of blood, either at once or at repeated intervals. In fact, it is now observed, that the administration of appropriate diet, and abstinence from lowering remedies, with cod-liver oil, while they correct the general nutrition, may also be so regulated as to subdue the constitutional irritation by a perseverance in their use for a period of not less than four or six weeks.

Moderate general bleedings in acute phthisis, as well as local bleedings during the exacerbations of chronic phthisis, undoubtedly confer a temporary relief in the diminution of local pain and general febrile re-action, and allow a more free respiration to be performed.

Dr. Bennett, however, is opposed to bleeding. His object is simply to favour excretion by means of antimonials; and, on subduing the re-action by their means, he again proceeds with the nutritive mode of treatment to fulfil the first indication.

Nevertheless it cannot be doubted that the condition of some cases demands blood-letting; but, as Sir James Clark observes, "The employment of general blood-letting in consumption requires great judgment and circumspection. The more general error is, the abstraction of too great a quantity of blood at a time; treating the disease as if it were a purely inflammatory one, and forgetting that the inflammatory symptoms are merely consecutive upon tubercles, and that the constitution of the consumptive patient is little capable of replacing the blood too lavishly drawn." Simply to remove or diminish congestion, the condition of the patient and nature of his constitution being considered, "blood may be abstracted," he continues, "with advantage, at any stage of consumption when the symptoms require it." The experience of Dr. Wood leads him to teach similar doctrines.

Topical counter irritants furnish the best means of subduing constitutional irritation in chronic forms of the disease. These may be in the form of setons, issues, succession of blisters, tartar emetic ointment, or croton oil rubbed on the chest in any of its regions. Amongst these the frequent use of dry cupping ought not to be omitted.

In fulfilling the third indication, the real power of the science of medicine may be demonstrated. It is by well directed hygienic measures, successfully and efficiently carried out, that the real strength of the physician may be put forth to prevent the recurrence of fresh exudation; and his hygienic exertions towards the patient are to be redoubled during the temporary intervals of apparent return to health.

It is now almost an axiomatic truth, that of all things which deteriorate the constitution on the one hand, and influence pul-

monary congestion on the other, none are so detrimental as impure and deficient air, together with frequent variations of temperature, and changes from sudden heat to chilling cold. These latter vicissitudes may be considered characteristic of the physical climate of Great Britain and Ireland.

Tonic treatment consists essentially in the adoption of those means which promote or stimulate the healthy nutrition of the body. Its elements exist in fresh air, abundant exercise, sufficient repose, and judicious diet. A hygienic code, applicable to the tuberculous cachexia, has been recently laid down by Dr. Richardson, in the second volume of the *Sanitary Review*, and very recently in a special work on the hygienic treatment of pulmonary consumption. It is derived from these elements of tonic treatment; and as it puts well known truths, too little appreciated, in a formal and more important aspect than is wont, its precepts are here quoted.

I. *A supply of pure and fresh air for respiration is constantly required by the tuberculous patient.*

As it is known that if *one* per cent. of carbonic acid exists in a room, the air is unfit for a healthy person, it is therefore much more so for a consumptive one. The temperature of a room ought to be equally maintained at from 55° to 56° Fahr.; ventilation and heating being effected by open fire-places. A single room ought not to perform the two offices of a bed-room and a sitting-room. The sleeping room ought not to afford less than 1,000 feet of space; and if larger, so much the more healthful will it be. In connection with these statements, while it is objected, for obvious reasons, with much justice to the treatment of tuberculous patients in special hospitals, there is much on the other hand that might be improved in all our hospitals, with reference to the arrangement of the patients, to secure to them fresher air than they generally obtain. For instance, all who are able to be out of bed, ought to have their meals in a common room, which is not used for any other purpose, and is apart from the wards or dormitories.

II. *Active exercise in the open air is imperatively demanded by the tuberculous patient.*

In the words of Dr. Jackson, "He must be made to feel that the *risk is in staying in the house*, and not in going out of it." But the skin must be perfectly protected, and while a chill or inclement weather is to be avoided, the patient must go out in all seasons, without being too fastidious about the weather, walking exercise being persevered in as much as possible. Next to diet, exercise in the open air is, of all things, the most important: it should be carried as far as the vigour of the patient will permit. It should not be done rashly, but boldly; and, if possible, the patient ought to have faith in it, for without

this he is not likely to pursue it so far as he can, and then he will not derive from it all the benefit which it can afford (JACKSON).

III. *It is important to secure for the patient a uniform, sheltered, temperate, and mild climate to live in, with a temperature about* 60° *and a range of not more than* 10° *or* 15°*; where also the soil is dry, and the drinking water pure and not hard.*

The classic work of reference on this topic is that by Sir James Clark. If it is possible to give a practical abstract of his extensive and valuable experience, it may be done somewhat as follows :—

(1.) After the functions of the digestive organs and skin have been re-established in improved action, the patient who labours under a tuberculous cachexia may derive benefit by a residence in a mild or temperate climate [such as has been defined], conforming to all the hygienic and medicinal treatment already mentioned.

(2.) When symptoms, however slight, indicate that tuberculous deposit has located itself in the lung, removal to a mild climate, especially if effected by a sea voyage, under favourable circumstances, may still be useful as a means of improving general health, of lessening the chance of intercurrent inflammatory affections of the pulmonary organs, and even of arresting the further progress of the disease. The nausea, squeamishness, or even sickness, which with some are always more or less associated with a sea voyage, are beneficial to cases of incipient tuberculosis. The effects of such nausea tend to increase the natural secretion and elimination from the pulmonary mucous membrane; so that minute portions of tubercular exudation, commencing to consolidate in the air vesicles, are effectually, gradually, and gently passed out with the motion of the pulmonary mucus in the expectoration. The sensation of nausea tends to subdue any local vascular irritation; and the unceasing motion of a sailing vessel tends to keep up a constant exercise which is advantageous to the patient.

(3.) When extensive tuberculous disease exists in the lungs, little benefit is to be expected from a change of climate; and a long journey will most certainly increase the sufferings of the patient, and hurry on a fatal termination.

(4.) There are cases, however, of chronic consumption, which may derive benefit from residence in a mild climate, namely, cases in which the deposit is limited to a small portion of the lungs, and little systemic irritation prevails; or in cases in which the disease has ceased to extend in the lungs, but where a long time is required to complete repair.

IV. *The dress of the tuberculous patient ought to be of such a kind as to equalize and retain the temperature of the body.*

Under this topic, waterproof coats, boots, and shoes, are to be condemned.

V. *The hours of rest should extend from sunset to sunrise.*

VI. *In-door or sedentary occupation must be suspended; but out-door employment in the fresh air, even in the midst of snow, has been, and may be advantageous.*

VII. *Cleanliness of body is a special point to be attended to in the hygienic treatment of tuberculosis.*

VIII. *Marriage of consumptive females, for the sake of arresting the disease by pregnancy, is morally wrong and physically mischievous.*

IX. *The medicinal treatment must be adapted to the site of the local deposits and the general nature of the particular case.*

Bitter infusions with aromatic stimulants may sometimes improve the appetite and assist the stomach to regain its tone, but it must be remembered that medicine is utterly powerless and useless, unless the hygienic means now insisted upon are carried out to the uttermost.

The two classes of diseases which have been now considered, namely, the ZYMOTIC and the CONSTITUTIONAL, are sometimes regarded and described under the name of "SPECIFIC DISEASES." The general theory regarding the nature of such diseases is thus expressed by Mr. Paget:—

"Each of them depends on a definite and specific morbid condition of the blood; and the local process by which each is made manifest, is due to the disorder produced by the morbid blood in the nutrition of one or more tissues; and generally this disorder is attended with the accumulation, and leads to the discharge or transformation of some of the morbid constituents of the blood in the disordered part. It is held also, that in some of the SPECIFIC DISEASES, the morbid condition of the blood consists in undue proportions of one or more of its normal constituents—in others, again, some new morbid substance is added to, or formed in the blood. In either case the theory maintains, that the phenomena of each SPECIFIC DISEASE depend chiefly on certain corresponding specific materials in the blood, and that, if characteristic morbid structures be formed in the local process, these morbid materials are incorporated in the organs which are formed as the products of the inflammation."

In the preceding part of this handbook, the SPECIFIC DISEASES have been considered in two distinct classes; the division being founded on the fact, that in the first class, or ZYMOTIC DISEASES, *the chief or essential constituent of the morbific agents enters the body from without;* while in the second class, or CONSTITUTIONAL DISEASES, *the essential constituent of the morbific agents appears to be inbred in the body, and makes itself manifest by various constitutional indications, previous to the development of local lesions.* There is sufficient circumstantial evidence with regard to all, and

absolute proof with regard to some of these diseases, that there is —(1.) A morbid condition of the blood; (2.) That the nature of that condition is in many definite and specific, inasmuch as it may be at will produced by the introduction of a definite substance into the blood, which then manifests itself by establishing a local disease, and which, within certain limits, has constant characters. (3.) That the morbid matter or poison by which the condition of the blood is changed, may accumulate, or augment in quantity and virulence, and at length may be discharged in various ways from the body, and under a variety of organic forms, chiefly through the excretory products. But many are also discharged at the seats of local lesions which are set up, the morbid poisons being for the time accumulated in the morbid structures.

As far as some of the *miasmatic diseases* are concerned, such as *typhous fevers, erysipelas, scarlet fever, cholera,* and the like, there is undoubted evidence of a morbid material in the blood (see page 139, ante), although it has never been isolated nor proved to exist in the products of the local morbid processes. In many of the *constitutional diseases,* too, similar evidence exists of a morbid matter *inbred* in the blood.

It will soon appear obvious to the student, that the diseases already considered differ very materially in their nature from the *local diseases* about to be noticed. While the LOCAL DISEASES may be regarded as *common* or *simple* diseases, those already noticed are so very distinct from them, and are possessed of such constant features by which they may be distinguished from the local, common, or simple diseases, that they are frequently described under the term "SPECIFIC."

Certain types of morbid local action, however, are common to both; and therefore the SPECIFIC DISEASES have some constant and characteristic modification, or something in addition which distinguishes them, such as *syphilis, gout, rheumatism, tuberculosis,* and the *eruptive fevers.* These additional elements appear to consist—

(1.) In a certain constancy and regularity of development, metamorphoses, duration, and decline, during which certain common morbid processes become modified according to the *special* nature of the disease. "In some the most evident specific characteristics are peculiar affections of the movements of the blood, as in the *cutaneous exanthemata;* in some, affections of certain parts of the nervous centres, as in *tetanus, hydrophobia,* and *hooping-cough;* in some, peculiar exudations from the blood, as in *gout,* and the *inoculable diseases;* in some, peculiar structures formed by the exuded materials, as in *variola, vaccinia,* and other *cutaneous pustular eruptions;* in some, destruction of tissues, as in the ulcers of *syphilis* (the *gangrene of ergotism*), and the *sloughs* of *boils* and

carbuncles; in some, peculiar growths, as in *cancers;* in some, or indeed in nearly all, peculiar methods of febrile general disturbance" (PAGET).

In the specific diseases these local and general morbid processes are concurrent.

(2.) The most striking feature (assuming specific diseases to be due to the presence of morbid poisons in the blood, which, by a morbid process, is again separated from it, and eliminated from the system during the progress of cure) is that "The whole blood for a time seems diseased, and nearly every function and sensation is more or less disturbed from its health; the patient feels 'ill all over,' before the local disease appears" (PAGET).

In the common or local diseases, on the other hand, the local phenomena precede the general or constitutional disturbance.

(3.) There exists in both classes of the SPECIFIC DISEASES now described, an apparent want of proportion between the cause and the effect. Thus in *small-pox*, *measles*, *hydrophobia*, or *syphilis*, the severity of the disease does not bear any proportion to the amount of poison applied; and numerous diseases have been described in which the morbid poison appeared to act with so much intensity, and produced such severe forms of disease, that the patient died before local lesions had time to become developed, *e. g.*, in *typhous* and *paludal fevers*, *scarlatina*, and the like.

The student is referred for more information on these important topics to what has been already written at page 12, *et seq.*, of this handbook, and also to Lecture XX., on "*Specific Diseases*," by Mr. Paget, in his work on Surgical Pathology, from which these few remarks have been chiefly compiled.

Of the two classes of SPECIFIC DISEASES, those which have been described as CONSTITUTIONAL or *inbred*, appear to be in their origin essentially *blood diseases*, the disturbance due to their development being indicated by what has been termed a *cachexia*. Those of the zymotic class again recognize the introduction of *materies morbi* from without, and symptoms arise which indicate much constitutional disturbance. But, in whichever way these diseases are brought about, their specific nature is such as has been described. Under the term *dyscrasiæ*, the specific condition of the blood in such diseases was wont to be described by many continental pathologists, implying a defective organization or elaboration of the circulating fluid. We cannot yet, however, associate particular diseases with definite and particular morbid states of the blood, however certain we may be that changes of a morbid nature do exist; and, therefore, the term *dyscrasiæ*, as implied to designate such states, is premature in application, and has not come into general use, because it takes for granted more than is known.

CLASS III.

Local Diseases.

This is the only other class of diseases which can be considered within the limits of this handbook. It comprehends those diseases which are sporadic, and which are limited to the disturbances of functions of organs or systems of organs, or which affect the structure of particular parts, with or without inflammation, and which are sometimes hereditary.

They are essentially local or intrinsic diseases, and are naturally arranged into *eight* orders, as enumerated at page 3 (Part I., ante). Of these, the first five orders will be alone considered in this place, as the diseases which belong to the remaining orders are now regarded as more exclusively within the province of the obstetrician or the surgeon.

Order 1. Brain Diseases—*Cephalici.*

It is with nerve texture as composing the essential parts of the nervous system contained within the cranium and distributed as nerves throughout the body that we have to deal in describing the local diseases of this order. The interest which attaches itself to the study of the nervous system cannot be surpassed either in a physiological or pathological point of view.

When it is remembered that the nerves are the channels of Sensation, that nervous textures compose the organs which conduct the influence of the Will to the muscles before motion can take place; while the textures which constitute the *nervous centres* associate sensation on the one hand, they at the same time balance and co-ordinate the motions of the body on the other. And, lastly, being the seat of the various mental processes through which *Sensation*, *Volition*, *Memory*, *Judgment*, and *all mental acts* are expressed, the pathological relations of the nervous texture contained within the cranium or distributed throughout the body are, perhaps, the highest and most important in a scientific, philanthropic, and sanitary point of view, to which the mind of the physician can be directed.

Moreover, there is every reason to believe that there has been of late years a marked increase in the number of cases of disease of the brain and nervous system. It appears, also, that "such diseases are not only of more frequent occurrence, but that a certain un-

favourable type of cerebral disorder develops itself in the present age at a much earlier period than formerly. Softening of the brain, for instance, now often manifests itself at the early age of thirty and thirty-five. The brain in the present day is overworked —its psychical functions are unduly exercised, strained, and taxed in the great effort required in the severe struggle and battle of life to obtain intellectual supremacy, professional emolument, and status" (Winslow, *Journal of Psychological Medicine*, July, 1857.) The same able writer remarks, that while "the faintest scintillation of mischief progressing in the *heart*, *lungs*, *liver*, or *stomach*, immediately awakens alarm, and medical advice and treatment are eagerly sought, serious well marked symptoms of brain disorder are often entirely overlooked and neglected ; such affections frequently being permitted to exist for months without causing the faintest shadow of uneasiness or apprehension in the mind of the patient or his friends. Morbid alterations of temper—depression of spirits, amounting sometimes to melancholia—headache—severe giddiness —inaptitude for business—loss of memory—confusion of mind —defective power of mental concentration—the feeling of brain lassitude and fatigue—excessive *ennui*—a longing for death—a want of interest in pursuits that formerly were a source of gratification and pleasure—restlessness by day and sleeplessness by night —all obvious indications of an unhealthy state of the functions of the brain and nervous system, rarely, if ever, attract attention, until the unhappy invalid, becoming unequivocally deranged, commits an overt act of insanity," by terminating his own existence.

The student is therefore called upon to give the Brain diseases a large share of his study.

The varied phenomena connected with the morbid conditions of the nervous system must be examined from the following points of view, namely,—(1.) The purely anatomical structure of the Brain and Nerves ; (2.) The chemical composition and properties of the nervous substance ; (3.) The physiological relations of the several parts ; (4.) The morbid and pathological relations. Each of these views mutually illustrate each other. Every student knows how very many physiological doctrines regarding the Brain and Nerves receive elucidation from accurately determined anatomical information ; and so such knowledge extends itself to explain various points in the pathology of cerebral diseases. He need only be here reminded of the phenomena explained by the decussation of the pyramids in the medulla oblongata ; the continuity of the fibres of the spinal cord upwards to the cephalic centres as explaining various secondary lesions of the brain as a consequence of lesions in the spinal cord altered by paralysis, as shown by the observations of Drs. Turck and Waller ; and, lastly, the interesting observa-

tions made by D. H. Bence Jones regarding the excretion of sulphates and phosphates by the urine in acute chorea, delirium tremens, and inflammation of the brain itself. These observations show, to some extent, how valuable accurate chemical and anatomical investigations may become in the elucidation of morbid phenomena occurring in living bodies.

Anatomical constituents of the Brain and Nerves.—The nervous texture may be simply considered as arranged into three great divisions :—

(1.) A large quantity of nervous matter collected into one mass and contained in one cavity, the cerebro-spinal. This mass is called the *Brain and Spinal cord, Encephalon, Cerebro-spinal axis,* or *central part of the nervous system,* composed of the *cerebrum, cerebellum, sensori-motor ganglia,* and *spinal cord.*

(2.) A nervous texture arranged in the form of long continuous cords or threads mutually connected and running in every direction throughout the body. These are simply called the *Nerves.*

(3.) An accumulation of peculiar nervous substance in the form of small round, and somewhat oval masses variously connected with each other, and with the surrounding parts ; and forming what is known as the *Sympathetic system.*

Chemical composition of Brain and Nerve Tissue.—The white or grey matter of the brain has been generally taken to represent pure nerve substance. It consists of albumen, fatty matter, salts, and from $\frac{4}{5}$ths to $\frac{7}{8}$ths of water. The fatty constituents are remarkable, inasmuch as two of them being acid compounds contain a large amount of phosphorus, from 8 to 10 parts in 1,000 of the mass, or $\frac{1}{20}$th to $\frac{1}{30}$th of the whole solid matter. This is continually being metamorphosed during functional and morbid changes of the nerve substance ; and the amount of alkaline phosphates may be taken in some measure as an estimate of the amount of nerve tissue disintegrated ; the earthy phosphates being disregarded inasmuch as they have been shown to depend on the quantity taken in the food. The phosphorus set free by disintegration of the nervous tissue unites in the form of an acid with the alkaline basis in the blood, and is thence separated by the kidneys and discharged with the urine.

In appreciating morbid states of the brain and nervous textures after death, it is useful to remember that the absolute and specific weights of the brain range within certain limits, which alone are consistent with the healthy exercise of function. The following statements of standard numbers are made for reference and comparison illustrative of this point.

Absolute Weight.—The absolute weight of the brain or encephalic mass varies at different periods of life, but generally it may be stated as follows :—

	Weight of Male.	Weight of Female.
From 1 to 20 years,.....	39 to 50 oz.	..... 37 to 44 oz.
„ 20 to 50 „	50 to 40 oz.	..... 44 oz.
„ 50 to 70 „	48 oz.	..... 38 to 44 oz.

Bulk.—The bulk of the mass varies from 65 to 84 cubic inches.

Specific Gravity.—The result of recent observations in Germany, France, and Britain, shows that any considerable change in the specific gravity of the cerebral substance is incompatible with a healthy exercise of the nervous functions.

To Dr. John Charles Bucknill, Physician to the Devon County Lunatic Asylum, Medical science is indebted for the first most extended account of the specific gravity of the cerebral substance, and its relation to disease, and more especially to *atrophy* and *paralysis*. The following are the general results of his observations as detailed in *The Lancet*, 25th December, 1852, and for the most part made upon patients labouring under different forms of mental disease:—

(1.) Average specific gravity of healthy brain, 1·036.

(2.) In paralysis of a chronic character complicated with insanity, the specific gravity ranged between 1·036 to 1·046.

(3.) In some acute cases the specific gravity was as high as 1·052.

(4.) In paralysis terminating by coma, 1·040.

(5.) In paralysis terminating by syncope, or asthenia, 1·036 to 1·039.

(6.) In general terms a higher specific gravity was found when life terminated by coma, or asphyxia, than when it ended by syncope, or asthenia.

In addition to these observations, an able and elaborate paper has since been published by Dr. Shankey, in *The British and Foreign Medico-Chirurgical Review*, showing the relative specific gravity of the *grey* and *white matter* of the brain, and of so extensive a nature, as to furnish very copious data for comparing morbid states with the standard of health.

The following are the general results of his researches, as given in *The British and Foreign Medico-Chirurgical Review* for January, 1853, p. 257:—

"1. Mean specific gravity of the grey substance of the brain, in either sex, 1·034.

"2. In the earlier and later periods of life the specific gravity of the grey matter is below the mean.

"3. The cerebral substance acquires its greatest density in males between the ages of fifteen and thirty, and in females between the ages of twenty and thirty.

"4. The density diminishes with prolonged illness.

"5. It decreases with a lapse of time after death in the ratio of ·001 for every twenty-four hours.

"6. A density of ·006 above the average, indicates the existence of the

following conditions during life:—Acute cerebral symptoms, or chronic disease with no cerebral symptoms, or only slight delirium; also with conditions associated with hyperæmia.

"7. Mean specific gravity of white matter 1·041."

Both sets of observations referred to above, have been made upon the brain as a whole, and as the observations of Dr. Shankey show that no constant relation exists between the absolute weight of the brain and its specific gravity, it is necessary, also, to examine the brain as we do its anatomy, namely, by comparative observations on its *central parts* or *ganglia*.

At the time Dr. Bucknill published his observations I was engaged in determining the specific gravity of the central parts of the brain, which are sometimes called the *central ganglia*, and which are now generally regarded as the parts more immediately related to the combined exercise of sensory and motor functions. These centres consist of the *corpora striata; thalami optici; tubercula quadrigemina; and the large mass of vesicular nervous matter, associated with the convolutions of the hemispheres and the substance of the cerebellum.* While these parts are the immediate seats of the origins of the nerves, they may be looked upon as parts where some changes in connection with the functions of special nerves are constantly going on, of such a kind that a result is expressed through "volition, perception, or emotion, or the balancing or co-ordinating of movements" (Todd).

These parts have a specific gravity as follows:—The central ganglia 1·040 to 1·047; the cerebrum 1·030 to 1·048; the cerebellum 1·038 to 1·049.

The same kind of morbid states which modified the specific gravity of the brain substance as recorded by Drs. Bucknill and Shankey also manifest their influence on the central parts. Thus death by *Coma*, and especially in *Typhus fever*, was indicated by an extremely high specific gravity; and while it was observed that a slight difference was common in most cases when similar parts on opposite sides were compared, it is presumed that further observation extended in this direction, especially in cases of hemiplegia, may lead to important results. In one case of *choreic hemiplegia* I had an opportunity of carefully investigating, the specific gravity of the corpus striatum and optic thalamus on the right side was 1·025, and that of the same parts on the left side was 1·031.—(*Glasgow Medical Journal*, No. I., 1853).

Pathological Relations of the Nervous Organs and Texture.—Our knowledge of these relations is necessarily imperfect, and for the following reasons:—(1.) The functions of the various parts which, connected together, constitute the encephalon, are not yet determined accurately. (2.) The inconstancy and irregularity of the functional

disorders which accompany the morbid state of the nerve substance renders it difficult to interpret the value of the symptoms by which the *nervous diseases* are manifested. (3.) Some of the diseases of the brain and nervous system which are marked by the most violent symptoms during life, such as *epilepsy*, *chorea*, *tetanus*, and *hydrophobia*, leave after death no constant lesion capable of being detected with the unaided eye, or even by microscopic examination; while *tumors* and serious destruction of the nervous mass may exist during life without producing any severe or pathognomonic symptoms whatever. (4.) We have no means of applying physical diagnosis to the cranium as we have to the chest, although it has been proposed by some (Drs. John Fisher and Whitney), to found diagnosis upon *Cerebral Auscultation*. For an abstract of the nature of the investigations on "the auscultation of the brain," the reader is referred to *Wood's Practice of Medicine*, vol. ii., p. 621.

The general principles on which the pathological relations of the *brain diseases* are determined, rest upon the anatomical, chemical, clinical, and physiological facts now accurately known.

In connection with the physiological view of the subject, there are several cardinal facts which must be constantly kept in remembrance, and which may be shortly referred to here.

There are separate and distinct functions performed by the *grey* and *white* matter which enter into the structure of the nervous centres and organs. Reasoning from the general properties known to be possessed by cells in other structures, it is now a generally received doctrine, that the cells of the *grey* substance of the brain and nervous centres are the seat or source of that force which has received the name of the "*nervous force*, *nervous power*, or *nervous influence*," and which makes itself known by *sensation*, *motion*, and the various ways in which the *mental acts* are expressed. The *white nerve fibres* are in connection with the *grey* or *cell elements* of the nervous tissue, conducting from and to these centres the "influences" which are sent to, or which originate there, and are thence sent forth.

The union of the nerve tubes with the nerve corpuscles is supposed to be connected with the transference of action from one nerve fibre to another, as in *reflex action*.

It is also a remarkable fact, that each nerve fibre in a fasciculus acts quite independently, and is, as it were, quite isolated from the others in its vicinity; so that each one acts for itself independently from end to end; and thus at once we have the enunciation of three distinct sets of physiological phenomena associated with the diseases of sensibility.

First, phenomena of isolated conduction.—Exalted or diminished action is presented by that nerve fibre only which is affected by the

irritating or depressing cause, and the adjoining fibre, though in ever such close approximation, is not implicated. *Secondly, phenomena of sympathy or irradiation of sensations.*—That irritation is propagated from a fibre originally excited to other centripetal nerves. *Thirdly, the brain furnishes the conditions* necessary for the manifestation of the intellectual faculties, properly so called, such as the emotions, passions, volition, and is at the same time essential to sensation.

That the evolution of power or nerve force immediately connected with mind is dependent, or emanates from the hemispherical ganglia, is rendered probable by the following facts :—

(1.) In the animal kingdom generally, a correspondence is observed between the quantity of grey matter, the depth of the convolutions, and the sagacity of the animal.

(2.) At birth, the grey matter of the cerebrum is very defective, so much so that the convolutions are, as it were, in the first stage of formation, being only marked out by superficial fissures, confined to the surface of the brain ; and as the grey substance increases, intelligence becomes developed.

(3.) The results of experiments have shown that, on slicing away the brain, the animal becomes more dull and stupid, in proportion to the quantity of grey substance removed.

(4.) Clinical observation points out, that in those cases in which the disease has been found to commence at the circumference of the brain, and proceed towards the centre, the mental faculties are affected *first;* whereas in those diseases which commence at the central parts of the organ, and proceed towards the circumference, the mental faculties are affected last ; *e. g.*, (1.) *insanity, delirium tremens, meningitis,* and the like ; (2.) *tumors* in the central white substance.

The white tubular matter in the form of the diverging fibres of the brain conduct influences, originating in the *hemispherical ganglia,* to the nerves of the head and trunk ; while they also conduct, in an inverse manner, the impressions made on the peripheral parts up to the *cerebral convolutions.*

The spinal cord, by its connection with the brain, furnishes the conditions necessary for combined movements ; and that its nervous force is also dependent upon its grey matter, is rendered probable by the following facts :—

(1.) The universal connection of the grey matter with all motor nerves.

(2.) Increased quantity in those portions of the spinal cord whence issue large nervous trunks.

(3.) Its collection in masses at the origin of such nerves in the lower animals as furnish peculiar organs, requiring a large quantity of nerve power, as in the Torpedo, Gymnotus electricus, and Silurus.

(4.) Clinical observation shows, that in cases where the central portion of the cord is affected previous to the external portion, the individual retains the sensibility and power of moving the limbs, but wants the power to stand or walk; whereas when disease commences in the meninges of the cord, pain, twitching, convulsions, numbness or paralysis indicates lesion in the white conducting matter.

Independent endowment of nerves is shown by the fact, that whatever be the stimulus which calls their power into action, a uniform functional result is obtained; and hence it is inferred that the nerves are not altogether the mere conducting tubes of a stimulus from one place to another, but are in some respects the seats of agents, or apparatus of power.

As far as we know, the brain alone furnishes conditions necessary for intelligence, the spinal cord conditions essential to movement; and, together, they furnish conditions connected with the balancing and co-ordination of motor and sensific power.

In dealing with the diseases of this order,—the *Cephalici*, it is incumbent on the physician to ascertain as correctly as possible the *locality of the lesion, the nature of the affection*, and the *anatomical condition of the part affected.* Although it is sometimes asserted that it is of little practical importance to discriminate accurately between diseases of one part of the brain or of its membranes, and those of another, because the treatment may be the same for all, yet, for the sake of science—because "knowledge is power," and because the acquisition of such knowledge must eventually alleviate the sufferings and lessen the sorrows of humanity,—the sooner such doctrines are ignored the better for the science of medicine; and moreover, the majority of the medical profession are now beginning to feel that diagnosis should be carried as far as possible. To the advanced student who would desire more minute information to guide him in the differential diagnosis of brain diseases than can be given in a handbook of medicine, he is with confidence recommended to study the work of Dr. J. Russell Reynolds on the *Diagnosis of Diseases of the Brain, Spinal Cord, and Nerves.* From this excellent work the following general remarks have been chiefly compiled:—

General Diagnosis of Brain Diseases as to Locality.—As yet we are able only in some cases of tumors of the encephalon to define their locality, as to whether they are in the cerebrum, cerebellum, or central ganglia.

With regard to the cerebrum, it may be determined in the majority of structural diseases which lateral half is affected, and in particular cases it may be predicated with strong probability that the lesion is situated in some one of the following sites:—(1.) The substance of the hemispheres (cortical or central); (2.) the ventricles—

hæmorrhage into these cavities, for example, may sometimes be distinguished from effusion into the substance of the hemisphere; (3.) the base of the brain; or (4.) its superior surface. Inflammation of the brain substance and of the meninges present different symptoms when occurring in the two last mentioned situations.

In the present state of science we are unable to localize exactly either the diseases of the *cerebellum* or of the *central ganglia* of the brain from symptoms during life.

Diseases of the *pia mater* and *arachnoid* may be discovered by the history and progress of a case from those of the *dura mater;* and sometimes it is possible to distinguish meningitis of the base from that of the convexity of the brain, chiefly from the influence which the diseased meninges exercise upon the functions of the parts beneath. Disease of the *dura mater*, for example, may often also be inferred from morbid conditions discoverable in the organs of *special sense*, or from disease in the *bones* of the *cranium*, or of the *integuments* or *scalp*.

With regard to diseases of the spinal cord, similar grounds for diagnosis exist; and the locality of the lesion may often be correctly referred to the *anatomical regions* of the cord, to *certain columns* of its *substance*, to the *white* or *grey nerve substance* of which it is composed, or to the *coverings*. It is of importance in cases of diseases of the nervous trunks to know which set of the cranial nerves are affected; and in relation to the spinal *nerves* it is necessary to distinguish diseases of the *anterior* from those of the *posterior* roots, as well as the region of the cord from which the diseased roots proceed.

General Diagnosis as to the Nature of the Affection.—The nature of the intrinsic diseases of this order may be shortly stated to be—

I. *Acute*, but *non-febrile*, to distinguish them from the nervous symptoms which attend the febrile state of many of the diseases already noticed, as peculiar to the zymotic and constitutional classes. They are of such a kind as are marked by—(1.) Diminution or loss of functional activity (apoplectic and paralytic diseases); (2.) Increase or excess of action, such as of sensibility (neuralgia), of mobility (convulsions, spasms), ideation (delirium).

II. Chronic diseases, the character of chronicity depending not only on the time such diseases last, but also on the severity of their course.

Such chronic diseases are marked by—1. Excessive functional activity, as in *neuralgia*, *hallucination*, *chorea*, *hypochondriasis;* 2. Diminution or loss of functional activity, for example, *anæsthesia*, *paralysis*, *dementia*, *epilepsy*. 3. Combinations of these conditions, such as—(1.) Loss of mobility with increased sensibility, as in *paralysis with pain*; (2.) Loss of mental with increased motor activity,

as in *coma* with spasms; (3.) Loss of sensibility, with increased mobility, as in *anæsthesia* with *reflex spasms.*

General Diagnosis as to the Anatomical Condition.—Although some of the diseases of this order are marked by excessive severity of symptoms during life, such as *tetanus, epilepsy, chorea, hysteria, neuralgia,* and the like, yet no characteristic or constant structural change can be detected in the nervous centres after death, either as a consequence or as a cause of such diseases; and although the belief is daily extending that no morbid conditions of function can exist without some correspondent change in the organs, yet so long as we have no means of appreciating such changes, the diseases now noticed must be regarded as "neuroses," "dynamic," or "functional" diseases. But there are many other diseases of this order which are attended by some physical changes in the organ, expressed by undoubted symptoms during life, and which leave evidence of their existence after death. For example, very different apparent vascularity is discoverable after death in the nervous masses and texture; and there are two very common classes of nervous symptoms during life which evidently depend upon the variable amount of blood in the brain. These symptoms are referable to *active arterial hyperæmia,* and distinguished by the well known phrase of "*determination of blood to the head;*" or they are referable to *passive venous hyperæmia,* and commonly called "congestion." The question has been much discussed and experimented on as to whether more than a fixed proportion of blood can find its way into the brain; and there can be no doubt that all considerations of the subject lead to this conclusion, that the quantity of blood within the cranium is extremely variable at different times and under different circumstances; and, as has been clearly stated by Dr. Sieveking, there is a peculiar property belonging to the white matter of the brain, which has a strong bearing on the question, namely, the great elasticity of the medullary tissue, and that the resiliency afforded by this property is a sufficient counterpoise to the rigid structures which envelop the brain, and which do not, as is erroneously supposed by some, remove the intracranial contents entirely from the influence of atmospheric pressure. That pressure is exerted on a large surface composed of columns or tubes of blood in innumerable small curved vessels which maintain through the scalp and diploe of the skull a direct communication with the blood within the cranium; and which is thus directly influenced by atmospheric pressure, while every anatomical arrangement of the parts within the cranium illustrates provisions made to counterbalance the varying interchange of bulk between the solid and fluid contents of the cranium. Among these may be noticed the ventricular and subarachnoid spaces with their varying amount of contained serosity, as furnishing most prominent

evidence of provision to accommodate the varying amount of fluids within the cranium.

Morbid states of the brain are also due to a poisoned state of the blood; although such a condition cannot be proved in all cases, such, for example, as occurs in many of the zymotic and constitutional diseases already noticed (*Typhous, Variola, Rheumatism, Alcoholism, Narcotism*).

The morbid textural changes of the brain consist chiefly of inflammation and its consequences, in the various forms of exudations; in softening, degeneration, or atrophy of the nerve substance; and in heterologous products such as result from *tuberculous* or *carcinomatous* infiltration.

In diagnosing the locality of diseases of the brain generally, it is necessary to distinguish, in the first instance, the *intrinsic diseases* of the nervous system, and which properly constitute the order *cephalici;* also, local diseases from nervous complications of other diseases not of a local kind; and it is necessary to distinguish affections of the *brain, spinal cord,* and *nerves,* as much as possible from each other; and lastly, to separate diseases of the *meninges* from *cerebral lesions.*

It is chiefly by the history of the case that nervous symptoms peculiar to the zymotic or constitutional class of diseases are to be distinguished. It is also generally worthy of notice that symptoms referable to altered nervous functions are the earliest indications of intrinsic or local diseases of the organs of the nervous system; and that when general disease exists of a zymotic or constitutional kind, the nervous symptoms are secondary in relation to the time of their appearance, compared with the earliest manifestation of symptoms of ill-health.

The diagnostic value of *vomiting* as a symptom of cerebral disease, is one which must be thoroughly appreciated. Regarding this symptom, Dr. Reynolds makes the following remarks:—"The intimate sympathy" subsisting between the stomach and the head is a matter of daily observation. Headache from gastric disturbance is as common as vomiting from cerebral derangement. In children, especially, the existence of obstinate vomiting is indicative of head rather than of stomach disease. A consideration of the following points (for comparison tabulated), may lead to the discrimination of the pathological significance of this symptom:—

GASTRIC OR HEPATIC VOMITING.	CEREBRAL VOMITING.
1. There is nausea, which is relieved, at all events temporarily, by the discharge.	1. Little or no nausea, and the vomiting continues, in spite of the complete discharge of its contents by the stomach, so soon as anything (liquid or solid) is introduced.

GASTRIC OR HEPATIC VOMITING.	CEREBRAL VOMITING.
2. The tongue is foul, the conjunctivæ often yellowish, and the headache secondary in respect of time.	2. Tongue may be clean, the conjunctivæ colourless or injected, and the headache primary.
3. Griping pain in the abdomen, diarrhœa, and disordered evacuations frequently attend the *gastric* or *hepatic vomiting*.	3. Obstinate constipation generally attends *cerebral* vomiting.
4. Retching and increased salivation attend *gastric* or *hepatic vomiting*.	4. In *cerebral* vomiting the stomach is emptied almost without effort, and without any increase of the salivary secretion.

Thus, while vomiting may depend upon derangement in the gastro-intestinal canal, it may also depend upon increased sensory or reflex action, and is thus a valuable indication of cerebral disease.

The grounds of diagnosis of the locality of nervous diseases generally may be also summed up as follows :—

I. The *brain* is presumed to be the seat of lesion, when several of the special senses are simultaneously affected; when *perception*, *ideation*, *volition*, and *special sensation* are affected; when the muscles and general sensory nerves are implicated longitudinally and unilaterally (hemiplegia); when muscles situated so high as those of the face and tongue are involved, and the orbicularis of the eyelids does not share in their affection. In these rare cases of bilateral (or transverse) paralysis (paraplegia), resulting from some cerebral change, the symptoms at some period of the case have generally referred to the head (by their special character), so that, by a combination of the two classes of observations, the general diagnosis may almost universally be established.

II. The *spinal cord* is presumed to be the organ affected when the symptoms of motory and sensory character are distributed transversely or bilaterally, inducing paraplegia or transverse spasms; when the mental functions are unchanged. The precise locality may be estimated sometimes from anatomy of the spinal nerves. If the lesion or disease is high, speech, deglutition, or respiration, may be impaired. There is often erection of the penis, the retention or voluntary discharge of fæces, or urine.

III. The nerve trunks are presumed to be the seat of lesion when the symptoms are referable to an isolated muscle, or group of muscles, or to a small portion of the sensory surface. When paralysis is the symptom, the irritability of the muscles to electric stimulation is quickly lost, and the symptoms show no disposition to wander from the special localities affected (Reynolds).

The distinguishing characters of meningeal from cerebral diseases may be arranged in the following tabular form, for comparison and reference :—

CEREBRAL DISEASE.	MENINGEAL DISEASE.
1. From the outset, or from a very early stage of their development, there is loss of some one or more of the proper nervous functions, such as paralysis, anæsthesia, loss of memory.	1. It is not till some time after the detection of signs of disease that diminution or loss of nervous function takes place.
2. Cerebral disease is not commonly attended by high marked exaggeration of function, such as furious delirium, convulsions, intense hyperæsthesiæ, pain, or tenderness.	2. The subsequent diminution or loss of nervous function which succeeds the prolonged existence of "head symptoms," is generally preceded, in cases of meningeal disease, by extremely severe excitement or exaggeration of function, such as pain, tenderness, furious delirium, or convulsions.
3. Little vascular excitement attends cerebral disease, nor is there frequently any highly marked general disturbance.	3. In meningeal affections there is usually much local vascular excitement, with general disturbance.
4. Paralysis and anæsthesia, losses of volition, ideation, perception, and the like, characterize cerebral disease.	4. Spasms, convulsions, pain, and delirium, are the general features of meningeal disease.

Meanings of some Words in common use in describing Brain Diseases.

Convulsion.—The occurrence of universal involuntary muscular contraction, generally of paroxysmal temporary duration.

Spasm.—Involuntary convulsive actions of less extent. Of these there are several varieties :—

(*a*) *Clonic Spasm*—Consists in rapidly alternating contraction and relaxation, as in *subsultus tendinum.*

(*b*) *Tonic Spasms* or *Spastic Contractions*—Consist in contractions having a certain duration, attended with rigidity or hardness of the muscles, as in *common cramps* and *tetanus.*

Epileptoid or *Epileptiform Attacks*—Mean a sudden loss of perception and voluntary power, with more or less generally distributed spasmodic movement ; the latter being generally quasi-tonic at first, then chronic, and appearing to impede the respiratory process ; the attack lasting from two to twenty minutes, followed by some exhaustion and sleep (Reynolds).

Coma—Denotes the loss of perception and volition ; in other words, the loss of consciousness, with the appearance of profound sleep, from which the patient may be partially roused.

1. Cephalic Diseases, attended with a Febrile State.

Meningitis — *Inflammation of the Arachnoid and Pia Mater.*

Definition.—*A complex morbid state of the immediate coverings of the brain, attended with more or less vascularity of the membranes, opacity of the arachnoid, and the formation of adventitious products between the arachnoid and pia mater, and the effusion of serum or of pus in the same situation. Acute pain in the head, from the first, accompanies the development of these lesions, attended with intolerance of light and sound; watchfulness, delirium, flushed countenance, and redness of the conjunctivæ, or a heavy, suffused state of the eyes; quick pulse, frequent spasmodic twitchings or convulsions, passing into somnolency, coma, and complete relaxation of the limbs* (Copland).

Pathology.—This morbid state is properly known as "*Meningitis*," and is distinct from *inflammation of the dura mater*. It may be simple and idiopathic, or it may supervene as the result of some zymotic or constitutional disease, such as of some of the fevers, or of the rheumatic or tuberculous cachexia.

In diffuse arachnitis the arachnoid has seldom any considerable redness or congestion, but is thickened and opaque; while the transparent serum naturally contained in the cavity of the arachnoid being now scanty, or wholly wanting, it has neither that polish nor that moisture which is natural to it in health, so that it appears brown and dry. The principal phenomena of arachnitis take place in the pia mater, so that the large vessels of that membrane are greatly congested; but still, according to Dr. Baillie, the redness is not so general or so continuous as in inflammation of other serous membranes. Also, if the pia mater be attempted to be removed, it is easily torn, and separates from the brain in small fragments. The arachnoid covering the dura mater seldom participates in this affection. These are the appearances observed in diffuse arachnitis, supposing it to terminate by resolution. The inflammation, however, often proceeds, and may terminate by effusion of serum, lymph, or pus.

When serum is effused into the arachnoid cavity, the opacity of the arachnoid gives it a gelatiniform appearance; but when that membrane is divided, it is found to be fluid, and to diffuse itself in every direction. Sometimes, however, the serum is found to be turbid, from an admixture of a small portion of free albumen. It is also not unusual to find a few points of lymph, of pus, or of blood, either at the exterior surface or within the arachnoid, effused along with the serum, and almost in juxtaposition with each other. The quantity of fluid effused is variable, from two to three drachms to as many ounces. The effusion most commonly takes place at the

upper surface of the hemisphere, but sometimes at the base, and sometimes into the ventricle of the brain. Lymph is the form which the exudation usually assumes, varying in density and thickness, and dipping down between the convolutions, and commonly is most abundant on the upper portions of the hemispheres.

Foville says he has met with cases in which the effused lymph covered the whole of the brain, or nearly so, as far as the tentorium. The lymph was deposited in the arachnoid sac in two layers,—one adherent to the cranial arachnoid, and the other to the cerebral arachnoid; while between them was a stratum of serum. He mentions having had six cases of this description under his care for several years, and that they were all in a state of the dullest stupidity, and apparently labouring under paralysis of every sense. They were like statues, with this difference, that, placed upright, they preserved their balance; if pushed, they walked; and if food was placed in their mouths, they swallowed it.—(Art. *Meningite*, p. 406, *Dict. de Médecine.*)

Lymph also may be effused into the arachnoid cavity, but it is generally in small quantity, and is so seldom organized, that Louis states he examined the brains of 200 bodies without finding a single instance. Rostan, however, is of opinion that in chronic inflammation of the cerebral arachnoid, the thickening is occasioned by the superposition of an organized false membrane, which being detached, the original membrane recovers its primitive delicacy of texture, and almost its primitive transparency.

Suppurative inflammation may take place either into the subarachnoid spaces or into the arachnoid sac. It is, however, by no means a frequent occurrence. Rostan gives several cases of effusion of pus into the arachnoid cavity, and so does Morgagni, Cruveilhier, and Dr. Bright. Dr. Baillie states, he once saw pus effused into the cavity to such an amount as to cover the entire upper surface of the brain. Two cases are also given by Dr. Hodgkin of cut wounds of the head in which pus was found in the arachnoid sac. Dr. Sieveking relates a remarkable instance of purulent exudation of the arachnoid occurring in a young woman aged twenty-seven, under his care, at St. Mary's Hospital, in whom sudden and unexpected coma supervened, and terminated, after thirty-six hours, in death. She had previously suffered from otorrhœa; but on her admission gave no signs of cephalic disease; nor was any direct connection traced, after death, between the affection of the ear and the meningitis.

The characters of chronic arachnitis are—a similar opacity and thickening of the membranes, together with granulations of a pearly colour, and more especially along the longitudinal sinus, and also an augmentation of the glandulæ Pacchioni. Much serum is also

effused into the cavity; and the cellular tissue by which the pia mater is attached to the brain acquires considerable strength, so that portions of the brain come away with the membranes. The surface of the brain is pale, and sometimes slightly atrophied. Ossification of the pia mater is extremely rare. Dr. Baillie, however, mentions one case, on the authority of Soëmmering; and Dr. Hodgkin speaks of a specimen in the museum of Guy's Hospital.

In acute arachnitis of the ventricles, the membrane becomes thickened, semi-transparent, pulpy, and sometimes sprinkled with minute spots of blood. It is rare to find lymph effused, but occasionally old adhesions are seen between the opposite surfaces of the ventricle. Pus has also been occasionally found in the ventricles.

With regard to the effusion occurring in the ventricles in "*meningitis*," it is correctly remarked by Dr. Sieveking that "it offers many relations different from the arachnoidal effusions occurring on the surface of the brain; nor is it quite intelligible why the secretion into the cavity of the ventricles should so rarely be found to communicate with the superficial arachnoidal space." The anatomical relation of these parts may in some measure explain the differences; for it is very doubtful that the arachnoid lines the ventricles of the brain; an arrangement which Kölliker considers impossible. Nevertheless, there is in meningitis generally an increase in the ordinary amount of the fluid in the ventricles to the extent of several drachms, which may, perhaps, be regarded rather as a result of contiguous sympathetic effusion, than as an extension by continuity of the inflammatory exudation.

A microscopic examination of the smaller vessels of the pia mater, in *meningitis*, shows that they are studded with the exudation corpuscles described by Gluge and Bennett, and with oily-like vesicles; and these appearances are found both within and without the vessels (SIEVEKING).

Every age is liable to meningitis. Children are often attacked by it whilst teething, under the form of hydrocephalus acutus, and also when labouring under scarlatina, measles, or other disease caused by a morbid poison. Adult age, as well as the middle periods of life, are still more liable to this affection, both from the greater exposure to the action of the typhous and paludal poisons, to mechanical injuries, as well as to the greater intemperance and greater excitement incident to this age. In old people arachnitis is likewise common, more particularly from the ramollissement and other organic lesions of the brain, to which they are subjected. Both sexes perhaps suffer in nearly equal proportions from this affection.

Meningitis, however, is a disease which most commonly occurs from the action of a morbid poison; and there are few agents of that class which do not act on the membranes of the brain. There

are many instances also of persons suffering from arachnitis after exposure to the heat of the sun, or to what is frequently called the "*coup de soleil.*" Intemperance, as well as great mental anxiety, is also a frequent cause of the chronic forms of the disease, and it is especially connected with insanity, and with every structural disease of the brain; and to these causes must be added mechanical injuries.

The meningitis which accompanies the cachexia associated with tuberculosis, is of a very distinctive kind, and is the cause of the great frequency of the disease in childhood. Its essential morbid character consists in the deposit of tubercle on the pia mater, generally in the shape of small miliary granules, resembling in appearance the Pacchionian bodies, but differing from them in minute structure and in position. They are found most frequently and most abundantly within the fissure of Sylvius, between and upon the convolutions of the brain, and at the base of the brain, and very rarely on the cerebellum. They are generally of the nature of the grey granulations, imbedded in the vascular network of the pia mater.

Symptoms and Diagnosis.—Meningitis has usually been described in three stages. The symptoms of the first stage are those of excitement, resulting from diffuse inflammation; those of the second are those of compression, marking that effusion has taken place; while those of the third stage are associated with progressive recovery, or terminate in death.

Symptoms of Simple Meningitis.—The type of this morbid condition is that in which the membranes covering the convexity of the hemispheres are the parts generally affected. The most important facts to be ascertained in the previous history of the case, before the development of cephalic symptoms, relate to the general health, and especially the absence of signs of cachexia or diathetic states, such as tuberculosis, rheumatism, or of the zymotic action of implanted poisons, such as syphilis. It is important also to ascertain whether any blow on the head has been sustained, or if the patient has been much exposed to the sun; whether any disease of the ear or nose exists; whether application to study has been intense, or to the cares of business.

Morbid premonitory symptoms may be trifling, or absent altogether. The most common are slight, but increasing pains of the head, sensorial disturbance, and irritability of temper, or restlessness, with some general malaise. Rigors quickly supervene, or simple chilliness, with cutis anserina and pallor of the surface, quickly followed by febrile re-action. An attack of convulsions may supplant the rigors, especially in children. Such, however, are by no means common in the adult, and are not necessarily indicative of any severe or advanced lesion. The fever is commonly high; the pulse sharp, hard, and frequent; the respirations are irregular, per-

formed with a sigh, and often with a moan. The skin is hot, the bowels obstinately constipated; and evacuations, when they occur, are dark and offensive. In this stage there is little or no prostration of strength. The headache of fever is supplanted by acute and intense pain; the face flushes and turns pale alternately; the eyeballs stare, and the conjunctivæ become injected.

The purely nervous symptoms as expressed by *mental*, *sensorial*, and *motorial* phenomena are thus classified by Dr. Reynolds:—

(1.) *Mental.*—The temper is extremely irritable. There is marked somnolence, or wakefulness, and the two sometimes alternate for several days. The most marked feature is delirium. Commencing early, and of a furious character, the patient screams and gesticulates in the wildest manner; the expression of countenance is savage and malignant, or sometimes has the fierce aspect of the brute.

(2.) *Sensorial.*—Marked and continuous headache (cephalalgia) prevails, with exacerbations of a darting, violent character, eliciting from the patient, and especially from children, a sharp, piercing cry. Pain is increased by movement, and the patient holds the head with the hands; or, if a child, frequently carries them to the head. The headache is increased by sensorial impressions, and hence the eyes are obstinately closed, and the ears, if possible, kept covered with the bedclothes. Double vision, tinnitus aurium, formicatio, and subjective sensations of various kinds are present. The sensorial disturbances are highly marked.

(3.) *Motorial.*—Restlessness is incessant, sometimes general or partial. The muscles of the face and limbs twitch involuntarily. There is strabismus, or the eyeball is unsteady, and with a contracted or oscillating pupil. Vomiting is frequent, without epigastric pain or tenderness, and often without nausea.

This stage generally lasts from *one* to *four* days, and its characteristics may be shortly expressed as consisting of—*the combination of great nervous hyperaction, with marked fever, a peculiar cry, cephalalgia, vomiting, and constipation.*

The second stage is one of a transition from the first to the third. The fever diminishes. The pulse sinks in frequency and force, becoming variable in frequency between very wide limits, and in very short intervals of time. Respiration becomes peculiarly irregular. The bowels continue constipated. The tongue becomes furred and dry. The heat of the head persists, but the body generally is cool.

The nervous phenomena present remarkable intermissions.

(1.) *Mental.*—Delirium becomes quieter, or passes into coma; or the patient may appear collected and well.

(2.) *Sensorial.*—Excitement diminishes and disappears, and drowsiness is the most common feature.

(3.) *Motorial.*—Muscular twitchings generally are increased on

both sides of the body. Convulsions are common in the child, and spasms often alternate with paralysis. A violent general convulsion may throw the patient at once into

The third stage.—It may come on almost immediately, or a week of transition symptoms may intervene. The face becomes sunken, the extremities cold, and the abdomen retracted. Sordes form on the gums and teeth. The pulse flutters, becomes thready, feeble, and uncountable. Great prostration of strength supervenes.

The nervous functions are gradually suspended.

(1.) *Mental.*—Perception, volition, and ideation become lost, so far as can be ascertained by corporeal signs.

(2.) *Sensorial.*—Anæsthesia is complete.

(3.) *Motorial.*—There is absolute paralysis to almost every form of stimulus, to be observed first in the eyelids and eyeballs, and then in the limbs. Muscular relaxation becomes complete, as evidenced by the dilated pupil, stertorous breathing, involuntary micturition, and defecation.

Generally there is absence of nervous action, and organic life gradually dies out.

The duration of these stages is very various. Sometimes each lasts a week ; and this, perhaps, is most commonly the case, but one or more stages may be wanting.

The tongue, in the first stage, is white ; in the second it becomes brown ; in the third it again cleans, or the patient dies. The pulse likewise, in the first stage, is from 90 to 100 ; in the second, from 110 to 130 ; and in the last stage, it either gradually returns to its natural standard, or runs on too rapidly and too feebly to be counted.

The symptoms which have been described are those which mark arachnitis at the superior portions of the brain. When, however, it occurs at the base, or in the ventricles, some differences are observable, although the condition cannot always be distinguished ; but in some cases such a location of the malady is rendered probable, if the intellect is less impaired, the passions more excited, and the patient lies fretful, impatient, morose, and, although somnolescent, he occasionally cries out, and grinds his teeth, very early in the disease ; while the parallelism of the axis of the eyes is frequently affected, also at an early period.

Symptoms of Tubercular Meningitis.—I. In the child. It is an object to ascertain the existence of the tuberculous cachexia in the first instance, as described at page 457. If such exists, tubercular meningitis may supervene on the occurrence of febrile disturbance, with slight thirst and anorexia ; irregular, somewhat quick pulse, vomiting and constipation, clayey evacuations deficient in bile, red and moist tongue, dry, but not very hot skin, and other phenomena of general derangement.

The special nervous phenomena are often feebly marked.

(1.) *Mental.*—There may be irritability of temper, and peevishness, with some slight delirium at night, rarely commencing early in the disease, disturbed sleep and restless manner.

(2.) *Sensorial.*—Pain in the head prevails, with intolerance of light and sound. Vertigo is also indicated by staggering, or clinging to objects for support.

(3.) *Motorial.*—Grinding of the teeth prevails, occasional vomiting, unsteady, restless movements and dragging of the limbs. After three or four days of these premonitory symptoms,

The second stage commences, with heat of head and flushings of the face alternating with pallor. The pulse is irregular, and commonly, when the child is still, it is of little frequency, but rises rapidly if the child is disturbed. The vomiting ceases, but the constipation persists with retracted abdomen.

The special nervous phenomena become more marked.

(1.) *Mental.*—The child inclines to lie quiet, resists being moved, as if pain was increased by motion. There is delirium, which is sometimes fugitive and sometimes persistent.

(2.) *Sensorial.*—The cephalalgia increases. The expression of countenance bespeaks great suffering, and the face looks aged. A peculiar piercing cry is now and again given by the child. The eyes are closed, and there is a tendency to drowsiness.

(3.) *Motorial.*—Strabismus and muscular twitchings occur. The pupils are variable and often oscillate, and the eyeballs are unsteady.

The third stage is ushered in by the general symptoms of approaching dissolution, such as coldness of the extremities, clammy perspiration, and an excessively rapid but feeble pulse.

The special nervous phenomena are first those of exalted spinal action, and then those of general prostration.

(1.) *Mental.*—Drowsiness passes into stupor, with an idiotic expression of face. There is loss of perception and volition.

(2.) *Sensorial.*—All signs of activity give place to anæsthesia, and the eyes are half open.

(3.) *Motorial.*—Death approaches by convulsions, with partial paralysis, subsultus tendinum, clenched hands, retracted head, and automatic movements, giving way to general relaxation.

II. In the adult, the symptoms occasionally assume an apoplectic, and sometimes a convulsive form at the commencement; and the febrile character is generally imperfectly marked. The premonitory symptoms are those associated with the tuberculous cachexia, and meningitis may occur at any stage of the lung disease.

After some remission of chest symptoms special nervous phenomena referable to the head may supervene.

(1.) *Mental.*—The patient looks bewildered; with a dull, heavy, expressionless face, often highly characteristic. There also appears to be some *intellectual* incapacity to speak; the patient seeming to understand what is said or asked; looks at the inquirer for a few seconds and then turns the head away without a reply. There is often marked somnolence.

(2.) *Sensorial.*—Pain in the head fixed to one spot (generally the forehead), is the most striking symptom of considerable intensity, and persistent for many days.

(3.) *Motorial.*—An attack of convulsions may precede every other symptom; but paralysis is rare.

The second stage is of very variable duration, the pulse is highly irregular, while alternate flushings and pallor of the countenance are common, and all the symptoms already noticed become more intense, mild delirium prevails, and the face becomes increasingly stupid-looking.

Paralysis of volition alternates or co-exists with chronic or tonic spasms, strabismus, or prolonged convulsive attacks.

The third stage is marked by increasing stupor, immobility, and involuntary defecation and micturition. The general characteristics of *tubercular meningitis* thus consist in the occurrence of fixed pain, vomiting, dull intellect and face, with partial paralysis or convulsions, slight fever, and diminution of the chest symptoms in a patient demonstrably tuberculous. The indications of inflammatory action are only feebly marked, not only during life, but after death; and very often the febrile state which had existed before, becomes less noticeable at the onset of cerebral symptoms. Still, heat of head, injected conjunctivæ, and flush of face denote a condition of vascular excitement.

Diagnosis.—Meningitis is distinguished from encephalitis by the headache, the early delirium, and by the general absence of hemiplegia (see p. 490). It must be admitted, however, that disease of the brain, and of its membranes, is often conjoined, so that meningitis is not in all cases a simple affection.

Treatment.—As a general principle, remedies have little influence over those forms of the disease which arise during the progress of any zymotic or constitutional disease, independent of the general treatment indicated for that disease. When arachnitis arises from mechanical injuries, the treatment is generally by bleeding, calomel, active purgatives, and by cold applications to the head. In chronic cases, Foville strongly recommends the cold *douche*, but with caution, as being a powerful depressant, yet producing less ultimate debility than bleeding. It acts, doubtless, by cooling down the general mass of the blood, and producing a salutary general re-action (see remarks under treatment of hydrocephalus).

The dietetic treatment should be strictly antiphlogistic, the patient especially avoiding all mental excitement; and, if not secluded, should at least be kept tranquil not only in body but also in mind.

Cerebritis *vel* Encephalitis—*Inflammation of the Brain Substance, or of the Structures generally within the Cranium.*

Definition.—*A morbid state of the brain, more or less complex, according as it is general or local, or as it may or may not be combined with meningitis. The usual evidence of the phenomena associated with inflammation is shown by symptoms during life and certain post mortem appearances after death, such as dusky redness, softening or suppuration of some part of the brain surface.*

Pathology and Morbid Anatomy.—The writers who have most contributed to remove the difficulties connected with the study of this disease are Morgagni, Rostan, Lallemand, Bouillaud, Abercrombie, Durard Fardel, Bright, Gluge, Bennett, Todd, and Reynolds. The most general fact that has been determined regarding this morbid state is that there are two very distinct forms of cerebritis to be recognized both anatomically and clinically. While dissection demonstrates the fact that inflammation may exist either in the brain alone, or in the membranes alone, yet clinically it is found that *meningitis* generally complicates *cerebritis*, and thus the phenomena proper to each of these morbid states become combined; and especially in that form of the disease in which the lesion is extensive, commonly known as "*general cerebritis*," "*phrenitis*," or "*encephalitis.*"

There is, however, more partial or local forms of this affection, to which the name of "*red softening*," or "*acute ramollissement*," has been applied; and which Gluge and Bennett have learned us to diagnose as an inflammatory affection by the aid of microscopic observation after death.

There are thus two states to be distinguished, namely,—(1.) "Inflammation of the brain generally;" (2.) Inflammatory red softening or acute remollissement, as contradistinguished from "white softening of the cerebral substance," the result of an *atrophic* process.

The red *diffuse* inflammation of the substance of the brain appears to have many degrees. In the first degree the substance of the brain, when cut into, exhibits more bloody points than usual, so that the medullary substance appears as if sprinkled with blood, while the colour of the cortical substance is increased in intensity. If the inflammation assumes a higher degree, the most marked red appearances generally only partially affects one of the convolutions of the brain, or a small portion of a hemisphere; and

the inflamed part now varies from a bright rose to a deep red dusky colour. This increase of colour is supposed by many pathologists not to arise from any greater vascularity of the part, but from blood escaping from the vessels and becoming effused or infiltrated into the substance of the brain, forming so many apoplectic spots (BOYER). The inflamed part is generally swollen, and sometimes considerably so, and is generally softer, though it may appear firmer than usual.

As the disease advances the exudation ultimately assumes the purulent character, or becomes more or less softened, approaching in character the condition of pus as it appears to the naked eye. Without suppuration, however, having actually taken place the mere effect of inflammatory exudation amongst the brain tissue is to soften its texture and increase its specific gravity, whereas in "white non-inflammatory softening of the brain" the specific gravity is diminished. When the softening results from the exudation merely before it has undergone any subsequent change, there are traces of congestion which give to the affected part a red appearance; and the microscope shows, as Bennett first demonstrated, a large amount of exudation corpuscles interspersed among the broken down nerve matter, as well as coating the inner and outer surface of the minute blood-vessels. Wherever exudation matter exists, although there may be no palpable indication of changed consistence in the tissues, yet the specific gravity will be found increased; just as we find that without microscopic examination we cannot tell whether or not congestion of the brain substance exists, combined with the exudation corpuscles of red softening.

The inflammations of the substance of the brain have thus much in them that is peculiar, depending on the nature of the tissue, and independent of physical appliances, such as the tests for specific gravity, and the microscope, the unaided senses cannot enable us to appreciate the exact pathological significance of morbid changes. It is only in a small number of cases that the red colour of the brain is characteristic of inflammation; for in by far the greater number there is no increase of redness; and on account of the frequent occurrence of such cases ramollissement has been described by many authors as a distinct idiopathic disease.

The varieties of softening, as characterized by their colour merely, cannot be regarded as essentially different: they are peculiarities due to the nature of the tissue and the effects of the morbid process upon its component parts. It appears to be the *liquor sanguinis* rather than the *corpuscular* part of the blood which takes the chief part in cerebral inflammations where softening is the prominent phenomenon. The characteristic of the part thus affected is, that it is generally whiter or greyer than the natural colour of the brain,

and also softer than its natural substance; and, accordingly, a rough way to appreciate the presence of this softening is to allow a gentle stream of water to flow upon the suspected part; if softening exists, the softened parts will be gradually washed away. This softening, however, has many degrees, and in some cases can be only accurately determined by a microscopic examination. In its extreme form the brain is absolutely diffluent, so that it can be poured out of the cranium with as much facility as a thickened cream or a thin jelly can be poured from one cup into another. In this semi-liquid state much serum can often be expressed from it.

Extreme softness of the brain, unattended with inflammatory coloration, may be well seen in those cases where the brain has been extensively injured, as by sabre wounds. Many such cases are related by our army surgeons. In cases of *hernia cerebri*, also, not only does the protruded portion become softened with red particles of blood intermixed in it, but in acute cases which terminate fatally in a few days after the injury, "the medullary structure intervening between the base of the protruded part and the anterior cornu of the lateral ventricle had entirely lost its natural structure and become soft and pulpy. Around this disorganized mass, and extending across the corpus callosum into the medullary substance forming the roof of the opposite ventricle, the brain had undergone a change from its natural colour to a greyish blue-white, while it still retained its natural consistency" (STANLEY). It was remarked also in this case during the last three days of life that a very considerable quantity of fluid constantly oozed from the centre of the protrusion, whence it trickled down the cheek in a continued stream.

Such cases show the acute and rapid nature of the softening process as an inflammatory phenomenon, but without any obvious discoloration. In fact, most of the phenomena connected with the inflammatory process in the nervous substance are characterized by the apparent want of increase of the red part of the blood.

In the three forms of suppuration which are described in by far the greater number of cases, no trace of redness can be seen in any part of the brain; and probably this want of vascularity may account for the rare development of pus corpuscles in the fluid of what appears to be abscesses, and which otherwise looks like pus. Pus is not always present in undeniable abscesses of the brain, but molecular granules, exudation corpuscles, and pyoid bodies, evidently the result of the exudation process, are the sole objects which the microscope can detect (LEBERT, BENNETT).

Exudation in the softened state resembling pus may be — (1.) thus collected into the form of an abscess; (2.) it may be infiltrated into the substance of the brain; or (3.) it may be detected on the

convolutions in the shape of a ragged ulcer, varying in size from a fourpenny piece, or less, to that of half-a-crown. It is in this latter form and site of the suppurative process that well-formed pus corpuscles can most frequently be detected.

In abscess of the brain the surrounding substance is generally of the natural colour, except in a very few cases in which it succeeds to apoplectic effusion, when the walls of the cavities are dyed by the previously extravasated blood. Dr. Baillie says, when the abscess is of large size, the weight of the pus breaks down the neighbouring parts, and they look simply as if they had been destroyed, or very much injured by the pressure; and also when the abscesses are small, there is an ulcerated appearance of the cavity in which the pus is contained. In other cases the usual membrane of an abscess forms. This membrane is at first extremely delicate, and easily torn; but as the patient continues to live, the membrane lining the abscess becomes of greater consistency, and even of considerable density, so that in some cases it is fibrous, fibro-cartilaginous, and even ossified, thus laying the basis for the formation of bony tumors of the brain.

Inflammatory ramollissement of the brain is looked upon as an essentially fatal disease, and the patient seldom perhaps survives the formation of an abscess; but it is apprehended that the pus may be occasionally absorbed, and that the opposite walls may unite by granulations, and leave an areolar-tissue cicatrix. Nevertheless, there is some evidence also, that inflammatory ramollissement is capable of being cured. The post mortem evidence of this fact is the disappearance of one or more layers of the cortical substance, probably by absorption, while the pia mater adheres to this part of the brain. The evidence of the cure of ramollissement in the grey matter of the corpora striata and other central parts, is the presence of a number of "holes," resembling Parmesan cheese, of a red colour when there has been transudation from the blood-vessels, and of a fawn colour in other cases. The part is also atrophied and softened; while the holes may be filled with a limpid fluid, sometimes lined with a membrane (Dr. Simms, *Med. and Chir. Trans.*, vol. xix., p. 413).

There is also evidence of the brain tissue becoming gangrenous, as a result of the inflammatory process, equally free from the red coloration. Mr. Stanley has shown, in his cases of hernia of the brain, that where portions of the brain have *sloughed* away they have *granulated* again, and have passed into a state of gangrene, often exhaling an exceedingly fetid odour. It is probable, however, that death of the brain tissue, as a result of idiopathic inflammation in the form of what is ordinarily known as gangrene, does not usually occur. Certain it is, that inflammatory ramollissement cannot be

regarded as such, or analogous to it, as suggested by Dr. Abercrombie, which he calls *white softening*, and due to interruption of the circulation. There is undoubtedly a softening which results from obliteration of the cerebral arteries, consequent on coagulation of the blood in them, or on obstruction from clots of fibrin (CARSWELL, HASSE, KIRKES, SANKEY). But Mr. Paget has shown that such softening is more probably the result of a fatty degeneration of the brain tissue, as a result of the deprivation of its nutrient material. When the softening is truly gangrenous, it is generally after wounds and injuries, and does not differ from gangrene in other parts; the debris is "of a greyish, brownish, or greenish colour, sanious and very fetid" (JOHN HUNTER, JOHN BELL, and others).

Thus softening of the cerebral substance, although characterized by some distinctive phenomena during life, cannot be regarded as an affection, *sui generis*, apart from inflammation, of which it is simply the result.

Instead of being softened, the texture of the brain is not unfrequently indurated as a result of the inflammatory process, and is associated also with an absence of red colour. It acquires the consistency of the white of egg boiled hard. M. Dance gives the case of a patient who received a blow on the head about seven months before his death. He afterwards suffered from epistaxis, and severe and frequent paroxysms of headache. At length he fell down in walking from the bath, and died convulsed in about a quarter of an hour. On inspecting the brain the convolutions were flattened; there was very little blood, and no serous fluid in the encephalon; but all the substance of the brain resembled white of egg boiled hard. Its weight and density were considerable, and it yielded and recovered its form like an elastic body. There was no trace of a red vessel, but the cortical substance was paler, and the medullary substance whiter than usual (*Répertoire Gènéral d'Anatomie et de Physiologie*, 1828).

The two hemispheres of the brain suffer from ramollissement with nearly equal frequency; and ramollissement of the cerebellum is much more rare than of the brain. But it is not determined whether the grey or the white matter is the more liable to inflammation. Bennett has been led to consider the white as the more frequently softened, while Gluge is of opinion that it is more frequently the grey; but it must be remembered that the grey matter is naturally specifically lighter than the white, and probably also from its structure more amenable to the softening process.

Causes.—Inflammation of the substance of the brain may be caused by every morbid poison that produces fever. Many cases also result from mechanical injuries, others from the excitement of insanity and uncontrolled moral feelings. In some instances

encephalitis has followed the suppression of a cutaneous eruption, or the accidental inclusion of a nerve by a ligature applied to a blood-vessel (LALLEMAND, *quoted* by SIEVEKING). In others, caries of the bones of the cranium, and especially of the petrous portion of the temporal bone caused by otitis. Intemperance also is a frequent cause of this as well as of every other disease of the brain. The disease is also sometimes brought about idiopathically, by exposure to the sun's rays in very hot summer days, especially in tropical climates. As a secondary disease, encephalitis is produced by cancer, tubercle, and by every other structural disease incidental to this organ.

Encephalitis occurs at every age: in childhood during the tendency to hydrocephalus; in adult age from the action of morbid poisons, and from mechanical and moral accidents; and in old age from the natural decay of the frame. Ramollissement of the brain has occurred at the following ages:—In a few cases from birth to fifteen; 39 cases occurred from fifteen to forty; 54 cases from forty to sixty-five; and 60 cases from sixty-five to eighty-seven. The frequency of this disease, therefore, increases with age. Men are supposed to suffer in a larger proportion than women from this disease, probably from their greater exposure to the exciting causes.

The Symptoms of cerebritis have a considerable latitude. In twelve severe cases related by M. Paroisse, and resulting from wounds, he states that the symptoms were nearly the same in all, and were as follows:—The men all stated that after the sabre wound they had felt no other inconvenience than local pain of the injured part, and that for two or three days afterwards they had all been able to march five or six leagues a-day. On the third day, however, they had all been seized with fever, which terminated on the evening of the fourth day; but from that period they had suffered little, always preserved a good appetite, and prayed not to be put on a low diet. About the seventeenth day they became downcast and dejected, owing, probably, to many sloughs being detached, and much suppuration taking place about this time. On the following day they first lost the sense of smell, and then the senses of sight and taste. With these symptoms, but without fever or convulsions, they fell into an easy sleep; and, as if they had no further strength to contend with the disorder, they died between the nineteenth and twenty-second days from the infliction of the wound.

The symptoms which have been related by Paroisse agree entirely with those observed by John Hunter. He observed that trifling wounds of the membranes of the brain were often followed by severe and extensive inflammation of those tissues, and by very dangerous symptoms; but if the injury had been great, so as to have excised a portion not only of the arachnoid, but also of the substance of the brain, that the symptoms which followed were com-

paratively slight—a circumstance which he attributed to the brain in the latter case having room for expansion; and he therefore suggested the propriety of extensively lacerating the arachnoid and pia mater in all cases in which the dura mater alone had been wounded.

In idiopathic inflammation the case may be acute or chronic. The first stage of the acute form is generally of short duration, and in so far the attack may be said to be sudden; and if there have been preliminary symptoms of ill health, they have generally been headache, or long continued derangement of the digestive organs.

The general symptoms of the first stage are but feebly marked (unless meningitis predominates). There is usually, in the first instance, some heat of head, and of surface generally. The face is pale, the pulse low and irregular. The breathing is variable and sighing. There is slight feverish oppression, with headache and vomiting.

The nervous symptoms are generally highly marked, and so are those of diminished functional activity in cases where the cerebral affection predominates as distinct from the meningeal. They consist of—

(1.) *Mental Phenomena.*—The patient is sullen, and his faculties become obscured. There is confusion of thought, rather than delirium, which occurs only in a mild form when the patient doses.

(2.) *Sensorial Phenomena.*—Unless meningitis is present, there is no hyperæsthesia; but there is deep-seated, violent, oppressive pain; frequently described as shooting from the centre to the vertex, the temples, eyes, or ears; and it is out of all proportion to the intensity of the febrile phenomena; and while the febrile phenomena subside (as they very generally do in the course of twelve or twenty-four hours), the local pain does not diminish.

The second stage may be ushered in by convulsions; or after the first stage has lasted two or three days, the pulse usually becomes rapid and weak. The cerebral nervous functions become inactive, anæsthesia, paralysis, and coma, commonly follow two or three convulsive paroxysms, and death follows after the first stage has lasted two or three days.

When the signs of meningitis co-exist and are unusually severe, the pain deep-seated, and followed after twelve or twenty hours by convulsions and coma, there is commonly meningo-cerebritis of considerable extent.

When the cerebritis is local or partial, the symptoms are those which are usually regarded as indicating "inflammatory softening," "red softening," as commonly called, or "acute ramollissement." Premonitory symptoms are common, and consist of—

(1.) *Mental Symptoms;* namely, some loss of intellectual vigour, failure of memory, confusion of ideas, irritability of temper, and a

consciousness of weakness; these symptoms becoming gradually persistent.

(2.) *Sensorial Symptoms;* such as pain of the head, dull, deep-seated, fixed, and protracted; tingling or numbness in one limb or side; imperfection of the special senses; dimness of sight; dullness of hearing.

(3.) *Motorial Symptoms*, as evinced in the loss of power of one limb or side; the most important of all the premonitory symptoms.

There is also more or less fever in proportion to meningitis; there is heat of head, vomiting, and general malaise. The signs of meningitis, on the other hand, may be feebly marked; but there may be convulsions followed by coma, partial paralysis, with rigidity returning more or less rapidly and ending fatally in a day or two, or from two to three weeks. Thus there may be the symptoms of meningitis, or of cerebritis, of both together, or alternately, and occurring with such premonitory symptoms as now indicated, leave little doubt of the existence of a partial cerebritis.

Although we have seen that the anatomical conditions of the brain substance generally in acute ramollissement are by no means associated with any appearance of much red blood, yet the clinical history of the disease seems closely to resemble that of cerebral hæmorrhage, and it is very often impossible to tell whether the physician has to deal with a case of *apoplexy* as commonly understood, or a case of *cerebral softening*. The premonitory symptoms peculiar to softening appear to be absent in a half or more than a half of the cases (ROSTAN, DURAND FARDEL). In some instances, however, the premonitory symptoms just noticed, afford strong probability of softening, and are of much value; the absence of them, however, cannot be regarded as equivalent to the absence of softening (REYNOLDS).

The attack itself may be gradual or sudden. Thus after the progressive development during some hours or days of such premonitory symptoms as have been mentioned, the patient gradually becomes apoplectic, or he may at once appear to become so, suddenly and instantaneously, without the premonitory symptoms. In the latter case, however, the attack is due to congestion; it gradually passes away, and the patient recovers intelligence for a time, but the confirmed symptoms of softening remain as follows:—

(1.) *Mental Symptoms.*—Transient excitement or mild delirium may precede the abolition of perception, and when this does occur, it is highly characteristic. Coma is frequently developed abruptly, and is often of the following peculiar character. The patient lies still as if in a profound sleep, but immediately gives the hand, or puts out the tongue if told to do so; intelligence remaining intact. The loss of perception and volition, however, is not recovered from.

Dullness and obscuration of thought and perception prevail often to a marked degree.

(2.) *The Sensorial Symptoms* are not so well marked as the motorial. Hyperæsthesia has erroneously been considered pathognomonic of ramollissement, perhaps because it is more common in softening than in any other apoplectic disease. Numbness and a sensation of cold are not at all unfrequent.

(3.) *The Motorial Symptoms* are of two kinds; namely, paralysis and spasmodic contractions of muscles. The face muscles act unequally, producing deviation of the features, sometimes very slight, at other times highly marked. Speech is almost constantly impaired, and after slight recovery it continues to be so. Paralysis is commonly limited to one side, sometimes to one limb, but in rare cases it is general.

The spasmodic contractions are either of a tonic or of a clonic kind, rigidity or occasional spasm being found in either the paralyzed or non-paralyzed limbs, most commonly in the former.

The physician, however, will not derive much information from the mere recognition of the presence of single symptoms; it is by a close observance of their combinations that exact diagnosis will be insured. The following combination of symptoms are those which may with most probability be referred to softening:—

(1.) Imperfect coma, partial loss of perception and volition, with rigidity of the limbs.

(2.) Perfect coma, without rigidity.

(3.) Paralysis without loss of consciousness.

(4.) Paralysis with hyperæsthesia.

(5.) Rigidity coming on after the return of perception and volition.

The after symptoms of softening are also strikingly different from those of apoplexy. The morbid phenomena do not suddenly disappear, nor is there the gradual improvement which takes place after apoplexy. Enfeeblement of the mental powers most commonly persist, and the motorial phenomena remain. Slight apoplectic-like seizures occur, convulsive movements and rigidity increase, and some little febrile excitement becomes developed, which in severe cases generally assumes a typhoid type with brown tongue and rapid pulse. From such a condition recovery is rare.

The duration of life in ramollissement of the brain is very various, but in 109 cases the disease terminated within the periods indicated in the table on the following page.

It thus appears that ramollissement of the brain is more frequently an acute than a chronic disease, the greater number dying before the twelfth day, while at the end of a month only sixteen cases out of the 109 were living.

Duration of life in cases of softening of the brain.

1	died in	12	hours.	2	died in	12	days.	1	died in	35	days.
1	,,	15	,,	3	,,	13	,,	1	,,	36	,,
1	,,	24	,,	3	,,	15	,,	1	,,	47	,,
1	,,	32	,,	1	,,	16	,,	1	,,	49	,,
5	,,	2	days.	2	,,	17	,,	1	,,	60	,,
9	,,	3	,,	4	,,	18	,,	1	,,	65	,,
5	,,	4	,,	5	,,	20	,,	1	,,	68	,,
4	,,	5	,,	3	,,	21	,,	1	,,	190	,,
7	,,	6	,,	1	,,	22	,,	1	,,	220	,,
8	,,	7	,,	1	,,	23	,,	1	,,	5	months.
8	,,	8	,,	1	,,	25	,,	2	,,	6	,,
3	,,	9	,,	1	,,	29	,,	1	,,	1	year.
5	,,	10	,,	4	,,	30	,,	2	,,	3	,,
4	,,	11	,,								

In the thirteen cases which have been collected of ramollissement of the *cerebellum*, the lesions of intellect were trifling, while motion was greatly affected in all except one doubtful case. In ten cases there was palsy with or without contraction of the muscles of the opposite side of the body; in two others convulsive actions of both sides of the body, and in the last case observed by Rostan, the palsy was on the same side. In this case the disease depended on an exostosis of the petrous portion of the temporal bone. In no instance is any sexual desire recorded to have troubled the patient.

The symptoms of abscess of the brain are likewise extremely obscure. In a case treated for disease of the nose, the man made no complaint of his head, and was able to sit up in bed, and to assist himself in every way. He died suddenly in the night. To the surprise of everybody an abscess of considerable size was found in the left hemisphere above the ventricle. In other cases, according to Dr. Baillie, pain, delirium, coma, and palsy were the symptoms observed.

The symptoms of hydatids of the brain are often very obscure. The slowness with which they form probably often causes the brain to become accustomed to their presence, and consequently they do not give rise to any very prominent symptom; Cruveilhier gives a plate of a hydatid occupying the internal surface of the right hemisphere, immediately above the corpus callosum, and which caused no cerebral symptoms. Dr. Baillie also gives a case in which a serous cyst, as large as a gooseberry, pressed on the optic nerves at their junction, and yet the pupils were not dilated, nor the eyesight impaired till within a day or two of the patient's death. In other cases they cause severe headache, palsy, loss of sight, or of other senses, and also absorption of the bones of the cranium, coma, and death.

Atrophy of the brain is usually congenital, or the consequence of some severe hydrocephalic disease, or of old age, or of long-standing exhausting diseases, especially in children. Serum being effused in

the space between the brain and its coverings in order to supply the defect. Sometimes also one side may be more atrophied than another; the membranes appearing to be greatly shrivelled after the fluids escape; the convolutions are thin and the sulci wide. The sufferers are generally idiotic, and possess but little use of their limbs. Andral gives a singular case in which the patient, a girl, though an idiot, was able to do little errands in the neighbouring villages, and lived to an early adult age, yet when examined after death she was found to have no trace of cerebellum.

Hypertrophy of the brain is usually connected with hydrocephalus, or is probably caused by some inflammatory action. Those persons seldom possess much power of intellect, but their faculties generally are less impaired than in cases of atrophy.

Diagnosis.—The great difficulty in the diagnosis of acute ramollissement is to distinguish it from apoplexy.

Prognosis.—The prognosis in every case of encephalitis is grave; but, as far as we can judge, even acute cases recover, and live for many years afterwards.

Treatment.—In diffuse inflammation of the brain arising from mechanical injuries, there can be no doubt that bleeding and the antiphlogistic treatment generally are most beneficial when employed with a wise discretion and at an early period. When, however, inflammation occurs during the progress of a *zymotic* or *constitutional* disease, it is necessary that such measures be employed with the greatest caution, and in the majority of instances they are better omitted altogether; for we find in many cases of typhous fever, in which the brain is probably partially softened, that the patient recovers under a powerful stimulant treatment.

In idiopathic ramollissement of the brain, the treatment can hardly be said to be yet determined; but there is good reason to suppose that bleeding is injurious, and that most advantage is derived from the use of tonics, and of a nutritive diet. As a general rule, cerebritis does not admit of so copious depletory measures as meningitis. In acute cases where the premonitory symptoms of congestion are obvious and urgent, bleeding should be carried to the greatest extent possible, consistent with the nature of the case and the individual; and after a reasonable quantity has been taken without producing nausea or fainting, the bleeding may be again repeated till some decided impression is made. But all this must be done before any decided symptoms of softening are established.

In chronic cases, local bleedings from the temples, or from behind the ears, combined with moderate purgatives every three or four days, are demanded in most cases, with a blister applied now and again to the nape of the neck; and as much as possible the currents of blood must be diverted from the brain. The diet ought to be

strictly that of a vegetarian, and as little stimulant as possible (WOOD).

In the more chronic and although ultimately fatal forms of the disease, life is evidently prolonged by mild tonics, attention to the bowels, and by a liberal and nutritious diet. Beyond this the medical treatment of ramollissement of the brain is still a problem with only a few unsure data to guide us for its solution.

2. CEPHALIC DISEASES, CHARACTERIZED BY A GROUP OF SYMPTOMS COMMONLY CALLED APOPLECTIC.

The literal meaning of the term *apoplexy* conveys the idea of a *sudden stroke*, and it has been usual to confine the term to the results produced by extravasations of blood into the nervous tissue of the brain, a portion of which is thus destroyed. More comprehensive pathological doctrines teach us to give a wider signification to the term. It is now used to characterize a group of symptoms, irrespectively of the anatomical conditions upon which they may depend. These symptoms consist of—(1.) Premonitory warnings, extending over very variable periods (seconds, weeks, months, or years), marked by sundry derangements of the nervous functions, such as loss of memory, dullness of sensation, or diminished power; (2.) The individual is more or less suddenly deprived of volition and perception in their relation to sensation and motion. Consciousness is thus more or less lost, and paralysis is more or less complete. The patient may fall to the ground completely insensible, or he may only stagger and cling to some object for support. The respiration and circulation may be unaffected, or the former may be stertorous, and the latter laboured. Some group of muscles, a side of the body, or the whole body is paralyzed, flaccid, motionless; or it may be rigid with tonic, or convulsed with clonic spasm. From this state the patient may never recover. Life becomes gradually extinguished, or the sufferer may recover partially or entirely; in the former case leaving some mental, motorial, or sensorial faculty impaired for weeks, or for the whole of after life. The essential phenomena of an apoplectic seizure consists in the severance of the brain functions, namely, volition and perception from motion and sensation; the other symptoms that occur are additional phenomena, depending on secondary changes, subsequently induced in the part, or its vicinity, which has been the primary seat of lesion.

The essential phenomena of the *apoplectic state* are found to be due to a variety of local lesions, or complex, morbid states, and not to any constant lesion. One or more of the following local lesions, or complex morbid states, may induce the apoplectic condition, namely,—(1.) *Congestion of the brain*, or what is commonly called

determination of blood to the head; (2.) *Hæmorrhage,* or *extravasation* (a) *into the substance of the hemispheres,* or *cerebellum,* (b) *into the ventricles,* or (c) *into the arachnoid cavity.* This second condition is *apoplexy* in the common acceptation of the term; (3.) *Sudden serous effusion in large quantity* is equally efficient in bringing about the apoplectic state commonly called *serous apoplexy;* (4.) *Local cerebritis,* or *softening of the brain,* produces, as already shown, symptoms, in the first instance, of an apoplectic kind; so also do (5.) *Tumors of the brain* or *meningitis;* (6.) *Tuberculous meningitis;* (7.) *The progress of various zymotic and constitutional diseases from blood-poisoning;* (8.) *Anæmia, disease of the heart, and vascular obstructions.*

To the phenomena produced by the first three of these conditions only, is it common or usual to describe by the term—

Apoplexy—*Apoplexia.*

Definition.—*A disease essentially characterized by the sudden loss, more or less complete, of volition, perception, sensation, and motion, depending on sudden pressure upon the brain, originating within the cranium.*

Pathology.—This disease was well known in the Greek and Roman schools of medicine, and is of too frequent occurrence, and of too striking a character, to have escaped observation even in the rudest ages of society. Patients have died with undoubted apoplectic symptoms when nothing has been found but congestion of the vessels of the scalp, of the membranes of the brain, and of the brain itself, but without the extravasation of a particle of blood. More generally, however, a greater or less quantity of blood has been effused either into the cavity of the arachnoid, into the substance of the brain, or into some of the ventricular cavities. Thus it is that the lesions found in cases which die of undoubted apoplectic symptoms vary much. Sometimes the evidently congested state of the brain during life leaves no trace visible after death. Such cases have been described as "nervous apoplexy" (Sandras). Although much stress is laid upon the fact that "a sudden pressure upon the brain is necessary to produce the apoplectic state," yet it is difficult in all cases to account for the proximate cause of the disease by such an explanation; for when the quantity of blood extravasated has been not larger, for instance, than a barley corn, it is difficult to account for all the phenomena by mere pressure. The ideas or theories which have thus been formed to account for the apoplectic state may be shortly stated as follows:—(1.) The result of sudden pressure, effected by causes within the cranium; (2.) From a peculiar (unknown, but probably of the nature of softening,

Rochowx) morbid state of the nervous matter of the brain, and which predisposes to the extravasation of blood (Drs. Robert Williams, Wood, Sieveking)—an apoplectic orgasm, as it has been called by some; (3.) A morbid condition of nerve matter and minute blood-vessels, and also probably of the blood itself (Paget).

When the quantity of blood extravasated is small, the disease is seldom fatal from the first attack; but the rapidity of the fatal issue rather appears to bear some relation to the vicinity of the hæmorrhage to the medulla oblongata; and the effusion of blood into the ventricles is also generally most rapidly fatal.

In examining apoplectic cases, it is therefore not unusual to find a cavity scarcely bigger than a barley corn in the substance of the brain, the evidence of the primary attack, and containing a clot of blood, variously changed. If the blood be effused among the membranes, it may be altogether absorbed, and not a trace of disease be found. In severe cases, still greater quantities of blood are effused; and if the apoplexy destroy the patient in a few minutes or a few hours, the quantity of blood effused will sometimes fill the whole cavity of the arachnoid, or extensively rupture the substance of the brain, forming a cavity as large as a nut or an egg, or even lay the ventricles into one cavity.

It is rare that sanguineous effusion occupies both cerebral lobes, or the whole extent of the membranes of the brain, although such instances are occasionally seen. More commonly it is limited to the substance of one hemisphere, or to the membranes covering it, or to the cavity of a ventricle. When the membranes of the brain are affected, the more immediate seat of the hæmorrhage is usually that portion covering the convexity of the brain. This varies, however, so that the portion covering the base, or that investing the cerebellum, or indeed any other part, may be its seat.

The superficial membranes of the brain are not the only membranes of that organ which are the seat of apoplectic effusion. Hæmorrhage may take place from the membrane lining the ventricles, and which sometimes bleeds so profusely as not only to fill the lateral ventricles, but even to enlarge their cavities. As death in these severe cases is usually sudden, the walls of the ventricles are generally healthy, but in some very few instances the septum lucidum has been found ruptured, and the ventricles have freely communicated. The smaller ventricles are in a very few instances also the seat of apoplectic effusion. Dr. Abercrombie gives a case in which the third and fourth ventricles were filled with blood. The patient was not at first insensible, but gradually became so, and died in a few hours.

The appearance of the blood effused into the membranes of the brain varies according to the time which elapses before the patient

dies, thus affording opportunity for its examination. If that event takes place in a few hours after the attack, the blood is still fluid, or is found in black clots, while the membranes, except being infiltrated with blood, are as yet healthy. The substance of the brain, likewise, has no other appearance of disease than that of being flattened from the pressure of the extravasated blood. If the patient, however, survives a few days, the membranes show marks of inflammatory action, are injected, thickened, and although dry and pitchy-like in the immediate neighbourhood of the clot, have yet some serum effused in other parts of the space they enclose. The convolutions of the affected part of the brain are likewise now not only flattened, but softened. Thus various processes immediately commence in the blood after it is extravasated, as well as an interchange of processes between the blood and the surrounding parts. The most obvious of these phenomena are the formation of a coagulum or clot, its solution and the formation of blood crystals; the gradual absorption of the more fluid constituents; the formation of an organized membrane round the clot; continuous absorption of the exudation; induration of the surrounding cerebral parts; contraction of the cavity and ultimately the formation of a cicatrix. Those changes are effected with very various degrees of rapidity, depending on the site and extent of the extravasations, the healthy state of the nervous texture, and of the patient constitutionally.

When effusion has taken place into the substance of the brain, if the patient has died in the fit, or shortly after, the hæmorrhagic cavity is found filled with half-coagulated blood, its walls irregularly softened, and dyed to the extent of some lines deep with the colouring matter of the blood; and a small stream of water directed upon this part at once removes the extravasated blood, and also a layer of softened cerebral matter. Again, if the patient has survived a week, the blood is found coagulated, and the serum set free; but the presence of the clot has caused inflammation, so that the walls of the cavity are not only discoloured, but more decidedly softened, and are softer in proportion as they are nearer the clot. If life be prolonged till the fifteenth day, the serosity is absorbed, but the walls of the cavity are still of a deep red. About the seventeenth day, Virchow has discovered blood crystals, or hæmotoid crystals, in the cavity. These blood crystals were first discovered by Sir Everard Home, and have been more recently described, and their nature explained, by Funke, Kunde, Lehmann, Parkes, and Sieveking. It appears that these crystals do not form from clotted blood until the blood corpuscles have become ruptured by endosmosis. Their contents then escape and crystallize, as the solution gradually becomes concentrated (Beale). Thus another guide to the age of the clot exists in the presence of these crystals. About the thir-

tieth day, if the patient lives so long, the clot is isolated, and a membrane forms, at first muciform, fragile, intermixed with particles of cerebral matter, and also with some of the colouring matter of the clot. By degrees, this membrane becomes more consistent, the clot diminishes, and some serum is probably secreted by the new membrane surrounding it. The cyst has also been found fully formed, organized, and nearly empty, by the thirteenth day (MACINTYRE); and by the seventeenth day it has been found to contain sanguineous fluid (MOULIN, SIEVEKING). The cerebral walls surrounding the cyst, previously softened, now become indurated, and are stained yellow from the usual changes which the extravasated blood with which they are penetrated undergoes, a colour, however, which they ultimately lose. The cavity thus formed is at length, perhaps, filled with serum only; or, the serum being absorbed, the membranous cyst may ossify, and be thus converted into a bony tumor. At other times, the opposite sides of the cavity unite by a kind of areolar membrane, which thus forms a species of cicatrix, but possessing so little power of conducting nervous influence, that the patient seldom recovers from his palsy. Such is a short outline of the effects of hæmorrhage into the substance of the brain. The size of an apoplectic cavity varies from a barleycorn to that of an egg, and their number is as variable as their extent. Sometimes we find but one, sometimes two, and in a very few instances three or more cavities. When many apoplectic cavities exist in the brain, it is rare to find them all in the same state. Some are old and almost obliterated, others are fresher, and others again quite recent, their different stages marking a distinct and different period of attack. As to the particular seats of the apoplectic effusion, Andral has collected a series of cases, which shows the remarkable tendency to extravasation of blood into that part of the cerebral hemisphere situated on a level with the *corpora striata* and *thalami optici*, and at the same time into these two centres. Out of 386 cases of cerebral and spinal hæmorrhage compared by him, 202 were in the locality thus indicated. The extravasations in the remaining cases were distributed as follows :—

Effusion into the corpora striata, ...	61	Behind thalami optici, or in the posterior lobes, ...	7
Thalami optici,.....	35	Median lobe of cerebellum,.....	5
Portions of the hemispheres situated above the centrum ovale,.....	27	Peduncle of the brain, ...	3
Lateral lobes of the cerebellum, ...	16	Peduncle of the cerebellum, ...	1
Before the corpora striata, ...	10	Corpora olivaria, ...	1
Mesocephalon, ...	9	Pituitary gland, ...	1
Spinal cord, ...	8		

Many pathologists affirm that apoplexy is caused by rupture of the blood-vessels in every case, although they admit this state of

parts can rarely be demonstrated. That rupture of vessels is occasionally the cause of cerebral hæmorrhage there can be no doubt, for Rochoux, Abercrombie, and others, have collected instances of the rupture of the larger superficial vessels of the brain, as of the carotid, the basilar, and meningeal arteries, these vessels being either aneurismal, ossified, cartilaginous, or otherwise previously diseased; but even such cases are rare except in old people. In 1850, Mr. Paget also directed special attention to fatty degeneration of the minute cerebral blood-vessels as a cause of sudden death by apoplexy, a morbid condition of the vessels detected by the microscope in parts of the brain which otherwise appeared healthy.

It is certain also that the large encephalic veins in a very small number of instances have been found ruptured in apoplexy, as the venous sinuses. As a general rule, however, apoplexy is the result of a hæmorrhagic action or exudation through the coats of the capillary vessels. The best evidence of this is afforded when the blood is infiltrated amongst the cerebral tissue; while there is evidence of general congestion within the cranium, the sinuses of the dura mater being full, the pia mater infiltrated with blood, and the cut surface of the brain abundantly dotted over with red dots of blood indicating the turgid state of the divided blood-vessels.

Symptoms.—Whatever may be the pathological doctrines taught regarding the morbid state of the cerebral parts in apoplectic states, we are able practically during life to do little more than merely to recognize the apoplectic state itself; the diagnosis between the congestive, the hæmorrhagic, and the serous or merely morbid nervous state can only be arrived at approximatively by a careful comparison of symptoms closely observed, such as are detailed in the treatise of Dr. Russell Reynolds already noticed, and from which the following statements are condensed.

Symptoms of Apoplexy from Congestion.

The face, scalp, and conjunctivæ are increased in vascularity, and the skin generally is of a dusky venous hue, and the surface is warm. There is fullness of the jugular veins, with increased pulsation in the carotids. The tongue is foul, and nausea prevails, with constipated bowels. Respiration and the pulse are both laboured, and the extremities are cold. Such are some of the general symptoms which indicate the approach of an attack of the congestive form of apoplexy.

The symptoms peculiar to the brain itself, are—

(1.) *Mental.*—The activity and power of the intellect are diminished. General confusion of thought prevails, with deficient memory. Any attempt at mental exercise increases the expression of these signs, so does the recumbent position and emotional disturbance. Sleepiness

also, with laboured respiration, is common, especially after meals, and there is a general tendency to inaction of body as well as of mind—a "not-to-be-disturbed" sort of desire is experienced. Such mental phenomena, however, are not permanent; and while there is a readily induced state of general confusion, there is no persistent, special, or permanent loss of power of intellect.

(2.) *Sensorial.*—The senses generally are obtuse. The hearing is dull; and heavy rumbling noises are constant auditory illusions. The sight is dim, or amaurosis is complete, and often black or variously coloured spots are seen floating in the field of vision, or other spectral illusions are more or less constant. The patient may see only half of an object, or halves of objects of different colours. Vertigo is also present, with a sense of fullness and oppression in the head; numbness and weight of the limbs; dull and heavy cephalalgia. These symptoms, however, are only of occasional occurrence, and change their localities. While the absence of pain is not now considered of much diagnostic value, yet the occurrence of severe acute pain is generally indicative of something more then congestion.

(3.) *Motorial Symptoms.*—Little jerkings of the muscles, irregular or sluggish movements of the eyeballs, are occasional.

These precursory symptoms having generally been more intense for a few minutes or hours, an attack takes place, distinctly apoplectic. The seizure commonly occurs during some muscular exertion, such as lifting a heavy weight, pulling on a pair of boots, blowing the nose, straining at defecation or the like; or even upon a simple change of posture, such as stooping, or suddenly assuming the erect attitude.

The special nervous symptoms of the attack in the *congestive form*, are—

(1.) *Mental.*—Some evidence of the existence of perception may generally be obtained by loud noises, speaking to the person by name, or pinching him. If, however, perception is quite extinct for a few seconds or minutes it soon again partially returns, and there is confusion of thought, with little volition as to the direction either of thought or movement.

(2.) *Sensorial.*—Except during the first few moments of the attack when sensation generally is gone, the changes are slight. Sensation indicated at least by reflex action (the limbs being withdrawn if pinched), is generally present.

(3.) *Motorial.*—There is more or less paralysis of all the limbs to a slight degree, and for a short time. It is very rare to have either hemiplegia or paraplegia. Short or involuntary evacuations do not occur unless there have been some convulsions. There is no rigidity of the limbs, but clonic spasms are not unfrequent. Generally and in the course of a few minutes the symptoms begin to

abate rapidly, and they rarely last even for an hour. With the return of consciousness paralysis disappears, and sensibility rarely remains deficient.

The manner of appearance and proportion between the three groups of nervous symptoms is of great diagnostic value. As indicative of *congestion* rather than of *hæmorrhage* or *softening*, any one of the following combinations or groups of symptoms are of importance to be noticed :—

(1.) *The simultaneous development of the three groups of nervous symptoms. There being either—*

(2.) *Distinct loss of perception, profound coma and general paralysis without rigidity or convulsion.*

(3.) *Imperfect loss of perception with general paralysis.*

(4.) *General paralysis, incomplete in degree, and sensation unimpaired, or but little affected;* or—

(5.) *Paralysis complete in degree, but without stertor or rigidity.*

Symptoms of Apoplexy from Hæmorrhage.

I. **Into the substance of the Cerebral Substance of the Hemispheres.**—Very different statements are made as to whether or not premonitory symptoms are present; and the practical point in diagnosis which such discrepancy of statements have taught is, "*that the non-existence of precursory symptoms in a given case is in favour of the belief that hæmorrhage rather than congestion is the cause of the lesion or softening.*"

The attack is generally sudden and rapid in its development. Sometimes after a few hours there may be sudden aggravation of the symptoms generally due to a renewed extravasation. The patient, if standing, generally falls instantaneously as if knocked down. It is the nervous symptoms, however, which are of the most importance.

(1.) *Mental.*—Loss of consciousness (of volition and perception) is commonly complete at the outset. For a few seconds at least, the patient is utterly deprived of intellectual power, which in slight cases partially returns in a few minutes. In severe cases, however, perception does not return till after some hours, and with vague ideas of things ; expressions of thought are confused, amounting to delirium ; *and after the first few minutes or half hour has passed, the degree of intellectual obscuration may be taken as an approximative measure of the amount of extravasation,* although it is to be remembered that there are some exceptional and rare cases on record of hæmorrhagic apoplexy in which the mental faculties were very slightly, if at all impaired. After some days the intellectual powers are often entirely restored; but in many cases confusion of thought

and partial loss of memory remain. If the case does not terminate fatally, the well marked character of the recovery is a strong presumption that the symptoms resulted from hæmorrhage, and were not due to softening of the cerebral substance.

(2.) *Sensorial.*—Sensibility is usually less commonly affected and less intensely than mobility. When cutaneous anæsthesia is complete, although the surface so affected may be limited in extent, the occurrence indicates severity of lesion. In slight cases there is generally only numbness and tingling of the tips of the fingers. Evidences of sensation may be obtained when there is no proof of distinct volition. During the profound coma of the attack at the commencement, the dilated pupil, and the half-opened eye, indicate that the retina has lost its impressibility; and if hearing and smell are similarly affected, the persistence of such symptoms are signs of evil omen.

(3.) *Motorial.*—*Paralysis* is present in the immense majority of cases, the characteristic form of its distribution being *hemiplegia*; but sometimes it is general, the proportion of cases being as ·84 to ·16 per cent.; and when the paralysis is general the hæmorrhage is rarely limited to the substance of the hemispheres. During profound stupor the deviation of the face indicates paralysis on one side. In less severe cases the condition of the limbs as to volition is the guide. The tongue commonly deviates to the paralyzed side; and any extreme movement of the face, such as crying or laughing, renders the inequality of action more apparent. The orbicularis oculi generally escapes paralysis, or is less affected than the other facial muscles. The loss of motion is commonly absolute at first, especially in the arm, which is generally more profoundly affected than the leg, the one being more completely paralyzed than the other. Stertor, with involuntary defecation and micturition, are common. *Involuntary contractions* of a tonic or clonic kind are extremely rare, from hæmorrhage limited to the cerebral substance.

The more common combinations of symptoms by which the existence of cerebral hæmorrhage limited to the medullary substance might be inferred, are—

(1.) *Profound coma, with hemiplegia on one side, of marked intensity, and without rigidity.*

(2.) *Paralysis of both sides, but one more profoundly affected than the other,—a rare occurrence in limited hæmorrhage.*

(3.) *Slight coma, but paralysis hemiplegic and complete.*

II. **Hæmorrhage into the Ventricles** cannot in some cases be distinguished from arachnoid extravasation, or in others from effusion into the cerebral substance only, especially when in the vicinity of the ventricles. The cases, however, which are less doubtful are

marked by the following characteristics, in addition to the general signs of apoplexy :—

(1.) *The Mental State.*—Coma is very profoundly marked at the commencement, and remains of equal intensity; or the patient, after partially recovering from a slight seizure, is again suddenly plunged into profound coma, from which there is no recovery. This second attack is presumed to indicate the rupture of the hæmorrhage either into the ventricles or the arachnoid cavity, from its original site of extravasation in the medullary substance of the brain near the ventricles or near the surface.

(2.) *Motorial Symptoms.—Paralysis* is complete in degree and is developed simultaneously on both sides; or after having been hemiplegic for a short time, it becomes general, when the coma of the second attack above noticed comes on, stertorous breathing is strongly marked. Involuntary evacuations follow. The pupils remain dilated. Deglutition is dangerous and difficult. When the paralysis is general and the coma profound it is almost a sure sign that ventricular hæmorrhage has taken place to a considerable extent. *Rigidity* or *tonic contraction* of the muscles is present in many cases of hæmorrhage, and in nineteen out of twenty-six cases occurs in the paralyzed limbs; and in about four out of twenty-six cases may be seen in those of the healthy side (Dr. Russell Reynolds). Its presence is a sign of extensive lacerative hæmorrhage.

The most frequent combination of symptoms indicative of ventricular hæmorrhage may be shortly stated to be *profound coma, with general paralysis and rigidity.*

III. **Arachnoid Hæmorrhage** occurs when the extravasation bursts through the pia mater and arachnoid into the space between the membranes, and such cannot be distinguished from the *ventricular extravasation* just noticed. If, however, the extravasation is immediately sub-arachnoid at first, and of limited extent, it may be approximatively diagnosed,—*First*, By the nature of the premonitory symptoms having partaken of meningeal inflammation, such as by severe pain in the head with impaired intelligence and motion; *Second*, The attack is less sudden than in cases of congestion or of central hæmorrhage, and the symptoms are progressively developed.

The following are the combinations of symptoms supposed to indicate the occurrence of subarachnoid hæmorrhage :—

(1.) *Complete and profound coma without paralysis; or with general paralysis very slightly developed in intensity.*

(2.) *Complete loss of consciousness without paralysis; but combined with rigidity or clonic contractions of the limbs.*

(3.) *Paralysis of hemiplegic distribution as regards the limbs, but*

without deviation of the features, the muscles of the face not being implicated.

(4.) *An apoplectic attack without anæsthesia.*

(5.) *Imperfectly developed coma with general paralysis.*

(6.) *An apoplectic attack of which the symptoms are somewhat interchangeable or remittent.*

Causes.—Among the most frequent causes of apoplexy, especially in some constitutions, is an intemperate use of fermented liquors, a class of substances which not only powerfully excites, but also subsequently powerfully depresses the action of the brain, and acts specifically on the heart and arteries, causing not only temporary energetic action of those parts, but also organic alterations in their structure (page 333 *et seq. ante*). In the latter case the powers of the heart are often permanently augmented, while the coats of the arteries, thickened, thinned, or ulcerated, have their elasticity destroyed, and thus the tendency to hæmorrhage in the brain is increased. The excessive use of narcotics, as opium or tobacco, is also supposed to predispose to congestion of the brain, and consequently to cerebral hæmorrhage.

Extremes of temperature are likewise powerful predisponents to apoplexy. In summer the fluids of the body tend to produce turgidity of the vessels in some constitutions, and the tone of the capillaries is impaired; while in winter the cold drives the blood from the periphery of the body to its central organs, and consequently to the brain. Sudden and great vicissitudes of the weather, as they rapidly exhaust the nervous power, are more frequently fatal than the uniform continuance of its extremes.

The powerful effects of *moral causes* in producing this fatal disorder are well known.

Mechanical obstruction is also a frequent occasion of apoplexy. If an obstacle, for example, be opposed to the course of the blood, as when the valves of the heart are diseased, the blood accumulates in the capillary system generally, and consequently in the brain, or errant clots of fibrine choke up the minute cerebral vessels. Apoplexy is still more common when the aorta is diseased, the force of the heart, unchecked by the elasticity of that vessel, acting directly on the brain, so that its vessels often give way from this cause. Mechanical violence, also, often produces apoplectic effusion. Thus, concussion of the brain, however slight, always produces more or less congestion of that organ; and, if severe, effusion may take place behind the dura mater, or between the membranes, or into the substance of the brain, which may be extensively ruptured.

Apoplexy has been known to occur even in childhood. Billard gives the case of a child, three days old, that died apoplectic from effusion into the left hemisphere and about the lateral parts of the

corpora striata. Serres also saw a similar case in a child three months old. Apoplexy, however, is extremely rare till puberty, and only a few cases are met with before twenty. It is not unfrequent between thirty and fifty, while after fifty it is one of the most frequent causes of death. There are many circumstances which favour the disposition to apoplexy in old age. At that period the capillary system becomes impaired in most organs, and thus the veins are filled with a greater quantity of blood, or become congested. The cerebral arteries also are often diseased; the heart has frequently acquired an abnormal power, driving the blood with great violence towards the brain, while the lungs have their functions so impaired that the blood is only imperfectly oxygenated; and all these are causes of congestion and of tendency to rupture of the vessels of the brain.

Both sexes are liable to this affection, and in nearly equal proportion. Those most liable to attack are the florid in complexion, those of short-necked conformation, with prominent eyes, broad chests, and protuberant bellies, and sometimes enormously fat, especially if high livers, sedentary, and indolent.

Many thin persons, with spare long necks, however, frequently die from apoplexy, but it is probable that in these cases the heart or large vessels have been diseased.

The act of digestion, or rather fullness of the stomach, appears to predispose to apoplexy. Numbers are attacked after dinner. Sleep, also, which some physiologists believe to be associated with a temporary congestion of the vessels of the brain, is another predisposing circumstance. Thus of 176 cases examined by Gendrin, 97 had been attacked during sleep.

Many diseases, or conditions of the body, probably from the plethora they induce, predispose to apoplexy, as mania, epilepsy, suppressed hæmorrhoids, amenorrhœa, and especially the "*turn or change of life.*"

Prognosis.—Apoplexy is always a grave disease, and the more grave in proportion, generally, as the respiration is stertorous and the deglutition difficult. Each succeeding attack is more dangerous than the former. The practitioner should also be guarded in his prognosis till after the first week or ten days, lest inflammation should come on, or a fresh attack destroy the patient.

Popular opinion (and it is useful in pronouncing an opinion to know what are popular beliefs), supposes the patient to suffer three apoplectic attacks, the first being mild, the second followed by paralysis, while the third is fatal. It is only in a few instances that this number is exceeded.

In the congestive form of apoplexy, if active and judicious measures of treatment are employed, the recovery may be rapid and complete; but if this is not the case, there is a liability to a more

aggravated form, from which nothing is more variable than the time of recovery. In a very few instances the patient is restored in a few days, or in a few weeks, or in a few months, but more commonly the lesions of motion are permanent, or nearly so. In general, however, some slight improvement takes place even in the worst cases, so that the patient recovers some use first of his leg, and then, perhaps, of his arm, so that he is able to walk with a "straight leg" and a dragging foot. The use of his arm returns more slowly and more imperfectly. This recovery is often preceded and accompanied by very severe pains, especially of the upper extremity, marking the still irritated state of the brain. The limb, however, uniformly wastes, and its vital powers are so impaired that if inflamed the inflammation seldom terminates by resolution, but has a great tendency to gangrene, while cicatrization is slow and difficult.

The commonest occurrence is the perfect recovery of the mental faculty, and the progressive but much more gradual return of motion and sensibility. Paralysis of motion sometimes persists in groups of muscles, such as those of the tongue, the fore-arm or hand. Sensibility is generally first restored, then the motion of the lower extremity, then the arm, and lastly, that of the fore-arm and hand. Discordant opinions are entertained relative to the influence of the electric structures on the paralyzed muscles. The late Dr. Marshall Hall was of opinion that the muscles of the non-paralyzed limb were the more irritable. Dr. R. B. Todd entertains precisely the reverse opinion. These are the highest authorities in this country. Duchenne draws attention to two conditions of paralysis after apoplexy, namely, one directly dependent on the central lesion, the other the mere result of inaction for some time. In the former case, there is contraction of the muscle as the result of increased spinal action, uncontrolled by the central ganglia of the brain, in the latter form the muscles are flaccid. Active tonic contraction of the muscles, distinct from simple shortening of the flexors, he also considers as indicating inflammatory action in the walls of the cyst.

This distinction is one which requires corroboration or contradiction by subsequent observation (Dr. Russell Reynolds).

No doubt, the principal adverse circumstances attending recovery from apoplexy are, that although the patient appears to be doing well the first few days after the attack, yet towards the close of the first week the brain, irritated by the presence of the clot, inflames and softens, and thus induces another and a fatal attack of apoplexy. Should the patient, however, survive this dangerous period, he may continue to live many months, or years, according to his age; but he is generally at length cut off by a fresh attack of apo-

plexy, or his brain ultimately inflames and softens, and he dies in a typhoid state as already described.

Although it is the general rule that the patient, on recovering from the attack, has the good fortune to recover all the faculties of his mind, yet his memory is not unfrequently impaired often to such a degree that he has forgotten all dates, the names of his friends, or even the names of things. Broussonet, professor of medicine at Montpellier, had entirely lost the remembrance of all substantive nouns, and another case is on record in which the patient lost the recollection of all his adjectives. In some instances the power of association is also so destroyed that although many remember both names and things, they are unable to connect the thing with the proper word, so that they call that which is cold, hot; or speak of night when they mean day; or call a coffee-pot a wash-hand basin. Others, again, have forgotten how to read, and the power thus lost either returns suddenly, or they are obliged to learn *de novo*.

The attention generally is also very greatly impaired, and the patient is no longer able to transact business; or if he begins a sentence is unable to finish it, or he repeats the same idea over and over again. The passions also are little under control, for while some weep like children, others laugh immoderately, and all are easily terrified, or otherwise easily acted upon.

All these circumstances must be remembered in giving a prognosis regarding an apoplectic patient.

Treatment.—The patient, if seen during the fit, should be bled, and bled copiously from a large opening, in order to relieve the congestion, to check, if possible, a further effusion of blood, and to divert its active flow from the head. The quantity taken should be proportioned to the degree of stertor and to the powers of the patient; and sixteen, twenty, and even thirty ounces may be allowed to flow. But if the pulse be small and slow, no advantage is to be gained by the abstraction of a large quantity of blood at this time and in this way. If the latter quantity is not followed by some degree of consciousness, it may be inferred that the amount of blood effused is considerable, and that the patient in all probability will not recover. Still, perhaps, an additional chance may be given by applying cold to the head, leeches to the temples, and mustard cataplasms to the feet, also by placing a drop or two of croton oil on the tongue, and by throwing up a cathartic enema of castor oil or other medicament, but not one of turpentine, as is commonly done, for the intoxication which that medicine is apt to produce is decidedly injurious.

Some persons are disinclined to any considerable bleeding during the fit, considering that the bony structure which contains the

brain removes all atmospheric pressure so entirely as to cause tha organ at all times to contain an equal quantity of blood. Th brain, however, is not in the position of a mechanical syphon, bu is a living machine governed by vital laws. A space within th head for a very sensible expansion and contraction at each pulsatio of the heart, is opposed to such a belief, while posthumous examina tion shows the brain to contain very different quantities of blood being sometimes gorged, and sometimes blanched of that fluid These facts distinctly show that some arrangement exists for regu lating the quantity of blood sent to the brain, and we ought, there fore, in a disease of this moment, to follow the dictates of a long ex perience rather than the conclusions of a fallacious reasoning. When emetics are now spoken of, it is generally with the view of con demning them. The physiological phenomena which attend their action increase the determination of blood to the head, as is now well known.

After the patient has in some degree revived, and the congestion has been consequently removed, we may pause for a few hours and allow some time for the absorption of the blood effused. Any very large depletion after that point is gained would rather facilitate extravasation than prevent it. A few hours then having elapsed, the conduct of the practitioner should be guided by the *pain of the head*, which may be taken as a measure of the fullness of the brain, and its tendency to inflammation. If, therefore, there be pain in the head, ten to twelve leeches should be applied from time to time till that symptom is entirely relieved ; or, supposing the pulse to be full and strong, and the patient free from headache, yet, under these circumstances, leeches should be applied to the head to subdue that re-action which so generally takes place from the fourth to the seventh day.

The further treatment of the case is by moderately purging the patient, both as a means of relieving the head, and of improving the secretions of the alimentary canal, which are often black and fetid. Five grains of calomel given as soon as the patient can swallow, and followed up by a black draught, or by an ounce of sulphate of magnesia with camphor mixture every four or six hours, and continued according to its effects for a greater or less length of time, are, perhaps, the best means we have for promoting the recovery of the patient, and for preventing a relapse. These prescriptions are recommended on the supposition that the attack has been caused by simple plethora. In many cases, however, it is a consequence of hypertrophy of the heart ; and in such cases less blood should be taken, and eight to ten minims of digitalis may be added to each dose of the purgative medicine.

All apprehension of a relapse being at an end, the patient is in

general most willing to believe that the palsy which may remain is a mere local disease, and to submit to any treatment for its removal. The ancients applied the actual cautery to the extremities, to the coronal suture, or to the occiput, but without any beneficial success. The moderns have had recourse to blisters, to friction, to electricity, and to strychnine; but every attempt to act locally on the muscular system is prejudicial so long as any central irritation exists (see *Paralysis*). Active or passive exercise are remedies highly beneficial.

Dietetic Treatment.—The diet of the patient should be low, till all apprehension of a relapse is passed, and limited to milk, boiled vegetables, light puddings, and fish. At no subsequent period ought he to indulge in a full animal diet, or to drink undiluted wines. At the same time, too lowering a regimen is to be avoided, as thereby the irritability of the system and the heart's action generally is increased. All the causes of the disease already fully referred to should be avoided, counteracted, or overcome.

3. Cephalic Diseases—*Characterized by Exalted, Perverted, or Functional Activity.*

The limits of this handbook prevent the consideration of many diseases of this group, which include such morbid conditions as are known by the names of *hypochondriasis, tarantism, hemicrania, hallucinations, illusions, and the like.* The group may be illustrated, however, by the diseases known as chorea, epilepsy, and insanity.

Chorea—*St. Vitus's Dance.*

Definition.—*An irregular convulsive action of the voluntary muscles of a clonic kind, especially of the face and extremities, they being either entirely withdrawn from, or but little under the control of, volition.*

Pathology.—The history of this disease is a sad picture of superstition. As late as the close of the fifteenth century, it does not appear to have been studied by physicians, but was supposed to depend on supernatural causes or "demoniacal possession." In Germany, it was said for two centuries to have been epidemic, and the patients, probably many of them maniacs, were wont to join in frantic dances, and as late as 1673 they went in procession to the church of some favourite saint, of whom St. John, St. Guy, and St. Vitus were the most reputed. Hence the name of St. Vitus's dance, by which the disease is sometimes described. As physical remedies were supposed to be unavailing in such a disorder, the priests said masses, sung hymns, and sought to exorcise the foul fiend. Paracelsus is said to have recommended the afflicted to mould their own

image in wax, to imprecate on it all their sins, and afterwards to burn it till every part was consumed. The moral effects of these methods must have been great, and no doubt many may have been cured simply by the influence of the intense moral impression.

The morbid appearances of the body which have been observed in cases of chorea, have not as yet thrown much light on its pathology. Sydenham, Cullen, Rostan, Bright, Stoll, Pinel, and others, who have had frequent opportunities of examining cases of this disease, failed to detect any other morbid appearances than those which were commonly seen in other affections of the brain and spinal cord. Accordingly, many various pathological views are entertained regarding this disease, which may be classed as follows :—

(1.) By some pathologists it has been regarded as a disorder entirely functional or dynamic, and independent of organic change.

(2.) It is also believed by some, and not without good reason, that the blood, at all events in some cases, is primarily diseased, or becomes so constitutionally ; the precise nature of the change being as yet unknown.

(3.) Associated with some other diseases, whose pathology is better known, it has been regarded either as a concomitant feature, or as a necessary consequence of their previous existence ; such, for instance, as rheumatism and diseases of the heart.

Much evidence has been brought forward in favour of the humoral or rheumatic character of the disorder. Dr. Copland has the merit of having been the first to indicate the complication of chorea with that class of diseases.—(*London Medical Repository*, vol. xv.) His views have been subsequently confirmed by Drs. Prichard and Roeser, and more recently by the elaborate researches of Dr. Begbie and Dr. Seé. Numerous instances have also been adduced by Andral, Bouillaud, Bright, Mackintosh, Watson, R. B. Todd, and others, in which diseased conditions of the heart and pericardium have been attended with, or have given rise to, spasmodic diseases of the nature of chorea, paralysis, mania, or dementia, and the evidence of these writers is amply sufficient to prove, that a considerable number of individuals affected with chorea, have suffered from cardiac or synovial rheumatism previously. But it is unquestionable that all have not so suffered, and indeed the history of the majority of the cases clearly shows that chorea has a more intimate connection with mental disease, such as imbecility, or even insanity, than with perhaps any other morbid state. The presumed blood condition can only thus be regarded as one of many occasional causes, the real essence of the disease being a perverted nervous function, as Dr. Reynolds writes, and with whose remarks I am pleased to find the views here stated agree.

As in the case of most diseases expressed during life merely by

perverted functional activity, morbid anatomy is often at fault. Our means and appliances for the accurate appreciation of nervous lesions especially, are but rude compared with the fine and delicate textures with which we have to deal. When patients suffering from chorea have died and the brain been carefully examined, the most experienced observers have failed to detect any lesions, by which the occurrence of the symptoms could be explained. Rostan had once an opportunity of examining a woman upwards of fifty, and who, from her childhood, had laboured under chorea of the whole of the left side of the body, and of which the limbs were atrophied. "I expected to find," he says, "atrophy of the right side of the brain, but there was nothing morbid ; at least, after a most careful examination, I could see nothing." Dr. Bright has given one case, which he had an opportunity of examining, and which gives equally negative results. It was that of a young woman, aged seventeen, who had formerly laboured under this disease. She had been free from it for four years, when she formed an attachment, was forsaken, was attacked with chorea, and died. The attack was of great severity ; she tossed herself about in all directions ; bit her tongue, and was with difficulty in any degree controlled. On examination, there was a slight effusion into the arachnoid cavity, more puncta cruenta than usual, and five or six bony plates opposite the cauda equina ; phenomena common in many diseases of the brain or cord, and of course incapable of having any pathological significance assigned to them in relation to chorea. It is equally impossible to fix upon any other organ or part of the body, in which anything like constant structural lesions have been observed, susceptible of being associated in explaining the nature of chorea. The structures which most obviously manifest disordered action during life are the nerves and muscles ; and for the following reasons we are led to believe, that they are maintained in their disturbed and excited state by some morbid condition of the central parts of the brain, and not of the spinal cord, either directly or by reflex action.

(1.) *Clonic spasm* of the incessantly repeated character peculiar to chorea, is not a phenomenon of persistent spinal irritation ; while *tonic spasm* is a mark of such a condition (Reynolds).

(2.) The movements can generally be in some measure controlled by the will ; unless they are very severe, and even then they are so controlled to some extent (Reynolds).

(3.) The spasmodic contractions cease during sleep, whereas phenomena of an excito-motor character are increased by the removal of volition. Fixing the attention also to some other object likewise diminishes the intensity of choreic movement (Reynolds).

(4.) The special occasions of increase, or of induction of choreic

movements, are the attempts at volitional action and emotional changes (REYNOLDS).

(5.) The phenomena of chorea during life, in accordance with the views expressed by Drs. R. B. Todd and Carpenter, which are now very generally received, tend to refer the exciting cause of the disease to changes going on in the central ganglia of the brain, such changes being expressed in a healthy state through "volition, perception, or emotion, or the balancing and co-ordinating of movements."

(6.) Experiments on living animals, and observations in morbid anatomy, tend to prove that injury to the optic thalami is productive of considerable disturbance to the movements of the body.

(7.) An opportunity was afforded me, when pathologist to the Glasgow Royal Infirmary, of examining carefully a case of chorea, which terminated fatally after a most violent attack, the acute symptoms lasting ten days. The result of the examination showed some decided changes in the corpora striata and optic thalami, sufficiently indicated by the following observations :—

"The specific gravity of the corpora striata and thalami optici was different on the two sides of the brain; those on the right side were of the specific gravity of 1·025, those on the left side of 1·031, and this difference appeared from the hydrostatic experiments as well as from those made with the gravimeter, confirming in some measure the accuracy of the general result.

"The vascularity also of these central parts of the brain, when compared with the grey matter of the spinal cord, which was healthy, was so well marked, as to leave no doubt of its abnormal increase.

"Microscopic examination confirmed the existence of increased vascularity, for numerous capillary vessels, in unusual abundance, existed in every section examined. Some of these were irregularly dilated, as in a varicose condition, and were all filled to a greater or less extent with the red corpuscles of the blood. The amount of granular substance in these parts of the brain on both sides, appeared to be greater in proportion to the fibrous substance, than in the same parts of healthy brain with which I compared them."—(*Contributions to Pathology*, *Glasgow Med. Journal*, No. I., 1853.)

"Further observations on this subject," remarks Dr. R. B. Todd, "are greatly needed, and will no doubt throw great light on the pathology of chorea and other allied affections."

Dr. Todd has also called attention to a not unfrequent occurrence in the course of chorea, namely, a high specific gravity of the urine. The high density of the urine is most marked where the choreic movements are most active—a condition, no doubt, due to the increased waste of tissue consequent on the disturbed state of the muscles and nerves. In a case recorded in his most interesting *Clinical Lectures on Paralysis, Disease of the Brain, and other Affections of the Nervous System*, where the urine was carefully examined

from day to day, it never fell below 1·019, and frequently reached 1·030, and once was found as high as 1·035. As the patient improved in health, the urine fell in specific gravity, but was never below 1·019. Lithate of ammonia was nearly always present, and oxalate of lime was frequently found mixed with it. An excess of urea was also frequently present. In another case he records the specific gravity of the urine as ranging between 1·030 and 1·040, and afterwards falling to 1·020 and 1·022. Generally speaking, he found the density of the urine highest in those cases in which the movements were most general and most active, and falling steadily with their diminution, and with the restoration of a greater controlling power on the part of the patient. Dr. H. Bence Jones has observed similar phenomena.

Symptoms.—This disease principally consists in singular and involuntary movements of one or more limbs, which prevent the patient from being able to lay hold with certainty of any given thing, or to carry that object, be it a spoon or a glass, with any certainty to his mouth, or to any other place. These symptoms are developed gradually, reach a certain point of intensity, remain at such a point for a very variable period, and it is often a long time before they subside and all traces of them disappear. Premonitory symptoms are neither frequent nor characteristic, but a certain susceptibility to nervous disturbance, and irascibility of temper, are not uncommon. General ill health is not unfrequent, arising from various causes, as delay of menstruation, and constitutional morbid states, such as rheumatism, or the existence of some zymotic disease. The commencement of the symptoms is often at first insidious, but more commonly gradual, and sometimes sudden. They consist at first simply of restlessness, or of hurried and somewhat clumsy movements. The left side and the upper limbs are frequently affected first; but subsequently the whole body is involved. The lower limbs are generally as much affected as the upper, and the patient can with difficulty walk in a straight line, or if he does, it is always by a series of movements which tend towards the object, counteracted by another series which altogether diverge from it,—his feet turning in and out, upwards and downwards, in every possible direction. The muscles of the face and neck are sometimes seized with this species of convulsion, when the head is not only tossed about, and the mouth contorted into the most singular grimaces, but it may require two or three persons to feed him, one or more to hold him, and another to watch the proper moment to pop the food into his mouth. Sometimes the motor nerves of the fifth pair are affected, and then the jaw closes with a loud snap, or the articulation of voice is affected, or the effort of swallowing difficult. Thus the essential phenomena of chorea are motorial, consisting of spasmodic involun-

tary contractions of the muscles, and which have been thus classified by Dr. Reynolds :—

(1.) *Clonic Spasms ;* of great frequency, unattended by pain, resembling the restless movements of a child who has been irritated or put out of temper. Such spasms occur independently of any attempt at voluntary movements, and are in slight cases almost unobserved.

(2.) The patient is agitated by all sorts of odd motions, and has often a vacancy of countenance which gives him a fatuitous appearance. These symptoms are constant during the day, but during sleep they generally cease altogether. They affect both sides as a rule, and in a very few cases, one side only. The patient is then said to labour under *hemichorea.* The child's health is generally good ; his pulse natural ; and his bowels, though occasionally constipated, are by no means uniformly so, but for the most part act regularly. The spasms are generally increased by emotion, and while they persist during the day, disappear during sleep. The heart acts irregularly, probably owing to the anæmic state generally associated with chorea. Dr. Addison describes a bellows murmur, often mitral, but sometimes aortic, and probably due to the same cause.

Causes.—The disease frequently attacks children otherwise in good health, and without any obvious cause. When any cause is assigned, it is usually terror. Somebody has pretended to cut off the child's head, and perhaps has drawn the back of a knife across the throat; or a person dressed in a white sheet has personified an apparition. The symptoms have been known to follow the fright in a day or two, at other times about three or even six weeks have elapsed before the disease became manifest. The causes producing this affection, however, are generally referred to mental impressions. A woman in the fourth month of her pregnancy had a frightfully disgusting object thrown at her bosom. She continued for two months in a state of extreme nervous illness from this circumstance, but recovered, and went her full time ; remarking, however, that the child was extraordinarily lively in the womb, and that she was often overcome with the sensations it produced. At birth, the child (a girl) displayed the writhing motions of chorea, and continued to suffer throughout life. When she was about thirty years of age she had the appearance of an elderly child, with a head remarkably small, and a mind hardly removed from complete idiotcy (Mayo).

Chorea is limited, or nearly so, to early life, and is rarely seen after twenty. Dr. Heberden states it to be most frequent between the ages of ten and fourteen, and also, that it is more common in the female than in the male, three-fourths of the patients under his care having been females. Dr. Todd's experience shows that chorea generally occurs between nine and fifteen years of age. It is really a

disease of childhood, and although symptoms somewhat resembling those of chorea are sometimes seen at the adult period of life and at more advanced ages, still such cases are exceptional; and it may be questioned whether they are due to exactly the same morbid condition as that which gives rise to the ordinary clonic convulsions of early life. The probable influence of the rheumatic constitutional state, or of some other unknown constitutional diathetic condition has been already noticed.

Prognosis.—The recovery of the patient, with a very few exceptions, may be always prognosticated. The disease will, in general, gradually decline, with complete removal of the spasms. Those cases only are apt to terminate fatally which occur during an attack of rheumatism or pericarditis, or when the disease assumes an intensely acute form, the patient losing rest at night and becoming exhausted; then emaciation progresses rapidly, and death occurs in from nine to twenty days. (See account of such a case by Dr. Wm. Weir in *Glasgow Medical Journal*, No. I., 1853.)

Treatment.—The indications of cure are—(1.) To remove, if possible, all morbid states of the body which may tend to aggravate the disease, such as constipation, anæmia, amenorrhœa, worms; (2.) By well regulated purgative medicines, to subdue any cerebral congestion; (3.) To sustain the strength and improve the vigour of the nervous system by tonic and stimulant medicines and by the cold bath.

The particular tonic is not of much moment. Dr. Wood recommends the powder of the black snake root (cimicifuga) in doses of from half a drachm to a drachm, or from one to two fluid ounces of a decoction; or from one to two drachms of a saturated tincture should be given three or four times a-day, and continued for several weeks, the dose being gradually increased till it produces headache, vertigo, or disordered vision. The sulphate of zinc has also had the credit ascribed to it of curing a large number of cases, beginning with a grain, in the form of a pill, three times a-day, and increasing the dose till it reaches seven or eight grains daily. The preparations of iron are also frequently resorted to with benefit.

Of other classes of stimuli, camphor in five grain doses has acquired much reputation, especially after the discharges have become healthy by the action of purgatives. Many young women, also, who attribute the attack to fright, frequently get well from the simple administration of the spirit of nitrous ether in one drachm doses three times a-day combined with the officinal camphor mixture. The catalogue of remedies proposed is endless. In many instances, however, the above medicines are continued for weeks without any manifest improvement. In such cases the cold bath, or the cold shower bath is an excellent adjuvant, and unless the child is suffer-

ing from some structural disease, the case uniformly yields to this conjoined treatment.

Dietetic Treatment.—The diet should be light and nourishing.

Hysteria.

Definition.—*A complex morbid condition of all the cerebral functions of a chronic kind, probably associated with some morbid state of the emotional or sensori-motor centres, and presenting every variety of alteration, so that the phenomena of hysteria simulate or mimic the phenomena of almost every other disease, while the most common and characteristic features of the affection are certain motorial changes of a convulsive nature, and of paroxysmal occurrence.*

Pathology.—Three theories have been entertained relative to the nature of this disease, and to the primary seat of the affection.

(1.) Some, with the ancients, refer this disease essentially to some morbid condition of the uterus.

(2.) Others consider it exclusively due to a morbid state of the cerebral structures.

(3.) A third class refers the phenomena to a morbidly excessive excitability of the whole nervous system, which renders it liable to be thrown into disorder by causes insufficient materially to disturb its action in health.

Post mortem examinations of the bodies of those who have died from other diseases while suffering from hysteria, have yielded no results.

Symptoms.—The forms and degrees of hysteria are so numerous that the difficulty of describing this disorder is very great. The modifications of age, temperament, states of nervous sensibility, physical and moral education, and grades of society, so influence its aspect that it is only possible to give a mere general outline. It is usually divided into three forms: first, that which is characterized by what is termed the "*globus hystericus*," in which the sensation of a ball rising in the throat, or a feeling of suffocation, is experienced by the patient, but without convulsions; second, its paroxysmal form, or that in which the *globus hystericus* occurs with convulsions; and third, those irregular and anomalous phenomena, which often manifest themselves during the intervals of severe attacks.

The milder forms are those which terminate without the formation of the paroxysm. They commonly begin with pains in the epigastrium, in the left side, or in some other part of the abdomen; or the patient is unusually nervous, her feelings excited or depressed. These symptoms having existed for a longer or shorter period, the patient experiences the sensation of a ball, the "globus hystericus," rising apparently from the lower portion of the abdomen, and proceeding upwards with various convolutions to the stomach, thence

to the throat, and causing sometimes an intense sense of suffocation. At this point the slighter forms frequently cease, but are followed by headache, stiffness of the neck, general weariness, a profuse discharge of a light coloured limpid urine, and by great flatulence, the abdomen becoming almost instantaneously distended.

When hysteria assumes a paroxysmal form or "fit," it may be preceded by the pains and mental feelings which have been described; but not unfrequently the attack is sudden, and is often caused by some transitory occurrence. In such a case the patient bursts out into a fit of immoderate laughter or crying, the *globus hystericus* begins to form and to rise, and no sooner reaches the throat than she falls to the ground apparently unconscious, and violently convulsed. The fit is now formed, and while in general the convulsions are easily controlled, yet—not only in the strong and plethoric, but sometimes also in delicate-looking slight-made girls,—many persons are sometimes necessary to restrain the patient, who writhes her body to and fro, agitates her limbs in various directions, and beats her breast repeatedly, with her arm and hand. During the fit the patient also often knocks her head against the bed or floor, tears her hair, screams, shrieks, laughs, cries, or sobs alternately. The respiration is slow, and is rendered still more laborious by spasms about the pharynx and glottis, so that the patient often grasps her neck and throat, or rubs or strikes the epigastrium and side with her hand. During this struggle she often bites her own arms or those of the bystanders, and will sometimes move round the room while lying on her back, by means of the muscles of the dorsal region. The abdomen is often singularly distended with flatus; but, in other cases, the muscles of that region are tense and irregularly contracted. The pulse is, in some cases, increased by the violence of the exertion, but in others its beat is natural. The veins of the neck are distended, the carotids beating with more than usual violence. The face is flushed, and "the head is generally thrown back, so that the throat projects; the eyelids are closed, but tremulous; the nostrils distended; the jaws often firmly clenched; there is no *distortion* of the countenance, and the cheeks are at rest," unless when giving expression to some of the above mentioned phenomena. The temperature of the extremities is often lower at the commencement than natural, so as to cause a momentary shivering; but as the paroxysm forms the heat is usually restored, and sometimes increased. The phenomena attending the subsidence of the paroxysm are very various; sometimes a flood of tears, a fit of laughter, or an exclamation, is followed by a great flow of limpid urine, after which the recovery is generally rapid and complete. In other cases the action of the stomach becomes inverted, and the sympathizing attendant, perhaps watching the patient

with the tenderest care, receives its whole contents, after which the patient may sink, most unconcernedly, into a profound sleep. In others, again, the fit only partially passes off, and the patient lies, to a certain extent, sensible of what is passing about her, perhaps jaw-locked, the secretion of urine suspended, unable to talk, and often obliged to be fed.

The fit having subsided, the patient lies exhausted and unwilling to be disturbed, and although more or less conscious of what has passed, she wishes to be thought ignorant of all that has taken place. A want of consciousness may exist when the fit assumes a severe or epileptic form, but this is not a common symptom of the purely hysterical convulsion. In some few cases the patient is delirious, and makes the most extraordinary noises, such as barking or howling like a dog. The duration of the fit is very various, from a few minutes to two, three, or more hours. These fits readily recur, and no sooner is one ended than the patient suffers from another; and in this manner the whole attack may last twelve, twenty-four, or even forty-eight hours. In general the intervals are much longer, and not subject to any general law of recurrence, except that they are more common about the period of menstruation.

In the interval the symptoms are extremely anomalous and irregular, and more strange and difficult to describe than even those of the paroxysm. Some have their senses so acutely alive, that although the window and bed-curtains may be drawn, still they are pained with light, and the slightest noise distresses them. In some, again, the sense of touch is so exquisite that they can scarcely bear the weight of the bed-clothes; and to others odours are similarly intolerable. Besides this extreme acuteness of the senses, others suffer pains under or in the mammæ, known to surgeons as the "hysterical breast," lumbar pains, pains in the hip-joint, headache fixed to one spot, *clavus hystericus*, and palpitation. Pain in the region of the spine is also frequent, and often so intense and so exquisitely increased by pressure that it has often been mistaken for ulceration of the intervertebral cartilages. Sir B. Brodie has seen numerous instances of young ladies condemned to the horizontal posture, and to the torture of issues and setons for successive years, whom air, exercise, and cheerful occupation would have cured in a few weeks.

As to painful affections of the joints, the same high authority states, that at least four-fifths of the females among the higher classes, who are supposed to labour under diseases of the joints, are suffering from hysteria, and from nothing else. The morbid sensibility is chiefly in the integuments, as in the case of the hip-joint, and if they are slightly pinched or drawn from the subjacent parts, the patient complains more than when the head of the femur is

pressed against the acetabulum. There is likewise no wasting of the glutei muscles, nor flattening of the nates, nor painful starting of the limbs. In some instances the patient becomes paraplegic and is unable to walk, while others suffer temporarily from hemiplegia.

It is the extreme acuteness and exquisite sensibility of the senses in hysteria which has led those less skilled in female arts to believe in the many instances of animal magnetism and mesmerism which formerly attracted so much public attention. A most interesting account of the vagaries of hysteria may be read in Dr. Watson's thirty-eighth Lecture.

Diagnosis.—The best diagnostic guide may be obtained by classifying the symptoms, according to Dr. Reynolds's plan, as followed in the description of the previous diseases. There is to be noticed—

(1.) *The Mental State.*—Volition is deficient, and misdirected. The emotions and ideas exhibit excessive activity; and to the combination of these two conditions is to be attributed many of the peculiar and characteristic features of the disease. *Assertions* by the patient are being constantly made—such as that she cannot control her thoughts, emotions, expressions, or general involuntary movements; or that she cannot move this or that limb, that she cannot open her eyes, that she cannot stand or walk; and if she makes the attempt under such impressions, she certainly fails; and she may simulate the real inability so completely, and so well, that it seems almost incredible that nothing but defective will is the real source of the failure. If, however, some strong motive, emotion, or sensation, come into operation, she may for a moment forget her condition, clap the hitherto moveless hands together, open the closed eyelids, and, with the rapidity and energy of robust health, run across a room or up a staircase with her *quasi*-palsied limbs. It does not appear that with all this there is any intention on the part of the patient to deceive any one, more than herself. It is truly a morbid, mental condition on her part, and she doubtless believes in the real nature of her symptoms. Often also a species of delirium prevails, in which nonsensical sentences are pronounced in an excited manner. Uncontrolled sobbing, singing, and laughing, are alternately produced, or accompany each other. Somnambulism, extasy, or hysteric coma (which is rare), may prevail. Often the expression of the face is insane. A listless, abstracted, vacant look pervades the countenance, as if the individual cared nothing for the things of this world. Combined with this condition there is restlessness and impatience of temper, with monosyllabic talking.

(2.) *Sensorial.*—The pain of hysteria, which may be anywhere, but most commonly in the head and mammary region, is always described as "intense," "horrible," or "agonizing," and is increased

when the attention is directed towards it, but lessens when the attention is withdrawn. The patient generally shrieks when the skin is touched.

(3.) *Motorial* phenomena, when voluntary, are performed sluggishly and imperfectly. The other phenomena in connection with the motor power are exhibited in convulsions or paralysis. It is the convulsive paroxysms of hysteria which may be mistaken for epilepsy. When they occur, it is almost always at the period of puberty in young females. They frequently attend the menstrual period, and are preceded by the premonitory phenomena of hysteria already described, and which re-appear towards the close of the convulsions. There is probably never complete loss of sensibility and perception. The spasmodic movements are general. The face undergoes little alteration. There is commonly a contractile movement of the eyelids. The patient appears to see, and there is no marked change of the pupil. Foaming at the mouth or a bitten tongue is rare. The attacks are sometimes of considerable duration, and the respiratory movements become very disorderly. After the paroxysm has passed there is no marked stupor, but merely general exhaustion; and loss of consciousness appears to be very seldom complete, and never occurs at the outset of the attack. "The patient," writes Dr. Watson, "is often able to repeat (although she may not always choose to confess it) what has been said by the bystanders during the period when she seems insensible. This is a point of distinction well worth remembering for more reasons than one. It not only helps the diagnosis when the fact comes out, but it suggests certain cautions to ourselves. We must take care not to say anything by the bedside of a hysterical patient which we do not wish her to hear; and we may take advantage of her apparent unconsciousness, and pretend to believe in it, and speak of certain modes of treatment which she will not much approve of; but the very mention of which may serve to bring her out of the fit."

The less expressed forms of hysteria cannot be confounded with the less expressed forms of epilepsy. The non-convulsive form of epilepsy is exclusively expressed through disordered sensorial states, such as by vertigo and a suspension (however brief and transitory) of the mental powers. The non-convulsive forms of hysteria, on the other hand, are chiefly expressed in derangement of the organic functions of the thorax and abdomen (Foville, Watson).

It is often difficult to distinguish between the many painful affections of the joints which arise from hysteria and the formidable diseases of these parts which they simulate, mimic, or copy, and many mistakes have been made fatal to health and even to life. The character, however, of the patient, her time of life, her general good health, the intermitting nature of the pain, and its following

the course of the nerve, enable us generally to determine with much accuracy between these different classes of disease. The most common mistake, however, is that of considering the pains under the mammæ as pleurisy, or disease of the liver, or the abdominal pain as peritonitis or enteritis, thereby leading to an abuse of bleeding, blistering, and the administration of mercury. The state of the pulse, however, the general good health of the patient, ("for" writes Dr. Wood, "one of the most striking circumstances connected with the disease, is the general integrity of the nutritive process—the patient continues plump and rosy,") and most commonly the existence of some uterine irritation, furnish sufficient grounds for diagnosis between these different diseases.

Nausea, eructations, borborygmi or tympanitis, palpitation of the heart with syncopal feelings, frequent micturition of clean pale urine, are characteristics of the hysterical state. A certain constitution is also characteristic of the sufferer from hysteria. The external conformation of the features of the face alone is often of itself sufficient to indicate the existing tendency. The "facies hysterica" may be recognized by the remarkable depth and prominent fullness of the upper lip, which is also more or less thick. There is also a fullness of the eye, with a tendency to drooping of the upper eyelids (R. B. Todd.)

Causes.—The remote causes of this affection are rather moral than physical; and in a young person predisposed to the disease almost any mental emotion will excite it, as anger, disappointment, jealousy, protracted expectation, the loss of a husband, a friend, or a child; indeed, all that brings the passions, emotions, or affections of the mind into play is a cause of this disease, and many women cannot go to church, or witness a tragic representation, without suffering from hysterical paroxysms.

This disease almost exclusively attacks females between the ages of fifteen and thirty, or during that period of a woman's life when the generative functions are fully developed and in their greatest vigour. Those most liable are the unmarried or continent, and those that labour under amenorrhœa or menorrhagia. The married woman often suffers just after conception, or before parturition, or subsequently as a consequence of protracted suckling. The barren woman, however, is more liable, and probably from her mind being acted upon by a greater number of exciting causes, such as disappointment in the prospect of being a mother. Taking classes of women, the higher classes, from their higher living and artificial modes of life, are greater sufferers than the lower orders.

But although this is a disease almost peculiar to woman, it is not entirely so, but occasionally affects the male sex under conditions of mingled debility and excitement.

Shakspeare makes Lear exclaim when Glocester relates the cause of his being put in the stocks,—

> "Oh, how this mother swells up toward my heart!
> *Hysterica passio!*—down, thou climbing sorrow,
> Thy element's below!"

The predisposition to the disease, however, is most manifest in that peculiar condition of the nervous system, for which we have no more precise or definite expression than *nervous irritability* or *mobility*, a condition which is more common in women and children than in men, and more common in all persons when in a state of weakness, than when in the full enjoyment of muscular strength. In women, the affection is more common about the menstrual periods, and immediately after parturition than at other times; more common likewise among those in whom the monthly discharge is habitually *excessive*, or *altered* as in *leucorrhœa*, or suddenly *suppressed*, or more gradually obstructed as in the different forms of *amenorrhœa*. In this condition of mobility, both sensations and emotions are intensely felt; and their agency on the body is stronger and more lasting than usual; continued voluntary efforts of mind, and steady or sustained exertions of the voluntary muscles are difficult or impossible; the muscular motions are usually also rapid and irregular.

Prognosis.—The ultimate result of these cases, though often long and tedious, is always favourable. "In nine hundred and ninety-nine cases out of a thousand, hysteria is attended with no ultimate peril either to mind or body" (Watson).

Treatment.—The treatment may be divided into what should be done during the fit, and into what should be done afterwards.

When the patient falls in a fit of hysteria, the first thing to be done is to loosen everything tight about her person. The window should be opened and the cold air allowed to blow over her. She should then be laid in the horizontal posture on a bed, or on the floor, as a means of rendering the circulation through the brain more equal, and to enable us the more readily to control the convulsive movements of her body. This being done, many modes of further proceeding may be followed. Some recommend, in plethoric cases, that the patient should be bled; a remedy certainly in many instances manifestly improper, and in all of doubtful efficacy. When the jaw is locked, Dr. Wood recommends that an enema, consisting of the yolk of an egg beat up with two drachms of asafœtida, with half a pint of water added, may be administered; or, still better, an enema of turpentine, in which half an ounce of turpentine is similarly mixed with the yolk of an egg, and half a pint of water added. These remedies, in some instances, he adds, instantly remove the affection, but in other cases not for some hours. An-

other remedy is to fill the mouth with salt: "You generally see them come round if you fill the mouth with salt." The remedy, however, which supersedes all others, and is unquestionably the best, is a good drenching. "I believe there is more virtue in cold water than in any other single remedy" (WATSON). If the patient lie on the bed, the head should be drawn over its side, and a large quantity of water poured on it from a considerable height out of a pail, jug, or other large vessel, and directly over the mouth and nose of the patient, so as to stop her breathing and compel her to open her mouth. This practice is generally introduced into hospitals, and until it was adopted it was not unusual to see three or four patients in hysteria in the same ward, and at the same time. Under this practice, however, an hysterical case is rare, and the fit seldom occurs twice in the same person.

After the paroxysm is over, if the patient complains of continued headache, a few leeches to the temples may be necessary, especially if the urine be small in quantity and high coloured; but in all other cases leeches, blistering, or cupping should be avoided as much as possible, as tending rather to aggravate than to control the disease. The next object is to regulate the bowels by such purgatives as may be necessary, and at the same time to support and tranquilize the patient by mild stimulants, as æther or asafœtida, combined with some mild sedative, as hyoscyamus in the form of tincture, the syrup of poppies, or small doses of morphia. The state of the uterine functions is next to be inquired into. If leucorrhœa be present, or the menstruation be profuse, the mineral acids, or the bitartrate of potass will be found most efficacious by restoring a more healthy state of the deranged organs.

The urine is often suppressed for a time after an attack of hysteria; but unless the bladder be sensibly, and perhaps painfully distended, no attempt should be made to draw it off. Something more should be hazarded to avoid this necessity, for the catheter once passed, that operation will require to be performed, morning and night, perhaps for several months.

CATALEPSY.

Definition.—*A sudden suppression of all consciousness; but instead of falling down convulsed, as in hysteria, the patients maintain the position in which they were when the attack commenced. The limbs and trunk persist in a state of balanced muscular contractions; the same expression of countenance which may chance to be at the moment of seizure is preserved. If sitting, the patient continues to sit; if standing, he continues to stand; and if occupied in any mechanical employment, he continues fixed in one attitude; and if he is under the*

influence of any passion of the mind, the countenance retains that expression.

Pathology.—This is a rare form of nervous disease apparently intermediate between hysteria and epilepsy; but probably more allied to hysteria. It affects the two sexes nearly with equal frequency. Dr. Reynolds has observed the cataleptic state ensue in cases of chronic ramollissement of the brain and in tubercular meningitis; and Dr. Laycock compares the condition to the state presented by the so-called "*brown study.*" The combination of fixed attitude and of unvarying expression gives to the patient the air of a statue rather than that of a living being, and he appears as if suddenly changed to stone. The most remarkable circumstance, however, in this disease is, that the attitude of the body and position of the limbs admit of being changed almost into as many new forms as a painter's lay figure, and the new position, however inconvenient, and almost volitionally impossible, is preserved till again changed, or until the paroxysm has subsided.

Besides this singular state, all consciousness is suspended, and the patient neither receives any impression from external objects, nor retains any recollection of what has happened during the fit. In this respect it approaches in character to epilepsy. The organic functions of life, however, continue to be performed, though feebly. The pulse and respiration are regular, only the former is smaller and the latter less frequent than in health. The colour of the countenance is either pale or undergoes no change. The fit may last a few minutes or a few hours, and is said to have continued three or four days. The patient at length awakes as from sleep, and generally with a deep sigh, when all the functions of the body are suddenly restored. The attack is generally sudden and without any previous symptoms, but it is sometimes preceded by headache, stiffness of the neck, or some obvious torpor of the mind or body. The return of the paroxysm is very uncertain, but the disease seldom subsides with the first attack. The following case, given by Dr. Gooch, will best exemplify this affection :—

A lady who laboured habitually under melancholy, a few days after lying-in was seized with catalepsy, and presented the following appearances. She was lying in bed motionless and apparently senseless. It was thought the pupils of her eyes were dilated, and some apprehensions were entertained of effusion on the brain, but on examining them closely it was found they readily contracted when the light fell upon them. Her eyes were open, but there was no rising of the chest, no movement of the nostril, no appearance of respiration. The only signs of life were warmth and a pulse, which was 120 and weak. Her fæces and urine had been voided in bed.

In attempting to rouse her from this senseless state, the trunk of the body was lifted up and placed so far back as to form an obtuse angle with the lower extremities, and in this posture, with nothing to support her, she continued sitting for many minutes. One arm was now raised and then the other, and in the posture they were placed they remained. It was a curious sight to see her sitting up staring lifelessly, her arms outstretched, yet without any visible signs of animation. She was very thin and pallid, and looked like a corpse that had been propped up and stiffened in that attitude. She was now taken out of bed and placed upright, and attempts were made to rouse her by calling loudly in her ears, but in vain; she stood up, indeed, but as inanimate as a statue. The slightest push put her off her balance, and she made no exertion to regain it, and would have fallen had she not been caught. She went into this state three times: the first lasted fourteen hours, the second twelve hours, and the third nine hours, with waking intervals of three days after the first fit, and of one day after the second; after this time the disease assumed the ordinary form of melancholy.

It might be supposed that symptoms such as these might be feigned; but there are cases beyond suspicion of this kind.

One very interesting case is related by Dr. George Buchanan in *The Glasgow Medical Journal* for July, 1857; and is an instance of this singular affection occurring in the male sex.

Prognosis.—The affection is generally innocent; but as it is apt to be associated with cerebral disease, which may end in cerebritis, apoplexy, or insanity, and also with serious organic disease of the viscera (Reynolds, Wood), it behoves the physician to be guarded in predicting results, especially in our ignorance of the nature of this disease.

No constant line of treatment can be stated. The individual case must be judged of upon its own merits, and prescribed for according to the principles which have guided the dictates of treatment in the allied nervous affections.

Epilepsy.

Definition.—*A complex nervous state in which, as a rule, a sudden and complete loss of consciousness prevails, associated with convulsions, as if tonic at first, but which subsequently become clonic, and ultimately impede the respiratory process. The attack lasting from two to twenty minutes is followed by some exhaustion and sleep. The expression of this epileptic state varies from the most severe paroxysm to simple vertigo, a momentary suspension of consciousness, a fixity of*

gaze, a totter of step, and a confusion which appears and disappears almost instantaneously, and which only the patient can recognize.

Pathology.—This disease has been known from the earliest antiquity, and is remarkable as being that malady which, even beyond insanity, was made the foundation of the doctrine of possession by evil spirits both in the Jewish, Grecian, and Roman philosophy.

The interest and importance which attaches to this disease cannot be better expressed than in the written opinions of Dr. Watson. He writes, that it "is scarcely less terrible to witness, when it occurs in its severer forms, than tetanus or hydrophobia; but it is not attended with the same urgent and immediate peril to life. Yet it is upon the whole, productive of even more distress and misery; and is liable to terminate in even worse than death:—a disease not painful probably in itself; seldom immediately fatal; often recovered from altogether; yet apt in many cases to end in fatuity or insanity; and carrying perpetual anxiety and dismay into those families which it has once visited" (Watson, Lect. xxxv.) Again, fully impressed with the responsibility entailed on the physician in the diagnosis between hysteria and epilepsy, and the necessity of its being certain and accurate in either case, he says, "it is a dreadful announcement to have to make to a father or a mother, that their child is epileptic" (Lect. xxxviii.)

It has been affirmed that in fifteen out of twenty cases, in which the brains of epileptic patients have been examined, the structure of that organ has been in every respect healthy. Even when the patient has died during the paroxysm, the brain has in many instances been found congested only. Epilepsy has been therefore regarded as a functional disease, the particular seat of lesion not being determined. But although epilepsy may exist without any obvious disease of the brain, or of its membranes, it must be admitted that the brain and its membranes are occasionally found in every state of disease to which those parts are liable. Thus, the membranes may be inflamed, thickened, or ossified, and with every variety of exudation; or the substance of the brain may be indurated or softened—the seat of abscess, of cancer, of tubercle, or of other structural disease. Any such structural disease is then considered to give rise to the epileptiform attack. Dr. Sieveking, whose researches into the nature of this disease have been most prolonged and laborious, recently showed me an interesting old German work in which the epileptic state was shown to have been invariably found associated with a morbid state of the *pituitary* body in the *cella turcica*—a spot of the encephalic region now very rarely examined in post mortem examinations. The tendency of modern pathology seems to be to connect the epileptic seizure

with a variety of pathologico-anatomical lesions of a variable and inconstant kind, such as have been mentioned. There are also cases referred to causes of an excentric kind, such as to uterine or ovarian disease which are thus said to act upon the brain through the medium of the nervous system, in some way unknown. Dr. Todd develops a theory of the disease suggested by the occasional occurrence of epilepsy with renal disease. He holds that the peculiar features of an epileptic seizure are due to the gradual accumulation of a morbid material in the blood, until it reaches such an amount as to operate upon the brain, as it were, in an explosive manner. In other words, the influence of this morbid matter, when in sufficient quantity, excites a highly polarized state of the brain, or of certain parts of it, and these discharge their nervous power upon certain other parts of the cerebro-spinal centre in such a way as to give rise to the phenomena of the fit. His theory assumes that the essential derangement of health in epilepsy consists in the generation of a morbid matter which infects the blood, and it supposes that this morbid matter has a special affinity for the brain, or for certain parts of it, just as strychnine exercises a special affinity for the spinal cord.

According to this theory the disease ought to have found a nosological place amongst the *constitutional diseases*. But to give a definite character to such a humoral theory it were necessary to discover some morbid matter in the blood in every case of epilepsy.

"This desideratum has, as yet, been only partially obtained.

"The clue to a discovery of this kind was first given by the observations of Prevost and Dumas upon the effect of excision of the kidneys. These observers found that the removal of the kidneys always led to an accumulation of a considerable quantity of urea in the blood, followed by convulsions and coma,—an epileptic state.

"After this, clinical observations by practical physicians showed that disease of the kidney was apt to be followed by attacks of convulsions and coma, when the excretion of urine fell in quantity to a very low amount; and it was found that, in such cases, a considerable quantity of urea was present in the blood.

"A connection was clearly thus established between the presence of urea in the blood, defective renal action, and the epileptic condition. But whether the active poison is urea, cannot yet be decided. Frerichs, indeed, has lately affirmed, that it is carbonate of ammonia, a product of the decomposition of urea. But even this is still *sub judice*. All that we really know is, that in certain states of diseased kidney, when the excretion falls below a certain point, urea will accumulate in the blood, and epileptic seizures will ensue; and, should the patient die, we find no brain-lesion to explain the phenomena; but we find unequivocal evidence of diseased kidney."—(Clinical Lectures, by Dr. R. B. Todd, *Med. Times and Gazette*, Aug. 5, 1854.)

In the present state of our knowledge, therefore, and knowing

that there are a great many cases in which the epileptic phenomena have recurred during a long period, and in which post mortem examination reveals no lesion with which symptoms can be connected, it is better to consider epilepsy as an intrinsic disease of the brain, because the most constant and marked groups of phenomena are referable to the functions of the central parts; while the loss of consciousness associated with excessive mobility, leads one to regard those parts of the brain in the immediate vicinity of the *cella turcica* and basilar portion of the occipital region, for example, the central ganglia or medulla oblongata, as parts where, in future, morbid anatomy may yet discover a lesion.

Symptoms.—Epilepsy has no varieties, but it may be grave or slight. The attack of this disease often occurs without any previous warning; so much so, that Georget estimates, that in 95 cases out of 100 there are no premonitory symptoms. These warnings are known by the term "*aura.*" It comprises all the premonitory symptoms which may prognosticate the approach of a fit. Dr. Sieveking has noted such "warnings" in 27 out of 52 cases. Many patients, however, on the approach of the fit, have vertigo or headache; some swelling of the veins, or throbbing of the arteries of the head; while others again have ocular spectra or affections of the other senses.

Dr. Gregory used to mention, in his lectures, the case of an officer whose paroxysm was always preceded by the spectre of an old woman dressed in a blue cloak, who issued, as he imagined, from the corner of the room, and knocked him down with her stick. Dr. Fothergill attended a Quaker who always fancied he saw his garb covered with spangles before he fell into the fit. These ocular spectra are very numerous; but the most common are flashes of light, tadpoles, flies, coloured areolæ around the flame of the candle, black dogs and white horses. Others have hallucinations of the ear, as the ringing of bells, or the roaring of the sea, while others again are annoyed by the smell of disagreeable odours, or by the sensation of unpleasant tastes.

When the sense of touch is the seat of the hallucination, the term "aura epileptica" is used to express it. In these cases the patient has often the sensation of a fluid creeping from the fingers or toes upwards towards the trunk; others feel as though a spider or other insect were crawling over the skin. Dr. Elliotson speaks of a patient that had two auræ, each of which ran along the dorsum of each foot, ascended up the front of the legs and thighs to the trunk, where they broke into five streams, all of which again met at the epigastrium, and, having reached this point, he fell into the fit. The late Dr. John Thomson, of Edinburgh, relates an instance of an epileptic "aura" commencing in an old cicatrix in the side; and Dr. Watson mentions the warning sensation as originating in

the thumb of one of his patients, which presently became twisted inwards; and he could sometimes prevent the complete expression of the fit by tying his handkerchief tightly round it.

Esquirol relates the case of a woman, in which the prodrome consisted in the patient turning round for a considerable time; and another of a man, in which the patient ran with all his might, till at length he fell down, overpowered by the disease.

Although these sensations may be subjective and experienced only in the skin, and not following the course of any particular nerve, yet their subjective origin may "be due to some injury done to, or some morbid impression made upon an *afferent* nerve," as well as to some morbid condition of the brain itself.

Regarding the frequency of the occurrence of individual symptoms, Dr. Sieveking's experience is given in the following statement:—

"Headache is a very frequent concomitant of epilepsy. It was observed in 33 out of 52 cases, or 63·42 per cent. The mode of its occurrence varies; the patient either suffers habitually or very frequently from it, and the symptom bears no immediate relation to the paroxysm; or the headache occurs shortly before the fits, so as to usher them in; or again, it affects the individual after they are over. It was constant or frequent in 36·5 per cent.; it occurred before the fits only in 7·7 per cent.; it occurred after the fits only in 17·3 per cent. Biting the tongue is justly regarded as an important corroborative symptom; but it is by no means uniformly present, nor does it constantly occur in the different paroxysms affecting the same individual. The tongue was bitten in 17 cases, or 32·7 per cent. The urine was tested for albumen in 19 cases, and it was found temporarily present in 1, permanently in 1. It was also tested for sugar in 14 cases, and this ingredient was not found once."—(*Med. Times and Gazette*, May 23, 1857).

In the *adult*, whether the warning symptoms be or be not present, the attack usually commences by the patient uttering a cry, losing on the instant all consciousness, and falling down in convulsions, his mouth being covered with foam. The convulsions vary from the most trifling and transitory convulsive movement, to the most frightful, terrific, and long continued struggles. In mild cases only one limb is convulsed; in others, only the face, the lip, or the eye. Esquirol gives the case of a lady whose fits were so slight that although often seized on horseback she never fell off. In a few seconds she recovered, and resumed the conversation by finishing the sentence she was expressing. In this case, however, the epileptic cry and the convulsed eye denoted the true nature of the attack. Another lady, advanced in life, suffered from fits so slight, that she preserved her seat in the chair; and, except for the occurrence of some slight convulsive motions about the mouth, followed by a short sleep, the attack would have passed unnoticed. Attacks

so mild often occur many times in the day, last about five minutes, and appear for a time to leave no feeling of ill health behind.

In severe forms of the disease the convulsions are more formidable; the hair stands on end, the forehead is wrinkled, and the brow is knit. If the lid be opened, the eye is seen to be injected, sometimes convulsively agitated, at other times in a state of strabismus, and sometimes fixed; more commonly the lid is quivering, and half open, so as to show the white of the lower portion of the conjunctivæ. The face is red, or livid and swollen; the teeth generally clenched, and the lips covered with foam; sometimes, however, the mouth is open, and the tongue thrust forward; and should the masseter muscles now act spasmodically, it may be bitten through, or otherwise much injured, and the foam consequently be mixed with blood. The force with which the jaw closes is so great, that teeth have been known to be broken and the jaw luxated. The limbs also are violently convulsed, thrown about in every direction, and with such power, that it often requires three or four persons to prevent the patient seriously hurting himself. In these convulsions, also, the hands are strongly clenched, and the body often arched backwards, as in opisthotonos, when, on the muscles relaxing, the patient may fall to the ground with great force. While the limbs and trunk are thus powerfully agitated, the muscles of the chest are often spasmodically fixed, so as hardly to permit the acts of respiration.

The functions of organic life are also implicated in this scene of tumult. The pulse is generally frequent, sometimes hard and intermittent, and at other times scarcely perceptible, although the heart beats strong and tumultuously. The respiration is stertorous; the stomach and bowels troubled with borborygmi; the skin bathed in sweat, while the urine, semen, or fæces, are occasionally emitted. Blood also sometimes flows from the eyes, ears, or nose, frightfully expressive of the violence of the attack.

When the paroxysm has reached its crisis, the muscles relax, the convulsions subside, the respiration becomes more free, the pulse more regular, and the countenance more natural; and at length the patient falls into a heavy sleep, from which he awakes sometimes in good health, but more often shaken, exhausted, and suffering from severe headache, which lasts some hours or even days. In neither case, however, has he the slightest consciousness or remembrance of what has passed. In other instances the termination of one paroxysm is but the beginning of another, and the succession is occasionally so continued that the attack, with short intermissions, may last twenty-four or forty-eight hours, or even longer.

When *children*, from teething or other causes, are seized with epi-

epsy, the attack is often preceded by a spasmodic affection of the larynx, causing the whooping or crowing sound so well known to every practitioner; but it may and often does take place without any warning. In the former case, the child perhaps is in his best health, but on awakening is seized with the characteristic whoop, often accompanied by a spasmodic flexion of the thumb against the palm; or the fingers are clenched, or the toes bent. These symptoms may recur a varied number of times, till at length, with or without this warning, the eye is seen staring, fixed, or convulsed; the face and extremities pale or livid; the hand clenched, the body rigid, and the head and trunk curved backwards. The fit is now formed; and if we examine the fontanelle, we find it distended and pulsating. These symptoms generally last only a few minutes, when a strong expiration takes place: a fit of crying succeeds, and the child, much exhausted, recovers its consciousness, and, after a short interval, generally falls asleep. These convulsions seldom occur during the early periods of lactation, nor until the commencement of the period of dentition, and not after three years of age.

The duration of the paroxysm is very various. In children it seldom, as has been stated, lasts more than a few minutes. In the adult it often does not exceed that period; but in many cases it lasts half an hour to two hours, while in others the greater part of the day passes before the paroxysm terminates.

It seldom happens that the paroxysm occurs but once. In the mildest case in the child, it is commonly repeated three or four times in the course of the first three or four years of childhood, while in other cases it will occur three or four times in the day; and in severe cases the child is hardly out of one fit before it falls into another, till at length they gradually subside. In the adult, the frequency of the fit varies extremely in different patients. In some instances there is an interval of several years; at others it returns annually, or every six months, or mensually, weekly, or even daily, while others will have twenty or thirty fits in the course of the same day. The paroxysm, however, returns not only periodically, but also at every irregular interval. The period of the day the attack takes place is also very varied, for it may occur during the day, at night when asleep, or in the morning when just awakening.

Causes.—When epilepsy is the result of a powerful original tendency, it often occurs without any apparent cause, and when the patient is in his best health. The effects of moral causes in its production are so well known, that Raphael has introduced into his picture of the Transfiguration, a boy falling into an epileptic fit. Fright is considered a very common cause. Dr. Webster says that one of the worst cases he had ever seen was that of a young female

who was frightened by seeing a young man dressed in a white sheet, personifying a "ghost." Besides moral causes, errors in diet, excess of any kind, blows on the head, every structural or functional disease of the brain, and especially insanity; or any severe disease, as fever or small-pox, are all powerful remote causes. In children, the irritation of teething is the most common cause.

The large number of children that die of this disease has been mentioned; and indeed in France epilepsy is often termed "mal des enfans." Puberty is the next most frequent period at which death occurs; and its frequency as a primary disease decreases from that time till fifty, when it again increases, from the tendency the brain now has to insanity and to structural disease. As epilepsy is common in idiots whose heads are deformed, it has been affirmed that mankind become more liable to this disease in proportion as the facial angle approaches to 70°. There are many exceptions, however, to this statement.

It is supposed that in infancy, and under seven years, epilepsy occurs in nearly equal proportions in both sexes. After puberty, when the distinction of sex is marked, some authors contend it is more common in males than in females: Dr. Elliotson thinks in the proportion of 27 to 11: Esquirol, however, states that, on comparing the number of epileptics at Bicêtre and at Saltpêtrière, the number of women attacked was one-third greater than that of the men.

In an analysis of the Returns of the Registrar-General, given by Dr. Sieveking, with reference to the mortality from the disease in either sex, during the past seven years, it appears that 6,729 were males, and 6,149 females, giving a relative proportion of 52·26 males to 47·73 females. Dr. Watson also states that he has seen "more epileptic boys and men than girls and women." Dr. Webster is of opinion that the disease is on the increase in this country.

Dr. Sieveking could trace hereditary tendency in 11·1 per cent. of his cases. Dr. Webster believes, from a combination of his own investigations with those of Esquirol and others, that *one-third* of the cases may be traced to hereditary descent. There is no doubt that a tendency to the disease is frequently hereditary. It may pass from parent to child; or it may skip over a generation or two, and appear in the grandchild or great-grandchild. The scrofulous diathesis is also a strong predisposing cause of epilepsy.

"There are certain vices," writes Dr. Watson, "which are justly considered as influential in aggravating, and even in creating a disposition to epilepsy. Debauchery of all kinds, the habitual indulgence in intoxicating liquors; and above all, the most powerful predisposing cause of any, not congenital, is *masturbation*, a vice which it is painful and difficult even to allude to in this manner, and still more difficult to make the subject of inquiry with a patient. But there is so much reason to be certain that

many cases of epilepsy owe their origin to this wretched and degraded habit; and more than one or two patients have voluntarily confessed to me their conviction that they had thus brought upon themselves the epileptic paroxysms for which they sought my advice."—(Lect. xxxvi.)

Sir Charles Locock attributes the great increase of the disease during late years to the cause last mentioned in the above quotation (Medico-Chir. Society's Report, *Medical Times and Gazette*, May 23, 1857). Irregularity and perverted state of the menstrual function associated with hysteria, is another frequent source of the malady, according to this observer.

The repulsion of eruptions, and especially those about the head, are also to be set down as causes which bring about the development of the disease; so are some of the constitutional diseases, such as rheumatism.

Diagnosis.—An immeasurable responsibility is associated with the diagnosis of such a disease, and as already seen, the very slightest cue may be all which may be given to distinguish the epileptic state. It is especially to be distinguished from *apoplexy* and *hysteria*. The following are the classified grounds of diagnosis as given by Dr. Reynolds :—

(1.) *The Mental State* of the epileptic is thus far characteristic. By far the greater number exhibit a deficiency of the powers of the will in relation especially to *thought*, *emotion*, *sensation*, and *mobility*. The mind is inclined to wander in a half abstracted state, and without energy of purpose. There is little or no power of attention or concentration of thought, and there is a slowness of apprehension with defective memory. The emotions and their expression are undirected and uncontrolled. The patient can only give unsatisfactory and often totally unmeaning accounts of sensations experienced. Something is felt to be wrong, but the place can hardly be fixed upon; and if the head, thorax, abdomen, or limbs are referred to, the patient is rarely able to express what he has experienced. A "working in my inside" is the comprehensive phrase commonly used to express their indescribable sensations. There is also a characteristic sluggishness and clumsiness of the voluntary movements. The walk and manner of the patient become ungainly He rolls along rather than walks, stumbling over objects in his way, in what appears an unnecessarily awkward manner. The countenance tends also to be dull, expressionless, and morose. These phenomena may be so slight as almost to escape detection; and may in many cases be overcome by a determined effort of will. Sometimes, on the other hand, they are extremely well marked, and graduate into utter stupidity and dementia with paralysis.

(2.) The *Motorial*, and (3.) *Sensorial* phenomena, are such as have been described under the head of *symptoms*.

The attacks may be distinguished into two groups, namely :—

(1.) Those in which the loss of consciousness is complete, associated with violent spasmodic movements. This group comprehends "le haut mal" of the French authors; and the laryngismal and tracheal epilepsy of Dr. Marshall Hall.

(2.) Those in which one element predominates much over the other, even to its entire exclusion :—(*a*) Attacks in which loss of consciousness being complete, there is little or no spasmodic movement. This class includes "le petit mal" or "vertigo epileptiforme" of the French, and the syncopal attacks of Dr. Marshall Hall. (*b.*) Attacks in which there is marked general or partial spasms of the muscles, somewhat of a tonic kind, but in which there is no appreciable loss of consciousness. Such seizures constitute the "abortive" attacks of Dr. Marshall Hall.

One individual afflicted with epilepsy frequently presents every variety of these attacks, while any one form may exist alone.

The essential features of a fully expressed epileptic attack, cannot be mistaken. They consist of—(1.) the simultaneous occurrence of the following symptoms : complete loss of consciousness, general quasi-tonic contraction of the muscles, impeded respiration, darkened face and surface generally with distended jugulars, dilated pupil, distorted features, throbbing carotids. (2.) These phenomena are quickly followed by—persistent unconsciousness, clonic violent muscular contraction, laborious respiration, with tracheal gurgling noises; slight return of colour in the face and body generally; oscillation of the pupil and eyeball; chewing movements of the jaws and foaming at the mouth. (3.) The gradual cessation of these symptoms and the production of another stage, marked by the following characters :—return of consciousness for a short time, with an aspect of astonishment, alarm, and suspicion; and then followed by drowsiness or profound coma; occasional semi-voluntary movements, such as change of position; laboured slow respirations with stertor and tracheal rattle; paleness of face, coldness of surface, with perspiration; the pupils often contracted, and the conjunctivæ injected. (4.) After sleep, the patient becomes more natural in manner, feels some headache and general soreness.

In the diagnosis of epilepsy, it must be always borne in mind, especially in dealing with soldiers, seamen, prisoners, mendicants and vagabonds, or others with whom powerful motives often prevail to feign diseases, that epilepsy is perhaps more frequently attempted to be copied than any other; and often with wonderful success. The means of detection consist :—

(1.) In cross-examination as to the consistency or inconsistency of the accounts of the fits and general description of the attacks. This can only be well done, when a perfect knowledge of the symptoms and grounds of diagnosis are familiar to the student.

(2.) By observing whether or not a situation (favourable always to the malingerer) is chosen for the seizure.

(3.) True epileptics seek retirement; and are frequently hurt by their falls. Feigned epileptics delight to exhibit in public, and rarely sustain any bodily injury.

(4.) Let the eyes be closely observed. In true epilepsy they are partly open, with the eyeballs rolling and distorted, the pupils dilated, and not contracting by the stimulus of light. The feigning epileptic prefers to shut his eyes completely; and may occasionally be seen to open them to "take a peep," so as to ascertain the effect of his exhibition. *His iris always acts on exposure to the light.*

(5.) The skin of an impostor generally perspires from his exertions; that of a true epileptic in the paroxysm, is generally cold.

(6.) An impostor will not readily bite his tongue, or void his excrements or urine.

(7.) Tests peculiar to beadles and police constables consist in dropping melted wax upon the suspected feigning person, putting some gin into the eyes, pressing the thumb nail with force under that of the supposed impostor, an experiment productive of sudden, excruciating, and harmless pain.

(8.) The mere speaking or proposing some severe remedy in the presence of the patient, is sometimes enough to detect imposition. Dr. Watson, from whose *Lectures* these statements have been condensed, specially recommends a very harmless and ingenious device, namely, in the hearing of the would-be-patient, gravely to propose to pour *boiling water* on his legs as a remedy, and then to proceed actually to pour *cold water* upon them.

Three humorous instances of detection are thus related by Dr. Watson:—

"Dr. Cheyne mentions an instance in which one table was placed upon another, and a soldier who was supposed to be shamming was laid upon the upper one, while his paroxysm was on him. The fear of falling from such a height soon stopped his convulsions. Mr. Hutchinson relates the case of a sailor who was suspected to be a cheat, in whom the convulsions were instantly removed by blowing some fine Scotch snuff up his nostrils through a quill. This brought on another kind of fit, namely, a fit of *sneezing*, which lasted nearly half an hour; and there was no return of the epilepsy so long as Mr. Hutchinson remained in that ship. He tried the same expedient in cases of *real* epilepsy, but never could produce any similar effects, although the patients were not snuff-takers. There was a beggar in Paris, who often fell into epileptic fits in the streets. One day some compassionate spectators, fearing that he might injure himself in his struggles, got a truss of straw and placed him upon it; but when he was in the height of the paroxysm and performing remarkably well, they set fire to the straw, and he presently took to his heels."—(Lect. xxxvi.)

Prognosis.—Epileptic convulsions during teething generally sub-

side about the second or third year; children, likewise, first seized between three and four years old, are often cured, or the disease often subsides at puberty, except when hereditary. Hippocrates imagined that epileptics attacked after puberty are incurable, and this is certainly the fact when epilepsy is conjoined with insanity. Pregnant women attacked with epilepsy are in great danger.

As to the positive certainty of any cure for the disease, a proper feeling of scepticism prevails. In the majority of cases no anatomical lesions exist even after a long series of years in which the recurrence of the fits have been more or less constant. According to the belief of Dr. Sieveking and of others, a diathesis is necessary to their occurrence, and this may be suppressed or held in check; but it is very doubtful if it can be eradicated. Nevertheless, well selected remedies have a power in repressing the paroxysm, and often of indefinitely postponing it;—more especially dietetic and regimenal treatment. The number of apparent cures in Dr. Sieveking's cases was in the ratio of 28·85 per cent.; and in other instances more or less benefit was obtained. The duration of the disease before treatment is commenced has an obvious influence over its curability.

"It is seldom," writes Dr. Watson, "that any permanent ill effect can be noticed as having been left behind by any one single fit; but, unhappily, this cannot be said of their repetition." "More, probably, depends," he continues, "upon the *repetition* of the fits than upon their precise *nature* or *severity*."

Aretæus, in describing the symptoms of epilepsy, has not neglected to speak of the baneful influence of this disease on the intellect, of the memory being lost, of the imagination being impaired, and of the functions of the brain being, in many patients, so subverted that they fell into incurable insanity. Esquirol gives the cases of 385 epileptics under his care, in the hospital Salpêtrière, and he states that four-fifths were more or less insane. The remaining fifth had preserved their reason, but, he adds, "a reason so broken!"

"A single paroxysm often leaves the patient in a worse condition than that in which it found him, but this is not perceptible to an ordinary observer, until after the alteration has been rendered apparent by repeated fits, and repeated small additions to the permanent injury. The friends of the patient remark that his memory is enfeebled in proportion to the number of the attacks; that his mental power and intelligence decline. His features even assume by degrees a peculiar character, and too often he sinks into hopeless fatuity, utter imbecility, or confirmed insanity. It is this tendency which renders epilepsy so sad and fearful a disease. . . . Cases do occur in which epileptic persons preserve their faculties to a good old age; but those who are early epileptic do not often attain old age; and whenever the disease comes on, if it repeat itself frequently, it is

followed much more often than not by impairment of the mind or by some apoplectic or paralytic affection."—(WATSON, Lecture XXXV.)

Such are the phenomena associated with the paroxysms of epilepsy,—a disease not only frightful from the violence of the symptoms, but also from the serious effects it may produce on the moral character as well as on the physical frame of the unhappy patient. While some may fall into the fire and may be burnt to death, others fall into the water and may be drowned, although the pool may be but a few inches deep (CHEYNE). Bruises and fractured limbs are also not unfrequent. Many epileptics have a convulsive action or *tic* of the muscles of the face, or their legs waste and are unable to support the weight of the body. In some instances the leg has been flexed under the thigh, a contraction which has lasted more than a year, while, in others, the patient has become paralytic.

Treatment.—The treatment divides itself into what is to be done during the paroxysm, and subsequently during the interval.

The best practitioners are of opinion, when adults are labouring under the paroxysm, that, in general, little can or ought to be done except bringing the patient into fresh air, taking off what may be around the neck, and baring the chest, together with the more imperative duty of preventing the patient doing himself any injury. Bleeding, so often had recourse to, except in parturient women, is rarely found beneficial, and is supposed, in many instances, to prolong the attack. If, however, the paroxysm be greatly prolonged, cold to the head, and opening the temporal artery, where symptoms of excessive cerebral congestion are obvious, may be of some service.

The paroxysm passed, the probable cause should be investigated, and if possible removed; the state of the bowels should be particularly inquired into and regulated, and leeches should be applied to the temples, if the headache be severe. In women, also, the catamenia, if defective or excessive, should be remedied. These few simple rules are of the first importance, not only as removing the immediate inconveniences incident to the attack, but also as a means of prolonging the interval, and, perhaps, preventing its future occurrence. In a few instances, the patient by their adoption is cured; but too commonly the fit returns, and then it must in candour be admitted that the pharmacopœia at present furnishes no efficient curative remedy. The most usual remedies employed are *valerian*, *iron*, *zinc*, *quinine*, *musk*, *opium*, *asafœtida*, *mercury*, *the iodide and bromide of potassium*, *camphor*, *æther*, *and the preparations of turpentine*. The *nitrate of silver*, once esteemed a specific in this complaint, has not only failed, but, by occasionally staining the rete mucosum of a dingy blue, has often permanently disfigured the patient. Of the long catalogue which has been mentioned, each medicine, is, perhaps, useful for a few weeks; but after that period

its good effects are, for the most part, lost ; so that it would appear to act rather mentally than physically, in removing the cause and altering the morbid tendency.

"Whatever remedies or course of treatment you pursue," writes Dr Todd, "do not appear to despond, or use any other language to the patient than that of hope. Avoid extravagant promises, as inconsistent with that love of truth which ought to characterize every professional man; but unless you have the strongest evidence against it, do not yourself, nor allow your patient, to abandon hope."—(Clinical Lectures by Dr. Todd, *Medical Times*, August 12, 1854.)

The judicious use of an anthelmintic sometimes frees the patient from the disease as well as from a tape-worm or other parasite which not unfrequently may be the *eccentric* source of the fits. Independently of its anthelmintic properties, however, Dr. Watson strongly recommends the use of turpentine in half drachm doses every six hours.

In cases in which epilepsy is conjoined with insanity, every attempt at the cure of the patient has been painfully unsuccessful. Esquirol states, that at Salpêtrière, he tried, on 339 epileptics, "bleeding" in all its forms, purgatives of all kinds, baths of all temperatures, as well as every kind of vegetable or mineral antispasmodic. But, as the result of his great experience and vast variety of practice, he found that every new remedy suspended the access for about a fortnight, and, in some cases, for one, two, or three months. After these periods, however, it always returned, so that he never saw one case in his hospital practice cured, nor was he more successful in his private practice ; for although the paroxysm was often suspended by the confidence inspired by consulting a new physician, yet the remission or suspension was short, and the disease always re-appeared. He concludes that hysteria may have been mistaken for epilepsy, and cured, but not epilepsy itself.

With respect to local or derivative treatment, as issues, setons, and actual cautery, he states that, when Pariset went to Cadiz to investigate the nature and causes of the yellow fever, raging in 1821 in that town, he was left in charge of Salpêtrière, when he found twenty epileptics treated with two, three, or more moxas on the vertex of the head, which had burned down to the external table of the skull. These wounds he kept open with great care, but not one patient was cured. In a young epileptic, whose fits were preceded by an "aura" commencing in the great toe, he cauterized that part down to the bone. The aura epileptica disappeared, but the paroxysms became more frequent and more violent.

Although the medical treatment of the adult is so unsatisfactory,

yet the treatment of epilepsy occurring in children during teething is almost always successful. The practice, on the child falling into a fit, is immediately to place it into a warm bath, and to pour cold water on its head, to lance its gums, and to administer an enema. These means generally restore the child; and the after treatment is to apply a few leeches to the head, to purge the bowels with calomel, either alone or combined with some other cathartic, and to diminish the quantity and quality of the diet. These means are all that the case will admit of, and they are very generally successful. Bleeding should be used with great moderation, for these fits in children seldom affect the intellect, and have a tendency to subside spontaneously in a very few months. When depletion, however, is carried to excess, the child's health is greatly broken, and the probability is, that the brain is rendered more irritable and the fits more frequent. Slight opiates, by soothing the irritation of the mouth, are useful in every stage of the complaint, and when greatly debilitated some mild tonic treatment may be necessary to restore the little sufferer.

Dietetic Treatment.—In the adult the diet should be light, and the patient should live temperately. He should live by rule. He should rise early, and take regular exercise in the open air, keeping his head cool and his feet warm. The diet of an infant so affected should be, if possible, its mother's milk, with or without arrow-root. If above three or four years of age, its diet should consist entirely of farinaceous or of other light vegetable food.

Hydrocephalus.

Definition.—*Hydrocephalus is an effusion of serous fluid between the membranes of the brain, or into its ventricles. The affection may be acute, congenital, or caused by some disease or defective development of the brain during fœtal life, or it may occur at some period in after-life as an original disease.*

Pathology.—Hydrocephalus was very little known till Dr. Whytt published his *Observations on Dropsy of the Brain*, in 1768; but since that period Dr. Fothergill, Dr. Watson, Dr. Cheyne, and a large number of other writers have contributed to illustrate its nature.

There are a few cases in which effusion of serum into the ventricles, or into the cavity of the arachnoid, is unaccompanied by any morbid appearance of the brain or of its membranes whatever; and thus there are many instances in which hydrocephalus is not demonstrably inflammatory. More commonly, however, some lesion of the brain or its membrane does exist. Thus the substance of the brain is often marked with more bloody points than usual;

the septum lucidum, the fornix, and other parts forming the walls of the ventricles, are often found in a state of softening, sometimes so soft that Golis gives a case in which water could be expressed from it as from a sponge. The membranes also are sometimes congested, or opaque and thickened, with spots of lymph, evidently the effect of a low inflammation.

The quantity of fluid effused varies from a few teaspoonfuls to seven or eight ounces; and of this the greater part is generally contained in the lateral ventricles, which from this cause are often so enlarged and distended that the finger placed on the brain immediately over the ventricle is sensible of a distinct fluctuation, while the anterior portion of the fornix is often so raised as to cause a free communication with the third ventricle, and, perhaps, with the fourth, at least the effused fluid is found likewise distending those cavities. The quantity of fluid effused between the membranes is also often very great, sometimes filling the whole cavity of the arachnoid as well as the ventricles. Dr. Abercrombie has found serum effused even between the cranium and dura mater, and so also have other observers, a circumstance hardly known in any other disease. The choroid plexus or ventricular membrane, although in general pale and healthy, yet sometimes has the intercellular tissue so infiltrated that it appears studded with small cysts.

The more frequent accidental occurrences are tubercles in the brain or membranes, and some congestion, perhaps, of the mucous membrane of the intestinal canal; but whether the latter is a primary affection or the result of the violent medicines which are sometimes had recourse to in this affection, is not determined. Dr. Joy has remarked that the peculiar green colour of the stools so frequent in this affection is imparted to them in the lower portion of the intestine, the fæcal contents of the upper portion being of a pale drab colour, while the bile in the gall-bladder is of a yellow colour.

The first thing that strikes us on examining those patients who suffer from the chronic form of the disease, is the enormous *size* of the head. The adult head averages about twenty-two inches in circumference. Dr. Bacon gives the case of a child whose head at three months had attained the enormous size of twenty-nine inches in circumference (*Medico-Chirur. Transact.*, vol. viii.) The head of Cardinal, a celebrated hydrocephalic man about London, long in St. Thomas's Hospital, and who afterwards died at Guy's, measured thirty-three inches and a-half. There are instances, however, in which the cranium has been found unusually small, and of a conical shape, the sutures being closed before birth, and in these cases the children are still-born, or die shortly after delivery. When the disease comes on at later

periods of life, and after the sutures are closed, the size of the skull is natural.

The *form* of the hydrocephalic head is also sometimes very irregular, one side being much larger than the other, while the base of the orbits is for the most part convex instead of concave, thrusting the eye unnaturally forwards. On cutting through the skull the bones are found to be remarkably thin and transparent. The sutures also, although generally closed towards the base of the skull, are commonly separated from each other by a wide extent of membrane at their superior portions. If, however, the patient should survive for several years, the membranous portion becomes ossified by a number of points forming "ossa wormiana," and the sutures are thus partially closed. In some very few instances the sutures not only close, but the bones of the skull have a morbid thickness, which thick and large skulls, Dr. Joy conceives, on being dug up have been mistaken for those of giants.

The membranes of the brain are generally thickened, and the fluid found effused either into the cavity of the arachnoid, into a cyst, or into the ventricles of the brain. When the fluid is contained within the cavity of the arachnoid, the brain is sometimes so compressed that there are instances in which hardly a vestige of that organ remains. A singular and rare variety of this affection occurs, when the arachnoid sometimes protrudes through the fontanelle or open suture, and the dura mater and integuments yielding, a pyramidal bag with its apex downwards forms externally, which hangs low down the back like a jelly-bag.

When the effused fluid is contained in the ventricles, those cavities are found exceedingly dilated. The convolutions have no depressions, but appear unfolded. The corpus callosum is much raised, the septum lucidum is torn and destroyed, or the grey commissure destroyed, and the white commissure elongated to the extent of an inch, so that the ventricles communicate. The parts at the base of the brain also, as the corpora striata and thalami opticorum, have scarcely any existence. In fact, the brain seems expanded into a large sac, in which the medullary and cortical substances are so confounded as to be undistinguishable. In Dr. Bacon's case the brain and membranes, even the dura mater, had ruptured, and a probe passed easily through the ethmoid bone into the nose, by whose orifices a considerable dribbling of the fluid took place during life. Golis met with a case in which the water was contained in a cyst the size of a goose's egg, situated between the hemispheres of the brain of a child aged six years, and who died, the cyst being entire.

The quantity of fluid contained in the cranium in cases of chronic hydrocephalus varies from a few ounces to a few pounds. In the

case of Cardinal it was found to exceed ten pints; nine pints in the cavity of the arachnoid and one pint in the ventricles. Other cases have been, however, recorded, in which the quantity has amounted to twenty pints.

Authors have greatly differed as to the nature of this disease. Some considering it a mere increase of fluid from functional activity, have named it *dropsy of the brain*, while others have as constantly referred it to an inflammatory origin, but they have generally concurred in describing an acute and chronic form.

Symptoms.—Acute hydrocephalus is divided into three stages; the first stage, according to Dr. Cheyne, being that of increased irritability; the second, that of diminished sensibility; and the third, that of convulsions or palsy.

The first stage may be either sudden in its attack, or be preceded several days by giddiness, so that the child stumbles or falls at play; by a furred tongue, constipated bowels, and, perhaps, offensive breath. At length the senses of sight and of hearing become morbidly acute; he starts at slight noises—complains of intermitting headache—rests his head on his nurse's lap—occasionally complains momentarily of his head—and then, after a time, rises up and plays again. As this stage advances the pulse rises, the skin is hot and dry, the urine scanty, the stomach irritable, the bowels constipated, perhaps painful, the stools black and offensive, while the brow is knit, and the pupil of the eye contracted or expanded. The most remarkable feature, however, is a great fretfulness of temper, so that the child is not merely pettish, but quarrelsome. If he sleeps, his sleep is short, uneasy, moaning; he also grinds his teeth, rolls his head, and when he wakes up it is with a scream. To sum up the phenomena of this stage in the language of Dr. Cheyne, "We are led to suspect some deeply seated evil from the frantic screams and complaints of the head and belly, alternating with stupor, or rather lowness, and unwillingness to be roused."

In much of this description some of the phenomena of meningitis may be recognized, and, doubtless, a great number of the acute cases are associated with this morbid state already described. (Pp. 491—498).

The second stage commences when effusion has taken place; and now the pulse, instead of being rapid, is as slow, perhaps slower than natural, but this is chiefly when the patient is in a horizontal position, for if he attempts to sit up it again becomes rapid; the sickness is also abated; nevertheless the child lies in a state of stupor and of great unwillingness to be moved, with his eyes half-closed, dull and heavy, or perhaps staring or squinting, the pupil being still contracted or expanded, and he often suffers from double vision. The stupor, however, is still interrupted by exclamations

or shrill piercing screams, while the tremulous hand of the little sufferer is incessantly engaged in picking his nose or mouth.

In the third stage the patient either sinks or recovers. If the event is unfavourable the pulse again rises, the eye becomes red and dim, and the child, delirious, is often attacked by partial or general convulsions; or one limb or one side may be palsied. From this point the powers of life gradually sink, till at last death closes the scene. If the patient should fortunately recover, the stupor subsides, the countenance becomes more natural, the bowels more regular, the secretion of urine perfectly restored, and at length his health, though long broken, is gradually re-established.

The duration of this disease is estimated at about three weeks, each stage averaging about a week.

There are two forms of chronic hydrocephalus, the internal and the external or hydrocephalus in which the membranes protrude. In either case, when this disease is fully formed, whether it be congenital or subsequent to birth, the child is generally of the most feeble intellect, irascible, often epileptic, and of extreme muscular debility, so that if not palsied he is hardly able to walk. Dr. Baillie met with an instance of chronic hydrocephalus in a man aged fifty-six, and whose ventricles contained six ounces of serous fluid. His chief symptoms were pain in the head, and a loss of memory so great that he could recollect only five words, which he continually reiterated to express all his wants. Cardinal, whose case has been mentioned, had more memory, and he prided himself, says Dr. Elliotson, in being able to say "The Belief," but he usually stumbled when he got to "Pontius Pilate." This man was epileptic, of very feeble intellect, and so irascible as to be always quarrelling with the patients, and would have been extremely difficult to manage except for his muscular debility. Heberden, however, mentions a case in which eight ounces of water were found in the ventricles, and yet no symptoms of hydrocephalus existed during life.

Causes.—The remote causes of this affection are often extremely obscure; but exposure to cold or heat, errors in diet, falls or blows on the head, the retrocession of a cutaneous eruption, or the extension of an inflammation of the ear, are among the most common. Disordered function of the liver or alimentary canal is also a frequent cause, and so is dentition, or the presence of worms; and the circumstance of a child being seized in consequence of its feet having by accident been put into a bath of boiling water, will show that any other extreme irritation will equally produce it. Many morbid poisons also will occasion it, as that of scarlet fever, of pertussis, or of measles; of *constitutional* diseases, tubercles of the brain are the most common exciting cause.

The epochs of infancy and childhood exercise a most remarkable

predisposing influence to this disease At those periods the rapid growth of the brain, the irritation of dentition, and the great susceptibility of the nervous system generally, are all powerful causes of determination of blood to the head. The greatest number of attacks, according to Percival, occur between the second and the fifth year; or, as a more general law, the disease occurs from infancy to twelve years of age. Children with large heads and precocious intellects, and more especially those of a scrofulous diathesis, are its most frequent victims. One warning may be learned from this disease; namely, that it is most common in the children of parents addicted to drunkenness, and from this cause it often runs in families.

Although it has been stated that this disease may occur during fœtal life, and is more common in the early periods of infancy and childhood; yet adult age is not altogether free from it, and Golis has mentioned three cases of persons attacked in old age, two of whom were above seventy, while the other, perhaps less advanced in life, suffered from this affection for ten years. It seems sometimes to run in families; at least Frank mentions a family of seven children, all of whom were born with this disease; and Golis, another, in which six children were aborted hydrocephalic at six months; while three others, born at the full period, were attacked shortly after birth.

Diagnosis.—Hydrocephalus is distinguished from typhus fever by the screaming, rolling of the head, grinding of the teeth, and by the absence of the peculiar tongue which marks the latter disease.

The external characters of chronic hydrocephalus are so extremely marked that it is hardly possible to mistake them. The diagnosis generally is established from the general external appearance and phenomena. There is always intense marasmus, although food may be taken.

There is a morbid state resembling the disease which is neither *acute* nor *chronic*, to which Dr. Watson gives the name of *spurious hydrocephalus*. To three great men of the past we owe our knowledge of this condition, namely, to Gooch, Abercrombie, and Marshall Hall. In children, from a few months to two or three years of age, of small make and of delicate health from exposure to debilitating causes, this morbid state not uncommonly supervenes. It is indicated by heaviness of the head and drowsiness. The child lies on its nurse's lap unable or unwilling to raise the head. It seems half asleep, one moment opening its eyes and the next closing them again, with a remarkable expression of languor: the eyes are unattracted by any object put before them, and the pupils remain unmoved on the approach of light. The breathing is irregular, sighs are occasionally expressed, and the voice is husky. The tongue is slightly white, the skin is not hot, but sometimes colder

than natural. In some cases there is now and then a slight and transient flush. Diarrhœa has often existed for some time, or the child has been severely purged by medicines, or having been weaned, has ceased to thrive since its change of food. When this condition of things occurs in a more elderly child it has been generally brought about by depletion, by loss of blood, or by medicines. As the more marked symptoms are sometimes ushered in by extreme irritability and a feeble attempt at re-action, cases of this kind, (which Dr. Marshall Hall named "the hydrocepha-*loid* disease,") have not unfrequently been mistaken for acute hydrocephalus and treated accordingly, the patient being generally leeched out of its life. In very young children the diagnosis is sometimes very difficult between congestion and exhaustion, between fullness and emptiness. Dr. Watson, from whom these remarks are chiefly taken, suggests the following test:—

"As a guide to diagnosis, take notice," he says, "of the state of the unclosed fontanelle. If the symptoms proceed from plethora, or inflammation, or an approach to inflammation, you will find the surface of the fontanelle convex and prominent, and you may safely employ and expect benefit from depletion. If, on the other hand, the symptoms originate in emptiness and want of support, the surface of the fontanelle will be concave and depressed; and in that case leeches or other evacuants will do harm, and you must prescribe better diet, ammonia," brandy in arrow-root, milk from the mother's breast if possible, and all such means as will tend to foster and nourish an infant.

Prognosis.—The chances of recovery in the first stage are very many if the patient be properly treated. At any subsequent period the prognosis is most unfavourable, and Dr. Cheyne estimates the loss of confirmed hydrocephalus at six to one, and perhaps this is near the truth. If acute hydrocephalus shall unequivocally declare itself, it will be rapid and almost inevitably fatal (Alison).

The immediate danger in the cases of chronic hydrocephalus is not great, but few patients survive the age of puberty; Cardinal, however, lived to the age of thirty-two. Aurival speaks of another instance which reached forty-five; and Gall of a third who survived till fifty-four.

Treatment.—The acute form of hydrocephalus is only successfully combated in the first or earliest stage. As the first symptoms are those characteristic of inflammation of the brain and especially of its meninges, there is perhaps no class of cases in which the sanative powers of judicious blood-letting become so apparent, as in children in whom the disease has been observed early and carefully watched. Dr. Alison relates the following highly illustrative case:—

"A boy aged eight years, of rather delicate habit, and who had complained occasionally for some weeks of headache and disordered bowels, temporarily relieved by laxatives, calomel antacids, and a careful regimen, but recurring, and attended with gradually increasing febrile symptoms, and *shooting* pain of head; impatience both of light and sound; pulse gradually rising to 108, distinctly sharp, and beginning to intermit, and then nausea and vomiting, not referable to any medicine taken, but gradually increasing, until it recurred every time that he sat up in bed for nearly twenty-four hours; and a slight but quite perceptible squint showing itself. The full action of laxatives and one application of leeches, as well as cold to the head, having failed to make any impression on this course of things, he was bled at the arm (which in such circumstances and at that age, has often appeared to me distinctly preferable) to *twelve ounces*, and the blood was sizy. I do not know what further evidence we could have had of the existence of such inflammation within the cranium as would infallibly, if let alone, have gone on within a few days to delirium, stupor, dilated pupil, slow pulse, succeeded by very frequent pulse, convulsions and death, and have left after it the usual appearances of the *acute hydrocephalus* (of Whytt, Cullen, and Abercrombie, now described) dryness of the membranes on the surface of the brain, distension of the ventricles of the brain with serum and some of the marks of inflammatory action, either on the membranes or surface of the brain. Instead of this, however, I am quite certain that from the time of the bleeding at the arm, this boy *never once vomited*—that the intermission of the pulse was *never again observed*, nor did he again complain of lights or sounds. The pain of the head, although less violent, continued in the evening of the same day, and *twelve leeches were applied* within eight hours after the bleeding, and from that time he never once complained of this symptom, nor admitted that he felt it; and *from this moment he recovered perfectly*, and much more rapidly than he had done from much slighter febrile attacks previously; neither has he suffered from that time to this (now thirty years) any return of serious disease."—(*Edin. Med. Journal*, p. 777, March, 1856.)

In short, all the symptoms vanished in twenty-four hours, most of them during the flow of blood, and never recurred:—a change under the circumstances so sudden and sanative, rarely if ever seen after the use of any other remedy for the same combination of symptoms.

With reference to the sanative influence of general blood-letting in children for inflammatory diseases, if performed at the outset, Dr. West observes, that such depletion is as important a remedy as in the adult; nor will the most energetic employment of any other antiphlogistic measure enable us to dispense with blood-letting. In a healthy child, two years old, a vein (if easily found) may be opened in the arm, and *four ounces* of blood allowed to flow, if faintness be not earlier produced, without our having any reason to apprehend that the plan adopted is too energetic. The immediate

effect produced is greater than that which follows local depletion, and the quantity of blood abstracted is less (WEST, *Diseases of Children*).

The first thing to be done is to purge the patient. The purgative is not of great moment, provided it acts freely. Some prefer two to five grains of gamboge; others, five grains of calomel with thirty grains of compound jalap powder. Such doses are to be followed up by a black draught, or the sulphate of magnesia. So difficult is it to obtain the action of purgatives in this disease, that doses of three times the strength for adults have been in some instances required: but such large doses are never to be given until the inefficiency of smaller ones has been ascertained (see DR. WATSON'S *Lectures*, No. XXVI).

The stools are generally black, or extremely offensive; and this state of the bowels corrected, the disease, if sympathetic, often ceases. If, however, the head be not relieved, some leeches should be applied to the temples, and the head should be shaved and surrounded with some cold evaporating lotion, as with a towel dipped in cold spring water, or in vinegar and water, or in solution of the muriate of ammonia.

If the disease be further advanced, no efficient treatment has as yet been determined. Many practitioners have attempted the cure by copious bleedings, but the symptoms do not yield to the lancet like those of simple inflammation. Mercury has also been used to a great extent, but with little success. In urgent cases, for instance, mercurial ointment has been rubbed on the back and thighs, even in very young children, to the extent of half a drachm to a drachm, three or four times in the twenty-four hours. Calomel also has been rubbed on the gums to the extent of three or four grains every four or five hours; and it has likewise been given by the mouth in doses of two grains every third or fourth hour. Mercury given in these large doses, it must be remarked, seldom produces salivation; for Dr. Clark says he never saw that effect in children under three years of age, except in three cases; but it is not successful, and more generally produces *spinage-like* stools, irritates the alimentary canal, and perhaps does harm. In France the mercurial treatment has been so unsuccessful, that some practitioners have even tried a most opposite remedy, namely quinine, but the result has been equally fatal. Blisters, moxas, and other modes of cauterization have been used as auxiliary treatment, but without apparent benefit.

During the whole course of this disease the diet should be slops and light puddings.

In congenital hydrocephalus the unassisted efforts of nature seem incapable of effecting a cure; and it is extremely problematical if medicine is of any use. When, however, the case is pronounced

hopeless, the propriety of evacuating the water by means of an operation may be entertained. Golis has given the names of twenty-seven writers who have expressed themselves in favour of it, especially if the fluid be slowly evacuated, and at several repetitions of the operation; yet he himself, along with seven or eight others, including Boerhaave, proscribe it altogether as cruel and useless; however, it has been successful.

When the operation is performed, it seems an axiom that the fluid should be allowed to escape gradually, for otherwise extreme faintness and collapse may be expected. In such cases small doses of ammonia, or a few tea-spoonfuls of brandy and water may revive the little patient. Should re-action take place, however, at a subsequent period, a few leeches and a cold lotion ought to be applied to the head.

It seems also determined, that the younger the child the more chances of success; for if it lives a few years, the sutures of the cranium, though open at the top, are united by bone towards the base of the skull, and thus present a mechanical obstacle to the closing of the sutures; consequently the operation is more apt to fail.

If this disease should occur in after-life, blisters and mercury to salivation are the remedies most relied on.

Insanity.

Definition.—*A mental state, in which false acts of conception, judgment, or reasoning are expressed, or in which there is a deficient, impaired, or perverted power of the will, or an uncontrolled violence of the emotions, or perverted sensations and instincts. Such complex mental states are separately or conjointly produced by disease, ordinarily of insidious approach, without fever, of a chronic kind, and resulting from specific morbid action of the hemispherical ganglia, ranging from the inflammatory tendency manifested by irritation or active congestion, up to positive and unmistakable inflammatory lesions; tending to render the patient an irresponsible being, and to unfit him for the performance of the social and political duties of life* (Esquirol, Winslow, Bucknill).

Pathology and Morbid Anatomy.—Many theories have been propounded to explain the nature of insanity. They may be resolved into two, as at present entertained, namely:—(1.) the *metaphysical, functional*, or *spiritual* theory; and (2.) the *cerebral* theory.

The "functional" or "spiritual" theory, which inculcates the belief that insanity is an affection of the immaterial principle, is at variance with all reasoning. Such a belief is in direct opposition to positive, well recognized, undeniable data. For, it is an almost universal belief, that the brain is the material instrument

by which that thinking principle, the mind, manifests itself, whether it be by the unseen phenomena of *conception*, *judgment*, *reasoning*, and *instinct*, or by the more obviously expressed phenomena of *volition*, *emotion*, and *sensation*. To consider then those subjective phenomena, which collectively, in their various manifestations, constitute "mind"—an immaterial essence, as subject to disease apart from all derangement of the material organ, the instrument with which it is so closely and indissolubly united—is to believe in a most incongruous, unphilosophical, unphysiological doctrine—to believe, in fact, in a *hallucination;* and those who act on such a belief, act under a *delusion*. The more consistent theory is that which is known as the *cerebral theory;* and which is now entertained by most of those eminent physicians who have made insanity a special study and subject of treatment. Among the most able exponents of this theory in our country may be mentioned Drs. Forbes Winslow, John Charles Bucknill, and Laycock.

The belief which this theory inculcates is, that the instrument through which the phenomena of mind are expressed, is the part diseased; that the encephalic nervous textures are primarily implicated. And, as it is consistent with the pathology of disease in every other organ and texture of the body, that the part may be diseased without our means and instruments of research being able as yet to demonstrate such morbid state to the senses, the diseased state being expressed through one or more disordered functions of the frame; so is it with the brain. It is an organ of such exquisite delicacy, both of structure and of function, that important and extensive structural change may and often does exist, which neither our naked eyesight, nor our touch can appreciate, and which can only sometimes be demonstrated by various complex methods of research.

In those cases also of insanity where the manifestations of the mental phenomena are simply disordered and perverted, but not abolished, it is consistent with the known pathology of disease in other parts, to expect *the very slightest* structural change, such as may rather be expressed as a *tendency* to those morphological lesions which occur between the blood and the elements of texture, and which are only manifested through vital phenomena, insidious, because unseen in their approach, and often inappreciable after death to the most experienced observers. Analogous to this morbid state in the nerve tissue of the brain is the local morbid state which attends that complex morbid process known as *inflammation*, and to that essential part of it to which Virchow gives the name of *parenchymatous*. It is expressed in the altered vital morphological phenomena, between the blood and the minute elements of tissue, and which, in some textures, has been appreciated through microscopic observation, as in cartilage, and some of the so-called non-vascular tissues.

The phenomena of insanity also offer the most conclusive data that the brain tissue is impaired, especially in those cases where the manifestations of insanity obviously yield to remedies.

Those pathological doctrines are, moreover, always to be regarded with distrust, whose tendency is to hold out no hope of cure. Such is the tendency of the *metaphysical* theory of insanity.

Believing in the cerebral doctrine, and acting upon it, the prospects of cure are hopeful, *if the case is diagnosed early and remedies judiciously applied.*

"If cases of insanity are brought within the sphere of medical treatment in the earlier stages, or even within a few months of the attack, insanity, unless the result of severe injury to the head, or connected with a peculiar conformation of chest and cranium, and in hereditary diathesis, *is as easily curable as any other form of bodily disease, for the treatment of which we apply the resources of our art*" (WINSLOW).

It is a serious error on the one hand to act upon the belief, that *physic cannot make a man think otherwise*, when "one man thinks himself a king, another a cobbler, and another that he can govern the world with his little finger." On the other hand, it is equally erroneous to act upon the belief, "*that no man was ever reasoned into insanity, or reasoned out of it.*" It is only by a proper combination of *medical* and *moral treatment* that the first manifestations of insanity are to be controlled and ultimately effaced. That able writer, Dr. Forbes Winslow, to whom psychology, in relation to medical science in this country, is so much indebted, who has done so much to elucidate the nature of insanity, and to base the science of mental diseases upon a comprehensive and rational pathology, writes as follows :—

"The existence of so vast an amount of incurable insanity within the wards of our national and private asylums, is a fact pregnant with important truths. In the history of these unhappy persons—these lost and ruined minds—we read recorded the sad, melancholy, and lamentable results of either a total neglect of all efficient curative treatment at a period when it might have arrested the onward advance of the cerebral mischief, and maintained reason upon her seat ; or of the use of injudicious and unjustifiable measures of treatment under mistaken notions of the nature and pathology of the disease. . . . My experience irresistibly leads to the conclusion that we have often in our power the means of curing insanity, even after it has been of some years' duration, *if we obtain a thorough appreciation of the physical and mental aspects of the case, and perseveringly and continuously apply remedial measures for its removal.*" (Pp. 59—61, Lettsomian Lecture, quoted by Dr. Laycock in *British and Foreign Medico-Chirurgical Review*, for January, 1855.)

According to Dr. Winslow, all the structural changes in the tissues of the brain connected with insanity, and appreciable after death, "are the results or sequelæ of a *specific* inflammatory condition of the hemispherical ganglia."

The testimony from morbid anatomy which illustrates the pathology of insanity, and which more directly supports the cerebral theory, is that which has resulted from observations made upon the *bulk* of the brain, upon its *absolute* and *specific* weight, and that of the grey and white substance of which it is composed. The original observations of Dr. Bucknill with regard to the *insane*, and of Dr. Sankey with regard to the *sane*, furnishing especially valuable data for comparison, are those which must be regarded as the initiative of observations from which we hope yet to learn much. Dr. David Skae, of the Morningside Asylum, near Edinburgh, has more recently confirmed some of these observations, already noticed at page 481, and has in some measure extended them. Such observations show generally—

(1.) That the absolute weight of the brain is slightly increased in the insane; a conclusion which is also consistent with the fact, especially established by Bucknill, that in many cases of insanity the absolute *size* of the brain is materially diminished relatively to the capacity of the cranium.

(2.) This increase in absolute weight appears to depend chiefly on an increase in the weight of the cerebellum, compared with the pons, the medulla oblongata, and the cerebrum. The general result is, that the cerebellum, in the insane, is heavier in relation to the cerebrum than it is in the sane.

(3.) On arranging the weight of the brain according to the form of insanity under which the patients laboured, the following average results were obtained:—

Average Weight of the Encephalon.

In *Mania*,	54	ounces	$11\frac{1}{3}$ drachms.
In *Monomania*,	51	,,	$11\frac{3}{7}$,,
In *Dementia*,	50	,,	$5\frac{4}{10}$,,
In *General Paralysis*,	49	,,	$12\frac{8}{29}$,,

The absolute weight, therefore, is greatest in mania, and least in the *general paralysis of the insane;* while also the cerebellum decreases similarly through the same series, with the exception, that in the *general paralysis* of the insane it presents the highest average. Generally it appears that in cases of acute mania, which is a form of insanity of very short duration, there is the smallest amount of increase in the relative weight of the cerebellum; while in *general paralysis*, a disease of prolonged duration, the greatest increase takes place.

(4.) The results of observations in the specific gravity, both of the grey and white matters of the brain, show an increase in the *insane* compared with the same texture in the *sane* (SANKEY, SKAE).

(5.) It is consistent also with the records of these three observers, that the *mode of death* has an influence upon the specific gravity; and generally it may be stated, that when cerebral symptoms are well marked, such as by convulsions, strabismus, and the like, and when the case terminates by *coma*, or by *apnœa*, the specific gravity is higher than when the symptoms are associated with exhausting disease, such as phthisis, and when the case terminates fatally by *anæmia* or *asthenia*. The high specific gravity of the grey and white matter in the former class of cases averaged 1·041, while the average specific gravity of the whole brain in similar cases, as observed by Dr. Bucknill, varied from 1·040 to 1·052; while the average specific gravity of the whole healthy brain is only 1·036.

(6.) Dr. Bucknill's most recent observations show the most essential change to consist in shrinking of the substance of the brain, with degeneration of the nerve cells, or a relative atrophy of its substance by a deposit of inert matter (*Med.-Ch. Rev.*, Jan., 1855).

(7.) On comparing the specific gravity of the grey substance in the different forms of mental disease, the lowest appears to occur in cases of *dementia*, where, however, it is 0·003 above the average in the sane. The next highest specific gravity occurs in cases of *melancholia*, the next in *general paralysis*, the next in *mania*, and the highest in *epilepsy*. In some of these, however, and probably in all, the *mode of death* appears to influence the specific gravity. For instance, in the *paralysis of the insane*, terminating by *coma* or *apnœa*, the specific gravity of the whole brain has been 1·040; while in similar cases, terminating by *syncope* or *asthenia*, the specific gravity of the whole brain has not exceeded the average, nor gone beyond 1·039. The average specific gravity of the white substance is lowest in cases of *mania*, next in *dementia*, higher in *general paralysis*, higher still in *monomania*, and highest in *epilepsy* (*Edinburgh Monthly Journal of Medical Science*, October, 1854).

The general results of the more crude examinations of the cranium and its contents in cases of insanity, in this and other countries, show, that in a very large proportion of cases, there are found some degree of thickening and opacity of the arachnoid, serous effusions into the subarachnoid tissue, into the arachnoid sac and ventricles of the brain, or of serum with lymph more or less gelatiniform, accompanied sometimes with increased, sometimes with diminished vascularity of the brain and its membranes. These lesions are also more frequently found at the anterior and superior portions than at the base of the brain. In that specific form of paralysis peculiar to the insane, there also appears to exist a peculiar softening of the grey matter, not indicated by any change appreciable to the eye, but by layers of the grey matter stripping off easily with the membranes, to which it often adheres, by the readiness with which it is

broken up by a stream of water, and by changes in the contents of the brain cells as observed microscopically. The morbid state of the brain in the insane, writes Dr. Winslow, may comprise one or more of the layers of grey matter (which he enumerates as six), composing the hemispherical ganglia, but the whole of these ganglia are generally more or less implicated, in conjunction with the tubular fibres passing from the hemispheres through the vesicular neurine. Such changes are associated with great vital and nervous depression.

Now, with the exception of these morbid changes last mentioned, and with the exception also of those observed and limited to cases of the specific general paralysis of the insane, all the other crude morbid appearances are found very frequently in the brains of persons who have died of other diseases, and without any manifestations of mental impairment of the nature of insanity.

Causes.—In modern times insanity is a disease unhappily of frequent occurrence, and has been supposed to be extending in proportion to the degree of civilization. It does certainly appear, from an interesting paper by Dr. Winslow in *The Journal of Psychological Medicine* for July, 1857, that diseases of the brain and nervous system are not only of more frequent occurrence, but that a certain unfavourable type of cerebral disorganization tends to develop itself in the present day. This type of cerebral disorder may be characterized as being—(1.) insidious in its approach; (2.) tending to that form of insanity which frequently terminates by suicide; or (3.) leads at an early age to softening of the brain, at an age—the prime of life—when the intellect ought to be in an active and vigorous condition of exercise and of health. "The saddest and most humiliating subject of thought," says Dr. Johnston, "is the uncertain tenure of the possession of reason;" and the truth of this is perhaps more manifest now than ever.

The remote causes of insanity are of a moral or physical nature. Of the patients principally admitted into the different hospitals of France, Italy, and Belgium, about *one-tenth* have their insane state attributed to falls, blows on the head, the abuse of mercury, or other physical causes not determined. The remainder of the cases have their insane condition ascribed to moral influences, as religion, having been crossed in love; to jealousy, family disputes, reverses of fortune, wounded pride, disappointed ambition, anger, fright, arbitrary detention, excess of study, libertinage, and drunkenness.

The action of moral influences in producing insanity is so striking that the passing events of the day often impress upon the disease its peculiar characteristic. When magic and witchcraft were believed in, Europe was overrun with persons who supposed themselves pos-

sessed by the devil. When the Pope was at Paris, that singular event caused many religious monomaniacs—a form of insanity, says Esquirol, which shortly after disappeared.

The causes of insanity are of a nature producing in the patient *emotional* changes only, in the first instance, either by the sudden and violent agitation of the passions,—

> " When all the heartstrings, like wild horses, pull
> The heart asunder; "

or by the long continued influence of circumstances operating more insidiously upon the mind, and producing an habitual state of abnormal feeling. There is no description of insanity which, if traced to its source, may not be found either to consist in perverted emotion, or to emanate from that origin (BUCKNILL, in *Medico-Chirur. Review* for January, 1854).

The principal predisposing causes are age, sex, hereditary descent, and disease.

Infancy is nearly exempted from madness, and so also is childhood, except in cases of congenital idiotism. Esquirol, however, gives the case of a child between five and ten years old whose monomania lay in attempting to destroy both her father and mother. Insanity, however, as a general principle, seldom breaks out till after puberty, when the passions are fully developed.

It has been much disputed which sex is more liable to insanity. Esquirol, from returns obtained from the different insane establishments of London and Paris, considered the numbers to be nearly equal—a result which is remarkable, considering the influence which menstruation, pregnancy, and suckling have in the production of this disease, and which Esquirol estimated as accounting for the insanity of one-sixth of the whole number of women attacked. An approximation as to the influence of social position on the patients, showed a larger proportion of insanity among the unmarried than among the married population, in proportion to their respective numbers.

Hereditary Origin.—The testimony of almost universal experience establishes the fact of a very general hereditary transmission of insanity. This is remarkably instanced among the Catholics and Quakers of England, and also among the high nobility of France, who almost in every instance intermarry, and are allied by blood to each other, inculcating a sad lesson to those parents who consult, in the marriage of their children, the interest rather than the health of their descendants. This hereditary tendency to insanity in the aristocracy is greatly insisted on by Esquirol, who states that only one-third of pauper female lunatics were ascertained to belong to families in which insanity had previously existed; while more

han one-half of the females of the higher classes were thus con-
nected. In general, children born before the insanity of their parents
are less liable to this disease than those born after the attack; also,
children born of parents diseased in one line are less liable to it than
parents diseased in both lines of descent. The condition of the mother
also during gestation has often a striking effect on the mental health
of her future offspring. Esquirol observed that during the French
Revolution many pregnant ladies whose minds were kept constantly
in a state of alarm and anxiety during that epoch, brought forth
children which, in their infancy, were subject to spasmodic, convul-
sive, or other nervous diseases; and in their youth either to *mania*,
imbecility, or *dementia*.

Certain diseases also are powerful predisposing or even exciting causes of insanity, as *epilepsy*, which gives rise to a large number of the most incurable cases. Derangement of function, or structure of the uterus, is also a powerful predisposing cause; and many persons also become deranged after severe fevers.

Symptoms and Forms of Insanity.—Insanity has many different forms, and it has been usual to describe these various forms under the names of *monomania*, *mania*, *melancholia*, and *dementia*.

It is hardly possible to understand the nature of insanity without first considering that every sense is liable to express, by the mode in which it performs its function, the existence of cerebral disease, as when light things feel heavy, small things seem large, hot things feel cold; or when the senses are liable, from the irritation of the brain or other cause, to become morbidly *active*, the patient seeing persons or hearing discourses when no such person is present, and no such discourse is related. When he is satisfied by reasoning and the evidence of his other senses that what he hears or sees is an *illusion*, he is said to labour under an *hallucination*. When, however, he believes and acts upon them he is insane, and the *hallucination* then becomes a *delusion*. Much objection has been taken to this term. The "symptoms of delusion are still accepted in our courts of justice as the most authentic mark of insanity, as the essence of cerebro-mental disease." The term is thus defined by Dr. Bucknill: —*A delusion is a belief in the existence of things which have no existence in reality, or an erroneous perception of the nature of things, or of their relation to each other, occasioned by cerebro-mental disease.* The following are a few instances of hallucination:—

Every sense is liable to suffer from hallucination. Dr. Falconer mentions a case in which cold bodies felt intensely hot to the patient, who could not move without believing he was burnt. Esquirol mentions a lady who, being recommended a lavement, was desirous of administering it herself. No sooner, however, was the syringe put in her hands, than she threw it away with an

expression of horror, stating it felt so heavy that she believed it to be filled with mercury, and that they wanted to make a barometer of her body. A gentleman, whose mind was in every other respect perfect, had constantly the sensation of his mouth being full of pieces of broken glass; while another, curious in his table and choice in his wines, believed everything tasted of oatmeal porridge. The sight also is often the seat of hallucination. Dr. O'Connor met with a patient recovering from measles, to whom every object appeared diminished to the smallest possible size. Baron Larrey mentions a person who saw men as big as giants; and another patient on recovering from typhus fever who felt himself to be ten feet high, his bed eight feet from the floor, and the opening of the chimney as large as the arch of a bridge. The celebrated Pascal always believed he saw a precipice on his left hand, and had a chair placed on that side to prevent his falling into it. The ear, also, is likewise often affected. It hears "The airy tongues that syllable men's names." A gentleman riding by a barracks at evening call never got the sound of the bugle out of his ears for nine months; and everybody knows that Dr. Johnson always entertained a deep impression that, while opening the door of his college chambers, he heard the voice of his mother, then many miles distant, calling him by his name, "Sam! Sam!"

It is remarkable also, that these hallucinations sometimes occur when the organ is itself destroyed, through which they are *objectively* expressed, thus showing their *subjective* nature. Esquirol, for example, attended an insane merchant who, though labouring under gutta serena, not only heard persons talking to him, but saw visions that perfectly enchanted him. He had also under his care a Jewess, who was blind, and yet saw things the most strange. She died, and the optic nerve, from its commissure to its entrance into the sclerotic of the eyeball, was found atrophied, so that the transmission of any objective impression was impossible. He mentions also two other women absolutely deaf, who had no other delirium than that of hearing every night invisible persons addressing them.

Such are instances of hallucinations, and the images thus excited are described to be as vivid as those produced by objective causes, so that the patient when insane entirely believes the empty and false forms he sees, the ideal sounds he hears, to be real and substantial. His symptoms are a series of delusions. Nothing can persuade him of their fallacy. Like Macbeth, he insists, "If I stand here I saw him." It is only by the occurrence of a temporary hallucination that we can explain the apparition of the ghost of Cæsar to Brutus, promising to meet him at Philippi; or the existence of the familiar spirit which conversed with Tasso; or the existence of the demon of Socrates, and such like hallucinations.

It is probable, also, that such hallucinations formed a portion of the psychological phenomena occurring in the cases of Luther and Swedenborg. Nearly every insane patient labours under hallucinations of one, two, or even of all the senses. Thus they are perpetually holding conversations with imaginary beings, seeing ecstatic visions, fighting with enemies ready to destroy them; and in a few instances an angel of light is at one ear, and the angel of darkness at the other.

In insanity, also, if a part be diseased, the imagination often personifies it into some strange reality. There are constantly in the hospitals patients who, suffering pains in the crown of the head, believe they are caused by worms gnawing the brain; or suffering pains in the stomach, believe that organ to be filled with serpents, frogs, or mice. A woman, for many years a lunatic at Salpêtrière, who suffered severely from abdominal pains, believed she had a whole regiment of soldiers in her abdomen, and when the pains were severe that they fought with each other. Another woman, called by the patients, "Mère de l'Eglise," believed she had in her entrails all the personages of the New Testament, and occasionally those of the whole Bible. At other times she believed the Popes held their councils in her abdomen. She died, and the abdominal viscera were found adherent to each other and to the peritoneum.

Dr. Winslow has recently shown with what inexcusable neglect affections of the brain are generally treated by the public, and the lamentable amount of ignorance that unhappily exists in the non-professional mind respecting these disorders;—a neglect and ignorance which, by sins of omission, often suffer the sacrifice of valuable human life to occur. The overwrought brain meets with but little attention and consideration when in a state of incipient disorder. While medical advice and remedies are eagerly sought for trivial organic or functional disorder in other parts of the body, serious well marked symptoms of brain disorder are often entirely overlooked and neglected. Such symptoms are not unfrequently permitted to exist for months without causing the faintest shadow of uneasiness or apprehension in the mind of the patient or his friends. These premonitory indications of cerebral mischief, or *prodromata* as they are technically called, consist of *morbid alterations of temper, depression of spirits, amounting sometimes to melancholia; headache, severe giddiness, inaptitude for business, loss of memory, confusion of mind, defective power of mental concentration, the feeling of brain lassitude and fatigue, excessive* ennui, *a longing for death, a want of interest in pursuits that formerly were a source of gratification and pleasure, restlessness by day and sleeplessness by night.* Any one or more of these symptoms obviously indicate an unhealthy state of the functions of the brain and nervous system;

but their insidious mode of approach, and the unwillingness of friends to believe that anything is wrong with their relative, rarely if ever permit the symptoms to attract attention till some of the forms of insanity about to be described become unmistakably developed. If a person previously in a state of bodily and mental health is conscious that abnormal changes are taking place in his mind—that trifles worry and irritate him—that he feels his brain unfit for work—that his spirits flag—that he tends to magnify all the evils of life; if, moreover, he is observed to be fanciful, if he imagines things to exist which have no existence apart from himself, if he believes that kind friends ill-use and slight him; if, besides, symptoms like these or analogous to these are associated with headache, derangement of the digestive organs, want of continuous sleep, the friends of such a sufferer may rest assured, and the patient may perhaps be convinced that the state of his brain is abnormal, and he may be induced to commit his case to the careful consideration of a physician. Symptoms of severe bodily fatigue, associated with extreme depression of spirits, mental exhaustion, reverie, paroxysms of melancholy, partial somnambulism, or hallucinations manifesting themselves at an early period of life, must be regarded as important psychical phenomena—deviations from the state of health requiring the most careful and cautious moral and intellectual training, combined with medical and hygienic treatment; more especially to be persevered in if despondency become more marked, or if gloomy thoughts and apprehension of an early death lay hold of the mind. Of the numerous, and seemingly increasing, cases of suicide which occupy a place in our daily newspapers, in most of them there may be traced to exist before the act of self-destruction, well marked symptoms of physical ill health, disorder of the brain and nervous system. In upwards of a hundred recent cases Dr. Winslow has shown this connection to have existed. These cases are full of interest, and demand the most attentive study by the student who would make himself acquainted with the earliest symptoms and most distressing results of insanity. They are recorded in *The Psychological Journal* for July, 1857, already referred to.

Having thus related instances in illustration of the nature of *hallucination*, which being believed in and acted upon, constitute the *delusions* of the insane; having also defined what is meant by a *delusion*, and shown that certain premonitory symptoms, apt to be overlooked and neglected, constantly precede confirmed attacks of insanity, it is necessary now to describe some of the different forms by which cases of confirmed insanity are expressed, and the names by which they are known.

Forms of Insanity.

Monomania is that form of insanity in which some *one passion* or *hallucination* so entirely possesses the patient as to lead to erroneous and often dangerous conduct. The modes by which this *delusion* is expressed are endless; but jealousy and love, sometimes of objects entirely imaginary, are examples. Some patients under its influence seek their own death or the destruction of other people, or have an uncontrollable desire to commit petty thefts, or to set everything on fire. These varieties have been severally termed *kleptomania*, *pyromania*, *autophomania*, and *erotomania*, and so on, according to the passion or imagining of the patient. A few of the endless varieties of this form of insanity may be described as follows :—

Hypochondriasis.—This morbid mental state is expressed by the *exaggeration or increase, to a morbid degree of intensity*, of that property which every one possesses, more or less by virtue of his physiological and psychological endowments, of creating around him or within himself sensations which are not the result of external impressions or corporeal conditions; but which, having their origin in the mind (subjective), are represented and appreciated by the material organs of the body. It consists essentially in the transference of a phenomenon, subjective or mental in its origin and essence, into what appears to be a real material change appreciable sometimes by others (Reynolds). It is often expressed by the sense of touch, combined with a morbid imagining, so that the patient believes himself to be strangely metamorphosed, changed into some inanimate thing, or he loses all knowledge of his personal identity; and this form of disease is sometimes combined with other hallucinations, which he believes and acts upon. The odd conceptions of the patients under these circumstances are singular enough. Men have imagined themselves to be so much butter or putty, and in the one case to be unable to bear heat for fear of melting, and in the other have forborne to walk lest their legs should be crushed by the weight of their body. One man keeps the house, imagining he is too large to pass through a given doorway; and when he is pushed through he screams, and affirms his flesh is torn from his bones. Another imagines he is a pump, that his arm, which is in perpetual motion, is the handle, and bitterly complains that the inhabitants will let him have no rest, morning, noon, or night. Another goes round to his neighbours, believing that he is a seven-shilling piece, and hopes, if his wife should bring him to their shops, they will neither take him in payment nor give change for him. A third supposes himself transformed into a beer-barrel rolled along the streets. A fourth, that he is a mutton-chop, and insists that he shall be taken daily to the butcher to

be trimmed. Bishop Warburton speaks of a person who thought himself a goose-pie, a circumstance referred to by Pope in his sketch of hypochondriasis :—

> "A pipkin there, like Homer's tripod, walks;
> Here sighs a jar, and there a goose-pie talks."

Among other singular forms of hypochondriasis is a belief in an absolute change of sex. Dr. Arnold saw a man who fancied himself in the "family way;" and Esquirol speaks of a male patient who fancied himself a woman, and felt insulted if the slightest liberty was taken with his dress. Some have thought themselves converted, like Nebuchadnezzar, into wild beasts.

In every madhouse there is a last surviving woman ; a last man overwhelmed with grief and horror at having outlived the whole world. Some patients imagine they have no soul, others no body, others that they are absolutely dead. One gentleman approaching his ninetieth year so far lost his mind that he assembled his family around him and announced to them that he was dead ; begged, in communicating the sad intelligence to his absent friends, they would say he went off easily, and expressed himself a little scandalized that the windows were not closed on the occasion, and entreated, as a last favour, for one pinch more out of his favourite snuff-box before he was finally screwed down. A soldier who received a severe wound at the battle of Austerlitz, believed he had died, and that the body he had now got was not his own. Another, that he was guillotined during the French Revolution, and had not only lost his own head, but, somehow or other, had got a new one. A third, that his head had been put on his shoulders with the face towards his back ; and, lastly, some believe they have not only lost their heads, but can see them rolling on the ground.

It is seldom, however, that insanity is of so simple and harmless a nature. More commonly the affections and feelings are subverted, and those who ought to be most dear to the patient by the ties of relationship become most hateful. The mind too is more commonly swayed by some destructive passion to effect some object criminal in itself. This state of the feelings may or may not be accompanied by *hallucinations*, so that *delusions* are not necessary nor essential symptoms. The most extreme form of this description of *monomania* is *androphomania*.

Androphomania.—Gall gives the case of a man at Vienna, who, after witnessing a public execution, was seized with an uncontrollable propensity to kill, although he had a clear consciousness of his situation, expressed the greatest aversion to commit such a crime, shook his head, wrung his hands, and cried out to his friends to keep away. Pinel mentions the case of a person who exhibited

no other unsoundness of mind than this propensity to murder; so that his wife, notwithstanding his tenderness for her, was nearly being destroyed, he having only time to warn her to fly. In the intervals of the paroxysm he expressed every remorse, was disgusted with life, and attempted several times to put an end to his existence. A man was tried at Norwich, in 1805, for wounding his wife, and afterwards cutting his own throat, an act so repugnant to his nature that he had been known to tie himself for a week together with ropes to avoid it. Esquirol mentions a woman seized with sudden paroxysms of phrenzy to destroy her children, and only saved them by locking the bed-room door and throwing the key away. Metzyer relates a similar case of a nurse who requested to be discharged, giving as a reason that every time she undressed the child, struck by the whiteness of its skin, she had an irresistible desire to rip open its belly. The deadly purpose with which the monomaniac is seized, is accomplished in many different manners and times. Sometimes the murder is long premeditated, and the victim marked out, the patient concealing a knife about his person till an opportunity for effecting his object presents itself, though that period be remote. In other cases the destructive propensity seems the result of a sudden paroxysm. Esquirol mentions the case of a maniac who was sitting by the fire with other patients, when he suddenly seized a chamber-pot and broke it over his neighbour's head; fortunately he was immediately secured. In a lucid interval he stated he had made this homicidal attempt in consequence of his brother having appeared to him at that moment crying out, "Kill him! kill him!" Others, again, are so aware of the approach of the attack, that they entreat to be confined in order that they may not commit the mischief to which they seem irresistibly impelled.

Autophomania.—Many monomaniacs, besides being impelled to destroy others, have an irresistible propensity to destroy themselves. A gentleman who was cheerful, amiable, well informed, and reasoned well on every other subject, made many attempts to commit suicide, giving as his reason "Je m'ennui." This patient, however, had hallucinations both of sight and hearing, imagined he was pursued by the police, and believed that he heard them through the walls of his apartment. Many of these unfortunate persons, not having resolution to put themselves to death, have killed others in order to suffer a judicial death. One woman reasoned, "In order that I may die I must kill some one," and accordingly she attempted to kill both her mother and her children. Some of these tragedies are most terrific. A man in a paroxysm of insanity is related to have killed his wife and three children, and would have killed the fourth had it not escaped. After these horrible sacrifices he

ripped open his own belly, but the wound not being mortal he again drew out the instrument and pierced himself through and through. This man had enjoyed a good education, and was of a mild character.

The propensity to commit suicide is in some persons so great that many destroy themselves although in possession of fortune, of station, of objects of affection, and apparently in every other respect in the fullest enjoyment of reason and happiness.

The ingenuity of the maniac in providing means for his own destruction is often singular. Some have thrown themselves under the wheels of a waggon; and recently it is not uncommon for them to cast themselves before the locomotive of a railway train in full speed; others have drowned themselves in an incredibly small quantity of water; others have most ingeniously strangled themselves; and others, more closely watched, have swallowed all sorts of heterogeneous articles—pins, needles, bits of broken glass, nails, buckles, and any and every hard substance they could force down their throats. Pinel gives the case of a man who had cut off one of his hands with a hatchet before his arrival at Bicêtre, and afterwards in spite of his bonds attempted to tear the flesh off his thigh with his teeth.

Pyromania.—The derangements of feeling and of reason may take other forms than murder; and arson is one of the more common. Some seem impelled to this criminal act by the mere sensual gratification of the excitement, confusion, noise, and bustle consequent on the conflagration. One lad committed repeated acts of arson solely from the delight he took in the blaze, the ringing of the bells, and in the thronging of the people. Often, however, it results from a process of reasoning, or from acting upon the belief in some hallucination of the senses. The destruction of York Cathedral by Martin was effected under a feeling of Divine impulsion, and of his being commissioned to purify the house of the Lord. A maniac has been known to set fire to his bed, believing that, like Shadrach, Meshach, and Abed-nego, the flames would respect his person.

Kleptomania is an irresistible desire to steal. Gall mentions that the first King of Sweden was always stealing trifles; and a countess at Frankfort had the same propensity. It is related of a physician that his wife was always obliged to examine his pockets in the evening, to restore the things she found there, for he always took something else as well as his fee.

Esquirol gives the case of a lady of an exactly opposite character. Her insanity consisted in a ceaseless dread of appropriating what did not belong to her; she therefore combed her hair an endless number of times in the day, examined her dress minutely every time she put it on or took it off, felt in her shoes, turned up the

chairs, looked under her plate, and thus consumed many hours in the day in endless cares, lest something of value might have adhered to her dress. Such are some of the forms of this wonderful malady, whose maniacal varieties are endless. Thus, some govern the sun, the moon, and the weather; others are savans, distinguished by their discoveries or inventions; others poets or orators, whose discoveries we must listen to under pain of their displeasure; others are kings or emperors, commanding the universe, and giving protection and dignities to those who surround them; others are submitted to the gentler sway of love, and believe themselves to sojourn among the sylphide and houris; others are gods or prophets in communication with heaven, and the immediate agents of some Divine commission; while others are the separate or conjoined persons of the Holy Trinity.

Mania, Melancholia, and Dementia are forms in which the powers of the mind are more generally overthrown, and the senses more commonly affected by hallucinations. In many instances the association of ideas is either so destroyed that the patient is in a state of complete delirium, or the expressions of judgment are erroneous, the memory impaired, and the affections perverted.

It is seldom in *mania* that the patient, as in *monomania*, is only insane on one subject. His mind, says Esquirol, is a perfect chaos; all is violence, effort, perturbation, and disorder. He confounds time and space, associates persons and things the most unnatural, creates images the most unreal, and lives isolated in feelings and reasoning from all the rest of the world. His actions also are often wicked. He hates all whom he was wont to love, and wishes to overthrow and to destroy everything. The female maniac, perhaps in health the model of candour and virtue, gentle and modest, an affectionate daughter, a devoted wife, and a good mother, becomes in this disease bold and furious, exposes her person unmoved to the gaze of every eye, is blasphemous and obscene, respects no law either of decency or humanity, and threatens her father, strikes her husband, or perhaps murders her children.

Of Dementia, the following may be taken as an example:—A merchant, after some losses in trade, became perverted in his affections, neglected his business, and refused to eat for fear of being poisoned, and, indeed, committed all sorts of excesses. This state of excitement was followed by a state of depression, during which he stood by his bedside, his head bent forward, his arms hanging by his side, his eye vacant and fixed, and his countenance unchangeable. This condition was followed by another paroxysm of excitement, in which he spoke incessantly; abused his family; walked with a rapid step—overthrew all in his way—laughed—stopped—heard and saw his enemies day and night, and especially his mother, who

reproached him. The stage of depression again came on; he slavered from the mouth; his urine was passed involuntarily; he refused to eat or drink, or to undress himself, and when placed in bed, lay all night in the position he was first placed in; kept an absolute silence, and at length fell into a state of stupor, from which nothing could rouse him.

Some persons suffering from dementia walk incessantly, seeking something not to be found. Others, on the other hand, can scarcely drag their legs after them; others constantly walk round and round within the space of a few feet; while others lie rolled up in bed, or extended on the ground. Some write incessantly, but the words or sentences have rarely any connection or meaning; others talk incessantly, but incoherently, beginning a sentence without being able to finish it. So completely do some lose the association of names with things, that they utter nothing but what Hamlet would call "words! words!" One will strike his hands day and night, while his neighbour will balance his body in one position with a most tiring monotony of movement; another will leap and laugh, whistle, dance, and sing during the whole day; others, again, dress themselves in all sorts of whimsical manners; while others will display a few rusty nails or common pebbles as the riches of the universe. The gradations of this form of madness are, first, a chaotic state of the faculties; secondly, the loss of all sense of propriety; and, lastly, the entire oblivion, or nearly so, of every spark of intelligence.

In dementia the patients are extremely liable to become paralytic. An affection of the tongue, denoted by a thickness of speech, is the first symptoms of its approach. After a time, the speech is more manifestly affected, followed by a loss of power in the limbs of one side, more marked in the lower extremity, so that the step is feeble and straggling. In the last stage they are completely paralytic, and only able to utter a few unintelligible sounds.

These illustrations and others which follow, are condensed from those originally given by Dr. Robert Williams.

Looking to insanity generally, it is seldom that the ideal character assumed by the patient is well sustained; more commonly it is little more than the name. In a few cases, however, it is well supported, and the prophet assumes a tone, energy, and attitude suited to the envoy of the Almighty; the emperor, the majestic step and deportment corresponding to his assumed regal state. In these instances he almost always sees visions, or is visited by invisible interlocutors, to whose dictates he generally becomes fatally obedient.

Whatever form insanity may assume, like other diseases it may be divided into three stages. The first stage may be sudden in its attack, sometimes almost instantaneous, but more commonly it is marked by a short prelude of an indefinable aberration from health

both of body and mind, as already fully noticed. The patient, besides being out of health, is easily excited, is headstrong, and ready to commit every sort of extravagance. In the second stage the disease is formed; while in the third stage the patient, if he recovers, becomes more docile, more natural in his affections, sleeps better, and takes more food; or the disease may become inveterate and incurable. Epilepsy, palsy, or other phenomena may unexpectedly terminate existence.

The attack of insanity may last many weeks, many months, or many years, but in most cases it has a tendency to remit; and hence some authors have classified insanity into continued, remittent, and intermittent. The remissions are more or less marked, and of various duration. Thus many patients are violent by day, yet are calm and tranquil at night; while others, on the contrary, are tranquil by day, but are sleepless and violent at night. Sometimes the remission is only every second day, when it takes place with great regularity. Shakspeare thus notices its remittent character:—

> "This is mere madness;
> And thus awhile the fit will work on him;
> Anon, as patient as the female dove
> When that her golden couplets are disclos'd,
> His silence will sit drooping."

Again, the paroxysm of insanity is sometimes so regular as to assume an *intermittent* type, occurring every week, every month, every three months, twice a-year, or every one, two, three, or four years, often without any other known cause than the return of the period.

Diagnosis.—There are two especially important reasons why it is important to obtain a correct diagnosis; namely, first, with reference to the necessity of an early application of remedies; and second, with reference to the question as to whether or not the person presumed to be insane, is or is not legally responsible for his acts. To obtain a correct and early diagnosis, and with a view to attain either or both of these objects, one "*only safe rule*" is to be observed. For in the existing state of legal and medical science, there is no uniform test of insanity, either of a legal or of a medical kind, which can be safely or certainly applied. This rule consists in a close and thorough appreciation of the physical and mental aspects of the existing condition of the presumed lunatic, at the period of his supposed insanity, compared with his prior physical and mental manifestations, which were regarded as his natural and healthy state, and which had not been observed to be different from those of other men—"*a comparison of the individual with his former self.*" The intellect must be considered in relation to itself—the manifes-

tations of mind *now*, must be compared with those which have been *heretofore* expressed by the same individual; and if mental phenomena are ascertained to exist of a morbid kind, compared with those which have been expressed before, and, especially, if there be any symptom of cerebral disease, the individual may be fairly deemed insane, and if so, legally irresponsible for his acts. Between the criminal and the insane mind there are important relations, and if it can be shown, as there is reason to believe valuable evidence and strong testimony exists to prove, that a large amount of crime is connected by hereditary predisposition and descent with minds diseased, a large field of usefulness is open to the politician, the lawgiver, and the physician, from which future generations can alone hope to reap the benefits; when crime and lunacy may perhaps be observed to diminish together.

One of the great difficulties to overcome in the diagnosis of insanity, especially in the endeavour to ascertain the antecedents of an attack, is the great risk the physician runs in being misled by the interested statements of friends and relatives. They invariably act on the principle, that "what they wish to be, that they believe." They may wish their relative to be considered sane, or the contrary, and they believe him to be so when he is not, and they will at first invariably disguise or deny circumstances which might be thought discreditable to the presumed patient or themselves. One of the great difficulties of diagnosis also is to distinguish cases of *monomania* from *sanity*. With the exception of some given *delusions*, the patient may be rational on all other subjects, and in some instances even the powers of his mind may be superior, and they often are so. One celebrated instance of this kind occurred to the late Lord Erskine. The lunatic had indicted a most affectionate brother, together with the keeper of the madhouse, for false imprisonment. He was placed in the witness-box, and the learned Lord, not instructed in the *delusion* of the monomaniac, consumed the whole day in fruitless attempts to expose his infirmity. At length Dr. Sims came into court, and suggested to the learned counsel that the patient believed himself to be the Lord and Saviour of mankind. Lord Erskine then adroitly addressed him in that character, lamenting the indecency of his ignorant examination, when the patient expressed his forgiveness, and with the utmost gravity and emphasis, in the face of the whole court, said—"I am the Christ!" In a similar case, tried before Lord Mansfield, the patient evaded the questions of the court the whole day, till Dr. Batty arriving, asked him what had become of the princess with whom he corresponded in cherry-juice. Instantly the man forgot himself, and said it was true he had been confined in a castle, where, for want of pen and ink, he had written his letters in cherry-juice, and thrown them into the stream below,

and that the princess had received them in a boat. Such answers of course immediately terminated the cases.

Prognosis.—As a general rule, the younger the patient the greater are the chances of recovery; but above the age of fifty few are cured. Of those that recover, the exciting cause often greatly influences the result. Many cases recover when the insanity proceeds from drunkenness, provided the patient can be restrained from drinking; and also if it arises from slight moral or physical causes. When, however, the shock is severe, the recovery is less certain, and if combined with epilepsy, recovery is almost impossible. The form of the disease also greatly influences the result. When the patient suffers from *hallucination*, the chances of recovery are much diminished. Taking insanity generally, *monomania* is least frequently cured, the *melancholic* and the *stupid* are most frequently cured or improved; and the *maniac* holds an intermediate place. If, when labouring under *dementia*, the patient be seized with palsy, it is rare that he survives beyond a twelvemonth after the first symptom—the affection of the speech.

The mortality among the insane appears to be as 1 in 6·7 cases annually (Esquirol). The largest mortality is from *dementia*, the least from *monomania;* in the latter, indeed, where there is no tendency to suicide, the duration of life is little abridged, so that premature death is almost in all cases owing to accidental and often preventable causes.

In the period of convalescence, the return of the correct exercise of judgment is an uncertain and fallacious indication of cure, so long as the emotions are perverted even in a slight degree from their normal conditions; but immediately the emotions are controllable and proper, the cure may be considered complete (Bucknill).

Treatment.—The treatment of insanity resolves itself into the medical, the moral, and the dietetic treatment. Medicine indirectly acts upon the brain as it does upon other organs, so as favourably to influence the course of the disease. It regulates the different actions and secretions of the other organs of the body, and thus improves the general health, so that the happiest results are often obtained by the early and judicious use of medicinal agents.

"Cases of severe mental despondency and distress—instances of alienation of mind associated with hallucinations, and with apparently chronic and fixed delusions, accompanied by strong suicidal and homicidal feelings, have all yielded to medical treatment; and thus persons in all grades of life, who, if those conditions had not been fully appreciated, would have fallen victims to their own insane impulses, have been restored to society in a state of mental health. The symptoms which so generally precede the act of suicide—such as depressed spirits, distress of mind, needless alarms and apprehensions as to some foreboding evil, great irritability of

temper, and inability to attend to the ordinary occupations of life, excitability, headache, disturbed or sleepless nights, morbidly exaggerated views of the actual ills and circumstances of life, are in many cases certain signs of acute disorder of the brain, requiring medicinal relief, and being manifestly and rapidly benefited by prompt and energetic medical treatment" (WINSLOW).

No uniform method of treatment can be taught. Generally it may be stated, that the more the symptoms approach those of *cerebritis, encephalitis*, or *meningitis*, in other words, in proportion as they indicate active inflammatory action, general and local bloodletting is advisable. Local bleeding is not to be confined to the head, for it not unfrequently happens that it may be adopted with reference to a distant viscus. Leeches to the vulva and thighs are beneficial in cases concurrent with the menstrual period; and to the sphincter ani, in those obviously connected with suppressed hæmorrhoids or hepatic congestion. In some instances leeches may be applied with benefit to the Schneiderian membrane, particularly in those cases occurring in early life, and in persons of plethoric constitution and of sanguine temperament. Illusions of hearing or of vision which had embittered the patient's life have been removed by leeching behind the ears, or over the supercilliary ridges. The utility, in acute mania, of prolonged hot baths, is much insisted upon by Dr. Winslow. The patients remain from eight to fifteen hours in them, at 82° to 86° Fahr., whilst a current of water at 60° is continually poured over the head. This method of treatment, however, is *inadmissible* in *intermittent* mania, and in insanity beginning with great mental derangement, or associated with *epilepsy* or *general paralysis*.

Sedatives, or agents which modify directly the condition of the cerebral tissue, constitute very valuable remedies. In recent acute cases they are generally admissible; but it is in the various chronic forms of melancholia they are most useful. Dr. Winslow observes—

"In suicidal insanity, when local cerebral congestion is absent, and the general health and secretions are in good condition, the meconite and hydrochlorate of morphia often act like a charm, if *uninterruptedly and perseveringly given* until the nervous system is completely under their influence."

Radical cures have been effected by the occasional local abstraction of blood from the head, the administration of alteratives, the warm bath, and sedatives. Success from the use of sedatives often depends upon a *ready adaptation of the form of sedative to the description of case in which it may be deemed admissible, and a judicious admixture of various kinds of sedatives*. With respect to opiates, "that medicine which will allay watchfulness in one will not in another, but, on the contrary, increase it. This is particularly the

case with opium, which is rarely found admissible in insanity in its crude state. It more frequently creates heat and general febrile action than sleep" (Sir William Ellis). In cases, however, of recent excitement, morphia in considerable doses has been found most beneficial.

Endermic medication in insanity offers numerous advantages, but in the opinion of Drs. Winslow and Laycock, is too little practised. "In some chronic forms of insanity, in dementia, and persistent monomania, connected, as was supposed, with morbid thickening of the dura mater, and with interstitial infiltration of the membrane, as well as with exudations upon its surface, the head having been shaved, a strong ointment of the iodide of potassium combined with strychnine has been perseveringly rubbed over the scalp. In other instances, the shaved head has been painted with the mixture of iodine, and both modes of treatment have been attended with benefit. When the mental symptoms are supposed to be associated with effusions of serum, iodine applied externally at the same time with minute doses of calomel, or mercury with chalk, so as slightly to affect the system, are recommended: and this treatment, conjoined with occasional tonics, diuretics, and stimuli to support the vital powers, is occasionally productive of considerable benefit, in cases apparently placed quite beyond the reach of improvement or cure."

A *solution* of iodide of potassium constantly applied to the shaven scalp has been followed by improvement in the mental state. Cases of *dementia*, the consequence of *strumous* irritation or inflammatory action, are those in which endermic medication will yield the most satisfactory results (Laycock in *Medico-Ch. Review*, for Jan., 1857.)

Purgatives are generally regularly required. When the bowels are constipated, the form of the purgative is determined by the state of the tongue. Supposing it to be white and coated, the *sulphate of magnesia*, or other neutral salt, combined with *tincture of hyoscyamus*, in the proportion of ʒj. of the former to ɱxv. to ɱxxx. of the latter, in *camphor mixture*, is a formula to be recommended. If, on the contrary, the tongue be clean, the cathartic should be given with some slight bitter, as the *infusion* of *orange peel*, or of *gentian*. In some cases the bowels are not only exceedingly obstinate, but the patient is greatly averse to all medicines. In such cases, one or two drops of croton oil placed on the tongue produces free evacuations.

The mild purgative treatment formed the basis of cure in the school of Pinel and of Esquirol, and they usually combined it, in cases of violence, with the application of cold to the head, and of warmth to the lower parts of the body, such as placing the patient in the warm bath and giving him the cold douche—a remedy since more particularly insisted upon by Dr. Brierre de Boismont of Paris, and Dr. Winslow of London. The further treatment consists

in restoring any other functions that may be in defect or in excess, as the functions of the uterus in the female, and of the liver or heart in both sexes, and by the usual remedies applicable for these purposes.

The moral treatment is by many supposed to constitute the more efficient mode of cure in insanity; and it must be admitted to be a most important adjunct. The first important rule is to remove the patient at once from his family. In slight cases, in order that he may be induced to exercise such command over himself as he possesses, and to remove him from influences which may have been aggravating his morbid state; and in severe cases, in order to prevent his doing mischief either to himself or others, are the reasons for this practice. In the latter instance, if the patient is excited, it is proper to place him at once in a darkened room, remote from noise, so that as few objects as possible may irritate him, just as a patient with his eyes affected is kept in a darkened room.

As convalescence advances, he should be induced to undertake some manual labour, or some office in the household, which, by amusing his mind, will invigorate his health, and greatly tend to restore the healthy working of his brain. When the circumstances of the patient admit of it, travelling, which embraces change of air and change of scene as well as exercise, is often highly salutary in incipient cases. Much has of late been done by the judicious introduction of music and other amusements into asylums. Esquirol, however, who made many experiments of this kind, induced the musical professors of Paris to perform concerts at Salpêtrière, and also took his patients to the theatres, but considered these amusements, in every instance, to have acted unfavourably. When reason is restored, and the affections again fix themselves on their natural objects, *and when the emotions are under control*, the patient may now be allowed to see his friends, and have his attention directed to the affairs and interests of his family; but it should be remembered that the mind remains weak and enfeebled for some time after apparent recovery, and consequently the patient's restoration to society should be gradual.

Dietetic Treatment.—In general the patient requires a light but nourishing diet, with a limited portion of wine. When, however, the head aches, or the tongue is coated and white, neither butcher meat nor poultry should be allowed.

Disease of the Spinal Cord and Nerves.

The doctrines regarding the nature of the diseases associated with the structure and functions of this portion of the nervous system are in a state of transition. The inquiries into the structure of the cord, the arrangement of its minute component parts, and their

connections with each other—with the brain on the one hand, and with the different parts of the body on the other, are only yet being investigated and elucidated with success. Difficulties of the most formidable kind surround alike these anatomical, physiological, and pathological pursuits. Much labour is required in the first instance to expose the spinal cord, in the dead body, and to examine its morbid states; while delicate manipulations and the most unwearied research, by the most experienced observers, during the last half century, have served alike to show how mysterious and difficult is the subject in all its bearings, and how important and interesting the results. In this arduous task the names of anatomists, physiologists, and the busiest of physicians of this country, have in all such recent investigations borne a distinguished and pre-eminent part.

In 1811, Sir Charles Bell took the initiative in these researches, and surprised the scientific world by his beautiful and interesting discovery regarding the distinct functions of the *anterior* and *posterior* roots of the spinal nerves.

The epoch of another era is marked by the interesting indication of the existence of the property of "*reflex action*," foreshadowed by Unzer and Prochaska, but which the ingenious and important investigations of the late Dr. Marshall Hall so largely contributed to develop. The names of John Reid, Grainger, Swan, Solly, R. B. Todd, and Bowman, stand prominently forward in this same line of inquiry.

A third era is characterized by the most inquisitive microscopic research into the connections and arrangements of the more minute component parts of the spinal cord. In this field of research the labourers are not few, and our own country is especially represented by the observations of Mr. Lockhart Clarke, Dr. Todd, and Mr. Bowman. Abroad the persevering industry of Kölliker, Valentin, Stilling, Remak, Engel, Vander Kolk, and Wagner, and many others, have thrown important light on most of the important questions regarding the structure and functions of the spinal cord. But "let not the spark be lost in the flame it has served to kindle." The beautiful discovery of Sir Charles Bell, while it astonished the scientific world at the time, soon expanded in magnitude and importance. From it, as from a mighty tree, the boughs that have dropt from its parent stem have borne to the earth those living blossoms, which, germinating in their turn, are now daily expanding their branches into every land where the science of medicine is advancing.

It may be useful in studying the nature of the diseases associated with the structure and functions of the spinal cord and nerves, to have a distinct conception, of the more important general points which seem to have been established, relative to its anatomy and

physiology, and how far these are illustrated and supported by observations on its morbid anatomy. The following is a condensed statement of the general results established by the prolonged labours of Professor Schroeder Van der Kolk of Utrecht; a more extended detail of which may be seen in *The Medico-Chirurgical Review* for January, 1857. These are consistent with the observations also of Valentin and Stilling.

(1.) The spinal cord (including the medulla oblongata) is the instrument through which the power of motion is germinated and expressed, and the co-ordination of movements effected, through which sensation is transmitted to the brain, and to the grey cerebro-spinal matters of the cerebro-spinal centres.

(2.) Complete division of the spinal cord abolishes sensation and voluntary motion in all those parts of the body supplied with spinal nerves from below the seat of injury. Any lesion of the nerve substance, which results from a disease-process, may do this if it destroys completely the nerve matter at the seat of lesion. According to the region in which such a lesion may be situated, so are the different forms characteristic of this loss of power. The nearer the brain and medulla oblongata, the more immediately fatal to life. If, at the junction of the cord with the medulla oblongata, such an injury were to happen, immediate death would ensue, as may be seen when an animal is "*pithed.*" It is in this way in bull-fights that the *matador* kills the bull; he dexterously introduces his knife, between the upper cervical vertebra and the skull, at the moment the head of the animal is directed to the ground by his experienced and skilful manœuvres.

Generally speaking, from the head downwards, the parts of the body are supplied, *seriatim*, by the nerves coming off from the spinal cord, so that according as the injury to the cord is situated lower and lower down, so does the paralysis affect less and less of the body from below upwards, to the seat of disease. Thus, in the cervical region, below the origin of the phrenic nerve, when the lesion is throughout a complete segment of the cord, and above the origin of the superior intercostal nerves, breathing is performed only by the diaphragm and abdominal muscles, while the intercostal muscles cease to act, and the ribs cease to rise and fall. In this condition the patient may live a few days, seldom a week, and never a month (Watson). If the lesion of the segment occurs below the cervical region, in the upper dorsal portion, for example, the breathing is not affected, or but slightly, while the digestive functions become impaired, and paralysis of the trunk and lower limbs is complete. Such a condition is technically called *paraplegia*. It implies palsy and loss of feeling in the lower limbs, hips, loins, and trunk, according as the injury is higher or lower in the dorsal or lumbar region of the cord. A person in this condition may live

a long time, depending greatly on the seat of injury; the higher up, generally the sooner fatal.

(3.) The nerves which issue from the cord by two roots (motor and sensific), unite and form compound or mixed nerves, whose filaments or strands pass from their origins to their destinations, isolated from each other; and, everywhere throughout the body the sensific ramifications of the mixed nerve pass to the surface of the part which is moved by the muscles receiving their motor fibres from the same compound nerve, so that while the former supply sensation to the part, the latter convey the stimulus to excite the act of motion (VAN DER KOLK).

(4.) The anterior (*motor*) and posterior (*sensific*) roots of the compound or mixed spinal nerves are now determined to have certain relations with the grey corpuscular elements of the spinal cord, which are accumulated throughout the central part of the cord, so that a transverse section of the cord shows anterior and posterior cornua of this corpuscular grey substance. These corpuscular cells, constituting the grey matter of the cord, are arranged in several distinct vertical columns, extending throughout its whole length. The most considerable of these cells constitute the columns of the anterior horns; next, those by the posterior commissure; then those between the anterior and posterior horns; and lastly, those in the posterior horns, which rank the smallest in size, and it is even doubted by some whether they are really nerve cells. These columns of corpuscular nerve cells are larger and richer in nerve cells at the cervical and lumbar enlargements; and the proportion of cells increases still more at all those points where the roots of the nerves penetrate into the cord to its grey substance. Thus, clusters of cells occurring more or less apart, are placed above each other longitudinally.

(5.) There is now no doubt that the anterior roots (motor nerves) spring from the cord itself and take their origin out of the ganglionic cells of the anterior horn, each cluster of which forms a ganglionic plexus.

(6.) The anterior medullary fibres of the cord are the channels through which the influence of the will from the brain is conveyed to these corpuscular or ganglionic plexuses, whence these motor nerves take their origin.

(7.) The posterior roots (sensific nerves) have been traced towards groups of ganglionic cells, but have not been shown to communicate with them.

(8.) These posterior roots have been traced to subdivide into two portions, which may be called sets of radicles or rootlets. At the posterior part of the cord one set of these posterior nerve-roots ascends immediately in the white substance, and appears to proceed

directly towards and into the brain, thus constituting the channel of sensation; the other portion of the posterior nerve roots transversely penetrates the white substance of the cord towards the posterior horn of the grey matter, through which it passes. Its fibres there mingle in part with certain nerve fibres which are observed to encircle in a transverse direction the posterior horn of the grey substance of the cord; and in part they lose themselves amongst the ganglionic cells of the centre of the grey matter, between the anterior and the posterior horns.

(9.) These latter rootlet nerve fibres, of the great posterior roots, are thus supposed (and with great probability) to constitute the apparatus of reflex action, directing their stimulus through the group of ganglion cells, with which they appear to be connected, into the ganglion cells of the anterior horn, from whose plexus of cells the filaments of the motor roots arise. Thus the posterior nerve roots include two descriptions of nerve fibres, namely, those for sensation proper, and those for reflex action; and hence the greater thickness of the posterior roots compared with the anterior; they are more than double the size of the latter.

(10.) These different cell groups or plexuses of corpuscular cells appear to be united throughout the cord by longitudinal connecting fibres, so that co-ordination of movement is thus effected.

(11.) The roots of the motor nerves thus receive the excitement or stimulus to action from the group of ganglionic cells in which they originate. It is communicated to them either through the will anteriorly, and from above downwards, or by the sensific nerves by their reflex filaments posteriorly, and from the peripheral parts of the body with which the sensiferous nerve filaments are connected. An individual group of corpuscular cells whence the motor roots arise thus becomes susceptible to a *psychical* as well as to a *physical* stimulus.

(12.) All reflex action thus takes place by a definite channel; and its operation seems to be regulated by communicating fibres which bring the different plexuses of nerve cells into communication with each other. Thus, co-ordination and combination of movements are explained; and so also is the diffusion of action over remote regions, especially in great irritation of the cord, as in attacks of epilepsy, tetanus, or under the influence of the strychnine poison or hydrophobia.

(13.) The grey matter of the cord seems chiefly to avail for motion; the posterior part being chiefly subservient to reflex function and to the co-ordination of motion; while sensation is transmitted upwards exclusively by the posterior and lateral medullary columns to the encephalon, and has probably its proper centre in the medulla oblongata. Here is probably localized the

centre from which the more universal reflex movements and convulsions take their origin.

Experience has convinced Professor Van der Kolk that the attention of the physician ought to be directed to the condition of the medulla oblongata in cases of epilepsy. He has frequently succeeded, where the disease has not been of long duration, in procuring a recovery through derivative applications to the nape of the neck; while the pathological changes resulting from protracted epilepsy are not unfrequently manifested by induration of the medulla oblongata.

The morbid state of the spinal cord in *four* cases of tetanus, which I have accurately determined to exist, is also consistent with statements regarding its minute anatomy, and the relation of its parts. They all exhibited one character in common, and pointed out the spinal cord as the seat of lesion in that formidable malady. The lesion referred to was not manifest to the naked eye, but was determined to exist with certainty, by an examination of the specific gravity of the cord substance. For this purpose the cord was separated from its nerves and divided into parts of a uniform size, and the specific gravity of each determined.

"Each of the four cases showed that the general specific gravity of the spinal cord throughout, is increased in cases of tetanus, the average specific gravity of the healthy cord being 1·036. They showed, also, that a change is *suddenly* indicated about the region of the cord, in immediate communication with the wounded part, and that in one case of idiopathic tetanus the change was uniform throughout. In the first case I examined, where the wound was on the occiput, the uppermost three inches of the cord were of the highest specific gravity, and the difference became *suddenly* and *not gradually* manifest at the fourth inch. In the third case, a very marked difference was apparent when the cervical region was compared with the rest of the cord; and the difference was suddenly marked where the roots of the cervical and first dorsal nerves left the cord to form the brachial plexus. The wound in this instance was on the fingers.

"In the last case the difference was suddenly manifested in the lowermost part of the cord, corresponding to the region where the nerves were in communication with the lower limbs, which were the seat of the injury."—(*Glasgow Med. Jour.*, No. IV., Jan., 1854.)

(14.) The anterior commissure of the cord is distinguished from the posterior by the decussation of the fibres. After their intersection, when traced downwards, these fibres are observed to be deflected so as to run in part along the margin of the anterior fissure, interlacing themselves within the white substance; and in part to enter the inner edges of the anterior grey horns, where they

mingle with the encircling fibres already noticed, which spread themselves thence in the medullary columns of nerve cells and join the longitudinal fibres. Their function is probably to maintain the motion of the right and left side of the body.

The fibres of the posterior commissure have a parallel course without any intersection.

(15.) Some interesting observations on the secondary affections of the cord by Dr. Turck seem to show that when the disease destroys a certain portion of the nervous centre, the strands, filaments, or cords of nerve substance which proceed from that centre or arrive there, subsequently degenerate, having ceased to receive or to convey an impulse. This degeneration takes place in the same direction in which these strands or filaments convey impressions; thus, in the centripetal fasciculi (posterior columns) the secondary affection occurs always in the centripetal direction; while in the centrifugal fasciculi (anterior columns) it shows itself in the centrifugal direction; and in the mixed fasciculi (lateral columns) it shows in both directions. Thus it happens that secondary affections of filaments or strands of fibres in the spinal cord may result from a lesion in one of the hemispheres of the brain; generally in about five weeks after the primary injury.

This observation may be regarded as a rule, and by it are also to be explained those cases of so-called "paralysis *musculaire progressive*" which have been described by Meryon, Cruveilhier, Aran, and Valentiner; although the nervous lesion has only been demonstrated in some of the cases.

Inflammation of the Membranes of the Spinal Cord.

Pathology.—The inflammatory states of the membranes of the cord, and the morbid effects they produce, are the same as those of the membranes of the brain, namely, serous effusion, which may organize or degenerate into suppuration or softening.

The rachidian dura mater may be inflamed either at its free or at its adherent surface. On examining the spinal canal, after caries of the vertebræ, the areolar tissue uniting the dura mater to the walls of this cavity is often found greatly loaded with venous blood; and in some instances is broken down, so that the dura mater is entirely detached. When this state of parts exists, it is most probably due to inflammation. This inflammation may terminate by resolution, or it may proceed, and serum be effused, as in two cases reported by Bergamaschi, in which he found that fluid poured out between the osseous structure and the dura mater. In this site the effusion has no communication with the cavity of the cranium, because the dura mater of the cord, while it is but loosely attached by areolar tissue to the vertebræ, is very firmly attached round the

margin of the foramen magnum, and especially to the basilar portion of the occipital bone.

The dura mater of the cord also appears liable to the ulcerative process, and to gangrene. In a case given by Ollivier (vol. ii., p. 569), of a druggist who died on the twentieth day after suffering from lumbar pains, with rigidity of the trunk and lower extremities, together with tetanic spasms, there was found, on cutting through the muscles of the lumbar region, half an ounce of pus, or more, which was traced to the cavity of the arachnoid, the rachidian dura mater having ulcerated and ruptured.

The spinal *arachnoid* and *pia mater* are liable to inflammations similar to the corresponding membranes of the brain.

Diffuse inflammation of all the folds of the arachnoid has often been observed, those membranes being red and injected for a greater or less extent.

Effusion of serum both into the cavity of the spinal arachnoid, and between the dura mater and pia mater of the cord, is not uncommon. Such effusion communicates freely with the cavity of the cranium, so that fluid may pass easily from the one to the other. Lymph is more rarely effused, yet has occasionally been found organized, uniting the opposite sides of the sac together. The pia mater and the arachnoid have also been found adherent after effusion of lymph into the cavity; and instances have occurred in which the layers of the spinal membranes have been found united to each other.

Suppurative inflammation of the spinal membranes also occasionally takes place. This form of inflammation, according to Ollivier, only occurs in the cavity of the arachnoid. This physician gives as an instance, the case of François Sabatier, aged twenty-eight, who, without any known cause, was seized with dorsal pains, lassitude, and weakness in all his limbs, and, as the disease advanced, with tetanic opisthotonos, which returned at irregular intervals. He died on the ninth day, and on examining the spinal canal, the arachnoid *cavity* throughout its whole extent was filled with pus.

Frequently if the inflammation is acute it is associated with disease of the cerebellum or of the intracranial membranes; and in the chronic form it rarely exists, except in connection with caries of the vertebræ.

Symptoms.—The symptoms of rachidian arachnitis are often obscure at the commencement; but, once formed, the disease is characterized by pains in the back, with affection of the muscles, and retention of urine.

A greater or less degree of pain of the back, proceeding from the point of greatest intensity of inflammation, is one of the most

prominent symptoms. It may be limited to one vertebra, or may extend along the whole of the spine, and even down the thighs. Sometimes it is continued, sometimes intermittent, and in either case it may be of uniform intensity or darting. Occasionally it is so severe as to cause the patient to shriek out. It is greatly increased by movement of the body, or by the application of a heated sponge; but is not augmented by pressure upon the spinous processes.

The affection of the muscles varies from simple stiffness of the part to opisthotonos. This latter symptom is often limited to the neck or trunk, without the limbs participating, as in a case given by Rayer, in which the trunk and neck were drawn backwards, while the patient walked freely till the time of his death. In the case of a waggoner thrown off his cart and pitched on his neck and shoulders, the neck was stiff, the jaw was locked, the body convulsed, and the patient delirious. It was not till the twelfth day, however, that the lower extremities became affected and palsied, when the patient sunk into a typhoid state and died. A large quantity of pus was likewise found in the spinal arachnoid cavity in this case.

Neither the pulse nor the tongue are much affected at the commencement of this disease, but towards its close the one becomes rapid and feeble, and the other brown and dry, and the teeth fuliginous. The patient's state is now typhoid, and he dies delirious or comatose.

Retention of urine generally persists from the beginning to the termination of the disease. Constipation often exists to a great degree at first, but afterwards the bowels act regularly, or even suffer from diarrhœa.

The duration of this affection is very various; in acute spinal arachnitis life is seldom preserved beyond a fortnight or three weeks; but if the case be slight, the patient often recovers in six weeks or two months; while in chronic cases, if the disease be of a character to terminate unfavourably, the period may be much longer.

Diagnosis.—The symptoms which distinguish spinal arachnitis from inflammation of the substance of the cord are *pain* and *contraction* or *convulsions* of the limbs; for in pure myelitis there is seldom any severe or constant pain, while the limbs are generally palsied, and their sensations benumbed or lost. It is distinguished from rheumatic lumbago or psoas abscess, by the affection of the limbs and of the bladder.

Prognosis.—Many authorities consider spinal arachnitis to be incurable, but numerous cases marked by the characteristic symptoms in a mild form do recover.

Treatment.—Spinal arachnitis, seldom depending on a morbid poison, is perhaps, in all cases, best treated by bleeding and mild purgatives. General bleeding is sometimes necessary; but local bleeding, either by cupping or leeches, along the vertebral column, is most useful, and perhaps cannot be omitted with safety. The medical treatment consists in moderate purging by the neutral salts, as the sulphate of soda or the sulphate of magnesia; for as these act on the bladder as well as on the bowels, they are probably the best remedies. But whatever purgative may be selected, it will be proper to combine it with the tincture of hyoscyamus, or other mild opiate, to procure the patient some relief from his sufferings. Mercury, it should be stated, is not supposed to exert that power in meningitis of the cord which it possesses over inflammation of serous membranes generally. The warm bath is an excellent adjuvant in the earlier stages of the disease; whilst in the latter stages blisters, setons, moxæ, or the ointment of the tartarate of antimony are more beneficial, or at least as a last resource are deserving of a trial.

An abstinence from all animal diet should be imperiously prescribed, throughout the whole course of the disease.

Myelitis, or Inflammation of the Substance of the Spinal Cord.

Pathology.—As the spinal cord is a continuation of the brain, and similarly composed of medullary and cineritious matter, it is reasonable to expect that its diseases will be similar. Such is observed to be the case. Inflammation of the cord may be diffuse. It is characterized by a few more bloody points than usual, or by a slight red or rose colour suffusion throughout its substance. There is reason to believe, writes Dr. Abercrombie, that inflammation of the substance of the cord, like the corresponding affection of the brain, may terminate fatally, either (1.) in the *acute inflammatory stage;* (2.) by *ramollissement;* (3.) by *undefined suppuration;* or (4.) by *abscess.*

In illustration of the first, Dr. Abercrombie quotes the following case from Portal :—

"A woman had long been subject to a convulsive affection in the left lower extremity, immediately before the appearances of the menses; this occurred at every period; when the discharge took place freely, it ceased. After the cessation of the menses, which happened at the age of forty, this extremity became paralytic. After some time she was affected with convulsions of the left arm, and soon after died comatose. On dissection, the membranes of the spinal cord were found in a state of inflammation at some of the last dorsal vertebræ. The cord itself was very red and softened on the right side; on the left it was sound through its whole extent."—(PORTAL, *Cours d'Anatomie Medicale*, tome iv., page 116.)

The most common affection, however, is the ramollissement or serous inflammation. In this form of disease the substance of the cord is greatly broken down and softened, so as to be sometimes reduced to a mere pulp. Ollivier mentions a case in which it was so diffluent as to give the sensation of fluctuation under the finger. This disorganization sometimes embraces the whole thickness of the cord, sometimes only one of its columns, so that it is of very variable extent. It is constant, however, that the centre or *grey* substance of the cord is more softened than that of the circumference or white substance. The ramollissement may exist in the cervical, dorsal, or lumbar portions; but it is most common in the lumbar, and after that in the cervical portions, or in those parts which contain the greatest quantity of *grey* substance, and the greatest number of blood-vessels. The part affected is generally swollen, a circumstance more striking than in similar diseases of the brain, because the spinal canal is large in proportion to its contents, compared with the cranium. The softened part is also generally ash coloured or white.

Some pathologists have regarded ramollissement of the cord as a particular alteration of the nervous system, resembling the effects of a contusion of soft parts, and the result of the shock. It often occurs, however, when no shock has been received, and has not the least resemblance to a contusion of soft parts.

Induration of the spinal substance is another result of myelitis, and probably depends upon a form of inflammation in which fibrinous exudation becomes consolidated. Portal states he has found the cord of a cartilaginous hardness, while the membranes were red and inflamed; and Abercrombie gives a similar case.

The substance of the cord may likewise become infiltrated with pus, or it may be collected into an abscess. The fact of infiltration is perhaps questionable, but there can be no doubt of an abscess having occasionally formed in the substance of the cord. Velpeau, indeed, gives a case quoted by Dr. Abercrombie in which an abscess was formed in the right column of the cervical portion of the cord, three inches long and two lines broad, while a smaller one existed also in the left column (*Revue Méd.*, vol. ii., p. 217).

Symptoms.—The symptoms of myelitis are in general limited to the parts below the injury. In a few cases, however, the accidents are reflected from below upwards. In general both upper or both lower limbs are affected; but in a few instances only one limb. The earliest symptoms are generally recognized in the fingers and toes. The first symptom is numbness, with a sensation of coldness extending up the limb. Shortly afterwards the patient complains of pain in the back, corresponding to the seat of greatest intensity of the inflammation. This is not constant, but when we make pres-

sure with the finger over the spinous processes of the affected part it may be augmented or only then felt. These symptoms are succeeded by impaired motion, and often likewise by diminished sensation of one or more limbs, followed by paraplegia, or other form of palsy. The palsied limbs may be either relaxed or permanently contracted: thus the hand may be bent on the upper arm, or a leg be flexed upon the thigh; or the affected limb may be attacked with convulsive twitchings, or may beat incessantly. As the disease advances the bladder becomes affected, and the patient is either incapable of retaining his urine, from the sphincters being palsied, or it is suppressed from their permanent contraction. The action of the bowels is slow in the first instance; but towards the close of the disease the patient is often purged, and the stools pass involuntarily. If the disease be the result of an accident, the pulse is at first rapid and full; but if it be spontaneous the pulse is generally natural, until the powers of life are broken down by the continuance of the affection. As death approaches, the nates and the prominent parts of the pelvic region, on which the body rests, ulcerate extensively, so that deep sloughs form, and although the patient, from anæsthesia, suffers no pain, he nevertheless ultimately sinks exhausted.

In injuries of the spine, from wounds and contusions, some differences in the symptoms have been observed, according to the seat of the injury. It is well known, for example, if the spinal cord be lacerated or divided above the origin of the phrenic nerves, or above the third cervical vertebra, death is the immediate consequence, the nervous influence being no longer transmitted to the diaphragm and other muscles of respiration. Petit gives two remarkable instances of this. The only son of a working man went into the shop of a neighbour, who, in play, raised the child from the ground by putting one hand under his chin, and the other at the back of his head. The child, only six or seven years old, struggled, dislocated his head, and died immediately. There are a few cases, however, in which disease of these parts has not been immediately fatal. Thus the odontoid process has been destroyed by caries, or the second cervical vertebra has been dislocated, and yet the patient has continued to live for some months, or even some years. A remarkable case of a diminished area of the occipital foramen, whence resulted great pressure on the cord, is related by Mr. Holberton in *The Med.-Chir. Trans.*, vol. xxiv., p. 180. The patient lived more than two years, the most remarkable symptom being an extremely low pulse. In these chronic cases the formation of the disease is slow, so that the cord becomes accustomed to the gradually increasing pressure, and the respiration consequently still continues to be carried on principally, though feebly, by the

muscles of the neck and shoulders, the diaphragm and intercostal muscles being more or less palsied.

When the injury, however, is below the origin of the phrenic nerves, or at the level of the fifth and sixth cervical vertebræ, the inspiration is free, but the expiration is laborious, for the intercostal and abdominal muscles are paralyzed and incapable of assisting in that process. The patient can yawn, for that is an act accompanied by inspiration; but he cannot sneeze, for that is an act accompanied by expiration. At this point, also, the upper extremities are still palsied, both as relates to motion and to sensation. When the palsy of motion and of sensation is complete, the patient, says Sir Benjamin Brodie, during the short remaining period of his life, presents the extraordinary phenomenon of a living head, with its sensibility and muscular powers unimpaired, attached to a trunk and extremities of whose existence he is only conscious by the sense of sight. Another very common symptom connected with injuries of the upper portion of the cord is *priapism*. This affection shows itself about the second or third day after the accident, and generally subsides after the first fortnight. It sometimes occurs even when all sensation in the part itself is destroyed, so that the patient is not sensible even when the catheter is introduced.

If the injury be in the situation of the sixth and seventh cervical vertebræ, the palsy of motion and of sensation of the upper extremities is frequently imperfect, while it is complete in the trunk and lower extremities.

When the spinal cord has been injured in the part corresponding to the first dorsal vertebra, the upper extremities may still suffer from an incomplete palsy either of motion or of sensation, or both. When, however, the seat of the lesion is in a line with the second dorsal vertebra, the sensation and motion of the upper extremities remain unimpaired, but the respiration is still difficult from the palsy of the intercostal and abdominal muscles.

The symptoms, when the injury is in the lumbar region, are not dissimilar to those of the dorsal region, except that the respiration is unaffected. Dupuytren has remarked, also, when the lumbar region is the seat of the disease, that the sound introduced into the bladder is more frequently covered with incrustations, and that the patient also more commonly suffers from ulceration of the nates; but these symptoms perhaps result only in consequence of the patient surviving for a longer period than when the superior portions of the cord are affected.

In chronic affections of the cord the palsied limbs usually waste and become atrophied.

In cases in which a limb has suffered from palsy, both of sensation and of motion, some singular phenomena of reflex action still

remain. When a stimulus has been applied to the palsied limb, it often occasions involuntary contraction of the muscles of that limb. Thus, when a feather is passed lightly over the hollow of the foot, as in tickling, convulsions occur in the limb although the patient is quite unconscious that anything is touching his foot. These movements also are quite independent of volition, and vary in extent and force inversely with the degree of voluntary power possessed by the affected limb, being most forcible when the loss of voluntary power is most complete, and diminishes gradually in extent and force as that power is increased. In some instances, by irritating one leg, movements were caused not only in that leg, but also in the other leg; and similar phenomena have been observed by Sir G. Blane and others, in decapitated animals, showing that, consistent with the anatomical observations already referred to, a portion of the cord may furnish a supply of nervous energy after disease has interrupted its connection with the brain.

Diagnosis.—Diseases of the spinal cord, and diseases of the brain, are often followed by nearly similar symptoms; and, consequently, the one may be confounded with the other. But the history of the case, whether it has or has not been preceded by a fit of apoplexy or of epilepsy, will often enable us to determine the particular seat of the disorder. Myelitis is distinguished from lumbago, psoas abscess, and hip disease, by the absence of pain, and by the existence of the palsy.

Prognosis.—There seems no reason to doubt that as many perfectly recover from superficial inflammatory lesions of the brain after fever, so also that many slight inflammatory affections of the substance of the cord may subside, and the patient do well. Many cases, indeed, even when the bladder is slightly affected, recover. If, however, the disease be of more than a few weeks' continuance the prognosis is always grave. Still some few cases recover, the leg becoming withered. But more commonly the disease runs on, and the patient at length dies after a long struggle.

Causes.—The most common causes of disease of this portion of the nervous system are accidental violence, as blows or falls. Affections of the cord, however, sometimes occur idiopathically, and the constitutional causes producing it are exceedingly undetermined. They have been referred to a suppression of the menses in the female, and to the suppression of a hæmorrhoidal flux in the male, while others attribute them to sitting in damp or wet clothes, to venereal excesses, and prolonged exertion in the erect posture without active movement.

No age, perhaps, is exempt from myelitis, but it occurs more frequently from ten years old and upwards. It is most common, however, in adult age, and more frequently attacks the male than the female sex.

Treatment.—In classing ramollissement of the cord with inflammation, it might appear necessarily to infer that the treatment should be strictly antiphlogistic. It is questionable, however, whether this mode is advantageous; and it may be laid down as a general rule, that bleeding ought not to be had recourse to after palsy has occurred. Previous to that symptom it may be admissible; but, even then, it sometimes happens that the symptoms are aggravated almost as soon as the blood flows. After the palsy has manifested itself, bleeding is plainly improper; for, the nervous influence being intercepted, the powers of the lower part of the body are so reduced that gangrene will rapidly supervene, a tendency which loss of blood greatly increases.

As bleeding rather aggravates than amends the symptoms, the chances of saving the patient mainly rest on our acting on the alimentary canal so as to produce three or four motions in the twenty-four hours, and thus create such a derivation as in some degree to relieve the parts: at least the greater number of patients that recover are restored by these means. The particular purgative is not perhaps important; but as the neutral salts act not only on the intestines, but also on the bladder, that class of remedies is generally preferred. At the same time that the bowels are kept free, the patient should be allowed a liberal supply of wine, from six to eight ounces daily, and should be indulged in animal food at least once a-day. Some physicians have recommended small doses of the tincture of cantharides, but the curative effects of the drug are problematical.

With respect to local counter-irritants, as blisters, moxas, or setons, little favourable can be said, as the tendency to gangrene renders their application of doubtful utility. When had recourse to, however, it will be found better to apply them above the seat of the disease than immediately over it, the greater vitality of the superior parts giving more assurance of the disposition of the wounds to heal.

Neuralgia.

Definition.—*Excruciating pain, which returns with renewed violence in a part after periods of temporary remission, and which is believed to be due to some unknown morbid state of the nerves of sensation.*

Pathology.—The affected nerves have been carefully examined after death in neuralgia, and so far as could be ascertained have been found healthy. In some few instances, some morbid appearances have been observed, but only such as are probably accidental, or the consequences of the long continued existence of the disease itself, as redness or atrophy of the nerve. Painful affections of the nerves have occasionally occurred in consequence of cancer or

other diseased structure of the brain. The labours of the anatomist have therefore thrown little light on this affection, and consequently the essential nature of neuralgia is not yet clearly determined.

Symptoms.—Authors generally agree that the most superficial nerves are those which are principally, if not solely, affected with this disease; and of those nerves the trifacial is of all others most frequently so—its particular seat in that set of nerves, being most commonly in the *infra orbital*, the *supra orbital*, or the *inferior* maxillary branches. Next to the trifacial, perhaps, the femoro-popliteal suffers in frequency. Occurring in the branches of the trifacial, the malady is known as *tic douloureux*.

The symptoms being similar in kind, whichever nerve is affected, modified only by the position, connections, and distribution of the nerve, it is proposed only to treat of the trifacial neuralgia, as being the more usual seat of this trying complaint.

Its branches may be attacked separately or conjointly; most commonly, however, only one branch is affected, less frequently two, and the case must be severe in which the three branches, or the whole side of the face is affected. Nevertheless it sometimes so happens, extending even over the summit of the head, and over the temporal region, by the deep branch of the fifth pair which emerges to the surface anterior to the external meatus. It is even also associated with a similar affection of the occipital branches at the same time.

The attack is sometimes sudden, but more generally it is preceded by a dull aching pain at the points where the nerve issues from the cranium or becomes superficial. After this threatening symptom has lasted a few hours or a few days, the patient is seized with a violent darting or shooting pain in the course of the nerve, returning at intervals, phenomena which are characteristic of the disease. The paroxysm is short, lasting only a few seconds or a few minutes, but the pain is perhaps the most severe that the human frame is capable of suffering. Some patients have compared it to an electric shock of great intensity, others to the conflagration of gunpowder, and others to the intensity and violence of a fulminating powder. The late Dr. Pemberton was known to have stamped the bottom of his carriage out during the paroxysm; and Valleix mentions a physician who, suffering from this disease, was induced, by excessive agony, to make deep incisions into his face, and then to apply the actual cautery to the wound; but his pain not being mitigated by these methods he several times attempted suicide. Even in mild cases, the patient often on the instant of attack becomes fixed like a statue, fearing to move a muscle or a limb lest he should aggravate the pain or reproduce the seizure. This is a condition common

to many nervous affections attended by excruciating pain, such as angina pectoris.

In cases of ordinary intensity the effect is so completely limited to the nerve that the skin is not discoloured, while the organs immediately in connection with it are little affected, the eye, perhaps, being only watery, the nose hot, and the teeth aching. In severer cases, however, and where the disease affects the nerve generally, or the whole face and scalp, the condition of the patient is most lamentable. The mouth is spasmodically drawn as in palsy, so that the saliva flows over the chin and neck, or the teeth chatter by the clonic spasms which sometimes attend the disease. The saliva, also, is increased in quantity, and altered in quality; for in cases in which the patient is afraid to clean his teeth lest the paroxysm should return, the whole of the teeth of the lower jaw become so incrusted with tartar as to form one solid mass, indicating at the same time a depraved state of the digestive organs. The eye and eyelid are likewise frequently convulsed, the conjunctiva injected, and the nose discharges a muciform matter. To touch the very hair of the head produces pain, and sometimes the affected nerve may be traced by a red line marking its course.

The recurrence of the paroxysm is very various: in slight cases it may return only once in a few weeks, or in a few days; but in some severe cases it will return every quarter of an hour, every five minutes, or every minute, and even every few seconds. In a few cases the paroxysms occur periodically and at stated intervals. In general, however, the times of recurrence are very uncertain; sometimes the patient is attacked with great violence many times a-day for many days or weeks together, so that the disease is almost continuous; at other times it intermits for a week, a month, six months, or a year.

The disease is situated nearly as often on the right as on the left side of the face. According to Valleix, twenty-three times on the right and twenty-one times on the left, and only twice on both sides of the face. Pressure over the diseased nerve rarely increases the pain.

The exceptional cases, where pain is relieved by pressure, show that the conditions causing the pain have their site to the central side of the place pressed upon. Such cases may be relieved by division or removal of a part of the nerve trunk at the part pressed upon.

The total duration of the disease is very various. In some cases it terminates after a few paroxysms, in others it lasts from one to six months, and in some cases it becomes chronic and embitters existence during the whole period of a long life. It seldom disappears suddenly, but oscillates with a decreasing intensity; the in-

tervals gradually becoming lengthened till at last the disease subsides.

Causes.—The remote causes of this class of affections are extremely undetermined, but extremes of heat or cold—or sudden changes from the one to the other often stand in the relation of cause to this disease. It is also often a result of impaired general health. Thus women, after profuse menorrhagia, or after child-birth, or persons recovering from fever or other severe disease, often suffer from neuralgic affections. Arsenic also appears to be a cause; at least persons who have attempted to poison themselves with that mineral often suffer agonizing pains along the course of the nerves of the limbs. Blows or wounds, or the pressure of an aneurismal or other tumor, sometimes seated in the nerve itself, are also causes of neuralgia.

This disease is more common in men than in women; and in women it occurs rather more frequently before thirty than afterwards, especially in those whose menstruation is irregular either as to time or quantity. The place of abode, manner of living, trade or profession, and as far as has been traced, hereditary predisposition, have little influence on the production of the disease.

Diagnosis.—The disease to which neuralgia bears most resemblance is rheumatism, but it is distinguished from it by the transitory nature of the attack and by the absence of all swelling. There are certain points of the face which, upon being pressed, in the interval of the paroxysm, give pain; and so far furnish phenomena which may aid in a differential diagnosis. Other diagnostic features are of importance to be noticed, such as if pain exists—(1.) where the nerve emerges from the bone, as at the supra orbitary, infra orbitary, and mental foramina, in trifacial neuralgia; (2.) where the nerve passing through the muscles, reaches the skin; (3.) where the nerve terminates in the skin; and lastly, where the nerve becomes very superficial as the peroneal nerves.

Prognosis.—This disease has very rarely terminated in death, and in general the patient's health is good throughout its whole course.

Treatment.—A practitioner has generally some mode of treatment which, during his practice, he considers specific in this disease. *Sarsaparilla*, the *sulphate of iron*, the *carbonate of iron*, *arsenic*, *mercury*, or the *disulphate of quina*, have all been recommended with confidence. Bleeding, either local or general, has had its advocates, while its opponents affirm this operation to be always useless and sometimes injurious. There can be no question that the disease has often subsided under the use of all these various remedies; but the tendency in neuralgia to a spontaneous intermission is so great, that it is doubtful whether in any case, medicine can be said to have cured it. Opiates are unquestionably

serviceable in mitigating the sufferings of the patient, and, perhaps, in influencing the disease, but not to the extent generally supposed. Belladonna, both internally and as a plaster, may sometimes relieve the pain. Stramonium and opium have a similar effect; but in many instances these remedies may be given till vertigo and even apoplexy be induced, and yet the pain will get no better. Belladonna and perhaps stramonium are better than opium as a habitual remedy, and they appear to have done occasionally good.

When these or other general remedies have proved insufficient, recourse has been had to local remedies. The most efficient of these applications is the alkaloid *aconitina* rubbed upon the pained part in the form of an ointment in the proportion of one or two grains to one drachm of lard. Morphia similarly used, and blisters have also often exercised a beneficial effect upon the disease. Holding the head over steam and the warm bath, are equally or even more beneficial. The belladonna plaster is also a favourite application.

When general and local applications are unsuccessful, the cause is often sought for in a diseased tooth or stump, and in a *very few* instances an exostosis of the stump has been discovered, removed, and the disease cured. More commonly, however, even when the patient submits to have every tooth in his head drawn, no relief or benefit has resulted.

Besides extracting a tooth, or teeth, the division of a nerve is sometimes had recourse to, but even this operation is very uncertain.

Paralysis or Palsy.

Definition.—*Loss of power of motion or of sensation, or of both.*

Pathology.—Palsy, or paralysis, may be seen in various forms rather as a symptom of a lesion than as a disease itself. The terms *palsy* or *paralysis*, being commonly restricted to that form where motion is lost, while the term *anæsthesia* implies a *palsy* of the nerves of sensation.

1. *Paralysis of the Nerves of Motion.*

Palsy of a part is a very constant symptom of structural disease of the brain or of the spinal cord, but it occasionally occurs also from a diseased state of the nerve itself. Palsy may affect a whole limb, or merely a part of one, and it is also limited to the muscles of certain regions. Palsy of a finger, a hand, an arm, or a leg, are examples of the first, palsy of the facial muscles of expression from disease connected with the seventh pair or facial nerve is an example of the second.

The phenomena of this latter form give a peculiar expression to

the face. The brow is motionless, the mouth drawn to one side, and the eye is often red from inability to close it.

In severer cases, the lower eyelid is everted and the tears flow over the cheek. The eye, if the disease be prolonged, inflames either from its constant exposure to light, or from the presence of other irritating substances removed in health by the action of the eyelids. The eye, also, is sometimes turned outwards from palsy of the third pair, and sometimes inwards from a similar affection of the external motor nerve of the eye. When the third pair is palsied, the upper eyelid, to which it sends branches, often falls down, covering the eye entirely, and is so completely powerless that it cannot be raised except by the hand. This state is termed *ptosis*. Sometimes the nostril also is motionless and flattened.

The interesting clinical lectures of Dr. R. B. Todd furnish the following particulars relative to the nature of paralysis of motion.

The conditions which give rise to the symptom may be summed up as follows :—

(1.) Lesion of a nerve in some part of its course destroys its power of transmitting that force which is expressed by a contraction of the muscle into which the nerve is distributed.

(2.) A lesion of some part of those central parts of the nervous system whence the nerve takes its origin, or with which it may be connected directly or indirectly.

And, as a correlative statement it may be written, that whatever interferes materially with the conducting power of nerve fibre, or the generating power of nerve vesicle, will constitute a paralyzing lesion. Poisoning of the nervous matter will operate in this way. Chloroform, ether, opium, the poison of lead, and of mercury, applied directly to the nerve fibre of a living animal suspends its power of transmitting the nervous force so long as the influence of the poison lasts. Poisons formed, or retained in the living body, operate in the same way, such as the retained urinary and biliary principles, the poision of rheumatism, gout, and probably also syphilis in some of its more severe tertiary effects of zymosis.

Whatever, in short, impairs the natural structure of the nerve matter, such as *inflammation, atrophy, condensation, softening, solution of continuity*, either by simply cutting the trunk of a nerve, or by the deliquescence of the nerve fibres as a result of disease, such as that of *white softening*, or a *sanguineous* or *serous effusion;* pressure on a nerve or a nervous centre, are causes which will produce more or less complete paralysis. Of this there is abundant proof, *e. g.*, the inclusion of a nerve in a ligature, compression of a nerve by a tumor, a depressed piece of bone in fracture of the skull, or an apoplectic clot on the exterior of the brain.

The different forms of paralysis of common occurrence are due—

(1.) To disease of the brain, in which form the muscles may be rigid or relaxed, the disease of the brain being the result of *apoplexy, softening, renal disease, induration*, the result of *syphilitic poison*, the *epileptic* or *choreic* state; (2.) To pressure upon, or injury to, a nerve; (3.) To hysteria; (4.) To the influence of poisons, such as *lead, arsenic, mercury.*

Paralysis, having its origin in disease of one side of the brain, is characterized by a very prominent feature, namely, *one-sidedness.* This phenomenon constitutes that form of paralysis called "*Hemiplegia*," or paralysis of one side of the body from disease of the opposite half of the brain.

Lesions which give rise to *hemiplegia*, are—

(1.) Softening; a clot or abscess in the *corpus striatum* or optic thalamus, or in the immediate vicinity of those parts, and which produces pressure upon these central ganglia or centres of volition. Unless pressure be produced, or the fibres otherwise interfered with, paralysis does not result.

The centre of volition "reaches from the corpora striata in the brain down the entire length of the anterior horns of grey matter of the spinal cord, and includes the *locus niger* in the *crus cerebri* and much of the vesicular matter of the *meso-cephalon* and of the *medulla oblongata.*" Disease of any part of this centre or range of structures is capable of producing paralysis.

(2.) The intra cranial portion of this range exercises the greatest and most extended influence in the production of voluntary movements, and the most extended and complete paralysis takes place from disease of the *intra cranial portion.*

(3.) In cases of cerebral disease, it must be observed and remembered, that the intra cranial portion of the centre of volition for the left side of the body is situated on the right side, and that for the right side is situated on the left side of the cranium, while the intra spinal portions maintain, relatively, their respective sides. These two portions are connected by the oblique fibres from the anterior pyramidal column of the medulla oblongata, which crossing from right to left, decussate with similar fibres proceeding from left to right.

(4.) Exudations which are the result of inflammatory or other diseased state of the membranes of the brain, which, as they increase and cause pressure on the surface, transmit the effects of pressure downwards to the *corpus striatum* and *optic thalamus*, and thus cause paralysis.

(5.) Morbid states which affect or destroy fibres of deeper seated parts, such as the *crura cerebri* or of the *cerebellum* in its crura (because a connection exists between the hemispheres of the cerebellum and the fibres of the pyramids in the pons varolii) cause paralysis.

(6.) The slow accession of paralysis following symptoms of irritation indicates a gradual morbid change, such as from exudations slowly taking place.

(7.) An important feature in paralysis is due to the condition of the muscles, as to whether they are rigid or relaxed.

(8.) Rigidity, whether supervening or occurring simultaneously with the paralysis, indicates irritative disease within the cranium.

(9.) In cases where the rigid condition of the muscles does not come on till after a long period of paralysis, and after the muscles are perhaps wasted from atrophy, such a condition indicates loss of substance in the brain, and that the cicatrix is undergoing contraction.

Four different conditions of the muscles are to be observed in cases of paralysis.

(1.) A condition little different from that of health, but less firm, less excitable by the galvanic stimulus, when the paralyzing lesion is not of an irritative kind.

(2.) Complete relaxation of the muscles; characterized by softness, imperfect nourishment, and rapid wasting, so rapid that in a few days the size of the limb experiences a marked diminution. Such muscles scarcely, if at all, respond to the galvanic stimulus.

(3.) Contraction of the muscles with rigidity and wasting (the flexors being always more rigid than the extensors); a condition which is due to a chronic shortening of the muscles themselves, and generally associated with a form of muscular atrophy.

(4.) Nutrition not impaired, constant firmness and rigidity, incomplete paralysis, increased susceptibility to galvanic stimulus.

The practical inferences to be drawn from these conditions are of great value in treatment. Thus early rigidity indicates local bleeding or counter-irritation, while complete relaxation is against antiphlogistic treatment.

Of the different forms of paralysis of motion, those known as *paraplegia* and *hemiplegia* require more prominent illustration.

Paraplegia is a form of paralysis affecting the *lower half* of the body only; in which both legs and perhaps also some of the muscles of the bladder and rectum are paralyzed.

Hemiplegia is a form of paralysis affecting one *lateral half* of the body. It is that form of palsy to which the name of "*paralytic stroke*" is commonly applied.

Either half of the body may be affected, and the parts which are actually involved are generally the upper and lower extremities, the muscles of mastication, including the buccinator, and the muscles of the tongue on one side. The paralysis may be either complete or incomplete, as regards motor power.

Consciousness may or may not be perfectly retained, and whether it is so or not the patient when seized falls to the ground, because

the power of maintaining his equilibrium is destroyed by the failure of the antagonizing muscles of one half of the body. The affected arm and leg lie as if lifeless on the side, all power of motion in them being destroyed. Stimulation, however, of the extremities of the sentient nerves, by slight titillation with the fingers, sometimes gives rise to active movements. The combined effect of such stimulation and the resulting movements is to cause considerable pain. These excited motions, to which the name of "*reflex actions*" have been given, occur almost exclusively in the lower extremities. Other involuntary movements of the paralyzed limbs occur simultaneously with the action of yawning, or result from emotions of surprise, joy, pleasure, grief, laughter, crying.

The palsy of the face which accompanies hemiplegia is characteristic, and is to be distinguished from palsy which arises from an affection of the *portio dura nerve.* The *facial* or *portio dura nerve* is not generally touched by the paralyzing lesion. The *orbicularis palpebrarum* and the other superficial muscles of the face are therefore unaffected. It is the *fifth nerve* which is generally more or less involved in *hemiplegia* by the paralyzing lesion. The cheek hangs downwards, and the angle of the mouth on the paralyzed side is lower than on the other. The cheek is also more or less loose and flaccid as the paralysis is more or less complete. The healthy muscles are contracted to an unnatural extent from the absence of the opposing force of those paralyzed, and the palsied cheek is drawn towards the mesial line. The patient can shut both eyes well and open them ; and he can move the cheek by the zygomatic muscles.

Sometimes the third nerve may be paralyzed, in which case the upper eyelid drops, and there is inability to raise it, combined with outward squint and dilated pupil.

The protrusion of the tongue is also characteristic in hemiplegia. It is pushed out, towards the side affected, and on being retracted, it is drawn towards the healthy side.

Imperfect articulation is often present in *hemiplegia*, and results from the palsy of the *ninth* and *fifth nerve;* and where the power of speech is wholly lost, or utterance is limited to monosyllables, the sign is not favourable, but denotes with other symptoms extensive lesion of the brain, superficial as well as deep. When deglutition is impaired, serious and extensive lesion of the brain connected with the *vagus* or *glossopharyngeal nerve* is denoted.

The Lesions which give rise to Hemiplegia are of various kinds.

(1.) *Hemiplegia* typical of diseased brain, depends on a softening clot, tumors or exudation, involving or compressing some considerable portion of the centre of volition. The palsy is on the side of the body opposite the lesion.

(2.) *Hemiplegia* typical of spinal disease, where the palsy is on

the same side of the body as the disease, is carried by a lesion involving a lateral half of the spinal cord *below* the decussation of the pyramids.

(3.) In *hemiplegia* typical of epilepsy, the lesion is transient, the palsy in general remaining only a few hours, or at most a few days, after the epileptic attack. It is termed *Epileptic Hemiplegia.*

(4.) The *hemiplegia* associated with chorea, occurs during acute attacks of that disease, and is termed *Choreic Hemiplegia.*

(5.) The *hemiplegia* associated with hysteria is also of transient endurance.

(6.) There is a form of *hemiplegia* where the morbid phenomena seem to spread from the periphery to the central parts.

In all these forms of hemiplegia the paralysis is a paralysis of motion, more or less complete. In general, however, sensation is also more or less impaired. In estimating the condition of the sentient functions, the same method is to be adopted which Weber devised in comparing the sensibility of the surface of the skin in different parts of the body. It consists in ascertaining how near the sharp points of a pair of compasses may be approximated, and yet be distinctly felt as two points by the patient.

The special lesions of the brain causing hemiplegia are—

(1.) Obstruction of a principal cerebral artery by a plug of fibrine, detached from an excrescence on one of the aortic or other valves of the heart, the result of a former endocarditis (KIRKES and VIRCHOW).

(2.) A coagulum formed in an artery, resulting from some altered nutrition of its wall, and connected in general with a rheumatic or other morbid state of the blood.

(3.) A softened state of the brain, such as the condition known as white softening, which follows the retardation and diminution of cerebral circulation by diseased arteries, or by the complete stoppage of an artery by a plug.

Treatment.—The object to be aimed at in the early treatment of hemiplegia is to keep down the frequency and force of the heart's action.

Strict maintenance of the horizontal position is necessary; and when consciousness exists, let the mind be kept tranquil by every means. Remove any local impediment to the easy flow of blood, and let the head be slightly raised, sufficient to prevent gravitation favouring the escape of blood from the ruptured vessels, but not so as to create any impediment to the flow, and so embarrass the action of the heart. Let the bowels be cleared out, so that no irritation from them may operate injuriously on the brain. In so doing, enemata ought to be employed; and failing these, castor oil or calo-

mel, with compound jalap powder, may effect an efficient evacuation.

With regard to blood-letting, Dr. Todd observes there are three objects to be attained—(1.) To diminish an undue amount of blood to the head; (2.) To check hæmorrhage, or to prevent it; and (3.) To quiet the action of the heart. The circumstances under which its use is inadmissible, are thus defined in the interesting *Clinical Lectures*, from which the preceding remarks have been compiled:—

If the patient be cold and collapsed; if the heart's action be feeble and intermittent; if there be an anæmic state; if the patient be of advanced age; if there is evidence of extensive disease of the arterial system or of the heart; or, lastly, if it can be ascertained that already a large amount of hæmorrhage has taken place into the brain; these, singly or conjointly, are reasons why bleeding ought not to be resorted to. If none of these objections exist, it is to be considered, whether any of the indications noticed require to be fulfilled, and whether they can be fulfilled by a local or general blood-letting. Modern investigations show that the brain is not generally in a hyperæmic state; so that it is chiefly to check or to prevent hæmorrhage that bleeding is to be resorted to in such cases. The sudden or rapid abstraction of a moderate quantity of blood, either from the arm or temple, or by skilful cupping, may check hæmorrhage, but the quantity taken should be small; and so likewise the quantity drawn ought to be moderate, if it is desired merely to lessen the frequency and force of the heart's action. "Generally," writes Dr. Todd, "I have come to the conclusion that, in cases of white softening, you are less likely to err by omitting than by adopting the practice." The rigidity of the muscles, which comes on very early, and which indicates an inflammatory process going on round the clot, is to be combated by the use of *mercury*. It is not desirable to interfere in the *late* forms of muscular rigidity. With regard to the use of expedients for promoting the restoration of the paralyzed limbs to their normal conditions, Dr. Todd writes that he knows of nothing which is of more decided benefit than a regulated system of exercise; active when the patient is capable of it, passive when he is not. "As to the use of *electricity*, or the employment of *strychnia*, I feel satisfied, as the result of a large experience, that the former requires to be used with much caution, and that the latter is very apt to do mischief, and never does good. I have seen cases in which, after the employment of electricity for some time, that agent has excited something like an inflammatory process in the brain, and so strychnia will also induce an analogous condition of the brain, and will increase the rigidity of the paralyzed muscles."—(Pp. 211–213).

2. *Paralysis of the Nerves of Sensation—Anæsthesia.*

The term *anæsthesia* implies a diminution or loss of function in a sensory nerve, from its nervous force being reduced or destroyed.

Sensibility admits of varying degrees, being different at different parts of the cutaneous surface, as proved by the experiments of Weber. His mode of experimenting may be adopted, as already noticed, as a practical means of diagnosis in paralysis of sensation.

Anæsthesia most commonly occurs as an immediate antecedent of motor palsy, or coincident with it, and also exists in various parts of the body, independent of paralysis of motion. It varies in extent from a mere numbness of the parts to a complete loss of sensation. The cutaneous nerves are those most frequently affected, and from this cause the disease most usually attacks the integuments of a portion of the trunk, or of an arm, or a leg, or some portion of the extremities, and also the whole face or parts of the face.

The most important form in which insensibility comes under the notice of the practical physician is that known as FACIAL ANÆSTHESIA. It consists in a deficient or entire loss of sensibility in the parts supplied by the fifth pair of nerves.

Symptoms and Diagnosis of the Seat of Lesion.—(1.) The more the anæsthesia is confined to single filaments the more peripheral is the seat of lesion. (2.) If the loss of sensation affects a portion of the facial surface together with the corresponding cavity of the face the disease may be presumed to involve the sensory fibres of the fifth pair before they separate, or one of the main divisions after its passage through its cranial foramen. (3.) When the entire sensific tract of the fifth nerve has lost its sensation, associated with derangements of the nutritive functions in the affected parts, the Casserion ganglion or the nerves in its immediate vicinity may be the seat of the disease. (4.) If the fifth nerve is complicated with disturbed functions of adjoining cerebral nerves, it may be presumed that the lesion is situated at the base of the brain (ROMBERG).

The symptoms may develop themselves gradually or may come on suddenly, and are not unfrequently preceded by neuralgia; and, owing to the differences in the seat of lesion, what may seem to be a permanent symptom in many, is absent or less marked in others. It is frequently complicated with facial palsy of the portia dura of the seventh nerve. In a well marked case, the symptoms may be generally stated to be loss of tactile sensibility of the parts supplied by the nerve, namely, the integuments of the cheek and side of the head, the eyelids, conjunctiva, tongue, Schneiderian membrane, &c., accompanied by loss of taste on the side of the tongue which is affected, frequently by loss of smell and hearing, and by inflamma-

tion of the eye terminating in ulceration of the cornea, and by no means uncommonly in total disorganization of the globe. Paralysis and wasting of the deep muscles of mastication are also sometimes associated. The real nature of the affection may escape notice, if the attention is directed solely to any one prominent symptom, such as ophthalmia. The disease makes its onset in two or three ways. It is often sudden, preceded by a slight perversion of sensibility or by a tingling sensation, frequent attacks of headache, and pains in the occipital region and side of the face. Dimness of vision is so prominent a symptom in some cases, that loss of sensibility may not at first attract attention.

Of twenty-four cases, vision was affected in fifteen, hearing in nine, and smell in six (Dr. J. B. Cowan in *Glasgow Med. Journal*, No. II., July, 1853).

There are two important features in facial anæsthesia worthy of special notice, namely, 1st, that the parts do not waste as in muscular palsy; 2d, that though the parts are insensible to touch, they still remain sensible to changes of temperature, and to pain arising from inflammation in the nerve itself.

Causes.—The anæsthesia may result from disease—(1.) of the cerebrum where the fifth nerve takes its origin; (2.) of the nerve within the cranium; (3.) of the nerve after it has emerged from the cranium, and according to the seat the symptoms vary.

The disease may be a consequence of some injury, such as the extraction of a tooth, as frequently happens to the submental branch which conveys sensation to half the lower lip.

Dissections show that condensation, atrophy, softening, and the pressure of tumors are the morbid conditions out of which the anæsthesia springs. So varied are the sources whence the anæsthesia results, that its treatment can only be palliative, and directed towards mitigation of the symptoms. Spontaneous cures are said not to be unfrequent. The local applications, such as blisters, leeching and cupping, are said to have been sometimes useful, combined with the administration of purgatives.

On the Diagnosis of Diseases of the Heart and Lungs.

The diseases which constitute the two following orders, namely, those of the heart and lungs, are especially recognized and appreciated by *symptoms*, local and constitutional, as well as by so-called *physical signs*.

Physical Examination of the Chest.

I. **By simple Inspection of the Form of the Thorax.**—It is necessary to note more especially—(1.) its general shape; the condition of the

supra and infra clavicular spaces as to flatness or fullness of development; the condition of the hollow above the manubrium of the sternum; the form of the clavicles and their curvature, and the height of the shoulders; the form of the sternum, as to whether or not it bends outwards or inwards; curves of the spine; position of the scapulæ; prominence of its inferior angle and firmness or laxity of the latissimus dorsi muscle; distance of scapulæ from each other and from the middle line; contracted contour or expanded form of the lateral regions; the width, depression, or bulging of the intercostal spaces.

(2.) Obtain a *general notion as to capacity or size of thorax, relative to the individual, allowing for fatness or emaciation.*

(3.) Observe the thoracic movements, and estimate in seconds the time taken to complete the inspiratory and expiratory acts; compare the abdominal respiratory movements with those of the thorax, so as to notice if either takes an undue share in the work of respiration. If the ribs scarcely move and the parietes generally of the thorax remain at rest, while the surface of the belly rises and falls alternately with the acts of respiration, the act is called *abdominal respiration*, because the abdominal muscles seem to take the larger share in its performance; but if, on the other hand, no motion of the abdomen is visible, the act of respiration is then said to be *thoracic.*

II. **By Measurement.**—The use of tape or calipers in deep and medium inspiration and expiration, will detect any differences between the two sides; or undue differences in the size of the chest at different times. There is about one inch of an average difference in favour of the right side of the chest compared with the left, and which is consistent with a normal state of the region.

III. **By Palpation** or the application of the hand. This method affords more extended information to that suggested by simple inspection, such as of the intercostal distances lateral and antero-posterior; expansion of the chest in the acts of respiration; appreciation of *vibrations* communicated through the walls of the thorax. The palm of the hand applied to the chest in a healthy state during the act of speaking, will appreciate a most delicate *vibratile tremor*, (commonly called *fremitus*), and more marked according to the graveness, coarseness, and loudness of the speaking voice. The intensity is generally greater on the right side than on the left, and is stronger towards the sternal than the humeral halves of the region below the clavicles. In disease, the *fremitus* on the two sides of the chest must be compared. It is *increased* by whatever consolidates the fine vesicular texture of the lung, without obliterating the bronchial tubes. It is *diminished* by the intervention of liquid or air between the lung and the thoracic walls; also by such extensive

consolidation of the lung substance as to fill up the smaller bronchial ramifications leading to the air vesicles.

Ordinary fluctuation may sometimes be detected by the hands, combined with shaking or suddenly altering the position of the chest.

The hand is also used to appreciate the action of the heart. The heart, after full *expiration*, is felt to beat between the cartilages of the third and fifth ribs, and at the neighbouring part of the sternum, generally immediately below and to the outside of the left nipple. After a full inspiration, it may be felt as low as the sixth rib.

IV. **Auscultation** implies "the act of listening," and is termed pulmonary or cardiac, according as the sounds listened to, relate to the lungs or to the heart. For this purpose the ear may be applied to the surface directly, merely interposing, for several obvious reasons, a fine towel or thin piece of linen or calico, between the chest of the patient and the ear of the observer; or an instrument called the *stethoscope* may be used, and which is especially necessary when the sounds to be heard are limited to a small and definite region, as in listening to the sounds of the heart. The ear-piece of the stethoscope ought to fit the ear of the observer, or as is now frequently used, the ear-piece may be removed, so that the end of the stethoscope may be introduced into the orifice of the ear. It is important that the ear be well fitted. The extremity applied to the patient should be about an inch and a-half in diameter.

To become familiar with the knowledge to be acquired by means of auscultation, much time and labour must be devoted to its practice, alike on persons in health and in disease. A verbal description of the sounds to be learned is difficult, because the impressions made on the senses of one person cannot be communicated exactly by language to another; and the distinctions which subsist between the sounds heard in health and those in disease, are not yet regarded as similarly significant by all; nor is their individual importance yet clearly determined in relation to practice.

With the view of affording the means for a comparative study of the auscultatory phenomena, the following tables relative to the natural sounds in health, and the altered or morbid sounds in disease, are compiled from the writings of Walshe, Thompson, Wood, and Bennett—and it is hoped they may furnish an outline to guide the student in appreciating the morbid states of the lungs and heart.

The arrangement in a tabular form has been preferred, because it is believed the descriptions of the sounds are more easily studied and compared with each other by this mode of arrangement than any other.

TABLE I.—*Thoracic* sounds *of* RESPIRATION *and of the* VOICE *heard in health.*

Sounds of Respiration.	Synonym.	Character of the Sounds.	Common Site of Production.
Vesicular.	Respiratory murmur of inspiration and expiration.	*Inspiration*—A soft diffused murmur of a gentle *breezy* character, increased in intensity with rapidity and force of respiration, and prolonged by a full inspiration. *Expiration*—Slightly harsher and more hollow, weaker and shorter.	Entrance of the air and its expulsion from the air cells and terminal portions of the bronchi—vibrations of tissue therewith connected.
Puerile.	Loud Vesicular murmur.	The respiratory murmur of children and women louder than that of adults, but with characters as above.	
Bronchial or **Tubal.**	Tracheal.	*Blowing* as of air passing quickly through a tube; higher in pitch than the vesicular sounds, more rapidly evolved, and following less closely.	Sites corresponding to the bifurcation of the trachea, the upper part of sternum, and between the scapulæ.
Sounds of the voice through the lungs. **Natural Bronchophony.**	Vocal resonance. Pectoral vocal resonance.	Obscure, thrilling sound of the voice, diffused, and conveying the idea of distant origin. Articulate sounds not appreciable. Resonance more marked in males than females, and in adults than children; is stronger in front than behind, and at the upper than the lower part of thorax. Equal in both sides of the chest, except under the clavicles, and in the spaces between the spines of the scapulæ and the median line. In these regions it is more strongly marked on the right than the left side.	The voice in articulation, passing down the trachea and bronchi, is obscured, intercepted, weakened, and diffused by passing through the spongy pulmonary vesicular tissue to reach the surfaces of the chest.

TABLE II.—*Thoracic* sounds *of a morbid type, sometimes called* rales *by French and* ronchi *or* rattles *by English authors, evolved during the acts of* RESPIRATION.

A.—IN THE PULMONARY SUBSTANCE.

English Name of Sound (THOMSON).	Synonym.	Character of Sound conveyed by	Relation to Inspiration and Expiration.	How and Where Produced.	Diseases with which it is most usually Associated.
I. Bubbling.					
a. Bubbling ronchi or rattles.	Mucous ronchus or rale.	The bursting of bubbles of some size, unequal and varying in number, modified by coughing and expectoration.	Co-existing with both.	Bubbling of air through liquid (mucus, blood or pus) in bronchial tubes of the size of a crow quill and heard in central or middle part of lungs.	Bronchitis after secretion has become established.
b. Small bubbling ronchus or rattle.	Subcrepitant or submucous rales or ronchi.	The bursting of more minute bubbles producing weaker sounds.	Co-existing with both movements, but predominating during inspiration.	Bubbling of air through more or less viscid fluid in minute bronchial tubes, as at their peripheral distribution.	Capillary bronchitis of both bases of lungs, tubercular bronchitis of apex, resolution of pneumonia.
c. Gurgling rattles.	Cavernous ronchi or rales.	The bursting of bubbles obviously of large size, with a hollow gurgling sound, or a metallic sound if the bubbles be small.	Co-existing with both acts.	Caused by the bursting of bubbles in a hollow space, enclosed by more or less dense and smooth walls—the more so, the more perfect the gurgling.	Excavations from tubercle or other causes, dilatations of bronchi, pus in the pleura with a bronchial fistula.
II. Clicking.	Humid crackling, humid crepitation, humid crackling ronchus.	Successive clicks, few in number, and tending to pass into the bubbling ronchi, especially during expiration.	Co-existing with both acts, but more regular and distinct during inspiration.	Mechanism of its production obscure. It probably originates in the interior of softened tubercles, which have just commenced to communicate with the minute bronchi.	Generally in *direct* connection with tuberculous exudation which has commenced to soften.
III. Crackling	Dry crackling ronchus, dry crepitation.	A succession of three or four minute dry, short, sharp, crackling sounds, permanent in many cases when once established, and tending to pass into the clicking sound. At first it may disappear for a day or two and again recur.	Co-existing exclusively *with inspiration.*	Mechanism of their production undetermined. Conveys the impression of being evolved at a distance from the surface, and in the great majority of cases is found in the *infra clavicular* and supra clavicular regions.	Generally observed on the eve of the softening process in tubercles.

IV. Crepitation. *a. Primary.*	Crepitant rale or ronchus.	The idea of crepitation, like that produced by rubbing slowly and firmly between the finger and thumb a lock of one's hair near the ear (WILLIAMS). An immense number of sharp sounds, conveying the notion of minute size and dryness.	Co-existing exclusively with *inspiration*, and at first towards its close only.	Probably due to the sudden and forcible expansion of delicate tissue, altered in its physical properties by the inflammatory state, and which probably undergoes minute ruptures.	Primary idiopathic pneumonia, or the pneumonic state established round tubercles.
b. Secondary.	Ronchus crepitans redux.	Crepiti of a bubbling nature, slowly evolved, few in number, and unequal or dissimilar and irregular in occurrence.	Audible in expiration as well as inspiration, but pertaining specially to the latter.	Probably due to the bubbling of air through fluid contained in the minute bronchi.	Co-existing with the resolution of pneumonia.
V. Vibration. *a. Sonorous ronchus.*	Sonorous rale.	A musical sound of a vibratory, deep, or grave tone, attended with fremitus of the walls of the thorax over a variable surface. *Snoring*, *humming*, *cooing*, and *bass* notes are its varieties.	Co-exists with inspiration and expiration, but especially marked in the latter, to which it may be limited.	Arises in the larger bronchi, and suggests the idea of vibrations.	Essentially associated with bronchitis.
b. Sibilant ronchus.	Sibilant rale.	A high pitched whistling sound, of variable intensity and duration, and irregular recurrence. *Clicking*, *whistling*, and *hissing* varieties are described.	Co-existent with inspiration and expiration, especially marked in the former, but occasionally limited to either.	The influence of the passage of air on a local accummulation of viscid mucus.	Pulmonary emphysema and bronchitis.

B.—ASSOCIATED WITH THE MOTIONS OF THE PLEURA.

VI. Friction.	Grazing, rubbing, grating, creaking, are varieties of this sound.	The sensation of friction by a series of abrupt jerking sounds, rhythmical with respiration, few in number and superficial in seat, limited in extent, attended with fremitus, palpable to the hand, and perceptible to the patient.	Invariably heard in inspiration, or in both respiratory acts.	The rubbing of two opposed serous surfaces together, attended by inflammation.	Pleurisy.

TABLE III.—*Thoracic* sounds *of a morbid type evolved during the act of* articulation *of the* VOICE.

Name of the Sound.	Character of the Sound.	Physical Conditions under which it is supposed to be Produced.	Diseases with which it is commonly Associated.
I. Bronchophony.	Exaggerated resonance of the voice, unattended with articulation, diffuse or concentrated, and rarely producing any tactile sensation to the ear.	Increased density of the pulmonary tissue surrounding pervious bronchi, with enlarged calibre and hypertrophy of the substance of the bronchi. The more homogeneous the consolidation the better probably is the sound transmitted.	Hepatization of lung; dilated bronchi; pleurisy, with effusion, when hepatization co-exists.
II. Pectoriloquy, or Pectoriloquous Bronchophony.	Complete transmission of articulated words from the walls of the chest into the ear; the resonance being generally circumscribed and limited in extent.	When solid masses of lung lie between a large bronchus and the parietes; when a moderate-sized excavation exists, with smooth and dense internal surface.	Various morbid states in which such physical conditions may exist.
III. Amphoric resonance.	A ringing metallic sound reverberating through a cavity, and resembling that produced by speaking into a broad-mouthed empty pitcher.	The voice reverberating in a large cavity, communicating with a bronchus by a small aperture.	Chiefly in phthisis.
IV. Ægophony.	A sound—vibratory, tremulous, cracked, and irregular, limited in its seat, comparable to the bleating of a goat, or to the voice of the exhibitors of Punch; synchronous with the articulation of each word, or following like a feebly whispered echo from a distant source. The sound appears to flutter tremulously about the applied end of the stethoscope.	When a stratum of fluid contained in the pleura compresses the lung, the voice in the bronchial tubes is thus rendered more distinct, by the compression of the pulmonary texture, and is thrown into vibration by the layer of fluid.	A tendency to it during the early period of pleuritic effusion, equally diffused and small in amount.

Sounds associated with the Action of the Heart.

The phenomena of the heart's action, as observed by the eye on the heart of a living animal exposed to view, or as appreciated by the ear and hand applied over the cardiac region of man, are of the most definite nature; and in determining the alterations of sound produced by disease, it is necessary to bear in mind the occurrence and sequence of the following incidents.

The two auricles of the heart contract at the same instant of time, and the contractions of the right and left ventricles are also simultaneous. The contraction of the ventricles follow immediately that of the auricles. The relaxation of the fibres of each part of the heart follows immediately their contraction, and a short but distinctly appreciable period of repose intervenes between the relaxation of the ventricles and the secondary contraction of the auricles. Each complete revolution of the heart is thus accompanied by two successive sounds, separated from each other by intervals of silence. These two sounds *are unlike;* and the two periods of silence *differ in duration.*

The first sound is coincident with the systole of the ventricles, the impulse of the apex against the side of the chest, and the pulse of the large arteries. It is sometimes also called the *systolic* or *inferior* sound of the heart. It should be listened to over the apex of the heart.

The second sound is synchronous with the diastole of the ventricles, the recedence of the heart from the side, and the pulseless state of the large arteries. It is sometimes also called the *diastolic* or *superior* sound. It should be listened to at *mid sternum* or near its left edge, and on the level of the second interspace.

A very short silence (which only becomes obvious when the pulse does not exceed sixty in a minute), succeeds the first sound; but a distinctly appreciable period of silence and repose of some duration succeeds the second sound.

The *first sound* is of a prolonged and dull character compared with the *second sound*, which is more quick, short, and clear, and bears a close resemblance to that produced by *lightly tapping, near the ear, the knuckle of a bent finger with the soft extremity of a finger of the other hand* (Hope).

The Line of Transmission of these sounds respectively, it is of the greatest practical importance to observe; because being so constant in health any variation indicates some modifying cause.

The *first sound* passes slantingly upwards to the left acromial angle, growing weaker and weaker on the way. Its intensity diminishes much more on the way to, and at, the right acromial angle. The propagation backwards of the first sound is thus

clearest and fullest to the left—so that while audible at the left back it may be inaudible at the right.

The *second sound* has the region of the base for its centre; and in nine people out of ten is heard more clearly at mid sternum *on the level of the second interspace*, than at any point of the præcordial region (WALSHE). It radiates towards the right and left acromial angles, and with greater clearness to the left than the right, while posteriorly it is heard at the surface with less clearness and distinctness on the right side than at the left.

Next to the lines of propagation of the sounds being determined as above indicated, it is necessary to analyze the sounds, and compare them—(1.) at both sides of the apex and region of the base; (2.) at base and apex on the same sides of the organ; (3.) at base and apex of opposite sides. In any one of these regions compared with the other the sounds in health are found to vary so materially in positive and relative properties, that any single description of them cannot be given.

The natural sounds of the heart thus indicated may be of abnormal character, as regards *intensity*, *pitch*, *duration*, *quality*, *rhythm*, *reduplication*, and *apparent distance*, at each of the following points; namely, at third interspace, and along third rib for the distance of three inches from the left edge of the sternum *for all sounds*;—at the point where the apex beats *for mitral sounds*;—at the left of the sternum and over the ensiform cartilage, if the apex be not in this position, *for tricuspid sounds*;—at third left costal cartilage and adjoining part of the sternum *for both aortic and pulmonary sounds*;—at second right and second left costal cartilages *for the sounds of aortic and pulmonary orifices respectively* (*What to Observe*, page 43).

The term "*sound*," in reference to cardiac diagnosis, is understood to refer to the natural sounds of the heart, either normal or modified in character as detailed above.

It is important to observe the relationship of the sounds of the heart to the pulse. The first sound anticipates, by a very short, but appreciable interval, the pulse at the wrist. An interval consistent with health is undetermined; but it may be stated generally, that if the diastole of the most distant arteries, such as the posterior tibial behind the inner ankle or the arteries on the dorsum of the foot, is so much retarded as to become synchronous with the *second sound*, the state indicates disease. It is a frequent attendant on insufficiency of the aortic valves.

When the sounds of the heart are suspended during the time usually taken to perform an entire revolution of the cardiac functions, the sounds of the heart are said to *intermit*; and such an intermission sometimes occurs regularly, or after a fixed number of regular beats.

Morbid Sounds of the Heart or Murmurs.—The term "*murmur*" s applied to a sound superadded to the normal sound, and which nay occur with one or more of the natural sounds. These may be o obscured, or even obliterated, that the *murmur* or *morbid sound* s alone heard. According to their supposed seat of production hese murmurs are—(1.) *endocardiac*, sometimes called *valvular;* (2.) *pericardiac*, also called *exocardiac.*

All endocardiac or valvular murmurs yield a "*blowing*" or "*bellows*" *sound*, as in the whispered expressions of the words "*who*" or "*awe*," the double letter "*ss*," or the single letter "*r;*" and there are certain spots where they may be heard in their greatest *maximum force;* namely—(1.) a few lines above the left apex; (2.) just above the ensiform cartilage at mid sternum; (3.) on the level of the third interspace; and (4.) at the junction of the third left cartilage with the sternum.

The physical causes which may explain the *mechanism* of these murmurs are due either to—(1.) pure constrictions of natural orifices; (2.) pure widenings of natural orifices; (3.) pure roughness of surfaces; or (4.) the association of the latter condition with either of the two former.

When murmurs are due to such single or combined mechanism, they are said to be *organic murmurs*, to distinguish them from *inorganic* murmurs due to certain morbid causes not well understood.

These *inorganic* murmurs are—(1.) connected with certain states of the blood as in spanæmia; or (2.), with dynamic or functional action of the heart itself.

It is of the greatest importance to determine, therefore, the nature of a *murmur*, especially as to whether it is really *organic* or *functional.*

In this investigation the essential points to be inquired into to guide the diagnosis are—(1.) the relationship of the murmur to the systole or diastole; (2.) the spot of its maximum intensity on the surface of the chest; (3.) the direction in which the murmur is transmitted; (4.) its quality and pitch; (5.) state of the natural sounds of the heart which may remain; (6.) presence or absence of any audible phenomena in the arteries or veins, or both; and (lastly) the duration and clinical progress of the case.

Each orifice of the heart may be the seat of two murmurs, *constrictive* and *regurgitant, with* or *against* the current; and thus *eight murmurs* are the total number, the occurrence of which is possible. The essential characters of these are condensed as follows from Dr. Walshe's *Practical Treatise on Diseases of the Lungs and Heart*, from which also the foregoing observations have been mainly compiled.

(1.) **Murmur connected with the Mitral Valve, Orifice, or neighbouring portion of the Left Ventricle,** may be the result of inefficiency of the valve, by changes in its structure or from roughness of its edges, as by vegetations, shortening of the chordæ tendiniæ or fibrinous coagula amongst them. It is a systolic murmur of maximum force heard at, and immediately above, or to the outside *of the left apex,* and which may completely or partially cover the first sound of the heart at the left apex, but which may preserve its natural characters towards the base.

This *systolic murmur* is faintly or wholly inaudible at the right apex, the mid sternal base; the pulmonary and aortic cartilages. It is more or less clearly audible about and within the inferior angle of the left scapula, and beside the dorsal vertebræ from the sixth to the ninth. The murmur is rarely of high pitch; and once established it is permanent.

(2.) **Murmur associated with the Tricuspid Valve,** may be due to regurgitation, or to the sharp collision of blood among thickened and roughened chordæ tendiniæ. It too is a *systolic murmur* heard of maximum force *immediately above or at the ensiform* cartilage; inaudible, or nearly so, at the left apex, and very faintly, if at all perceptible, in the left vertebral groove opposite the lower angle of the scapula. It originates in the right ventricle; and, when due to regurgitation, there is distension and pulsation of the auricle, vena cava, innominate and jugular veins, the distension of the latter being visible. It is generally a soft murmur, of low pitch, and rarely masks the systolic sound completely. It is a rare murmur, and often escapes detection from two causes; namely, a powerful mitral murmur, with which it is usually associated, or a deep-seated venous hum.

(3.) **Murmur connected with the Aortic Valve** habitually signifies a rough constriction of that orifice, and in rare cases has been traced to fibrinous coagula impeding the egress of the blood. It likewise is a *systolic murmur,* heard of maximum force at *mid sternum, opposite the third interspace, or upper part of the fourth rib.* It abruptly loses force between this point and the left apex, where it may be almost inaudible. Faintly perceptible at the second left cartilage, it is clearly audible at the second right cartilage, the notch of the sternum, and the left vertebral groove, opposite the second, third, and fourth dorsal vertebræ, thence rapidly losing strength downwards. It originates at the aortic orifice, and disappears about the sixth dorsal vertebra. It is a high-pitched, harsh, loud and prolonged murmur. The concurrence of ventricular hypertrophy increases its intensity and prolongs its duration, the more contracted the orifice is.

(4.) **Murmur connected with the Orifice of the Pulmonary Artery,** may indicate obstruction or simple roughness in its valves, or pressure on the vessel by adventitious masses in the pericardium. It

is a *systolic murmur*, heard of maximum force at the *sternal edge of the third left cartilage*, or a little lower down, and imperceptible in the back. It is rarely met with.

(5.) **The Murmur indicative of Obstructive Narrowing of the Mitral Valve**, is a *diastolic murmur*, heard in maximum force *immediately above and about the left apex.*

(6.) **The Murmur which indicates the probability of Tricuspid Narrowing**, is also a *diastolic murmur*, and is heard in maximum force at the *ensiform cartilage.*

(7.) **The Murmur which indicates Regurgitation at the Aortic Orifice**, is likewise *diastolic*, and is heard of maximum force at mid sternum, opposite the third interspace or fourth cartilage. It is usually of an aspired blowing character, sometimes almost hissing, rarely rough, and completely fills up the interval of repose and silence which ought to follow the second sound. It differs from *constrictive* aortic murmur, in being heard with almost as much intensity *about the ensiform cartilage as opposite the third interspace.* When it covers completely the second sound of the heart at the point of its maximum intensity, the valves may be presumed to be utterly incompetent.

(8.) The diastolic murmur connected with insufficient pulmonary valves is so rare, that it is only mentioned here to complete the notice of cardiac murmurs which may be heard.

The relative frequency of intra cardiac organic murmurs, Dr. Walshe states to be in the following order, commencing with the most common; namely, *mitral regurgitant; aortic constrictive; aortic regurgitant; mitral constrictive; tricuspid regurgitant; pulmonary constrictive; pulmonary regurgitant; tricuspid constrictive.* These may, however, be variously associated together; and when they co-exist, they are to be distinguished by the *rhythm*, the *pitch*, and the *character* of the aspiration.

The Pericardial Murmurs consist of *friction* or rubbing sounds, analogous to those already described in the pleuræ (Table, p. 617), and result from the movements of two opposed surfaces on each other having been rendered dry or rough by change of tissue or exudation.

V. **Percussion** is another form of auscultation; for it is listening to sounds we artificially produce. The sounds produced are appreciated as different, according as the parts struck differ physically from each other. For, to use the illustration of Dr. Watson, if a drum is struck we get one kind of sound, and if a brick wall is struck we get another.

The percussion may be mediate, as when a thin plate of ivory is laid flat upon the surface whence the sound is to be elicited, and so struck with a little hammer, armed at its head with a piece of India rubber; but, in general, one or more fingers of the left hand are used

in place of the ivory plate, and in this country are generally preferred; while the stroke to elicit the sound is made upon them by the tips of the fingers of the right hand, the free borders of the nails being cut close.

If we percuss with equal force different parts of the thorax and abdomen, some places are found to yield a more *persistent* sound than others, and the sound seems as if it were spread over a larger surface. Such *persistent* sounds are necessarily prolonged; and are more or less *full-toned*, *loud*, and *sonorous*, according to the nature of the part struck.

A *tympanitic sound* is such a sound as the healthy abdomen always yields.

A *dull sound* is that which one obtains by striking a piece of solid wood, or a solid mass of paper, such as a thick book. By appreciating such sounds, the extent, boundaries, or limits of solid condensed, or more or less hollow viscera, may be mapped out on the surface of the living body.

The elucidation of these topics, of which this short outline has been given, claims for the name of Laennec an immortal fame. He discovered how, *by auscultation*, disease might be detected. He not only accurately described the sounds heard in diseased states, and compared them with the sounds in health; but by morbid anatomy in connection with careful clinical observation, he traced the mechanism of those sounds to anatomical and physical conditions of the organs with whose functions they were connected. The immediate effect of this inestimable discovery was to divert the attention of the physician from the study and observation of those vital symptoms and general states of the constitution, so pregnant with information, when correctly observed and properly appreciated.

It was the close observation of these vital symptoms, watching the order and the periods of their manifestations, and the modes in which they were combined, that distinguished the successful practice of our forefathers in medicine, such men as the Cullens and the Gregories of former days. Disastrous results of treatment were the consequence of the circumscribed study of so-called physical diagnosis; "but what was lost in lives was gained in pathology." The physician of the present day now knows better. He is a close observer of vital symptoms, constitutional states, and of so-called physical signs; and he forms his judgment from the combined evidence of all.

General Symptoms of Thoracic Disease.

The general symptoms which express derangement of the pulmonary organs and their functions, are *dyspnœa*, *cough*, *expectoration*, *tenderness*, and *pain*. The general symptoms which indicate derangement of the cardiac apparatus, are, *palpitations*, *sinking*,

and *fainting*, combined sometimes also with *dyspnœa*, *cough*, *pain*, and *tenderness*.

The sensation of *dyspnœa* is brought about by an embarrassed or laborious breathing, amounting in severe cases to a sense of suffocation, expressed by the common English phrase, "*want of breath;*" or by the meaning conveyed by the Latin term, "*anxietas*," when the dyspnœa is at the point of greatest intensity. It is aggravated by exertion, some positions of the body, and a full stomach. The act of speaking is frequently arrested "*to fetch a breath;*" and the patient who suffers from dyspnœa cannot hold the breath, or refrain from the attempt to inspire, as a person in health can. The dyspnœa may occur in paroxysms, and the acts of respiration may be painful. The number of respirations performed in a given time are greatly increased, and often unequally so, when the paroxysm is aggravated. In health, from twelve to eighteen acts of respiration are unconsciously completed in a minute, according as a person is lying, sitting, standing, or walking; and the ratio of the acts of respiration to the pulse vary in the proportion of one to four (Watson), or one to nearly six (Wilks), that is, about one complete act of respiration for every *four* or *six* beats of the heart. But so intimately are the functions of the heart and lungs dependent upon each other, that any deviation from these proportions, in the acts of the one or other set of organs, immediately influences the actions of the other.

Cough, *expectoration*, and the nature of the *sputa*, furnish valuable indications.

The severity, the frequency, or paroxysmal nature of the cough, must be ascertained; also the circumstances which excite it most; and whether it is attended with pain, or followed by expectoration or vomiting. The ease or difficulty of the expectoration must be noted, and whether it is accompanied or not by pain. The quantity of the sputa ought to be measured in the day and night, the form of the masses spat up, their transparency or opacity, colour and viscidity, tenacity or adhesive property. The special characters of the sputa ought in every case to be closely observed, noting particularly its thin, serous, or frothy character, whether it contains any membranous or concrete exudation masses or blood, and it should be examined microscopically.

The exact locality of pain in the chest should be ascertained, its severity, and the direction it tends to take. What particular circumstances aggravate it, and the effects of breathing, coughing, pressure, and postures, should be ascertained.

When *palpitation* occurs, its severity ought to be estimated by laying the hand over the region of the heart of the patient. It is desirable to ascertain its constancy; the circumstances which aggra-

vate its existence or produce it—such as the influence of exertion, going up a hill or up stairs, and the influence of mental emotion.—(*What to Observe*, pp. 39-44).

Order 2. Heart Diseases—*Cardiaci.*

Of Inflammation and other Simple Organic Diseases of the Heart.—Our knowledge of the anatomy as well as the pathology of the heart and large blood-vessels, may be said to begin with Harvey; but the subject can hardly be said to have taken a scientific form till the beginning of the present century, when the work of Corvisart appeared, followed by that of Burns in England, of Testa in Italy, of Kreysig in Germany, and of Bertin, and more especially that of Laennec, Bouillaud, and Collin in France. A large school has since been formed in Europe by the labours of these eminent pathologists.

Eighteen years ago, Dr. Williams and Dr. Hope, in their respective treatises, showed how it was possible to make an accurate and minute diagnosis in almost every case of cardiac diseases; and the subsequent labours of Stokes, Graves, Walshe, Davis, Sibson, and Latham, in this country, have brought the pathology of diseases of the heart and lungs to their present advanced state of perfection.

The inflammations of the heart embrace Pericarditis, Endocarditis, and Carditis.

Pericarditis.

Definition.—*An inflammation of the fibro-serous membrane containing and investing the heart externally.*

Pathology and Morbid Anatomy.—The pericardium, like other serous membranes, is liable to inflammation, tending to the effusion of serous exudation, diffused over a large extent of surface, and which is apt to become purulent. The morbid action may also be of such a kind, that the serous exudation coagulates upon the opposed surfaces, becomes vascular, and glues them together. These different forms of morbid action may co-exist, so that different parts of the pericardial surfaces may present very different appearances when examined after death.

If the patient dies from acute pericarditis, the inflamed portion is of a bright rose colour. This redness is, in the first instance, caused by the increased vascularity of the subjacent areolar and fibrous tissue; but as the disease advances, red blood penetrates the serous membrane, and punctuates the exudation with a number of dots, which become confluent, and form patches that extend till perhaps the whole membrane is one bright scarlet colour. Besides being red, the membrane is thickened, first from exudation of coagulable lymph upon its surface, and then from the incorporation of inter-

stitial deposit with the sub-serous tissue. It is now opaque, white, thickened, and readily torn from its attachments.

The inflammation may terminate by resolution; but more commonly serous effusion results, the quantity of serum effused varying from a few ounces to a few pints. Louis has given one case in which it amounted to four pounds, and Corvisart another in which the quantity was still more considerable; Walshe records sixty ounces; and when such great effusions occur, the diaphragm is depressed below the end of the sternum by the great amount of fluid contained in the sac of the pericardium.

The adhesive results of inflammation often co-exist with the preceding inflammation, and lymph is now thrown out, and generally in much greater quantity than from any other serous membrane. The lymph thus extravasated may be only in such quantity as to render the serum turbid, or so extremely loose in its texture as to float in it; more commonly, however, it is disposed as a membrane, often covering both surfaces of the pericardium, and especially that covering the heart, and measuring from two to several lines in thickness. This mass, when considerable, presents a remarkably irregular appearance, which has been compared to the stomach of a calf, to a portion of a honey-comb, or to two opposed surfaces united by grease and forcibly separated. If the patient dies in the acute stage this membrane is found only slightly coherent, and very rarely exhibits any trace of organization.

When acute inflammation results in a purulent exudation, the pus is generally of a laudable healthy character, though sometimes of a greenish hue. The quantity is very various, sometimes only a few ounces, but in other cases so abundant as to fill the pericardium.

In the chronic forms of the disease all these morbid states may be observed; and when lymph has been effused it is then commonly found organized, so that the pericardium is often partially or universally adherent all over the heart. In some instances the lymph effused, instead of forming adhesions, becomes converted into cartilaginous and even osseous patches, which are readily detached from the surface of the heart by the scalpel.

The acute forms of pericarditis sometimes involve the muscular walls of the heart. On cutting through them the muscular substance is seen for a greater or less depth of a deeper colour than usual, and the cohesion of the tissue is also impaired, the finger readily passing through.

General Symptoms.—The symptoms of pericarditis vary much as regards their expression. In some instances they are most insidious in their approach, in others they appear to be violent and unmistakable from the commencement.

In this disease rheumatism has been found to assume a new and formidable type. Its most marked characteristic is pain more or less severe in the præcordial region; and from this point it radiates over the whole of the sternum, sometimes extending to the brachial plexus and down the left arm. This pain is accompanied by a sensation of constriction over the whole chest, and by an incapacity to take a long breath, or to cough. From these causes the patient is restless and anxious, and this anxious expression of the countenance is often peculiar and striking from the first.

The countenance is pallid, and assumes an aspect of distress, and there is an incapacity or unwillingness on the part of the patient to lie on his left side. The pain in the region of the heart is increased by pressure upwards against the diaphragm. His pulse varying from 90 to 110, full and strong, and often intermittent or otherwise irregular; and this state of things having lasted from three or four days to a week, the patient often dies suddenly.

Before death, and often throughout the more severe periods of the disease, there is delirium of a peculiar kind, sometimes quiet, but often wild and furious. This delirium has been particularly described by Drs. Watson, Burrows, and others.

When acute pericarditis is the result of idiopathic inflammation, the patient may suffer no pain, and the symptoms are often most obscure, general as well as physical. Even when the disease is most unmixed, it has been mistaken for a common fever, or for pleurisy.

Dr. Stokes arranges cases of pericarditis into three classes. In the first class are to be placed those in which there is a slight, though general effusion of coagulable lymph. In the second those in which there is superadded the secretion of serum in abundance, causing distension of the pericardial sac. In the third class are to be placed those cases in which signs of muscular excitement, if not of myo-carditis, are added to the preceding conditions. These three classes are thus contrasted in the following tabular arrangement given by Dr. F. Sibson :—

First Form.	Second Form.	Third Form.
Absence of pain or local suffering frequent. No sign of muscular excitement, nor any special character of pulse. No increase of dullness over the heart.	The local and general symptoms more decided, though often very trifling. Irregular action of the heart and pulse, often very manifest in the advanced periods. Remarkable increase of dullness over the heart.	Local distress often extreme, even at the outset. Tumultuous action of the heart. Irregularity of pulse. Dyspnœa, orthopnœa, œdematous swellings, syncope, death.

As the disease passes from the first to the last of these forms there is a progressive increase in the violence of the inflammation,

denoted in the second by the occurrence of excessive serous effusion, and in the last by the altered and impaired condition of the muscular substance of the heart itself. Death tends to occur by syncope, induced by paralysis of the left ventricle. Rokitansky thus describes the influence of pericarditis on the heart tissue—its muscular substance is paralyzed, being of a dirty brown or yellow colour, flabby, and easily torn; a condition which speedily leads to passive dilatation of the heart, general cachexia, and dropsy.

The first stage of pericarditis, before exudation, is not discoverable by physical signs (Stokes). This period rarely lasts longer than thirty-six hours. To Dr. Stokes, in 1833, the science of medicine owes the description of the most characteristic physical sign of pericarditis. He established that in pericarditis a double *frottement* or friction sound exists. Others also about the same time had noticed such a sound, and had correctly interpreted its meaning. Bouillaud and Collin, on the continent, and Drs. Watson, Latham, and Mayne in this country, had all, independently of each other, perceived and appreciated the symptom; a circumstance which Dr. Watson rightly remarks gives to the symptom a greater amount of importance. This sound closely resembles a bellows or rasping murmur. It has been named a "*to and fro*" sound by Dr. Watson. It disappears gradually from below upwards with the increase of effusion, and returns with its decrease. It disappears also from the apex to the base with the progressive formation of adhesions. It is usually limited to the region of the heart, but changes its character and its seat from day to day. It is remarkably modified by local bleeding, passing from a loud rough sound to a soft bellows murmur;—most rough and intense during inspiration. The hand applied over the cardiac region will sometimes detect a rubbing sensation, which ceases with the cessation of pericarditis.

These pericardial or exocardial friction sounds or murmurs may be, and are often mistaken for endocardial murmurs (Taylor, Stokes, Graves, Skoda, Sibson). The following distinguishing signs are condensed from Dr. Sibson's interesting review of the works of Stokes and Bellingham on diseases of the heart, in the *Medico-Ch. Review* for 1854.

The exocardial may be distinguished from the endocardial sounds, by the nature and nearness of the exocardial sound—by its existence with diastole as well as systole—its limitation to the region of the heart—its non-existence over the great vessels—its variations over different parts of the heart—its rapid and frequent change in character, or its disappearance from day to day—its want of correspondence with the rhythm of the heart, while it seems to follow upon its movements (Skoda), or to precede and follow the impulse (Wunderlich), its co-existence with tactile vibration, and where

there is much effusion, with an extensive cone-shaped region of cardiac dullness. The apex of this dull region points to the top of the sternum—its broad base extending downwards to the right and far to the left of the epigastrium. In addition to these signs which, when they exist, serve to establish the existence of pericarditis and separate pericardiac from endocardial murmurs, we have other very characteristic signs by which to distinguish every case of pericarditis, especially in the earlier stages. By the aid of pressure, as first demonstrated by Dr. F. Sibson, applied gently over the region of the heart, we have a test decisive as to the cause of these sounds, when we are in doubt as to whether it is endocardial or exocardial. If the noise is that of a valve murmur, pressure from without does not increase or modify it, except in some ænemic persons, over the aorta. If, on the other hand, it is that of a friction murmur, soft and bellows-like, of exocardial origin, pressure intensifies the noise and converts the sound into a rustle or rub. By pressing gently on the costal cartilage or end of the sternum with the stethoscope, the intermediate fluid is displaced, and the roughened surfaces are brought in contact. This method of diagnosis is most valuable, especially in the early stages, when it is of real importance to arrive at a correct diagnosis (*Provincial Med. Transac.*, vol. xii., p. 540).

Increased extent of dullness in percussion and marked prominence over the cardiac region are also two characteristic signs.

When extensive effusion takes place the heart is pushed upwards to the second, third, and fourth intercostal spaces; consequently the seat of the heart's impulse, of the rubbing sounds, and of tactile vibrations, are all correspondingly raised (Sibson, Latham, Walshe).

A valuable distinctive sign of pericardial effusion, when contrasted with pleuritic effusion, is thus stated by Dr. Stokes. He observes that when the left side is dull in front, and resonant behind, it is a pericardial and not a pleuritic effusion. Any large increase of fluid at once betrays itself, especially in the young, by the protrusion of the left cartilages and ribs, the widening of their interspaces, prominence of the ensiform cartilage, and, in some extreme cases, by an epigastric fullness or even tumor. When the fluid increases the pulse also becomes feebler and more disposed to falter and to flutter. It becomes irregular and excited; and often the patient is so fixed in one position that he fears to move lest he may aggravate by exertion the dyspnœa and action of the heart from which he suffers so intensely. The jugular veins also not unfrequently become distended, and this distension does not lessen during inspiration when the effusion is great. A significant sign is thus furnished of the greatness of the obstruction which exists to the thoracic circulation. Œdema and great coldness of the extremities

are also apt to supervene with such a state of things. When, however, the products of inflammation become solid, and little serum remains, the pericardium by the opposed serous surfaces becomes attached to the heart throughout, and the pulse then resumes its force and regularity, and if the patient survives, this adhesion remains for life.

The chief general complications of pericarditis, and which also in many cases may be regarded as the exciting cause of the disease, are, Bright's disease, rheumatism, diseased heart and dropsy, pyæmia, pneumonia, vomicæ, pleurisy. These diseases are mentioned in the order of the frequency with which they give rise to pericarditis, as consistent with the observations of Drs. Taylor, T. K. Chambers, and A. W. Barclay.

Prognosis.—While the consequence of pericarditis "is sometimes, though rarely, the speedy extinction of life; in nineteen cases out of twenty the disorder proves fatal at a remote period; destroying the subject of it more slowly indeed, but almost as surely." Such is the opinion of Dr. Watson; and again he writes, "I am certain it is a fertile, but often unsuspected source of chronic disease of the muscular substance of the heart and of its consequences; asthma, dropsy, sudden death." Sometimes death occurs suddenly when least expected; and the mode of death tends to be by asthenia. A fatal termination may occur, although rarely in less than forty-eight or thirty hours. In ordinary cases which progress favourably the disease generally begins to yield in the course of a week or ten days, and sometimes sooner under active treatment.

It is not now generally believed that when the disease terminates by adhesion, dangerous or fatal lesions of the heart tend to supervene, as Dr. Hope believed. It is consistent with the experience of Drs. Stokes, Sibson, Wood of Pennsylvania, W. T. Gairdner, Smith, and other observers, that hypertrophy and dilatation of the heart do not commonly follow on pericardiac adhesion. Dr. Watson, however, with many others, regards adhesion of the pericardium as a suspicious prognostic of future evil—"that other structural changes will soon or slowly develop themselves; and first render life burdensome and full of suffering, and then consign the patient to an earlier grave than might else have awaited him."

Treatment.—The results of treatment are unsatisfactory in the highest degree. Dr. Watson thus writes, that "in a large proportion of the cases, whether they be treated well or ill, or not treated at all, the patients will seem to recover." Blood-letting and calomel are the two most efficient agents in accomplishing the indications of cure. A too energetic use of these remedies, however, tends to weaken the heart and the system at large, and thus prove a source of additional irritation to the cardiac tissue, by undue re-action on

the system. "A single bleeding from the arm," writes Dr. Stokes, "appears, on the whole, justifiable, but its repetition will be a matter for careful consideration." It is a remedy which has been clearly shown by the late Dr. Taylor to shorten the duration of pericarditis, and to do so the more effectually, the earlier it is performed (*Medical Times and Gazette*, 1851, quoted by Dr. Walshe). The treatment by bleeding may also be further carried out by leeches over the præcordial region or by cupping there. Dr. Watson gives a most judicious opinion when he says, "I think there is a peculiar risk in frequently bleeding to syncope in this affection. Blood may be drawn from the arm till some effect upon the pulse is produced; but Dr. Watson gives the preference to repeated relays of leeches over the præcordial region, or to free cupping.

To judge as to the repetition of blood-letting, the force of the heart must be observed, as indicated by the pulse at the wrist, by the actual strength of its impulse, and by the character especially of the first sound. If the impulse continues vigorous and the first sound is undiminished, blood-letting may be repeated by the further *local* abstraction of blood; but if the impulse has manifestly declined in force while the first sound is lessened, great caution is required in the further abstraction of blood.

While the treatment by bleeding is thus judiciously carried out, the gums must be made tender by calomel, and it should be given in frequently repeated doses; while at the same time mercurial inunction should also be adopted. The mouth should be *kept sore* for a considerable time (Watson, Graves, Stokes). In the second stage of the disease, when liquid effusion distends the pericardium, reliance may be put in treatment by a blister of a large size over the præcordia.

"Stimulants," writes Dr. Stokes, "are often imperatively called for. The weakened heart requires to be supported and invigorated. This may be effected by the use of wine, and by the use of opium in large doses." If depletion has been excessive—if signs of muscular weakness supervene—if there be evidence that the heart, previous to the attack, was in a weakened state, if a tendency to collapse or to a typhoid state manifests itself, "we must give wine, quite irrespective of the physical conditions of the heart" (Stokes).

Opium in doses of one grain every third hour, seems "to expend itself solely on the disease," and its beneficial effects are seen to result when it does not produce contraction of the pupil, nor headache, hot skin, furred tongue, nor constipation (Corrigan, Stokes, Graves, Sibson).

There are two more important circumstances to be attended to, as stated by Dr. Sibson, namely, that our treatment of pericarditis

must depend upon the stage of the disease in which it is first discovered to exist; and it is important to know that pericarditis from acute rheumatism calls for a totally different line of treatment from that associated with Bright's disease, or diffused inflammation of a low type.

In the rheumatic form, colchicum, in the form of a draught, along with the mercurial pill, and the administration of alkaline remedies, are indicated by the constitutional state.

Paracentesis is recommended by Dr. Sibson, in all those cases in which the effusion is so great as to cause alarming distress, orthopnœa, obstruction to the venous circulation, and serious interference with the heart's action. In such cases a fine exploring trochar and canula is to be introduced (not plunged), so as to make a valvular opening below the heart, either to the left of the xyphoid cartilage, or through the fifth intercostal space close to its anterior extremity, and the fluid drawn off by means of a syringe (SIBSON, in *Medico-Chirurg. Review*, July, 1854).

ENDOCARDITIS.

Definition.—*An inflammation of the serous membrane, or endocardium, covering the valves and lining the chambers of the heart.*

Pathology and Morbid Anatomy.—By a species of preference the coverings of the orifices and valvular structures of the heart are by far the most frequent seat of lesion in the internal inflammation of that organ. The frequency with which these parts suffer, may in some measure be explained, if their minute anatomical and histological relations are connected with the morbid states of similar tissue. The peculiarity of the minute structure of these parts, as influencing the arrangement assumed, in the first instance, by morbid deposits, seems to have been first definitely stated and illustrated by Dr. Watson (Lect. lxi., p. 275, 3d edit.) There is found to exist, enclosed between the reduplications of the endocardium, a quantity of fibrous tissue. An increase in its amount takes place at the centre of each aortic valve, forming the corpora aurantii, and at each of the extremities or angles of the segments. The minute exudations which are formed as the result of the inflammatory process in the endocardium, may be seen to arrange themselves in double festoons, suspended as if from the corpus aurantii, often in a row like a string of beads, along the line of union of the thick portion of the valve, with the inner convex margin of its two thinner crescentic portions. The repeated attrition of the opposed surfaces of the valves pushes the exudation, as fast as it is deposited, and while yet plastic, from the thin crescentic portions of each valve, and so heaps it up along those boundary lines of contact; "just as

a thin layer of butter on a board would be displaced, and heaped up in a little curvilinear ridge by the pressure of one's thumb."

While doubtless the structure of the serous membrane is the same throughout the heart, yet its mixture with white fibrous and elastic tissue, in great abundance at the valvular reduplications, renders it prone to disease, especially in those constitutional states of the system in which the fibrous textures are more particularly involved, as in rheumatism. These are the parts also on which the great tear and wear in the action of the heart is expended, and thus they are probably the first to suffer, owing to the mutual friction of the valvular edges upon each other.

Diffuse inflammation of the endocardial membrane has been known to follow the application of a ligature round an artery. The morbid appearances of its inflammation are similar to those in other serous textures, namely, a silvery opacity, and more or less thickening of its tissue. Inflammatory lymph is often found strongly adherent to the valves, as already described, and forming fringe-like or fibrinous warty growths, or excrescences, as they are termed. By its agency the lappets of the valves become variously distorted in shape, or soldered together, and insufficient to perform their functions. By the subsequent changes which take place in these deposits, an orifice, naturally large, may be reduced to the condition of a mere slit, or to the diameter of a goose quill. One segment of the aortic valve may, for example, be turned up and bound to the aorta, or it may be turned down and bound to the inner surface of the heart, or it may be curled up like a shell.

The prolonged existence of the inflammatory state ultimately thickens and hardens by interstitial deposit, the tissue enclosed between the folds of the serous membrane constituting the valves, so that their action is much impaired. These changes may be limited to the fibrous zone which forms the base of the valves, surrounding the aortic orifice with a sort of collar, contracting its diameter as well as impeding the play of the valves. In other cases the thickening may affect the free edge, or the central portion of the valve. The most remarkable circumstance, however, connected with chronic adhesive inflammation of the left side of the heart, is the excessive tendency which the valves have beyond all other serous tissues to become cartilaginous or ossified. This transformation commences in the substance of the serous tissue, but more commonly in the tissue connecting the duplicature of the valvular fold. This ossific deposition is not necessarily preceded by a cartilaginous formation, but is most frequently an original abnormal secretion, often containing a good deal of earthy matter. In most instances in which I have examined such deposits, they did not exhibit the histological appearances of true bone tissue. It is deposited in

various forms: sometimes in layers, at others in points, and at others in large masses, in knobs or pyramids, and occasionally acquiring a size as large as a pigeon's egg. Sometimes the tendons, or the chordæ tendineæ attached to the mitral valve, participate in these indurations, and Corvisart met with one entirely ossified. The irritation of these deposits often leads to their destruction, and the whole exudation softening and breaking down, may mingle with the current of the blood, and produce results to be noticed of a most serious description.

Dr. Latham and Dr. Hope were of opinion, that endocarditis is more frequent than pericarditis. Dr. Stokes, Dr. Sibson, and others, entertain a different opinion, consistent with the evidence of post mortem inquiries, as recorded by Drs. T. K. Chambers, A. W. Barclay, and Taylor.

The tendency of endocarditis is—

(1.) To produce those affections of the heart which are also described respectively as "*valvular disease of the heart*"—"*hypertrophy*," and "*dilatation*"—morbid conditions more or less simple or combined.

(2.) Associated as it often is with pericarditis, and acknowledging rheumatism as a most frequent exciting cause, we have the *muscular* substance of the heart itself sometimes affected, constituting what Dr. Watson terms "*rheumatic carditis.*"

The nature of those affections will now be described under the head of—

Symptoms and Results of Endocarditis.—A more extensive, forcible, and abrupt impulse of the heart than natural, combined with endocardial murmurs of a soft low pitch tone, and blowing sound, combined with a febrile state of the system, and cardiac uneasiness, suggest the probability of endocarditis. A careful study of the development, order of occurrence, and combination of the general symptoms and physical signs, can alone convert that probability into a certainty.

(1.) **General Symptoms.**—The patient is observed to prefer to lie on his back (dorsal decubitus), and he may perhaps incline to toss about with his arms. Pyrexia may prevail of a specific kind, as when rheumatism, Bright's disease, or typhus fever is present, or it may be idiopathic inflammatory fever, associated with the endocarditis. So long as the cardiac orifices are not seriously obstructed, and no obstruction exists in the lungs from pneumonia or bronchitis, no special sensation of dyspnœa is complained of. The pulse ranges in frequency between 80 and 120, and it has been stated by Dr. Taylor even to lose in frequency at the outset of the affection. More or less headache may prevail.

(2.) **Local Symptoms.**—Discomfort and uneasiness at the heart

are most common symptoms, and more or less palpitation may be present.

The extent and power of the impulse of the heart ought now to be examined carefully and repeatedly, and the conditions which tend to subdue or to aggravate these phenomena ought, if possible, to be ascertained. The areas of the heart's dullness, both superficial and deep-seated, undergo increase (BOUILLAUD, WALSHE).

The murmurs which accompany purely acute endocarditis are thus arranged in the order of their frequency by Dr. Walshe :—(1.) Aortic obstructive ; (2.) Mitral regurgitant ; (3.) Aortic regurgitant; (4.) Aortic obstructive and mitral regurgitant together. (The student is referred back to page 622 for the account of the sites of maximum intensity where these murmurs may be listened to).

The comparative frequency of aortic and mitral valve disease has been determined with more accuracy by the results of the combined observations of Drs. Barclay, Chambers, and Ormerod, as tabulated by Dr. Sibson. From these records it is seen that the *mitral valves* are more subject to disease than the *aortic ;* that the disease is more often limited to one valve, or others, than common to both, but that it is more often common to both valves than limited to either. When associated with acute rheumatism, the disease affects both valves in the greater number of cases ; and the *mitral* more frequently than the *aortic.* In the young, who are subject to acute rheumatism disease of the *mitral* valve, and in the old, who are subject to atheroma, disease of the *aortic* valve predominates.

In the more severe cases in which the valve disease is itself the cause of death, the *mitral* valve disease is shown to be the most prone to go on to a fatal issue (*Medico-Chirurgical Review*, Oct., 1854, p. 431).

As there is no difference in character between the murmur of endocarditis and that which attends established valvular disease, to appreciate the existence of endocarditis more certainly, it is necessary that the *murmur should be developed under observation at the early period of an acute attack* (WALSHE) ; and if a mitral or aortic murmur supervene, while a case of acute rheumatism is being watched, especially if there be congestion and an expression of anxiety in the face, with distress in the region of the heart, *not caused by pericarditis,* there is a strong probability of endocarditis (SIBSON). But the symptoms are often exceedingly insidious in their origin and progress, and the disease is rarely simple, but is generally combined with pericarditis ; and, moreover, as the *general* constitutional symptoms of these two diseases do not differ, the detection of endocarditis, *per se,* is one of the most difficult in prac-

tice. Like pericarditis, it is often latent, as in rheumatic fever, and the practitioner is often surprised by his patient showing symptoms of valvular disease after an apparently perfect recovery from fever (STOKES). A murmur, *per se*, is no sufficient evidence of endocarditis. Stokes, Sibson, and Graves, have each of them recorded cases where *mitral*, and still more often *aortic* murmurs have been generated, when no valvular disease existed, in cases of fever especially, in a case of fatty degeneration of the heart, and in a case of pericardial adhesion. These murmurs have also been recorded to exist during life, in cases in which no trace of valve disease was observed after death, by Drs. Barclay, Markham, Chambers, and W. T. Gairdner (SIBSON, in *Medico-Chirurg. Review*, Oct., 1854).

As in pericarditis it is important to recognize the *friction sound* pathognomonic of its existence, apart from any endocardial murmur, with which it might be confounded; so in endocarditis it is, if possible, still more important to detect endocardial murmurs when masked by pericarditis, for the grazing sounds of the latter disease may altogether mask those of the valve murmurs. The principles on which the diagnosis is to be effected, are involved in the facts, that friction sounds of pericarditis are limited to the heart's region (STOKES); while, as Dr. Walshe so clearly describes, the sounds of the heart, and the murmurs which attend the lesions of its valves, are propagated in certain determinate directions; and while they are heard in maximum intensity, at certain points more or less defined, they may be detected by following the line of propagation at points beyond the mere limits or region of the heart itself. Upon these grounds data are furnished by which to distinguish the murmurs of endocarditis.

For this purpose the murmurs of endocarditis must be looked for in suspicious cases from day to day, *beyond the region of the heart;* and if a systolic mitral murmur is heard extending an inch and a-half beyond the nipple, it is due to mitral regurgitation (SIBSON). The detection of an aortic murmur with pericarditis is much more difficult, because the *friction sound*, the *frottement*, or "to and fro" sound, often mounts to the top of the sternum. The aortic murmurs are therefore to be listened to in the line of the natural propagations of the aortic sounds, and if an aortic murmur exists, it can only be distinguished in the neck, the best point for examination being just above the sternum, a little to the right over the innominata. If, after listening to the first sound, the second sound be observed to follow clearly and distinctly, the chances are that there is no affection of the aortic valves, even if there be a loud systolic murmur. If, however, the second sound be indistinct, inaudible, or prolonged, or be replaced by a diastolic murmur,

aortic endocarditis may be suspected or detected (SIBSON). (The student is requested to contrast page 622 with these statements).

As far as the immediate practical value of the information is concerned, it seems to be really unimportant where the exact seat of the murmur is. It is of no practical importance, for example, in the first instance, whether the murmur proceed from a "mitral, a tricuspid, or a semilunar valve, or whether it may be due to a contraction, or a dilatation, an ossification, a permanent patency, or a warty excrescence."

The practical points to be determined, in the first instance, reduce themselves to two, namely, *First*, Do the murmurs proceed from an organic cause? *Second*, What is the vital and physical condition of the texture of the heart itself with which they are associated?

For subsequent practical purposes the limits of inquiry may also be very much circumscribed; namely, to the recognition of the occurrence of contraction or of dilatation of the orifice, because both of these conditions are attended with a permanently open state.

While, therefore, the occurrence of murmurs, and their nature, and the circumstances under which they are developed, are of the utmost importance to establish the existence of an endocarditis, the condition of the muscular substance of the heart must be the great guide in prognosis and treatment. The vital and mechanical state of the heart's cavities must be ascertained. The action of the heart must be carefully noticed at different times, as to whether its force and vigour is above or below the natural standard—whether it is liable to excitement from slight causes—and whether it tends to regular or to irregular action, as regards rhythm or frequency of revolutions. The duration and origin of the disease must be ascertained; and how far the brain, lungs, or liver suffer from the mechanical or vital effects of the lesion (STOKES).

The symptoms, therefore, of acute endocarditis being detected, the immediate treatment of the disease must be proceeded with, and the physician requires also to look before him in anticipation of the results which are likely to ensue if valvular lesion is established. An analysis of ninety-six cases collected from various authors and tabulated by Dr. Sibson (*Med.-Ch. Review*, October, 1854, pp. 434, 435), shows that by far the larger proportion of cases of valve lesion tend to thicken the walls and enlarge the cavities of the heart;—that aortic regurgitation with narrowing of the aperture, and still more without such narrowing, induces active dilatation of the left ventricle, followed consecutively by enlargement of the left auricle, and the right ventricle and auricle;—that disease of the pulmonic valves causes dilatation of the right cavities;—that

mitral narrowing with regurgitation leads to enlargement of the left auricle, followed in succession by dilatation of the pulmonary veins, congestion in the lungs, enlargement of the right ventricle and auricle, distension of the venæ cavæ, engorgement of the liver, congestion in the systemic capillaries; and, at length, and in nearly one-half of the cases, enlargement of the left ventricle itself;—that combined disease of the aortic and mitral orifices causes enlargement of the left ventricle, and to a less, but nearly to the same extent, of all the other cavities. Thus there is established a great pathological fact originally stated by Senac and confirmed by Morgagni, that *dilatation* and *hypertrophy* owes for its cause a force acting *a tergo* attempting to overcome an obstacle in advance. But there are also other morbid states which tend to these results upon the same principle independent of valve disease; namely, *bronchitis*, *emphysema*, and any lung disease in which there is an obstacle to the flow of blood through the lungs. Disease also of the arterial trunks, such as atheroma, anæmia, dilatation or narrowing,—whether of the lungs or of the system, may induce dilatation of the right and left cavities of the heart (Rokitansky). The retrograde influence of the systemic capillaries, as shown by Dr. Sibson, tends to exercise a similar influence; as shown by the effect of sudden fright and despair, causing rupture of the left ventricle, or by the influence of Bright's disease altering the quality of the blood, tending thereby to retard its progress through the systemic capillaries. Thus hypertrophy and dilatation ensue from increased resistance to the exit of blood from the cavity of the heart, and from the necessarily increased efforts to expel it, and to propel it onwards. (See under "Bronchitis," how collapse of the lung may also produce dilatation.)

In detecting enlargement of the heart and thickening of its walls, the size and force of the heart, ascertained by the hand and by auscultation, furnish the principal data. It is by the extent and power of the impulse that the heart's muscular condition is ascertained, and so long as the muscular condition is sound the valve disease has but little influence on health (Sibson and Stokes). As a rule, however, the persistence of valve disease implies an enlarged heart, with an impulse increased in extent and in power. But there are also cases to be guarded from mistake; namely, those where a murmur exists, with a preternaturally strong, troublesome, quick, and smart impulse, *but limited within a diminished cardiac region*. In such cases such a murmur is of anæmic origin, and the heart is usually lessened rather than enlarged.

Another class of symptoms and results are apt to be associated with endocarditis and valvular disease; as when the products of inflammation are apt to poison or spoil the blood. Rigors, heat

of skin, profuse perspiration recurring irregularly, dull, earthy-yellow discoloration of the skin (not of the conjunctivæ), diarrhœa, more or less bilious, pinched, anxious countenance, intense prostration and muttering delirium, are the symptoms which Dr. Walshe describes as announcing this untoward occurrence. Secondary deposits in the lungs, the liver, or the brain, are the records of its morbid anatomy. But, again, these secondary deposits may not be the direct result of existing endocarditis. Virchow, Kirkes, Simpson, and Rokitansky have shown how the fibrinous coagula, which have become permanently attached to the valves constituting the vegetations upon them, may become worn away superficially, and taken into the blood in fine particles, thus leading to secondary coagula in the capillaries of the spleen and kidneys, to obliteration of these vessels; and, in the capillaries of the brain leading to softening and sometimes to sudden death. The great tendency to the formation of these coagula on the valves, in rheumatic pericarditic attacks, must be specially remembered when it is determined to abstract blood, as the slowness of the heart's action which may ensue, greatly favours the tendency to coagulation of the blood and the disposition of those fibrinous deposits on the valves.

Carditis, as already noticed, is known as a concomitant state associated with endocarditis and pericarditis, and especially in the strata of fibres nearest the inflamed membranes. The most powerfully exciting causes of this condition are Bright's disease and rheumatism. As an idiopathic disease nothing clinically is known concerning it.

Hypertrophy and Dilatation.—Hypertrophy of the heart's substance is usually described to occur under three forms; namely, (1.) *Simple hypertrophy*, when the cavities retain their relative capacities to each other, although the walls are increased in thickness; (2.) *Eccentric hypertrophy*, when the cavities enlarge or dilate, and the muscular walls thicken, commonly known as *hypertrophy with dilatation;* (3.) When the walls thicken at the expense of the capacity of the cavities, known as *concentric hypertrophy.* The existence of this last form of hypertrophy is now disbelieved except as a congenital malformation. Cruveilhier, and more recently, Dr. Budd, have proved that no such form of hypertrophy exists as a result of disease.

Dilatation of the heart implies that the capacity of its cavities is increased disproportionately to the thickness of their walls. It occurs in three forms; namely, (1.) *When dilatation predominates over hypertrophy;* (2.) *Simple dilatation where the thickness of the walls are normal;* (3.) *Dilatation where the walls of the heart are attenuated or thinner than normal.*

Practically, therefore, the physician has principally to deal with

the diagnosis and treatment of—(1.) *Simple hypertrophy;* (2.) *Hypertrophy with dilatation of one or more of the cavities;* and, (3.) *Simple dilatation with or without attenuation of the walls of the cavities.*

The following table, compiled from Dr. Walshe's treatise, exhibits sufficiently the main points in the symptoms of these forms of disease, for the purposes of comparative diagnosis :—

Table contrasting the main Symptoms of the Forms of Hypertrophy and Dilatation.

A.—General Physical Signs.

Simple Hypertrophy.	Symptoms superadded to constitute Hypertrophy with Dilatation.	General Simple Dilatation.
Arching of the præcordial region, with widening and bulging of the left intercostal spaces from the third to the seventh.		No prominence of cardiac region.
Impulse increased in extent to the left of the sternum.	Extent of visible impulse much greater; pulse may be felt in the back, and its character is less heaving, sharper, and more knocking than in simple hypertrophy.	Apex beat indistinctly visible or actually invisible, the rounded off form of the heart destroying the apex form.
Maximum impression felt below and about the left nipple.	Point of the apex beat carried downwards and outwards beyond the line of the nipple, so as to reach the seventh interspace.	Impulse conveys an undulatory sensation to the hand, and feeble in proportion to the purity of the dilatation.
Heart's impulse slow and heaving, as if pressing steadily against an obstacle—in rhythm regular, in force unequal.	Force increased, so as to shake the head or trunk of the patient, or the bed on which he lies.	Force of successive beats is unequal. Rhythm irregular, to a slight or to the very highest degree. The hand applied to the region where the impulse is felt does not feel the beat always strike at the same place.
Superficial and deep-seated dullness, augmented in area, but its shape retaining the triangular form.	The dullness tends to assume a square form in place of a triangular one, and may reach from the second interspace to the eighth rib, and from an inch and a-half to the right of the sternum to three inches, or even more, outside the vertical line of the nipple. It may be detected in the back.	Intensity of superficial percussion dullness not increased; and in cases of attenuated walls of the heart's cavities, the resistance is less marked than in health. General areas of dullness widened.
First sound is dull, muffled, prolonged, and weakened, almost to extinction, directly over the ventricle.	Sounds gain greatly in loudness and extent of transmission, especially if the valves are not thickened.	*First sound* short, abrupt, and unnaturally clear at the apex and base, appears near the surface, and its maximum point of expression is slightly lowered.
Second sound, full and clanging, *post-systolic silence* shortened. Mitral regurgitant murmur, as a clinical fact, exists at one time and disappears at another.	In consequence of the altered direction of the orifice of the aorta to the cavity of the ventricle, a systolic basic murmur may be generated.	*Second sound* not specially affected. Upon the quality of the heart's texture, as regards softness or flabbiness, will depend the extent to which the sounds are transmitted. Intracardiac murmur always regurgitant.

Table contrasting the main Symptoms of the Forms of Hypertrophy and Dilatation.

B.—General Functional Symptoms.

Simple Hypertrophy.	Symptoms superadded to constitute Hypertrophy with Dilatation.	General Simple Dilatation.
Strength unimpaired. Power of walking or of ascending a hill diminished, on account of dyspnœa induced by the effort. Face florid.	Strength tends to become impaired. Purpleness and lividity great in proportion to the valvular or pulmonary obstruction.	Strength fails, and the patient is habitually irritable and melancholy. Lividity and mottling of the face prevails, and of the lower extremities generally, with chilliness of surface. Softly pitting anasarca spreads from the feet to the abdomen, external genitals, thorax, face, and neck. Ascites follows anasarca.
Constipation habitual.		Bowels habitually constipated, or alternately relaxed—discharges dark.
Dyspnœa occasional.	Paroxysmal attacks of dyspnœa.	Dyspnœa, sometimes called cardiac asthma, becomes complete and habitual, with asthmatic paroxysms, in which the cough is dry, harassing, and convulsive. Expectoration serous, sometimes streaked with blood.
Radial pulse, full, strong, firm, tense, resisting, and prolonged, without jerk or thrill.	Fullness of pulse continues, but strength and power of resistance lost.	Pulse small and feeble, and abnormally late in time, after the ventricular systole. It may be regular, or narrow, feeble, fluttering, and irregular.
Pain rare.	Pain not uncommon.	Palpitation and cardiac uneasiness most distressing.
Rarely, and never rapidly, the direct cause of death.	Indirectly, and more or less rapidly leads to a fatal issue.	Faintness occurs from time to time, and may lapse into syncope and sudden death.

Causes of Endocarditis.—The inner membrane of the heart, exposed as it is to the action of many morbid poisons, and also to many substances which may be taken up by the absorbents and introduced into the circulation, is not found so frequently diseased as we might expect. Of all substances, however, alcohol has the most striking effects on this tissue. It is not only proved to be absorbed and actually to circulate in a free state in the blood, but there are few drunkards the inner membrane of whose heart and large vessels is not more or less diseased; so that alcohol probably acts as a specific poison on the endocardium. The morbid conditions associated with Bright's disease, with rheumatism and gout, appear to act especially upon this tissue, and many who suffer from these diseases often ultimately die of some form of endocarditis.

Prognosis.—So far as the endocarditis is concerned, the immediate prognosis is very similar to that stated under pericarditis;

ut the future chances of life being prolonged depend upon the esions which remain permanent. If valvular lesion is fully established, and remains persistent, hypertrophy is certain to follow, nd the danger will be the greater in proportion as dilatation of he cavities of the heart predominates over hypertrophy. "Under ll circumstances," writes Dr. Walshe, "dilatation is a most serious lisease; and the danger increases directly as the excess of the apacity of the cavities over the thickness of their walls; directly, oo, as the softness and flabbiness of the heart's tissue; directly, oo, as the general deficiency of tone in the system and impoverishnent of the blood. Once dropsy has supervened, life can with lifficulty be prolonged by art beyond twelve or eighteen months. Dilatation of indubitable existence is not removable by *treatment.*"—(Walshe, *On Diseases of the Heart and Lungs*, p. 487.)

If neither aortic lesion, hypertrophy, nor dilatation result, the issue of the heart itself may be so impaired as to lead to softening, s in typhoid and typhus fevers, scurvy or purpura. Fatty degeneration of the cardiac tissue is also a result to be apprehended.

The valuable medical reports of St. George's Hospital, London, prepared by Drs. A. W. Barclay and Rogers, contain the following statistics relative to the per centage of mortality *among hospital patients* from *diseases of the heart* during a period of six years; namely, from *pericarditis*, 34·8; from *endocarditis*, 9·19; from *hypertrophy*, 60·5; from *dilatation*, 52·1; from *valvular disease*, 24·5.

Treatment.—What has been written relative to the treatment of *pericarditis* applies equally to acute *endocarditis;* but the management of cases in which the patients suffer from the valvular lesions and their immediate consequences demand the adoption of very various lines of treatment. From whatever cause, it is one of the most intractable diseases with which we are at present acquainted.

When endocarditis seems lapsing into the chronic stage, Dr. Walshe recommends the use of iodide of potassium and liquor potassæ combined with bitter tonics.

The symptoms of simple hypertrophy may, in the majority of cases, be greatly mitigated by such means as tend to tranquillize the action of the heart. This end may be best accomplished by occasional very moderate cuppings or leeching over the præcordial region. No known drug possesses the power of controlling the growth of the heart. Saline and aloetic purgatives aid the calmative influence of the local abstraction of blood. Diuretics are useful independently of the existence of dropsy; and direct sedatives of the heart's action are indicated throughout, such as hydrocyanic acid, acetate of lead, digitalis, and belladonna; but of all medicines of this class, Dr. Walshe considers aconite the best, in the form of the alcoholic extract given in doses of *one-eighth of a grain.*

In repeating the doses, the effects must be watched, while they relieve the painful sensations and disquietude about the heart. If anæmia prevails, animal food should be permitted. Fluids must be taken in small quantities; and alcoholic fluids of all kinds are to be entirely avoided. Months and even years of treatment may be required to produce any impression on the disease.

Like *hypertrophy*, *dilatation* of the heart is not removable by treatment, but judiciously directed remedial measures may render the condition bearable, and even for a time unappreciated by the patient. To improve the tone of the muscle, and strengthen the action of the heart, without exciting its irritability, are the objects to be aimed at in the management of the case. The groundwork of medicinal remedies consists in the administration of general tonics in the form of *bitters*, *mineral acids*, and preparations of *iron*. Belladonna may be employed to tranquillize undue excitement, with greater safety than any other sedative remedy. Sedatives, as a rule, are unsafe, and require the utmost caution in their use. Due action from the bowels must be daily obtained, to accomplish which the aloetic medicines are the best, aided by the gentle action of an occasional mercurial aperient.

The diet should be nourishing without exciting, embracing animal food, and a moderate allowance of light beer or wine in small quantities to dinner.

When dropsy appears, diuretics yield most relief, in the form of *acetate*, *nitrate*, *iodide*, and *bitartrate of potass*, *nitric æther*, *compound tincture of iodine*, the *infusion* and *spirits of juniper*, or *gin*, may all be employed in successive changes, and variously combined. Occasional small doses of blue pill and squill, at bed-time, will facilitate their action generally; and so will cupping over the region of the kidneys, if symptoms of congestion of these organs prevail.

Hydrogogue cathartics also aid the diuretics in subduing the dropsical effusions, in the form of *elaterium*, *gamboge*, *bitartrate of potass*, and the *compound jalap powder*.

Dr. Walshe, whose mode of treatment has been here described shortly, prescribes the following formula for the administration of elaterium :—

℞. Extract. Elaterii, gr. $\frac{1}{6}$ — gr. $\frac{1}{2}$.
„ Creasotonis, gr. i.
„ Hyoscyam. gr. ii. Misce. Fiat pilula.

Order 3. Lung Diseases—*Pneumonici*.

The acute inflammatory diseases of the pulmonary apparatus are more or less distinctly defined, according to the tissue which they implicate, and the symptoms to which they give rise. The three

structures which mainly take part in the constitution of the lung substance, being—(1.) the *bronchial tubes*, terminating in (2.) the *pulmonary air cells, vesicular structure, proper substance,* or *parenchyma of the lung;* and (3.) *the membrane covering this parenchymatous part,* forming a portion of that serous sac interposed between the lungs and the walls of the thorax. That portion of this serous sac, which immediately invests the lungs, is known by the name of the pulmonary pleura; while that which is applied against and invests the parietes of the thorax, is known as the parietal or costal pleura.

One or more of those pulmonary structures may be associated in the processes and results of inflammation. Thus the bronchial membrane may be inflamed, when the disease is termed *bronchitis;* or the substance of the lung may be inflamed, the disease being then called *pneumonia;* or the pleura may be inflamed, a condition which is described as *pleuritis.* It is rare, however, in practice, to find that these morbid states are so completely isolated. More frequently, for instance, with *pneumonia,* or inflammation of the substance of the lung, there is associated, more or less, inflammation of the air tubes (bronchitis), on the one hand, constituting *broncho*-pneumonia; or there co-exists inflammation of the investing pleura (pleuritis), constituting, on the other hand, *pleuro*-pneumonia. The physician of modern times can now distinguish each of these elementary conditions by definite symptoms, and by observing the combination of physical phenomena, their association with general symptoms, and the sequence of their occurrence, he is able to determine how far any given pneumonic affection involves one or more of the structures which compose the lung; and to direct the treatment of the case accordingly. It is therefore necessary to describe the phenomena of inflammation in each of these structures in detail.

Pleuritis—*Pleurisy.*

Definition.—*Inflammation of the pleura, characterized at its outset by a febrile chill, followed by an acute sharp pain in some part of the chest, frequently called a* stitch in the side, *as it is usually confined to one spot about the lateral regions of the thorax. The acts of respiration are performed rapidly, and are not completed. A dry short cough supervenes, and the pulse is hard and quick. The natural serous secretion of the pleural sac is arrested in the first instance, but soon becomes increased in quantity, and of an inflammatory type, the exudation tending to assume the* corpuscular *character. The effusion more or less rapidly increases, and may ultimately assume a sero-purulent character; and the parietes of the corresponding side of the chest may dilate accordingly.*

Pathology and Morbid Anatomy.—The inflammatory phenomena begin in the sub-pleural tissue, whose vessels enlarge and admit red blood, and shortly afterwards the red blood penetrates the web of the pleura itself, and the process is more or less diffuse. At first a number of red dots may be visible, which at length are so multiplied as to become confluent and form large patches, which spread till perhaps the whole of the pleura pulmonalis and costalis is one continuous inflammation. The membrane is in all cases of a bright red or arterial colour, slightly thickened from interstitial deposit, and easily detached, from the diminished cohesion of the sub-pleural fibrous tissue.

If the diffuse inflammation be of any intensity, the secretion from its surface is in general suspended at first, and the membrane is dry. In this state the inflammation may terminate by resolution, or serum may be poured out, forming the *serous inflammatory effusion.*

The quantity of serum effused is very various. In some cases it hardly exceeds a very few ounces, while in other instances it amounts to many pints, filling the cavity of the pleura, and compressing the lung. Laennec is of opinion, that the time of effusion after the commencement of the inflammation is often very short, as he has detected ægophony and absence of respiration, as well as of thoracic resonance, an hour after the patient has first felt pain in the side. If the effusion be considerable, the lung becomes collapsed, contains no air, and therefore no longer crepitates; the vessels are devoid of blood, while the bronchii, even to the large trunks, are evidently contracted; still, if this lung be inflated, it enlarges more or less perfectly. Again, should the pleuritic effusion be less in quantity, some fluid appears spread all over the lung; but the greater quantity is collected at the lower portions of the chest.

Accompanying either of the previous forms, or existing *per se*, the *fibrinous inflammatory lymph* may predominate, and adhesion of the opposed surfaces ensue. In many cases the lymph is loose and watery, rendering the serum turbid or flocculent; but in other cases it is more solid, and adheres with great tenacity to the opposite membrane, becoming organized at both surfaces. The organization of these membranes is rapid, and is often effected in the course of forty-eight or even twenty-four hours. If the patient dies shortly after an attack of acute inflammation, these adhesions are found soft, easily lacerable and extensible. If, however, he survives a longer period, the adhesions are often of great tenacity, are indurated, and with difficulty separated from their attachments. The extent of membrane affected with adhesions is very varied, sometimes limited to a small portion, and sometimes extending over

the whole cavity, but their most common seat is generally the anterior lobes, or the portion of pleura from the mamma to the axilla.

The pleuritic inflammation sometimes terminates in suppuration; and should the pus be in such quantity as to accumulate in the cavity of the chest, the disease is termed *empyema*. Empyema may be true or false: it is said to be true when the pus is secreted by the pleura, and false when it results from the bursting of an abscess of the lung into the cavity of the chest. The quality of the pus in true empyema varies from a genuine laudable pus to a sero-purulent fluid. In quantity also it varies from a few ounces to many quarts, filling the entire cavity of the chest. Under these latter circumstances the side of the chest is dilated, and the intercostal spaces widely separated and bulging.

Effusion of pus may take place into either cavity of the chest, but the left perhaps is the most common. The phenomena accompanying empyema of the left side are remarkable; for, besides the lung being found collapsed, and not so big as the fist, the heart is sometimes seen transposed as far over on the left side as it usually is on the right. In cases, however, in which paracentesis has been performed, and the pus has been drawn off, the heart is observed to return to its place, while the lung, less completely collapsed, may be bound down to the upper and lower portion of the chest by long and multiplied adhesions.

General Symptoms of Pleuritis.—Pleurisy, like other inflammations of the lungs, may be acute or chronic. The acute form of this disease may be preceded by fever, but often no such antecedent is present. Its local symptoms, however, in most cases, are strongly marked; the patient suffering with severe *continued pain* in the affected side, of "a dragging, shooting character," which is greatly exasperated by coughing or forced inspirations, movement, pressure, and percussion, so that the lungs can only be imperfectly filled with air. The seat of the pain, however extensive the inflammation, is generally limited to one point; and this point is usually about the centre of the mamma, or just below that part, towards the lateral attachments of the diaphragm. While the pain is constant, it nevertheless sometimes remits, and with the occurrence of effusion often totally disappears. The tongue is commonly white, but the pulse varies perhaps according to the form of the inflammation and its intensity. If the disease be limited to an effusion of lymph or serum, the pulse is seldom more than 90 to 110, but "hard and concentrated in impulse." Either form of pleuritis is also generally accompanied by a short troublesome cough, and some expectoration. The respirations are increased in frequency, phenomena of more constant occurrence than even the local

pain, and unless dyspnœa exist, are unnoticed by the patient. While one *respiration* is performed, only *three* beats of the heart in place of *five* or *six* occur. The patient likewise is for the most part restless, and lies on the affected side; but if the effusion is great, the lung is compressed, which increases the general uneasiness, as well as the oppression of the breathing, and the patient, instead of lying on his side, now lies on his back, or sits propped up in bed. If he recovers, the fluid effused is absorbed, with greater or less rapidity, and his amendment is proportionally retarded or accelerated. In fatal cases, although the lung may for a time become accustomed to the altered state of things in the chest, yet fresh effusions occur, which shortly terminate the life of the patient.

Again, if the inflammation is about to issue in the formation of pus, the pulse is extremely small and frequent (from 120 to 150), while the restlessness and anxiety of the patient are greatly increased. There are cases, however, of empyema, in which the patient suffers little pain, or any more marked symptom than usually awaits the last stages of phthisis. In some instances he is for a time even capable of walking about the ward. Supposing, however, empyema to have occurred, any acute pain which may have existed subsides, but the anxiety of the patient is increased, and his state of collapse shows his imminent danger. On the contrary, if the constitution be less affected, the symptoms vary according to the side of the chest which is the seat of the empyema. If it be on the left side, for example, the heart is often transposed, and felt beating as far over on the right side as it usually does on the left, and the pulse is small and frequent. If we now bare the chest of the patient, we find the affected side enlarged, sometimes œdematous, with projecting intercostal spaces. As the lung is now greatly compressed, no respiratory action is seen on that side, which is entirely at rest. If paracentesis be now performed, the heart is restored to its place as the pus flows; but as the lung for the most part only imperfectly expands, the affected side, even in the most favourable cases, contracts, and the spinal column, pressed upon by an unequal weight, acquires a lateral curvature; the shoulder sinks, and the patient is greatly and permanently deformed.

The duration of acute pleurisy is very various, sometimes terminating in a few hours, sometimes in a week or ten days, while cases have been met with in which many months have elapsed before the pleuritic effusion has been absorbed, and the patient restored to health.

In *pleuritis*, auscultation and percussion are equally valuable in determining the amount of effusion, and sometimes the nature of the effusion. If serum or pus be effused to the amount of a pint, for instance, the lung is displaced to that extent; and consequently the lower portion of the chest, when struck, returns a dull sound, which

extends as high as the level of the fluid. If we now auscultate the patient, the respiration is also lost below the level of the fluid. Besides these results, the voice gives very striking indications of the lung becoming so far condensed from the pressure of the fluids; for we very constantly have bronchophony, and occasionally ægophony.

When the effusion is so considerable as to form empyema, and the cavity of the chest is only partly filled, we sometimes have the metallic sound.

If the chest be completely filled in empyema, the respiratory sound is altogether wanting; so is ægophony and bronchophony, and the containing cavity returns a dull sound at whatever part percussed. Under these circumstances, and especially if the heart be transposed, the affected side will be seen entirely motionless, rounded, and distended; and when these signs are present, there can be no doubt that the distension is due to the presence of serous effusion or pus. But the physical signs of pleurisy are much more delicately varied according to the anatomical conditions of the disease. For example, at the most early stage, when the serous secretion is at first arrested, the expansion of the walls of the chest is diminished, as may be proved by measurement. The percussion sound, however, is not perceptibly altered, and respiration is weak, because imperfectly performed. The characteristic *friction sound* of inflamed serous membranes may, perhaps, now be detected if listened for in the infra mammary or infra axillary regions. When the secretion has returned, increased in quantity, the signs continue as described, but the clearness of the percussion sound becomes diminished, and the *friction sound* is of a rubbing or grating character. The period of inflammatory effusion is now established, and the infra mammary and infra axillary regions become more or less bulging; the projection of the intercostal spaces of the affected side during both respiratory acts become most obvious; the thoracic vibration from the voice is abolished where the fluid intervenes, and so also are friction murmurs there. The area of dullness and of the peculiar sounds may be changed by altering the position of the patient. The natural respiratory murmurs become greatly intensified above the level of the effusion. When the effusion exists on the right side, the sounds of the heart are more clearly audible than in the natural state in the right axillary region, because the lung is more solidified by the pressure of the effused fluid.

Such are the more salient symptoms which mark the progress of pleurisy. The disease, however, may exist without any of the general symptoms. There may be neither local pain, cough, dyspnœa, nor febrile action, and yet effusion may have occurred to such an extent as to have reached the clavicle, while the patient remains

utterly unaware that his chest was the seat of disease (Walshe). The physical signs alone reveal the disorder, which is termed *latent pleurisy*—a form of disease which had no existence in nosology previous to the time of Laennec.

Causes.—The inflammation may acknowledge an idiopathic origin, or it may result during the progress of some *zymotic* or *constitutional* disease. Exposure to cold, especially to currents of air when the person is heated, is a frequent exciting cause. In the latter class of cases, it may occur during the progress of typhus or puerperal fever, or during Bright's disease, or it may acknowledge some adjacent irritation as *pneumonia*, constituting *pleuro-pneumonia*, or the irritation of some deposit in the lungs, such as tubercle or cancer.

Prognosis.—Simple idiopathic pleurisy on one side of the chest almost always terminates favourably, if taken in time and treated judiciously and with energy, and if the effusion has not been copious; but when it occurs as a complication in other diseases, the result may be doubtful.

Treatment of Pleuritis.—In acute pleurisy the best practitioners of all times and of all countries have taken blood from the arm; and if, says Laennec, after one or two bleedings the pain in the side and fever have not abated, blood should be taken from the side by leeches or by cupping. The practitioner should also remember that effusion often takes place after bleeding in consequence of a subsidence of the inflammation, so that the breathing is often more oppressed, and the symptoms for a time aggravated, although the condition of the patient is in reality improved. The lung, however, soon gets accustomed to this new state of things; and the fluid in a few hours beginning to be absorbed, the symptoms are generally ameliorated.

Tartar-emetic, says Laennec, is in general well supported in pleurisy, and contributes powerfully to subdue the inflammatory tendency; but, nevertheless, when the pain in the side and fever have ceased, it loses all further power over the disease, at least it does not appear to promote the removal of the fluid effused, so that its use must generally be abandoned as soon as the acute symptoms have passed away.

With respect to the application of blisters, Laennec objects to their use until the acute stage is passed; but when the pain has ceased for some days, and absorption of the fluid proceeds slowly, and the disease promises to become chronic, a succession of blisters may be applied.

Such is an outline of the treatment recommended by Laennec, and which is still followed out. There can be no question, however, after bleeding the patient from ten to twenty ounces, accord-

ing to the severity of the case, and after free evacuation of the bowels has been effected, calomel, to the extent of producing *slight* mercurialization, is the most beneficial line of treatment to be followed. The more rapidly mercurialization can be produced the better; and hence, writes Dr. Walshe, during the first six hours small doses of calomel with opium (a grain and a-half of the former, combined with a sixth of a grain of the latter, or more, if the pain continues acute), should be given every half hour, while mercurial ointment is rubbed into the skin of the affected side near the axilla every fourth hour. The moment mercurial action has been established, the further administration of the mineral must cease. After twelve or more hours, small quantities of *tartar-emetic* in solution may be given at night, combined with small doses of *opium* and *ipecacuanha*, to allay the cough and general irritation. After the febrile action has in some measure subsided, a blister ought to be applied over the lateral region of the chest, and if the fluid continues to accumulate, the blisters ought to be repeated, so as to maintain the surface in a constant state of counter irritation. Diuretics ought at the same time to be freely given, and Dr. Walshe believes the compound tincture of iodine in doses of twenty minims freely diluted, to be a valuable medicine at this juncture.

Should empyema have taken place, and pus be effused to such an amount as to make it impossible to hope for its removal, the operation of paracentesis of the chest ought to be performed, after the disease has become chronic. Laennec says the space between the fifth and sixth rib, counting from above downwards, should be selected (if adhesions are ascertained not to exist there), being the most depending part of the chest when the patient lies on his left side, the more usual position in this disease. When the chest is punctured the pus should be entirely evacuated; at least no advantage results to the patient from any portion of it being retained. After the pus has been drawn off, the great difficulties of the further treatment arise out of partial adhesions of the lungs preventing the escape of the matter, and consequently the closing of the wound.

The diet of the patient while labouring under acute pleurisy should be slops; after, however, the operation of paracentesis of the chest, he should have a liberal supply of wine as well as of animal food.

Bronchitis—*Inflammation of the Bronchia.*

Definition.—*Inflammation of the air passages leading to the pulmonary vesicles, characterized by hoarseness, moderate cough, heat and soreness of the chest anteriorly—symptoms which are more and more*

intense according to the severity of the disease. The natural mucous secretion is at first arrested, but subsequently it becomes increased in amount and altered in quality, tending to assume the corpuscular character.

Pathology and Morbid Anatomy.—The mucous membrane lining the bronchial tubes may undergo the inflammatory process, followed by results peculiar to the texture of the part affected.

In diffuse bronchitis we find the inflamed portions of the mucous membrane of a deep venous red, and this redness may be general or partial, in spots, streaks, or arborescent forms. The more asthenic the inflammation, or the more feeble and cachectic the patient, the more livid and purple is the redness. The secretion of the tubes at first arrested, is increased in quantity and variously altered in quality. It becomes thin, watery, and frothy, and subsequently thicker and more consistent, assuming the appearance of pus. (See Introduction, p. lxx.)

Abortive or young epithelial cells loaded with serous effusions, and losing their vital cohesion with the basement membrane are rapidly and easily discharged, constituting the thin watery frothy serous expectoration of bronchitis in its early stage. Fibrinous exudation subsequently abounds, and the expectoration becomes tenacious and more opaque, and even pus-like. In a very few cases lymph is thrown out, forming a false membrane or cast of the bronchial tubes.

Since Dr. Baillie first described and figured these tubular expectorated products, cases have been minutely described by many observers, and especially by Dr. T. Peacock of St. Thomas's Hospital, in the *Transactions of the Pathological Society of London.* Figures of such casts are also to be seen in the description of a case published by him in *The Medical Times and Gazette* for 1854, p. 659. Such a form of bronchitis is known and described by the various names of *plastic bronchitis, bronchitis crouposa,* or *bronchité pseudo-membraneuse.*

Occasionally it has also occurred that the expectoration of bronchitis is of a very fetid character, so that the case simulates gangrene of the lungs. An instance of this description (with other analogous cases) has been carefully described by Dr. Laycock, Professor of the Practice of Medicine in the University of Edinburgh. A chemical analysis of the expectoration demonstrated the presence of butyric and acetic acids; and the odour was characteristic of the *butyrates of ethyl.* It resembled the smell of the May-flower or apple-blossoms, but was combined with an odour of fæces.—(*Med. Times and Gaz.*, May, 1857, p. 480).

In a small number of cases ulceration of the bronchial membrane occurs from within outwards, frequently associated with dilatation

of the bronchial tubes, and constituting characteristic bronchial abscesses.

Many authors affirm that the bronchial membrane, when inflamed, is thickened, and more particularly at the points of division of the tubes, and that the various abnormal sounds depend on the degree of thickening of this membrane, slight alterations of diameter producing great alterations of sound. Andral even says that the mucous membrane of the smaller bronchi may be so thickened as to cause a complete obstruction. This thickened state of parts, however, is very difficult to demonstrate, and the different sounds so often heard in bronchitis, are with much more reason ascribed to spasmodic contraction of the circular fibres; and there are good grounds for believing that a partial spasm of the tubes is in all cases connected with bronchitis, especially in its early stages, and which is the chief cause of the narrowing of the tubes at particular points in connection with sonorous and sibilant râles.

The bronchitis may affect one lung, or both lungs, or a part of a lung, and the upper lobes are more commonly affected than the lower ones. The larger bronchi are also supposed to be more commonly inflamed than the smaller ones. Hence it is, that the more marked primary effects of bronchitis are most obvious in the bronchi towards the roots of the lungs ; while the secondary effects, which are apt to follow a prolonged or severe attack, such as vesicular emphysema, are mostly developed towards the pleural surfaces of the lungs, and especially towards those surfaces most directly under the influence of the expansion of the more moveable portions of the thoracic parietes.

One most direct, invariable, and important result of bronchitis in the adult, has thus been recently demonstrated by Dr. W. T. Gairdner of Edinburgh. He has shown by most ample evidence that condensation of the vesicular substance of the lung, of a peculiar type, occurs as a result of mucous or other obstruction in the air tubes leading to the condensed portion. He has shown that such a condensation is most apt to occur in bronchitis associated with asthenia, although in such cases the amount of obstruction may be small, as in patients debilitated by disease or by age. Such condensation is produced by collapse of the pulmonary vesicles, the boundaries of this local condensation being distinctly mapped out by the interlobular divisions of the pulmonary lobules implicated. Such collapse when extensive and sudden, is not only a frequent cause of death, but, at the same time, it is a fleeting, temporary condition of immense frequency, and which it is important practically to distinguish from the condensation of pneumonia.

The morbid anatomy of bronchitis which an examination of the air passages discloses, shows that obstruction in the tubes may be

due to fluid, mucus, or even to solid fibrinous coagula, or more or less prolonged spasm of the circular muscular fibre, and that such obstructions tend to the production of pulmonary collapse, and if the obstruction be considerable and persistent, large portions of the lung may be emptied completely of air in the course of a few hours. The mechanism by which a mechanical obstruction, such as mucous fluid or more solid substances, brings about this collapse, appears sufficiently obvious when it is observed that such obstruction is never absolutely complete. The air gradually finds its way out by the edges of the obstructing substance, impacted as it is, more or less, in a series of diminishing tubes such as the bronchi, and acting the part of the ball-valve of a syringe, so that when the obstruction is driven onwards towards the narrower tubes by the force of inspiration, occlusion is more or less perfect only in the one direction. The expiratory force, however, so long as there is air in the vesicles, constantly tends to dislodge the obstructing body, by pushing it towards the wider end of the tube. While, therefore, the entrance of the air is constantly and more or less effectually opposed, its exit is always permitted, so that ultimately the air vesicles of the tubes beyond the seat of obstruction become completely emptied, and they collapse. The result of such collapse, is a condensation of the tissue of the lung; a condition which had previously been ascribed to a limited inflammation of the pulmonary tissue, known as *lobular pneumonia*, and which was commonly believed to be peculiar to infants. Such collapse and condensation of the lung, however, whether in the lobular or diffused form, is an exceedingly common lesion in the adult, as shown by Dr. West and confirmed by Dr. Gairdner, especially in old persons, in typhus fever and in fatal dysentery, and is always associated with a certain degree of bodily weakness. Dr. Gairdner has further shown, however, that it is almost invariably found as a concomitant of fatal bronchitis, and that it depends on the obstruction of the tubes as just described. When this collapse becomes permanent, it leads to still more obvious and important results :—

(1.) Like other parts which become useless, the collapsed portions become atrophied, leaving only a small amount of fibrous tissue in its place, the proper and special elements of the pulmonary tissue having disappeared. Such an atrophy causes a diminution of the volume of the lung, at the place where the collapse occurs.

(2.) By a definite law (which may be expressed thus :—*that a compensation by increased volume in one or more parts of the thoracic viscera invariably occurs to make up for diminished bulk in another, the internal capacity of the chest remaining the same*;) this pulmonary collapse and atrophy invariably leads to vesicular emphysema of the lung, and may even tend to dilatation of the heart itself. The

most constant result of collapse, however, is emphysema, so much so, that the one almost never occurs without the other.

Bearing upon these statements, several general phenomena have been noticed which may be thus shortly enunciated—

(1.) That emphysematous portions of lungs are almost invariably free from every diseased appearance except the dilatation of the air vesicles, and the consequent stretching and disorganization of their parietes.

(2.) That the bronchi leading to them are usually quite free from obstruction.

(3.) That vesicular emphysema by *increase of volume* of these portions of the lung to which the air has access, compensates for the *diminished volume* of the collapsed portion.

(4.) That vesicular emphysema prevails in the opposite parts of the lung to those in which the direct effects of bronchitis are observed.

General Symptoms of Bronchitis.—Bronchitis, of whatever kind, is often preceded by fever, but more commonly by symptoms of what is commonly called "a *cold*," or a "cold in the *chest*." It often commences without any previous illness, and the uneasy sensations frequently commencing about the region of the frontal sinuses, gradually pass down the nasal mucous passages, and thence by the trachea and windpipe, are experienced in the chest, especially over the anterior region. The symptoms of bronchitis becoming developed, are expressed by the hoarse altered voice, the cough, and expectoration, and are too palpable to allow us to mistake the nature and existence of the disease. In a very few instances of diffuse inflammation the cough is dry and without expectoration, but far more generally it is accompanied by sputa. The sputa vary greatly according to the different degrees of inflammation, or according as that inflammation is acute or chronic, sthenic or asthenic. In acute cases, it is at first a thin mucus sometimes streaked with blood, then more opaque, and lastly purulent; in more chronic cases it may be merely a muciform saliva, or a gelatiniform mass, or it may be like the unboiled white of egg, so tenacious that it may be poured from one vessel into another without separating. In other instances it is puriform, varying from a laudable pus to a red or green putrilage. When purulent it is usually formed into sputa, but in a few cases it is thrown up in large quantities unmixed, as from an abscess. The quantity of matter expectorated also varies greatly; sometimes only a few sputa in the morning, at others half a pint or a pint in the twenty-four hours, while other patients actually die suffocated from the immense quantity which is suddenly poured out, causing obstruction of tubes and collapse of the vesicular structure of the lungs.

The cough is seldom accompanied by any pain in the inflamed membrane, and has many degrees of violence. It may occur in

paroxysms, and the sputa be discharged after a violent effort, at night, or in the morning, or at other definite intervals. Again, it may be incessant, harassing the patient at every instant, causing a sense of soreness or constriction of the chest, and sometimes severe pain at the ensiform cartilage, in consequence of the mechanical exertion of coughing.

With respect to the effects of the cough on the constitution, the patient, supposing the disease to be unconnected with any morbid poison or organic affection of the substance of the lung, suffers little in his general health, and often feels he would be well if he could get rid of "the cough." In other cases he loses flesh, ejecting every meal from the violence of the cough, or he sinks into a state of marasmus simulating phthisis. His pulse is generally natural, although in some cases it is frequent; his bowels also are regular. In bad cases, however, the patient's nights are broken, and he sleeps towards morning, while in slighter cases, he sleeps through the night, but is disturbed early in the morning by cough and expectoration.

The duration of this affection is very various: sometimes it terminates in a few hours, sometimes in a few days, ceasing with the cold weather that ushered it in. In other cases its duration is long, and it is with difficulty recovered from, and thus often laying the foundation of other formidable diseases, which may ultimately destroy the patient. In old persons it generally returns every winter, or lasts, with intermissions, during the whole year.

Physical Symptoms.—The natural and healthy respiratory bruit of an adult has been compared to the sound heard during the calm sleep of a healthy child. In bronchitis this sound in the adult is changed, and varies in different cases, from a tolerably sharp sound, which, when multiplied from a number of bronchi being similarly diseased, . resembles a chirping sound, or the bass notes of the violoncello. The sounds thus embrace a musical scale of considerable compass; the principal and more marked division of which compose the *sonorous* and *sibilant* râles, as they are termed. The cause of the higher notes has been supposed to be owing to a thickening of the mucous membrane at the orifices of the various bronchial tubes, so that the natural embouchure is narrowed, and a musical wind instrument thus formed. To those who have observed in the dead body a swollen state of the bronchial membrane, this explanation may seem satisfactory; but to those who have not seen such a phenomenon, it seems more easy to explain this morbid sound by the different degrees of contraction of the circular and longitudinal fibres of the bronchi, in the same manner as we observe contraction of the muscular fibres of the œsophagus, or of the small intestines, causing a constriction.

Besides the alteration of tone in bronchitis, its quality is also often affected by the presence of liquid matters within the cavity of the bronchi, and hence we have it interrupted and modified by the air passing through bubbles of mucus; and as the size of these bubbles and their viscidity vary, so the sound varies. Hence a scale was established by Laennec, whose extremes are the "râle muqueux," and the "râle tracheal;" the former representing the bursting of small slightly viscid bubbles; the latter larger ones of greater tenacity, and yielding a gurgling sound. Sometimes this mucus, instead of being fluid, hardens so as occasionally to adhere and play as a valve, giving rise to a clicking noise. These are the various morbid sounds heard in bronchitis; and the danger of this disease is denoted by the quantity of fluid effused, and by the gravity of the sound. The sharp chirping sound is less to be feared than the graver and deeper notes. When the sounds of expiration are also much prolonged, severe bronchial inflammation is indicated.

Percussion generally returns a healthy sound in bronchitis. An important physical sign is one which indicates a sudden disappearance of the respiratory murmur over a definite part or parts of the lung. Percussion sometimes shows, however, that the part still contains air, and therefore it is presumed that the disappearance of the murmur is due to obstruction of one or more of the bronchial tubes; and which, as already shown, may lead to *collapse*, *condensation*, *atrophy*, and *emphysema*.

Diagnosis.—It is hardly possible to confound bronchitis with any other disease; but there is often much difficulty in assigning its cause, and distinguishing it from phthisis. The quietness of the pulse, however, the absence of great emaciation, and the clear resonance returned on striking the chest, are the most salient points in diagnosis.

Treatment.—When the symptoms of a "common cold" first express themselves, and even when the sensations have extended to the chest, as indicated by the hoarseness and tendency to cough, the disease may be at once subdued in a healthy person by a full dose of opium at bedtime; or, if the appetite is unimpaired, a full supper followed by a moderate amount of some hot alcoholic stimulant may have the same effect. If such remedies are not suitable for the cure, the object to be aimed at is to induce a copious perspiration and a continued action of the skin and kidneys, in the first instance, by small doses frequently repeated of antimonial and ipecacuanha wines combined with tinctures of squills and hyoscyamus.

Abundant experience has shown that large bleeding in acute *bronchitis* uniformly weakens the patient without greatly influencing the disease. Neither has medicine any very marked effects in

the cure; for although some persons rapidly get well under a given treatment, yet many similar cases, under exactly the same treatment, will run on for weeks, and perhaps for months, without any amendment. In the most acute cases of bronchitis, however, some blood should be taken from the chest either by cupping or leeches, and in general from ten to twelve ounces are sufficient. After this a blister should be applied to the chest, and, on its being removed, a large linseed poultice should be placed over the blistered part, and be continued for many hours, which will not only keep the ulcerated surface open, but gratefully foment the part and relieve the patient. The bowels should also be freely evacuated by a purgative dose of calomel combined with compound jalap powder, and they should subsequently be kept in regular and gentle action by some neutral salt, such as the sulphate of magnesia in the liquor ammoniæ acetatis, combined at the same time with some nitrate of potass.

After these means have subdued the severity of the symptoms at the outset, expectoration should be promoted by such remedies as *squills*, *ipecacuanha*, and *tartar emetic* combined with *hyoscyamus* or *conium*. Opium is inadmissible if the evacuation of the loaded air passages is to be promoted, because its tendency is not only to diminish the secretion but to paralyze the action of the mucous passages in eliminating that secretion. When large doses of opium have been given at this stage, death has been known to follow, and microscopic examination has revealed the air passages loaded with frothy serous mucus, and the air cells congested and collapsed. It is not till after secretion has begun to diminish in acute cases that opium may be prescribed with benefit, and it is then to be given in the form of the solution of the salts of morphia added at bedtime to the doses of the *cough mixtures* so usually administered.

In chronic cases of bronchitis, after blistering, and perhaps poulticing the chest repeatedly with mustard poultices, the treatment in general should be more tonic. The *camphorated mixture* or *paregoric* and stimulant expectorant remedies are indicated now and then, but not to be constantly followed. On the contrary, it is often advantageous to administer astringent remedies, and one of the most useful is *tannic acid* in doses of one to three grains two or three times a-day, as originally recommended by Dr. Alison of Edinburgh.

Inflammation of the Lungs—*Pneumonia.*

Definition.—*Inflammation involving especially the minute vesicular pulmonary tissue, tending to interstitial exudation, but this tendency, under proper regimen and proper remedies, is often abortive.*

Pathology of Pneumonia.—The substance of the lungs is liable

to the most severe results of the inflammatory process. Both in the acute and chronic forms of diffuse inflammation of the substance of the lungs, the vesicular pulmonary tissue is more loaded with dark venous blood than usual, and its texture is more easily broken down than in health; air, however, still penetrates the air cells, and consequently the lung still crepitates, swims in water, and, if washed, the colour is nearly restored. This state of inflammation may terminate by resolution, or it may pass to more complicated and dangerous lesions.

When effusion of serum succeeds, the lung is in the same gorged state, but in addition it is loaded with watery fluid, so that on cutting into it the serous fluid mixed with blood streams from it as from a sponge. When its action is listened to during life, a lung in this condition no longer crepitates, and its bulk is enlarged, for it may be seen after death to have taken the impression of the ribs, and it does not collapse when the chest is opened.

Inflammatory lymph may also be thrown out, and the lung is now technically said to be in a state of *red hepatization*, or, as Andral has termed it, *red softening;* for although firm, its texture has lost its natural toughness, cohesion, and resistant power. It readily breaks up by a thrust of the finger into its substance. This state has many degrees. In some instances the lymph effused is very large in quantity, mixed with blood, and can be readily separated, or, as it were, pressed out of the lung, and in this loose state it is not organized. In the other extreme of this form of inflammation the lymph effused has become organized, and forms an integral part of the lung, which now becomes so solid that, if cut, it represents with much accuracy a portion of the liver or spleen. In this state it contains at the diseased part little or no air, does not crepitate, nor float in water; it cannot be injected, is of a deep venous colour, while its texture is easily broken down and penetrated by the finger. The lung also is enlarged, and does not collapse when the chest is opened.

Suppuration may follow this form of pneumonia, and the pus effused may be either infiltrated or limited as if contained in an abscess. Infiltration is by far the most common; and although this form of disease may occur suddenly, as a result of serous infiltration in unhealthy persons, or during the progress of zymotic diseases, yet in the belief of most pathologists it more generally follows *red hepatization*. In this latter case the pulmonary tissue, red, dense, compact, and impermeable to air, passes to a grey colour, and hence it is termed *grey hepatization*. The structure in other respects of either form of hepatization appears to be the same; for if we examine the lung with a microscope, we find the same granulations, only they are white or grey instead of red. There are

instances, however, in which these granulations are wanting, and we observe only a grey smooth surface.

In the *grey*, as in the *red hepatization*, the pulmonary tissue is easily torn, and the quantity of pus infiltrated is sometimes so great that, on cutting into the lung, that fluid readily flows from it; at other times the pus will not flow on a simple incision, but exudes by compression.

Although pus is more commonly diffused through the pulmonary parenchyma, yet sometimes it is collected into an abscess. In the infancy of pathology physicians regarded phlegmonous abscess of the lung as a common and ordinary occurrence, but it is extremely rare; and Laennec, when he published the first edition of his work, had only met with six cases, notwithstanding his extensive research; and in the practice of other physicians, phlegmonous abscess of the lung is equally uncommon. Abscess of the lung, although termed phlegmonous, to distinguish it from tubercular abscess, generally exists without any great intensity of inflammation or other considerable alteration of its tissue.

Pneumonia may also terminate by gangrene, which is also as rare a termination as by abscess, although it is now said to be more frequent than was wont. It occasionally arises from excess of inflammation, but more commonly the inflammation which precedes this state is of little intensity, so that it rather approaches to anthrax, and may be of pestilential origin. The gangrened portion may or may not be circumscribed, and it is found in the different states of gangrenous eschar, of deliquescence, of sphacelus, and lastly of simple excavation, it having been detached and expectorated.

The frequency with which these different forms of inflammation occur is not yet estimated, but is probably in the inverse order of their intensity.

Pneumonia may be either single or double—that is, it may attack one or both lungs at the same time. Of the part of the lung attacked, inflammation of the inferior lobe is most frequent; next of the superior lobe, while rarely the whole lung is inflamed.

Bronchitis may take place without pneumonia, but in many cases pneumonia follows as a consequence. Pneumonia also may take place without bronchitis, but in general bronchitis accompanies it. Pneumonia also may take place without pleuritis, but it generally happens that the pleura is more or less affected.

Much speculation has been entertained with respect to the more particular seat of pneumonia, some contending that the inflammation affects the cellular tissue of the lung, and others the air cells, others both. It is quite certain, however, that the minute bronchial tubes are not affected in slight pneumonia, for in such cases their divided extremities stand out in the midst of the inflamed part like so many

white points. When the lung is more acutely inflamed, the bronchial tubes are red, and evidently greatly inflamed. There can be no doubt, however, from what we now know of the nature of the inflammatory process, and also from direct observation upon the tissue of inflamed lungs, that the minute elements of the vesicular and connecting tissue composing the parenchyma of the lung, are from the first directly altered in their vital properties. (See Introduction, page lx.)

General Symptoms of Pneumonia.—Pneumonia is generally preceded by some antecedent fever, by shivering more or less violent, and often by bronchitis. In a few cases, however, it is the primary affection.

The disease being set up, the patient is restless and uneasy; his respiration difficult and hurried—from 30 to 50 in a minute; his cough frequent, and his expectoration streaked with blood; but notwithstanding this symptom, he seldom, unless the pleura is affected, suffers pain, which consequently increases the danger. His pulse is full and frequent, from 100 to 120; his countenance livid; his nostrils dilated; his tongue and lips more or less livid, and the former is coated with a white or yellow mucus. He inclines to lie on his back, supported by pillows. If the patient recovers, these symptoms are gradually mitigated; but should he die, the tongue becomes brown and typhoid, his pulse more rapid, profuse sweats break out all over his body, and at length his mind wanders, and he dies by *coma* or *apnœa*. There are many instances, however, where the course is widely different, and in which the patient, though evidently distressed by impeded respiration, has yet moments of cheerfulness; gets up, and may walk about; but suddenly dies, seized with a severe paroxysm of dyspnœa or of coughing, followed by collapse of the remaining healthy part of the lung.

Such are the general symptoms of pneumonia; and, except by their different degrees of intensity, it is difficult to distinguish the different forms of inflammation from each other without the application of the stethoscope. The general symptoms of serous pneumonia, however, are the most marked; the uneasiness being greater, the respiration louder and more difficult; the countenance more livid and swollen, the cough more harassing, the expectoration more abundant, and the attempt to lie down impossible. A gangrenous state of the lung is determined chiefly by the intolerable fetor of the breath.

The duration of the pneumonia is very various. Laennec conceives the diffuse inflammation to last seven or eight days—Andral considers red hepatization to last fifteen to twenty days; while grey hepatization, when extensive and sudden, is supposed to destroy the

patient in twenty-four or thirty-six hours. More generally, however, taking all its forms, pneumonia terminates between the seventh and the twentieth day.

Physical Symptoms of Pneumonia.—On striking the chest of a person in health, it returns a certain hollow resonant sound, demonstrating it to be partly filled with air. Also, if we place the ear to the chest, we hear certain sounds on inspiration and on expiration, which are termed the respiratory or vesicular murmur (as described at page 615, *ante*). In pneumonia these natural sounds are altered, the sound on percussion being rendered duller than natural, while the bronchial respiration undergoes still more remarkable alterations; and these modifications enable us to determine the nature and seat of the disease.

The Physical Symptoms of Pneumonia vary in proportion to the intensity of the inflammation, and the consequences it produces. Diffuse inflammation is determined by a sound termed "crepitant." This sound evidently takes place in the pulmonary tissue, and has been variously compared to the crackling of salt thrown upon the fire, or to air blown into a dried bladder, or to the crepitation of the hair when pressed between the fingers near the ear. The cause of this sound is variously interpreted, some pathologists attributing it to the dryness which accompanies the early state of inflammation, while others attribute it to bubbles of air breaking in a fluid of greater density than water, and contained in the air vesicles of the inflamed part.

If the pneumonia assumes the character of serous inflammation, a loud mucous rattle is heard, which resembles a loud roaring rather than crepitation. It is supposed to be caused by bubbles of air breaking through a mass of slightly viscid fluid. This phenomenon is one of the most remarkable connected with disease of the lung. In both the preceding forms of inflammation the chest on percussion returns a clear sound from the lung where the air is still penetrating. If a dull sound is returned, it is on account of the fluid in pleurisy, or collapse of the lung in bronchitis.

Should the pneumonia proceed, and red or grey hepatization take place, the lung is solidified, and the bronchial tubes being either temporarily or permanently obliterated, no air penetrates the diseased portion, hence it follows that not only is the vesicular respiratory murmur lost, but the chest at this part returns a dull sound on percussion. If the disease involves a great portion of the lung, these physical phenomena become more or less complicated by the noise of the surrounding bronchitis; and the supplemental loud sounds of other portions of the lung almost entirely mask the absence of respiration in the affected portion. Again, if the hepatization be central, the air in the more superficial portions

of the lung often prevents a dull sound from being returned on percussion. In this difficulty, however, there is one symptom which greatly assists diagnosis, namely, *bronchophony*. When the lung is hepatized or solidified, it has necessarily become a better conductor of sound, so that the voice, instead of being destroyed in the chest, as in the healthy lung, is now conducted downwards. In this altered state of parts, if the stethoscope be applied to the chest, and the patient directed to talk, his voice is distinctly heard in the chest, and at the end of the stethoscope, but without appearing to pass through it. This phenomenon is termed bronchophony.

Pneumonia, it has been stated, sometimes, though rarely, terminates in abscess. The physical symptoms previously to the bursting of the abscess are those of hepatization; but supposing the abscess to have burst into the bronchial tubes, the pus of course escapes, and a cavity filled with air is left communicating with the bronchial tubes, and this new state of parts gives rise to a new series of phenomena. The air, for instance, having penetrated into the cavity, the part which returned a dull sound, while the abscess was yet unbroken, will now return a sharper and clearer sound on percussion than natural, denoting a larger admission of air than takes place in health. Again, on auscultating the chest, we find some changes have taken place both in respiration and in the transmission of the voice. If the cavity, for example, be large, and the opening small, the natural respiratory murmur at that part will be superseded by a sound resembling a person blowing into a jug, and from this circumstance termed by Laennec, "râle amphorique," or "bottle sound."

Again, if the cavity be large and its walls dense, and the abscess still contains some pus, we hear a sound as if a drop of water had fallen into a pool; and this sound is so sharp and metallic, that it has still preserved the designation originally given to it by Laennec of *metallic tinkling*. It is usually supposed that this sound is produced by a globule of pus dropping from above into the fluid below; but some pathologists are inclined to believe that it is owing to the bursting of a bubble of air, mixed with the pus of the abscess. If, on the other hand, the abscess be large, and contain some pus, on the patient coughing, we actually hear a *splashing sound* of the pus against the walls of the abscess, especially if the chest of the patient be quickly moved to and fro (succussion).

Another circumstance revealed by auscultation in the event of an abscess is *pectoriloquy*. This physical sign is heard when the stethoscope being applied to the chest, and the patient desired to talk, we hear his voice as if he were speaking directly at the end of the stethoscope, the sound passing to the ear as through an ear-trumpet.

Pectoriloquy, however, does not take place in all cases of abscess of the lung—its occurrence may be considered the exception rather than the rule of this disease. The cause of this is, that many conditions are necessary to its existence; first, that the lung must be condensed so as to have some conducting power, or the voice will be destroyed, as in health, before it reaches the aperture communicating with the abscess. Again, it is necessary that the patient should have a sufficient quantity of voice to produce strong vibration; but this is often wanting. Another condition is, that the bronchial opening of the abscess be not too large, for in that case the vibrating force is diminished. It is likewise injurious to the effect that there should be more than one opening into the abscess; for in that case not only is the vibrating force diminished, but the counter motions of sound destroy all vibration. It is plain also that the walls of the abscess must have a certain density, or their flaccidity will act as a damper, and destroy all vibration. Many conditions, therefore, are necessary to pectoriloquy; and we cannot feel surprised that one or more of these signs of an abscess cavity may be wanting.

Besides an opening into the bronchial tube, the abscess may at the same time open into the cavity of the chest, and this new pathological state gives rise to the sound of a *metallic tinkling* of the chest, infinitely more powerful than that caused by a simple pulmonary abscess. Indeed the intensity and sharpness of the sound quite equals that returned by a copper vessel when struck with a slight force; for the intercostal muscles brace the walls of the chest like a drum, so that they become an excellent conductor of sound. The immediate cause of the sound is supposed to be exactly the same as when it results from an abscess, that is, either a drop of fluid falling into the pus below, or the extrication of a bubble of air from the gravitated pus. The chest in these cases always returns a remarkably clear sound on percussion beyond the precincts of the fluid.

Pneumonia is distinguished from phthisis by the previous good health of the patient, and by the more acute nature of the disease; and, in some degree, by a difference of its seat, the lower lobes being more particularly affected in inflammation, the upper lobes in phthisis. The two diseases, however, it should be remembered, are often combined. In determining distinctly the further diagnosis of pneumonia, from the phenomena of condensation and respiratory murmurs, it is necessary to bear in mind the various conditions which may produce condensation of the lung, either in the child or in the adult. The observations of Laennec, Legendre, and Bailly, Jorg, Fuchs, Barthon, Rilliet, West, and Gairdner, have especially elucidated this subject, and shown its importance as an element to be attended to in diagnosis. The following is a short

statement of the conditions which lead to consolidation of the vesicular tissue of the lung :—

(1.) A partial unexpanded state of early infancy, termed *atelectasis* (JÖRG).

(2.) Consolidation connected with the accumulation of mucus in the bronchi—*bronchitis*, in the infant, followed by what has been called *lobular pneumonia* of children, the *état fœtal* of the French (FUCHS, WEST).

(3.) Collapse of the pulmonary air cells causing *lobular* or *more diffuse* forms of pulmonary condensation in adults, as well as in children, due to bronchial obstruction (GAIRDNER).

(4.) It is probable that the *hypostatic pneumonia*, described by Piorry, and the *peripneumone des agonisans* of Laennec, and *some* of the so-called *latent pneumonias*, are forms of condensation due to *pulmonary collapse*, combined with serous effusion or vascular congestion.

(5.) The consolidation of inflammatory lymph in or about the pulmonary vesicles, so that the vesicular tissue of the lung is imbedded in solid material, "as the stones of a wall are in mortar."

(6.) Condensation of the lung from the pressure of pleuritic effusion.

(7.) Condensation of the lung from extravasation of blood (apoplexy of the lung), or from tubercular or cancerous deposits; or enlarged bronchial lymphatic glands which are arranged along the sides of the air tubes in their passage through the substance of the lungs.

Seeing, therefore, that consolidation may result under such a variety of conditions, the truth of the statement, so well expressed by Dr. Stokes, must at once appear in the strongest possible light, namely, "that in the cases we are every day called to treat, the value of physical signs must be tested by the history and symptoms, and these in their turn must be corrected by the physical signs." In truth, no disease shows more forcibly than cases of pneumonia do, both as regards diagnosis and treatment, that every individual case of disease requires to be made a special study as regards its individual history, progress, combination and sequence of symptoms.

The treatment of *Pneumonia* has been, and seems with some still to be, one of the most discordant topics in the science. At one time, especially about fifty years ago, large bleedings appear to have been demanded and to have been well borne. Laennec and Louis seem to have been early impressed from their experience that large bleedings were by no means an eminently successful practice, and that in some cases they are absolutely injurious; and the same difference of opinion was held with respect to large doses of the tartrate of

antimony. These discrepancies are now to be explained by the circumstance that pneumonia like other inflammations not only varies in type, but that the *medical constitution*, as it has been called, also varies; so that now, and for the past thirty or forty years, the constitution of mankind has not required such great depletion to subdue the inflammatory process, nor does the individual tolerate with impunity such means of cure pushed to the extent they once were.

The ancients bled in pneumonia, and sometimes to deliquium, and Galen appears to have adopted this practice. This was also the practice of Sydenham; and Laennec says it was common in France at the beginning of the last century to take twenty-four, thirty, and thirty-six ounces of blood at one bleeding. This practice was also followed throughout Europe at that time, and there can be no question of its having been proper, in cases of simple inflammations, like pneumonia occurring in healthy persons.

Now, however, it would be an unwarrantable error to make such excessive bleeding the basis of remedial measures in all cases (see Introduction, p. lxxxix., *et. seq.*)

In epidemic pneumonia, says Laennec, it is hardly possible to bleed the patient without rendering him worse. In 1814 pneumonia was very common among the conscripts, yet there were few indications for bleeding, and those that were bled were rendered much worse. It is probable that Louis, under similar circumstances bled, and was equally dissatisfied with the result he obtained. It will be plain, then, that with respect to bleeding, much must be left to the discretion of the practitioner. That there are cases in which the patient can only be saved by energetic bleedings everybody must admit, while, on the contrary, when pneumonia is epidemic, the quantity of blood drawn must be greatly limited and the case well watched. The ancients held that bleeding should not be practised after the fifth day, as it prevented *concoction.* In other words, it tended so to change the type of the disease in its natural tendency to a cure, that the processes which change the inflammatory products, tending to the resolution of the inflammation, the natural *cell therapeutics* of the part are altered for the worse. The cases of Louis appear to establish the propriety of early bleeding as a general rule; for he says those bled in the first four days of the affection are cured four or five days sooner than those who are bled later in the disease. The experience of Dr. Alison is similar. In short, as a general rule, the earlier the inflammatory state is detected (if possible before the third day, ALISON), the more likely will bleeding be followed by well marked beneficial results—the disease will be sooner cured, and the convalescence more rapid and perfect.

It is rare now that the cure of pneumonia is left entirely to the influence of bleeding. Rivière used to treat pneumonia by giving the patient an emetic every day or every other day, a practice which has at all times had many partizans. Senac being told by his son that he bled too little and gave too many emetics in pneumonia, abandoned his own plan, but with so little success, that he exclaimed one day, "You have made me a worse physician than I was before." We owe to Rasori the introduction, in modern times, of large doses of tartar emetic in the treatment of pneumonia. Laennec was so dissatisfied with his own results of bleeding that he adopted it, and thus describes his practice :—

"As soon as the disease is determined, if the patient be in a state to bear bleeding, I take from eight to sixteen ounces of blood from the arm. I do this as momentarily arresting the inflammation, and thus giving the tartar emetic time to act, and I rarely repeat this bleeding. Immediately after this bleeding I give the first dose of tartar emetic, or a grain in two ounces and a-half of orange flower water, and I repeat this dose every two hours for six times ; I then allow the patient to repose for six or seven hours. If, however, the disease be severe and the oppression great, I continue it every two hours till the symptoms are mitigated, increasing the dose from one to two grains, or even to two grains and a-half." The immediate effects of this practice were, that the larger number of patients vomited two or three times, and had five or six stools on the first day, but afterwards the evacuations were trifling, and when tolerance was established they often required purgative medicines, while many bore these large doses almost without vomiting or experiencing any purgative effect. The result was that Laennec cured 27 cases out of 28 in 1824 and in 1826.

The great success obtained by Laennec appears, however, to have been of short continuance, for M. Lagarde published an account of 16 cases treated by Laennec by this method afterwards, of whom 5 died, while Lecoultreux has given a list of 30 cases, likewise treated by Laennec, and of whom 12 died. Neither have other physicians in other years been more fortunate, for Louis treated 15 cases according to this method, and 6 died ; Chomel, 140 cases, and 40 died ; while Gueneau de Mussy treated 90 cases, of whom 38 died. Andral has likewise treated a considerable number of cases of pneumonia by tartar emetic, in quantities varying from six to thirty-two grains in the twenty-four hours ; and he adds, I have seen but two unpleasant or grave accidents result from these large doses. Sometimes the patient has not been at all affected, has neither had nausea, vomiting, or diarrhœa, or abdominal pains ; at others he has suffered from nausea and distressing vomiting, effects which have subsided on omitting the medicine. Tartar emetic, he adds,

may therefore be given with impunity. But is it useful? I have not, he adds, seen pneumonia ameliorated by large doses of this medicine; for neither has it appeared to do good when borne by the stomach, nor when it has excited distressing nausea and vomiting.

Having thus stated the practice of these eminent physicians, it only remains to add the more matured opinions entertained as to the line of treatment to be adopted with pneumonia as it now occurs. The quantity of blood to be drawn varies greatly according to the individual, the period of the disease, the severity of the fever and *its type*, as well as to whether or not there is any prevalent epidemic tendency associated with the pneumonia. It rarely happens that more than from sixteen to twenty ounces of blood are now required to flow before some marked result follows to indicate that enough has been taken, and the blood should be drawn as early in the disease as possible, if bleeding is to be practised at all. It is seldom right, however, to trust to bleeding alone; and it appears that a combination of antimony and calomel has saved a much larger number of cases than antimony alone; a quarter of a grain, to a grain of the tartarate of antimony, combined with one grain of calomel, given every four or every six hours, according to the severity of the disease, is the treatment in most cases to be adopted. Previous to its use, the bowels should be well cleaned out, and after the mercurial effects are indicated by the gums, the further administration of the remedy should cease. In cases of simple serous pneumonia, even simpler remedies are sufficient; and two grains of ipecacuanha given every four or six hours, have frequently been followed by the recovery of the patient.

Pulmonary Tuberculosis—*Phthisis.*

Definition.—*The deposition of tubercular matter in the lungs, associated with the constitutional phenomena of tuberculosis.*

Pathology.—The nature and treatment of this disease, commonly known as *consumption* or *phthisis*, has been already fully described at page 439, and therefore it is only with reference to its diagnosis by general symptoms and local physical signs, that it requires some notice here.

Symptoms of Tuberculosis of the Lungs, or of Phthisis.—As a general law, it may be stated that the presence of tubercular matter in the substance of the lungs, whether in its semi-transparent, crude, or softened state, does not cause the slightest pain to the patient; and when pain does exist in the chest or between the shoulders, it proceeds entirely from the effects of violent coughing, or from inflammation of the pleura of no very active character in general.

The greater number of cases of pulmonary tuberculosis are indicated in the commencement, with some slight cough, the sputa being hardly discoloured, or only slightly stained by a trace of pus or blood. The patient is feeble, easily fatigued, has burning heat of the soles of the feet at night, and some perspiration in the morning. He is irritable, his appetite capricious, a most constant important and early symptom, and he is convinced of a sensible loss of flesh. At this period the sounds of the chest on percussion are healthy and perfectly sonorous under both clavicles, but the respiration is affected, being louder and more puerile in both lungs; or it is feeble in one lung, and louder in the other, while the times of expiration are prolonged. These symptoms are accompanied by a permanently accelerated pulse, from eighty to ninety; a more certain sign is sometimes present, when the heart is heard beating all over the chest, showing that the lungs are condensed, and thus rendered better conductors of sound. This stage or state of things may last a few weeks or a few months; and even the patient often revives, and seems to an unpractised eye, for a short time, to have recovered his good general health.

The disease, however, silently proceeds, and all the preceding symptoms are gradually but sensibly aggravated. Hectic fever becomes permanently established, and the sweat from the head and chest towards morning is often so profuse that the patient lies bathed in perspiration. The cough is more distressing, the sputa purulent, the hæmorrhage more constant, and the pulse more frequent, perhaps from 90 to 110. He now often vomits after each meal, and the emaciation consequently is well marked and decided. On percussion a dull sound may now be returned from under the clavicles; and on listening with the stethoscope we may hear bronchophony. The heart's action becomes still more palpable over the chest; the respiration is accompanied by some mucous sounds; while the times of expiration are still further prolonged. The duration of this stage is very indefinite, a few weeks to many months may end in a fatal issue. During its progress, however, the disease occasionally intermits and becomes latent, so that there is for a time often a marked amendment, and the patient regains some strength, a most important interruption, to be sedulously taken advantage of, for the purpose of promoting the tendency to cure.

The third and last stage of this eventful constitutional disease is that in which the tubercle softens and an abscess forms. In this stage all the preceding symptoms attain their highest degree of intensity; the hectic is now often followed by a cold, clammy sweat; the appetite is lost; a colliquative diarrhœa may supervene; the sputa are often pure, as from an abscess, but at length become

little more than a rusty sanguineous mucus; the pulse rapidly increases to 110 or 150; the emaciation is excessive; and nothing, indeed, appears to survive this general wreck of material existence but the mind, which is often firm, collected, and even hopeful to the last. In this stage the phenomena on percussion has undergone another alteration. The dull sound returned in the second stage now gives place to an unnaturally clear sound, in consequence of the introduction of air into the cavity of the lung; and, according to the condition of the abscess, we have now the amphoric, or the metallic tingling sounds; while the mucous sounds are for the most part tracheal. It is remarkable, however, that as soon as the abscess bursts the cough is often greatly relieved. The duration of this stage is generally shorter than the former, but still, notwithstanding the existence of one or more abscesses, it often lasts many months. Such is a short outline of the course and phenomena of this destructive disease when it manifests itself by local deposits in the lungs. It sometimes terminates life within a month, more frequently in a few months, while it occasionally lasts many years. The following is a short analysis of the principal local, constitutional, and stethoscopic symptoms of this remarkable affection.

Affection of the bronchial membrane, mucous membranes of the pharynx and larynx are certainly the most frequent concomitant symptoms of phthisis, but the part of the bronchial membrane affected is not always the same; most commonly the mucous membrane of the smaller bronchial tubes is first affected; then that of the larger ones, the disease gradually ascending till it often ends in a chronic laryngitis, with a partial or total loss of voice. In a few cases, however, this order is inverted, and almost the first symptom is a laryngitis, with hoarseness and constriction of the throat; after which the disease descends to the larger and then to the smaller bronchi, when the patient begins to expectorate; his pulse becomes hurried; he loses flesh; and all the unerring symptoms of phthisis are established.

The *expectoration* which takes place in phthisis from the bronchial membrane is usually purulent, the pus thrown up in the early stages being for the most part of good quality, and formed into "sputa," sometimes sinking and sometimes swimming in water; and may be either of a sweet, insipid, or saltish taste, as experienced by the patient. As the disease advances, it is often expectorated pure, as from an abscess, and without any separation into sputa, and is sometimes mixed with particles of a curdy substance.

In the last stages it is often of a rusty green, a dirty sanies, or a rusty muciform serosity. The quantity expectorated varies greatly; sometimes only a few sputa, or not more than half an ounce in the twenty-four hours, and then perhaps more than a pint in the same

period, so that in a few weeks the patient has often expectorated more than his own weight of pus. If a small abscess has burst into the bronchi, the sputa, though somewhat increased in quantity, are hardly changed in character; but if the abscess be large, the quantity thrown up is proportionally great.

Hæmorrhage may precede, or be contemporaneous with, or succeed to, the bronchial affection. If it precedes, the patient being, as he imagines, in excellent health, is suddenly seized with hæmoptysis, followed perhaps by cough. This attack subsides, but a second and a third follow, till the condition of pulmonary tuberculosis becomes undoubted. Hæmoptysis more commonly, however, occurs later in the disease, increasing the debility, aggravating the symptoms, and hastening the fatal issue. The quantity of blood lost is very various; sometimes only enough to streak the sputa, at others a few teaspoonfuls, but in some instances so profuse as to amount to one, two, or more pints. In the still more advanced stages, though cases occur in which the quantity of blood thrown up is very great, yet more usually it is trifling, and more resembles a bloody sanies than pure blood.

The cough is as variable as the other symptoms. In some few cases the patient dies from tubercles in the lungs, and yet no cough is present. More commonly, however, the cough is troublesome, and often intense, so that every change of position, even turning in bed, the act of speaking, of eating, or of drinking, gives rise to it. Often it returns in fits or paroxysms, occurring at uncertain periods, most commonly at the time of undressing at night and getting into bed, and again on getting out of bed in the morning. It is singular that, as the disease advances and large abscesses open, the cough, which was at first frequent and troublesome, often becomes comparatively tranquil, or is only excited to expel the purulent matter collected in the bronchi. A tickling cough usually denotes some affection of the glottis and larynx, parts which are more irritable and more abundantly supplied with nerves than the trachea or bronchi.

The *dyspnœa* is generally great in phthisis, the patient being unable to make any active exertion, or even to read a few lines without pausing. The dyspnœa, however, is not always proportioned to the amount of mischief; for there are instances in which the respiration has been performed with facility, even when two-thirds of the lungs have been in a state of tuberculoma. It is doubtful whether adhesions, unless very extensive, greatly affect the respiration. Should effusion of serum, however, or of pus from the bursting of an abscess, have taken place into the cavity of the chest, then the respiration is greatly impaired. The most common situation of the fistulous opening, caused by the bursting of an abscess into the

chest, is the summit of the lung, or a little below the clavicle. It is usually very small, hidden by the lung, or so surrounded by adhesions that it is difficult to discover it. Again, when the abscess bursts not only into the chest but also into the bronchi, the disease is termed *pneumo-thorax*. When this latter event occurs, the life of the patient might be supposed rapidly to terminate, either by pleurisy or by entire exhaustion; but it is singular that the patient often survives this state many days, sometimes a few weeks, and Louis has given instances in which two or three months elapsed before death supervened.

The Stomach is supposed to be more or less diseased in three-fifths of the cases of phthisis; yet it so seldom gives rise to any well marked symptom that for the most part the affection may be said to be latent. In the worst cases the symptoms are only a capricious appetite, indigestion, some pain in the epigastrium, and vomiting after coughing. The indigestion is peculiar, as already mentioned at page 454. With reference to fats and fat meat, the dislike of consumptive patients to such food is unquestionable My friend Dr. Steele, the superintendent of Guy's Hospital, furnished me with a direct illustration of the fact. Accompanying him round the wards of Guy's, he questioned the *sisters* in charge of the medical patients as to the distribution of the food, and especially with reference as to how the fat and lean parts were disposed of. It was by all stated, that the fat and the lean parts had to be adjusted to the likings of the patients, and that it was of no use giving the consumptive patients any but the leanest parts of the meat, as they could not eat the fat. They are partial also to fish, and especially to soles.

The Intestinal Canal is at least as frequently affected as the stomach in phthisis; but in general the abdomen is without pain. The only marked circumstance is, that the stools are more copious than in health, the body being unable to appropriate the accustomed quantity of nutriment prepared by the stomach. As the disease advances, the patient often suffers from irritable bowels, or from diarrhœa alternating with constipation; while, towards the close of the disease, the diarrhœa often becomes colliquative, hastening the fatal result. In some very few instances the peritoneum ruptures, and the patient dies of *peritonitis*, while in a somewhat larger number ascites takes place.

The Liver undergoes a fatty degeneration in about one-third of the cases, and so remarkable a lesion might be expected to give rise to some particular symptoms; but this is not the case; it may occasionally be felt somewhat enlarged, but neither pain, nor altered state of the secretions, or other circumstance, denote its diseased condition.

Of the Hectic Fever.—In some very few cases the patient passes

through this affection without any attack of fever; but in the large majority of persons no sooner is the "crude tubercle" established than the constitution suffers, and hectic fever of a marked character appears (see Introduction, p. lxxxiii).

The emaciation so remarkable in this disease is common to nearly all the tissues of the body, as the adipose tissue, the muscles, the bones; and even the intestines and skin are thinned. This emaciation often commences before the disease can be said to be well established, so that the patient has often lost one or two stones in weight before he applies for medical advice. In the more advanced stages emaciation progresses in a peculiar manner, the patient losing perhaps three pounds in one week, and gaining two pounds or more in the next; and this alternation of gain and loss goes on for many weeks, or months, but generally leaving a balance against the patient. Towards the close of life the loss greatly surpasses the gain, and occasionally amounts to four, five, six, and seven pounds in a week. The total loss the patient sustains is perhaps from one-third to half his whole weight.

The mind, though not capable of continued exertion, is perfect throughout the disease, or only wanders during the few last days of existence. It is seldom the patient dreads the future or despairs of the present, for nature, however threatening his symptoms, has imparted a singular buoyancy to his hopes, and he always says he is better; would be quite well but for his cough; feels able to take a long walk, and sometimes, in expectation merely, enjoys his meals; yet, with all this, he may faint if he attempts to cross the room, or nauseate when his food is brought to him.

Such are the general and local symptoms of phthisis, and which are sufficient indications that the lungs are diseased. The stethoscope, however, adds many interesting additions, and enables us to determine not only that the lung is diseased, but also the particular part of the lung which is diseased, and likewise the present state of the diseased part; and thus the discoveries of Laennec and Avenbrugger have rendered the diagnosis of tuberculosis of these organs almost as perfect as though the disease was exposed to sight.

Physical Symptoms.—If the chest of a patient labouring under cough and other symptoms of incipient phthisis be carefully examined, we may at first observe nothing remarkable, except as a general rule that its transverse diameters are small. If the disease be further advanced, we find the patient emaciated, together with a singular immobility or incapacity of dilatation of that portion of the chest immediately below the clavicle, so that he breathes chiefly by his shoulders and diaphragm, and is unable to "fill his chest." In the latter stages of the disease, the whole of the affected side, viewed anteriorly, is perfectly motionless; at a still more advanced stage,

if an abscess has burst into the cavity of the pleura, and caused *pneumo-thorax*, the affected side is not only motionless but distended, and as it were bulging out. The examination of the bared chest, therefore, often affords valuable data for forming a diagnosis in phthisis.

If we apply the stethoscope to the chest in incipient phthisis, the action of the lungs is perhaps little impaired, but we hear the heart beating all over the chest, and at a rate which varies in different subjects from 90 to 100. This symptom, if heard repeatedly, is always of anxious portent, for it denotes the density of the lungs to be increased, thus rendering them a better conductor of sound. At this period air permeates the pulmonary tissue generally, so that percussion is still followed by a comparatively clear sound.

In the second stage, or that of crude tubercle, the density of the lung is still further increased, and the heart is consequently heard still more distinctly beating all over the chest. We have also the phenomenon of bronchophony. We hear the louder pulmonary sounds in the healthier lung, and a more feeble one in the diseased one, accompanied for the most part with bronchial or tracheal mucous sounds. On percussion, also, under the clavicles, the sound now returned is dull.

These are the more salient general, local and physical phenomena associated with *pulmonary tuberculosis* or phthisis, a disease which can only be confounded with chronic bronchitis. The diagnosis, however, between the two diseases, is often extremely difficult, sometimes impossible, the patients equally labouring under cough, expectoration, emaciation, and hectic fever. The history, progress, and combination of symptoms will alone guide to a correct judgment.

Order 4. Bowel Diseases—*Enterici.*

Inflammation of the Peritoneum—*Peritonitis.*

Definition.—*An inflammation of the serous membrane lining the cavity of the abdomen, and covering the viscera contained in that cavity.*

Pathology.—The peritoneum like the pleura is liable to the influence of the inflammatory processes, either acute or chronic in their progress.

Acute inflammation of the peritoneum, as of all serous membranes, begins in the connecting fibrous tissue, which becomes red and injected, and at length the same phenomena pervade the serous membrane itself. The colour of the membrane, when inflamed, like that of all serous membranes, is a bright arterial scarlet hue; the mem-

brane being first dotted with a number of small red points, which become confluent, and form streaks and patches, which in their turn coalesce; or a small central nucleus of inflammation may form and spread till the whole extent of the peritoneum is one entire bright scarlet hue. In addition to the redness, some interstitial deposit accompanies diffuse inflammation of the peritoneum, so that the membrane loses its transparency, and is thickened. When redness does not exist, opacity is often the only evidence of the previous existence of the inflammatory state. The consistency also of the subperitoneal tissue is greatly impaired, and rendered easily lacerable, so that the peritoneum is now capable of being detached in considerable portions. This inflammation may terminate by resolution, or it may proceed, and serum be effused. The quantity may be trifling, not exceeding a few ounces, but occasionally it is large, fills the cavity of the abdomen, and constitutes inflammatory dropsy.

The exudation may be of the fibrinous type, when coagulation of the effused fluid tends to occur, and the opposed surfaces to be glued together. In some cases, however, the fluid predominates, and the fibrinous coagulated masses are loose, so as to float unattached in the serum, or of such consistency as to unite opposite parts together, and of such extent as sometimes to form an adventitious membrane, covering the entire surface of the abdominal walls as well as the whole of the intestines. The period at which organization of the lymph thus effused may begin, Mr. Hunter determined to be in about twenty-four hours. If the disease proceeds, pus forms, sometimes not to a greater amount than a few ounces, but in other cases it amounts to many pints, or even fills the whole of the abdominal cavity. Ulceration of the peritoneum is not frequent, and generally takes place from without inwards, as from a perforating ulcer of the small or large intestines, or from the rupturing of an abscess or other tumor. The different acute inflammations described have been mentioned as though succeeding each other; but in many instances all these different forms co-exist in different parts of the peritoneum at the same time, and perhaps have been irregularly set up.

Experience has also shown that, although the structure of the peritoneum appears to be uniformly the same, yet certain parts of it are more liable to inflammation than others, as the convex surface of the liver or spleen, the right iliac fossa, the surface of the small intestine, and in females the broad ligaments, the Fallopian tubes, and the parts immediately adjoining them, as also the space covering the rectum and bladder. The parts the most rarely affected are those covering the stomach, bladder, the omentum, and the mesentery. It will be seen that the liability of different parts of the peritoneum to inflammation is in proportion to the liability of the organs they cover to become diseased, and that these partial

inflammations are for the most part the result of contiguous irritation.

Symptoms.—Peritonitis may be acute or chronic, partial or general. It is occasionally ushered in by some previous shivering and fever, but in many cases there are no preliminary symptoms. The symptoms of peritonitis, from perforation of the intestine or stomach, are characterized by the *suddenness* and *intensity* of pain, often referred to a particular region of the abdomen ; but the whole abdomen soon becomes painful to pressure. The pain is constant, exquisite, and leads to such lowering of the heart's action, that death rapidly follows by *asthenia*, preceded by the most marked symptoms of collapse.

If acute peritonitis should terminate by resolution, or by effusion of serum, or of lymph, the patient complains of a severe pain in the abdomen, which is increased on pressure ; he lies on his back, fearing to move. His pulse is from 90 to 120, and peculiar, as an inflammatory pulse. In proportion as it is frequent, so is it smaller. The tongue is coated, and the bowels constipated or regular. If serum be effused, that event can often be determined by fluctuation, or by percussion in some parts ; or if lymph, by a rubbing sound heard under the stethoscope when the abdominal movements of respiration are not suppressed. The course of these forms of acute peritonitis varies from a few hours to ten or fourteen days.

When acute peritonitis, however, terminates in effusion of pus, the symptoms are infinitely more formidable. The pain in the abdomen is often the severest that human nature can suffer. The patient lies on his back, but his legs are drawn up and bent so as to relax as much as possible the abdominal muscles. By fixing his pelvis he endeavours to keep the abdomen still, he is restless, and unable to bear the slightest pressure, not even the weight of a sheet, and is incessantly tossing his arms about in every direction. The state of his tongue and bowels are similar perhaps to what have been described, but his pulse is excessively small and rapid, varying from 130 to 150, while his stomach is often distressingly affected by retching and vomiting. These symptoms perhaps continue without intermission for twenty-four, forty-eight, seventy-two, or more hours ; when, with or without some previous shivering, pus is effused, and the pain from being agonizing, is now bearable. The subsidence of the pain, however, is not followed by any amendment ; on the contrary, a most alarming collapse succeeds, a cold clammy sweat breaks out over the body, while hiccup, and a pulse hourly increasing in frequency, proclaim the entire hopelessness of the patient's surviving beyond a few hours.

When acute peritonitis is confined to the liver or other organ, the pain is often limited to that part, while the other symptoms vary according to the severity of the affection and the organ attacked.

Chronic peritonitis often takes place to a great extent, and without any great amount of suffering. The symptoms are rather those of abdominal soreness and uneasiness than of pain, together with a full but sometimes rapid pulse. The intestines indeed may be glued together, and sometimes pus has been found effused, without the patient suffering more than in ascites. When chronic peritonitis is partial, as of the liver or spleen, the patient often experiences a dragging pain, which is increased by change of position, and arises from the parts being suspended by adhesion.

Causes.—Inflammation of the peritoneum often manifests itself during the course of some zymotic disease, such as the paludal fevers, scarlet fever, and the like. Mechanical violence, as the kick of a horse, the operation for hernia or the stone, or of paracentesis, are occasional causes. Rupture of the intestine from ulceration, or the bursting of an abscess, or of an aneurismal tumor into the abdominal cavity, are examples of another class of causes. Errors of diet, and especially frequent intoxication, is also an occasional cause. The disease termed *gin-colic*, is a chronic inflammation of the peritoneum. Sudden and great changes of temperature are also causes, especially in women at the period of menstruation. Intussusception of the intestine, or strangulation of the intestine from hernia, or other accidents, are also occasional causes. As a secondary disease it is frequently produced by hepatitis, splenitis, enteritis, and by cancerous and tubercular deposits in the subperitoneal tissue.

Children sometimes die of this affection after fevers. Peritonitis, however, is most common between the ages of twenty and forty. Women appear to die more frequently from it than men; this greater liability to peritonitis in the female arising perhaps from the great sympathy between the uterus and the peritoneum, a sympathy which is strongly marked, not only at the period of menstruation, but also at the time of parturition. At the latter period, indeed, puerperal peritonitis often becomes contagious.

Diagnosis.—The pain being greatly increased on pressure, and the pulse rapid, together with the general uneasiness and evident danger of the patient, readily distinguish peritonitis from colic. Its salient points of difference from enteritis will be noticed under that head.

Prognosis.—Partial peritonitis often terminates without in any sensible degree impairing the general health; thus we often find extensive adhesions of the liver without any marked symptoms, as well as limited opacities of the membrane. In every case, however, in which the structure of the peritoneum is thickened or otherwise impaired, the patient may recover, but generally he relapses and dies of dropsy; for the peritoneum, like all other serous tissues, appears to possess little power of restoration after disease. Every

attack of acute inflammation is of grave import, and when pus is effused, it is very generally fatal; neither will the patient recover if the peritonitis is caused by subperitoneal tubercles.

Treatment.—The treatment of acute peritonitis must be active, and there are few diseases in which the life of the patient is more completely in the hands of the practitioner. The activity of the treatment must be proportioned to the amount of pain, the rapidity of the pulse, and intensity of the inflammatory fever, which is frequently marked by the peculiar depressing influence of the inflammation on the heart's action. In the milder forms of the disease, when the pain is bearable, and the pulse steady, and under 100, one bleeding from the arm, or twenty leeches over the abdomen, together with the administration of calomel and opium, in frequently repeated doses, preceded by moderate purging with neutral salts, are sufficient to effect a cure. In the severer forms of disease, and with a tendency to the exudation becoming purulent, all these modes of treatment must be modified. Thus sixteen to thirty ounces of blood should be taken from the arm, and thirty leeches applied to the abdomen, and a poultice afterwards to encourage the bleeding. Bleeding, however, is not enough, for sometimes when carried so far as obviously to affect the patient, the peritoneal inflammation is not subdued. It is necessary, therefore, to have recourse to mercury, and with a view to affect the mouth, five grains of calomel, combined with half a grain of opium, so as to give the patient some relief from pain, should be administered every four, six, or eight hours, according to the intensity of the disease. As soon as the mouth is affected the patient may feel relieved, and at this point the mercury should be withheld, and the patient moderately purged with neutral salts, combined with an opiate.

The treatment of chronic peritonitis must be directed by the same principles; but we should be content with effecting a present alleviation of symptoms, and without attempting the removal of the mischief which has already occurred; for in patients that have laboured under chronic peritonitis, and survived many years, the peritoneum has still been found opaque, thickened, and silvery, so that in all probability these alterations are permanent, and not attended with danger.

The diet of the patient in the acute forms of peritonitis should be of the mildest and least stimulant kind.

Ascites—*Peritoneal Dropsy.*

Definition.—*A collection of simple serous or effused inflammatory fluid into the cavity of the peritoneum.*

Pathology and Morbid Anatomy.—Cases of ascites are often

examined after death, in which no affection of the peritoneum or of any organ or tissue can be discovered. More commonly, however, the peritoneum shows evidence of having been either acutely or chronically inflamed, some viscus diseased, or some tumor pressing on the large vessels, and causing the effusion which constitutes the ascites.

When the peritoneum is chronically affected, it becomes thickened, opaque, and, in some cases, of an aponeurotic whiteness. In general the portions covering the liver or the spleen are much the most thickened and diseased, owing probably to primary disease of those organs having extended to their peritoneal covering; on the contrary, if the peritoneum be acutely inflamed, it is red and injected, and more readily detached from the walls of the abdomen than in health : and it may also be found tuberculated.

The kidney is the organ most frequently affected when the ascites is secondary. In the vast majority of cases it is found in that peculiar state of degeneration usually termed Bright's kidney, and as a complication of *Bright's disease.*

The next most frequent concomitant affection with ascites is disease of the heart and large blood-vessels, to which it is supposed that at least one-fourth of all the cases of ascites is owing. In these cases the cavities of the heart are often enlarged, and their walls either hypertrophied or atrophied, or the valves are ossified, or their action otherwise impeded, and the aorta may be pouchy—its elasticity and contractility being impaired by calcareous or other degeneration.

Morbid states of the liver and spleen are the next most frequently associated affections. These organs may be found in every possible state and stage of disease.

In general, *anasarca* accompanies *ascites.* It is an infiltration of serous fluid amongst the elements of the general connecting or areolar tissue of the body, passing therefore up through and amongst the more loosely connected parts of the body generally, such as between the skin and the muscles. In these cases the areolar tissue is found in very varied states : in some cases the interspaces or areolæ are greatly enlarged, while the tissue itself, generally thickened, tears most readily in some cases, while in others it is not only greatly thickened, but also greatly indurated. The fluid also which it contains is generally limpid and watery, composed merely of the serous part of the blood, while in other instances the fluid is viscid, contains lymph, and the organizable elements characteristic of inflammatory origin.

The quantity of fluid contained in the abdomen varies from a few ounces to many gallons ; three to four gallons are by no means unusual, and as much as eighteen gallons are said to have been

drawn off at one time by the operation of *paracentesis*. The quality of this fluid is very various. In colour it is generally green or yellow, in consistency viscid, often containing so much coagulable matter, as to be incapable of flowing through the canula.

Symptoms.—The symptoms of ascites are extremely well marked, but vary in some degree according to the cause, so that it is better to give, first, a general outline of its more prominent features, and afterwards to point out those particular symptoms which indicate the cause from which it springs.

In ascites, if the quantity of fluid effused be considerable, the abdomen is distended and shining, with a number of large superficial veins creeping over its surface. From the weight of the abdomen, the gait of the patient is upright like that of a pregnant woman, and he generally walks wide from the anasarca. In bed he is unable to lie down on account of the fluid in the abdomen gravitating towards the chest and compressing the lungs, so that he is obliged to be raised towards the head and shoulders. If the anasarca be limited to the lower extremities, the upper portion of the body is in general greatly emaciated, the sharp and pinched features, and the withered arms, forming a striking contrast to the protuberant abdomen and swollen legs. On the contrary, if the *anasarca* be general, the trunk, the arms, the hands, the eyelids, and face generally are tumid and swollen to a most unsightly degree. The urine is often defective in quantity, but is sometimes natural and sometimes in excess. The skin is dry and the patient thirsty; his appetite greatly impaired, and his spirits generally greatly depressed.

The progress of the disease is seldom accompanied by any severe constitutional symptoms; but at length the legs and scrotum become greatly distended, and often inflame, so that the patient sometimes ultimately dies from gangrene of these parts. Again, bronchitis may take place; or the urine become nearly suppressed, and similar effusions may occur in the cavities of the pluræ.

The favourable circumstances are, the secretion of urine being re-established and becoming natural, the subsidence of the anasarca and of the ascites, and then a gradual return to health.

The presence of water in the abdomen may be determined by percussion of that cavity; and the best mode is to place one hand on the abdomen, and to give a sharp but gentle tap on the opposite side with the fingers of the other, when, if water be present, a fluctuation will be felt; when, however, the quantity of fluid is small, the fluctuation is best felt by percussing the side of the abdomen, from before backwards. The existence of fluid in the areolar tissue of the trunk or extremities is determined by the finger leaving a mark or "pit;" and the fluid being thus displaced, the part does not recover its original form and fullness for some seconds.

The ascites may form suddenly, and the abdomen of the patient may be distended in a few hours, or the fluid may take weeks or months to accumulate. The duration of the disease is very various. If the effusion be general, the patient's life may terminate in a few days; but more commonly the affection is chronic, and the patient survives many weeks or months. Such are the more general phenomena of *ascites* and *anasarca;* but it is now necessary to pass to those particular forms which constitute its varieties.

Ascites sometimes results from the large effusion of serum which is poured out occasionally into the cavity after undue exposure to cold and wet. To this form the name of *active ascites* has been given, and although such cases have not the marked symptoms of inflammation such as pain, yet the febrile re-action which generally accompanies such cases, and the fact that they yield to those remedies which subdue the inflammatory tendency, indicates such a connection. There are cases of a similar kind in which the *ascites* obviously results from chronic peritonitis; and now, although the patient sometimes suffers much pain, more commonly this symptom is wanting, or only occurs in occasional paroxysms. In this latter form the patient generally appears to die from the conjoint effects of anasarca and of ascites. The urine is scanty, but for the most part free from albumen in both these forms of disease.

The forms of *ascites* resulting from the following causes are examples of *passive* ascites, because they are all explicable by the fact that the cause tends ultimately to retard the flow of blood through the system of the venæ portæ.

A *diseased heart*, or diseased state of the aorta, is often the primary cause of ascites. The heart's sounds, its impulsion, together with the character of the pulse, will indicate the particular lesion under which the patient labours, as explained under cardiac diseases. Dropsy from this cause may first show itself either by effusion into the abdomen, or into the areolar tissue of the lower extremities, causing *anasarca.* When effusion has taken place, it is often remarked that the action of the heart becomes more regular, its impulse more natural, the pulse slower and steadier, while perhaps the murmur also may disappear. This apparent amendment, however, is fallacious; the dropsical symptoms increase, effusion takes place first into one cavity and then into another, so that the patient seldom long survives this fatal symptom. The urine in this form of dropsy is generally deep in colour, small in quantity, and of a healthy density.

The liver offers the best illustration of how morbid states obstructing the *portal* circulation are the main causes of *passive* ascites. When ascites arises from a *diseased liver*, that viscus is generally enlarged in the left lobe when it is enlarged; but mere enlargement

is not a common condition giving rise to ascites. The liver in most instances is smaller than usual; it is contracted and condensed, so that its shrunk and diminished bulk compresses the portal circulation. The condensation is also of a peculiar kind. It generally results from a compression of the proper hepatic substance by a contracting tendency in the connecting fibrous tissue which accompanies the portal vessels, namely, the *Capsule of Glison*, and giving rise to the condition known as *cirrhosis* or *hob-nail* liver. The ascites in this case has no new feature, except that the patient may or may not be jaundiced. In the former case, all the fluids effused are of a yellowish or greenish-yellow colour. The urine also is loaded with bile, which is generally turned green by the addition of nitric acid; while in a smaller number of cases the bile appears to be in a peculiar state of combination with the urine, so that the acid has now no effect on it; the urine likewise is always small in quantity, much loaded with the usual salts, and of a high density. The bowels are difficult to act upon, and the patient is liable to severe abdominal pains simulating chronic peritonitis. The pulse continues throughout the disease for the most part natural, and the patient usually falls into a more or less typhoid state, from which there is no recovery.

In ascites associated with disease of the *spleen* the viscus is uniformly enlarged, and can readily be felt occupying the left hypochondriac region, and thus the cause, though not its exact nature, may be determined; for we have no diagnostic symptoms denoting whether the spleen be simply hypertrophied or in a cancerous or tuberculated state. The early symptoms are similar to those which occur in dropsy of the liver, and, for the most part, are secondary to hepatic obstruction; and the termination of the disease, if the patient dies, is generally by hæmorrhage from the stomach and bowels, often so profuse as to amount to many pints in a few hours, greatly exhausting the patient, and hastening the fatal issue.

In dropsy from disease of the *kidney* the urine may or may not contain *albumen;* but in the great majority of cases it does so. When albumen is absent, as the chronic forms of diseased kidney are all devoid of pain, we are unable to determine either the seat or the nature of the disease with which ascites is associated, and the ascites is consequently in general attributed to an affection of the peritoneum of the liver, or other viscus.

Causes.—These have been already sufficiently indicated, and may be summed up as comprehending undue exposure to sudden changes of temperature, loss of blood, obstruction of the portal circulation from morbid states of the liver or spleen or heart, and especially from dilatation of the chambers of that organ. The lesions of the kidney associated with the disease, generally exercise their perni-

cious influence through the diseases of the heart, which supervene during their course. Such cases prevail most between the ages of twenty and forty-five, while cases from disease of the heart and liver are most common from the ages of forty to sixty.

Diagnosis.—Ascites is readily distinguished in the male from every other intumescence of the abdomen by the fluctuation on percussion. In the female it can only be confounded with *ovarian dropsy*, which consists in the accumulation of fluid in one or more cysts, generally multilocular, within the substance of the ovary, or in a serous cyst connected with the uterine appendages.

The grounds of diagnosis may be thus shortly stated:—

(1.) The uniform and symmetrical appearance and general increased breadth across the flanks possessed by the abdomen in *ascites* from the first, contrasted with the general *one-sided* growth of an ovarian tumor.

(2.) Percussion gives useful diagnostic results when performed in the different positions in which a patient may be placed. In ovarian dropsy, dull sounds are fixed and invariable in one place, whatever position is assumed by the patient. In ascites the dull sound follows the gravitating fluid in all positions.

The development of hydatids in the abdominal cavity may also simulate ascites, and so may an over-distended bladder.

Prognosis.—The *prognosis* in anascara in young persons not labouring under any organic disease is always favourable. If, however, it be consecutive to organic disease, a fatal termination is ultimately to be feared.

Ascites arising from indeterminate causes is often recovered from, but no case is free from danger, the peritoneum often being so much impaired, that the function of absorption ceases to be effected through it, and so the disease resists the action of all remedies.

Ascites depending on moderate inflammation of the peritoneum is often recovered from, and especially if the inflammation depends on the action of exposure to cold or to paludal poison.

Ascites with albuminous urine, arising from mere functional disorder of the kidney, is generally recovered from; but if the structure of the kidney be impaired, the disease is always grave and generally fatal. In a few cases, however, the disease subsides, and the patient may continue well for two, three, or four years, when he generally relapses and dies.

Ascites from disordered function of the heart is often recovered from; but if it depends on diseased structure either of the heart or large vessels, some temporary amendment may take place, while the patient quickly relapses and finally sinks.

Ascites depending on diseased structure of the liver or of the spleen is rarely recovered from unless the primary disease be cured.

Treatment.—When ascites occurs without any obvious organic cause, and without albumen in the urine, the best remedy is the bitartrate of potash, administered in divided doses, as one drachm three times a-day, or every six hours, or in one large dose, as half an ounce, combined, if the patient's bowels be confined, with ten to fifteen grains of jalap. When the smaller doses are used, it is often exceedingly useful to add ten grains of the citrate or tartrate of iron to each dose. If these remedies should fail, a $\frac{1}{6}$th to $\frac{1}{3}$ a grain of the extract of elaterium every night or every other night may be given.

There is a form of ascites without any obvious organic cause, in which there is accompanying anasarca. Under these circumstances squills appear to afford most relief; and by giving five to eight grains of the *pulvis scillæ* three times a-day, the dropsy is generally relieved and the patient sometimes cured. If the stomach be irritable, half a grain of opium should be added to each dose, so that the remedy may be retained.

Should the ascites arise from simple inflammation of the peritoneum, this form of dropsy in general yields to leeches and fomentations to the abdomen, together with the administration of a mild saline aperient every six hours. If, however, the case be severe, some mercurial influence may be necessary, in the form of *blue pill*, or moderate doses of the chloride of mercury.

When the ascites arises from disease of the heart, the kidney being sound, and the urine free from albumen, the treatment must have reference to the nature of that disease. If the valves of the heart are diseased, the patient, though he cannot recover, may be greatly relieved by the administration of tonics, stimulants, and saline or drastic purgatives. An *ounce and a-half* of *camphor mixture*, with a *drachm* of the *spirit of nitrous æther*, *fifteen* minims of the *tincture of hyoscyamus*, and a *drachm* of the *sulphate of magnesia*, will form a draught which, taken *three times* a-day, will often greatly reduce the dropsy. When the stomach will bear it, the tincture of squills (m x. to m xx.) with a drachm of the acetate of potash, has occasionally also succeeded. Small doses of elaterium, as $\frac{1}{8}$ to $\frac{1}{4}$ of a grain three times a-day, is a medicine that is also sometimes useful.

The ascites may be caused by disease of the liver; and should that organ be merely inflamed or hypertrophied, without other alterations of structure, the dropsy may disappear with the cure of the hepatic disease. The treatment is by bleeding, and the neutral salts, as the sulphates of magnesia or of soda, or should they fail, by moderate doses of calomel. When, however, its structure is otherwise altered, the patient is seldom cured; but the disease may still be alleviated and life prolonged. In this form of ascites the patient suffers greatly from abdominal pains, which are relieved

most effectually by fomentations. In these cases, also, the bowels are often greatly constipated, and require the most powerful drastic purgatives, as the black draught, castor or croton oil, or elaterium. In this form of dropsy, however, the peritoneum becomes more impaired in its power to absorb the fluid than in most of the others; the fluid is therefore seldom reduced, and the patient generally requires the last imperfect resource of the art, namely, tapping, or *paracentesis.*

Ascites depending on enlarged spleen is also difficult of cure. If the spleen be simply hypertrophied, the bromide of potash and the iodide of potassium, in doses of five to eight grains three times a-day, have been recommended. The patient, however, often dies from hæmorrhage from the stomach after all the more prominent symptoms have been relieved.

The dropsy which often occurs in young chlorotic women, in which the urine *contains albumen*, the kidney, being healthy in structure though disordered in function, is generally cured,—the most efficient remedy being the bitartrate of potash in *drachm* doses three times a-day. It acts as a diuretic and as a purgative in these cases.

Stomach Diseases.

Definition.—*Under this indefinite heading it is proposed to notice some morbid states of the stomach, expressed by functional disorders, lesions of texture, or both combined.*

Pathology and Morbid Anatomy.—The organic diseases and functional disorders of the stomach have been recently especially elucidated in this country by the researches of Drs. Budd, Handfield Jones, Chambers, and Brinton. Nevertheless, the morbid changes which are known to occur in it are still but very imperfectly connected with the expression of clinical phenomena. "There is no part of the body," says Dr. Chambers, "of which we hear so much from our patients, and are able to communicate so little knowledge in return, as about the stomach; and truly," he also observes, "it is an ill-used viscus; flattered in metaphor, and insulted in fact." It has been regarded as a mere bag, a mere mill, or a mere chemical laboratory for the solution of substances; yet still all such similes and metaphors, as Hunter remarked, explained nothing, and he wisely insisted that it is a viscus *sui generis*, with definite functions to perform; in short, "a stomach is a stomach." Its morbid states are similarly peculiar to itself and to its functions.

Instead of describing a series of disorders, one by one, and by names such as *gastritis, dyspepsia, hæmatemesis*, and the like, it may perhaps be more instructive to write a condensed statement of that positive knowledge, so satisfactorily established by the prolonged and

well directed labours of those men just mentioned. Such a method will better furnish those grounds for diagnosis, by which clinical phenomena, often of the most painful, prolonged, and harassing kind, may be connected with some understood morbid state, and so furnish some fixed and definite principles by which the treatment of stomach diseases may be directed.

The morbid states of the stomach, ascertained, after death, to have existed during life, and in some measure to have been expressed by certain symptoms, may be enumerated as follows:—(1.) *Softening of tissue.* (2.) *Glandular degeneration of the proper mucous substance.* (3.) *Congestion.* (4.) *Forms of inflammation tending to exudations and destruction of parts, or condensations of tissue, especially about the pyloric orifice.* (5.) *Ulceration.* (6.) *Carcinoma.*

Abnormal functional states are expressed by—(1.) *Vomiting, associated with lesions of other organs.* (2.) *Deficient secretion of gastric juice.* (3.) *Fermentive processes tending to the development of entophytes, such as sarcinæ.* (4.) *Indigestion, associated with and depending upon* (a) *morbid states of those viscera which are conjoined with the stomach in the processes of digestion, such as the liver, pancreas, and small intestines.* (b) *Imperfect action of the kidneys, as in Bright's disease.* (c) *Defective or diminished morphological changes during the processes of nutrition in the tissues, generally expressed by altered secretions and excretions, as in many constitutional diseases.* (d) *Indigestion, associated with Pyroris and increased secretion of the juices of the stomach and salivary glands, and with cutaneous disorders, such as urticaria.* (e) *Indigestion, associated with drunken habits.*

The essential juices of the stomach and of the intestines play a most prominent part in determining the nature of these diseases; and some of the most important principles of treatment are based upon the physiological relations of those juices, and upon the fact that while the process of digestion of food is only commenced in the stomach, it is completed in the alimentary canal by the influence of the intestinal fluids. There is a stomachal digestion in which the gastric juices, with the saliva and mucus of the stomach, play the most prominent part; and there is an intestinal digestion, in which the intestinal juices, composed of the *biliary, pancreatic,* and *intestinal secreted fluid,* play the most prominent part. It is also an important fact, especially insisted upon by Dr. Chambers, having been proved by the experiments of Bidder, Schmidt, and Handfield Jones, that the intestinal digestion may be made to do more or less of the work of stomachal digestion, so that the exercise of the function of the stomach may be spared when necessary, and the food encouraged to pass from it into the bowels, to be digested entirely by the intestinal juices.

The reader is referred for information regarding the properties

and constituents of the gastric juice, to the text-books on physiology; but it is necessary here to advert to the fact, recently established by the experiments of Schmidt and Bidder upon animals, and the observation of Grünewaldt upon an Esthonian peasant who suffered from a stomach fistula, that there is a constant circulation of an immense quantity of fluid through the mucous membrane of the alimentary canal, and which is necessary to the solution and absorption of food from its interior. It is now also well ascertained, that from the gastric glands, the principal part of the solid animal matter of the gastric juice is derived, and which is the exciting cause of the solution of albumenoid substances in the stomach. This solid matter is regarded as a *gastric ferment*, and has been variously named as such, and also as *rennet*. But water constitutes the chief bulk of the juice; and, from the experiments and observations alluded to, is known to perform a most important function. It is continually poured forth from the surface of the mucous membrane in vast quantities, to the extent of between a *fifth*, or *a quarter* of the *weight* of the body, and as constantly returns to mix again with the sanguineous fluid. This secretion of fluid is constantly going on from the internal alimentary mucous surface. It mixes with the dissolving food in the alimentary canal, and takes up those particles of it which it is calculated to hold in solution, loaded with which it returns again to the sanguiferous, chyliferous, and lymphatic circulations. Thus a "poor" watery fluid is constantly being sent forth to return "*laden with wealth*," and so minister to the nutrition of the body. This has been described as an internal mucous circulation of fluid within the body, and the arrest of this interchange with the great retention of water has been shown by Virchow and Parkes to be a constant condition in the febrile state. (See Introduction, page xlv.)

I. **Softening of the Stomach.**—It was first announced by Hunter, and subsequently confirmed by the experiments of Spallanzani, Wilson Phillip, and Carswell, that the stomach under certain conditions as to temperature and properties of the gastric juice, especially at death, and immediately after that event, may be dissolved or digested by the secretions poured forth from its own secreting glands. In certain diseases also of a catarrhal kind, it has since been ascertained that potent gastric juice is sometimes secreted by the empty stomach, or that lactic acid being freely generated from the saccharine principles of food, forms with the mucous membrane an efficient digesting mixture, and not unfrequently a softening of the stomach may be predicted with tolerable certainty by a peculiar train of symptoms, and resulting from the presence of free gastric juice, or of a digesting acid in the otherwise healthy stomach (Budd). Dr. John Gairdner of Edinburgh, however, so long ago

as 1824, inculcated a similar doctrine. He observed, in a numerous series of cases of children, that a peculiar action of the gastric and intestinal mucous membrane analogous to inflammation, weakened the texture of the organ and rendered it morbidly susceptible to the action of the gastric juice during life (*Ed. Med.-Ch. Trans.*, vol. i., p. 311). It was in opposition to this view that Carswell performed his experiments, an account of which he published in 1838; so that the testimony they undoubtedly afford regarding *post mortem softening*, as the only kind of softening, must be received with qualifications. The observations of Dr. John Gairdner and Dr. Budd evidently show that the probability of softening may be predicted during life, although Dr. Budd is of opinion that the softening does not take place till after death. A similar opinion is expressed by Andral. The diseases in which it is so apt to occur are those in which there is much cerebral disturbance and increasing debility and emaciation before death, and from such diseases as *typhoid fever*, *cancer of the uterus or peritonitis*,—in infants who die of *tubercular hydrocephalus;* in deaths from exhaustion from inflammatory diseases of the brain, when vomiting is a constant symptom; in persons who die from phthisis and from ulcer of the stomach. The symptoms from which the softening may be predicted are that when along with any of these diseases, there is much disorder of the stomach, such as pain and tenderness at the epigastrium, loss of appetite, thirst, frequent vomiting of acid fluids, nausea, the lesion may be expected to be found after death. In the common form, as Hunter described it, the mucous membrane towards the splenic end is thin, and for the most part stained by hœmatine, very slippery, and appearing as a dark film gliding over the submucous tissue. The tubes appear under the microscope to be a good deal altered, chiefly by solution of their epithelium, while dark grains of melanic matter are deposited between the tubes. The amount of probable knowledge we possess respecting softening of the stomach is thus expressed by Dr. Handfield Jones:—

(1.) There are two forms of softening, one, the commonest by far, which is simply the result of the action of the acid contents of the stomach upon its own dead tissue; the other, the consequence of a peculiar change taking place in its glandular structure, which generates a powerful acid, dissolving, corroding, or destroying the surrounding tissue. (2.) The latter form may occur either with an empty or a full state of the blood-vessels of the stomach, the softening part of which will accordingly be either quite pale or of a dark blackish tint.

(3.) This same form occurs in a great variety of morbid states, which seem to have only this in common,—that they are attended with great depression of the vital powers.

(4.) It is more common in children than in adults, on account [probably] of the greater delicacy and less resisting power of the system.

II. **Glandular Degeneration of the Proper Mucous Substance** is by far the most common of the organic lesions; existing in 72 out of 100 cases examined by Dr. Jones. It is expressed in a variety of forms, the most marked of which are—(1.) Peculiar morbid changes in the tubes, probably analogous to the process which occurs in the tubes of the kidney in Bright's disease, where the molecular contents of enlarged epithelial cells increase, ultimately leading to complete destruction, so that the tubes become filled with the debris of this destruction. (2.) Melanic and fatty deposits in the epithelium. (3.) Interstitial deposit of nuclear and fibroid exudation at the expense of the gland substance, so that hypertrophy of tissue may exist, along with—(4.) Atrophy of the tubular epithelium of the tubes themselves, and of the solitary glands.

There is thus, on the one hand, in some instances, an utter destruction of the tubular glands, actual loss of substance without replacement; on the other hand, there is no actual loss of substance, but a replacement of elements by the deposition of granular matter within the tubes, without diminution or alteration of their form. That these partial degenerations, even when they extend over a considerable portion of the stomach, do not materially interfere with the ultimate digestion of food, seems to be established by the cases described by Dr. Jones; deficiency of stomachal digestion being compensated for by increased vigour of intestinal digestion. Such loss of the gastric glands appears thus to have little influence over the vital acts, so that it is rare to find any evidence of the existence of such lesion during life, even when the degeneration is very extensive. I believe, however, from observations upon the intestinal mucous membrane in analogous glandular degeneration, that in cases characteristic of intestinal wasting, associated with anæmic states, as described at page 422, the mucous membrane throughout the whole alimentary tract is similarly affected, and that an examination of the mucous membrane of the lips, and buccal membrane of the mouth, indicates with great probability the change below, just as the condition of the tongue is the index from which we judge generally of the functional state of the alimentary canal. The general symptoms of such cases are undoubtedly anæmia and debility, without any obvious organic cause, often associated with vomiting or nausea in the morning—no desire for food, and a sensation as if it never was effectually swallowed, but stuck at the diaphragmatic entrance of the stomach, causing the peculiar feeling of weight which attends indigestion, and the abundant generation of gaseous fluids. It has been also well remarked by Dr. Chambers, that such

symptoms indicate a participation of the whole alimentary tract in such lesions, and that where the lesion is merely confined to the stomach, the absence of such symptoms are sufficiently accounted for by the compensation to stomachal digestion afforded by the healthy intestinal tract.

III. **Forms of Congestion.**—These may be described as *passive congestions;* or as *active congestions* associated with inflammatory lesions.

The *passive* form of *congestion*, like the passive form of *ascites*, is explained by the physiological phenomenon now recognized as perfectly familiar, namely, that the freedom of the transit of blood through any part is in a great measure dependent upon the healthy performance of its functions, and of the function of those parts immediately associated with it—so that, if function is arrested, the circulating current is arrested also, and the blood reverts, or is thrown back to those intervening parts, in the course of the circulation, between the site of obstruction and the force propelling the blood. Thus blood ceasing to flow freely through the lungs, reverts, or is thrown back upon the right side of the heart; blood ceasing to flow freely through the liver, is thrown back upon the stomach, upon the one hand, or upon the spleen by the gastro-epiploic vessels, expressed by congestions of these viscera; or, on the other hand, the portal system being obstructed, the blood reverts to the membranes of the intestines, and expresses such an occurrence by ascites, as well as by gastric venous congestion. Any mere mechanical impediment, therefore, which prevents the blood returning from the stomach towards the heart, will induce congestion of the stomach.

The immediate effects of such congestion upon the functions of the stomach are sufficiently expressed by symptoms, such as hæmatemesis or the vomiting of blood; the secretion of the gastric juice also is diminished, the stomach can digest less food, and requires longer intervals of rest between the meals.

The persistence of such passive forms of congestion further leads to the deposition of melanic matter, and to disintegration of the tubular glands of the stomach, the formation of ulcers in its mucous membrane, just as varicose ulcers are established in the limbs from the passive congestion which attends varicose veins in the lower extremities, by impairing the nutrition of the part as explained by Simon, Budd, and Jones.

Besides congestion from mere mechanical impediments, there are congestions of the stomach, which have been described as *vicarious*, that is, as taking the place of congestions which ought to occur in other parts, such, for example, as when it occurs along with hæmorrhage in women from stoppage of the catamenia; and which has

been observed to occur in yellow fever, in malignant cholera, and in typhoid fevers. Congestion also arises during the development of—

IV. **Forms of Inflammation tending to Exudations and Destruction of Parts, or Condensations of Tissue, especially about the Pyloric Opening.**—Idiopathic gastritis is an exceedingly rare disease. When inflammation of the stomach does occur, it is generally the consequence of direct injury to the stomach from irritant or corrosive poisons. Dr. Jones has never met with a case of acute idiopathic gastritis. Louis examined five hundred bodies without finding a single instance. Andral, however, relates several cases in his *Clinique Medicale;* and it is stated by Dr. Robert Williams, that during the whole of the Peninsular war, not more than six cases were reported among the troops, although exposed to every species of privation, and addicted as they were to its most efficient exciting cause, the use of spirits in every form in which alcohol could be got to drink.

The difficulty of exciting acute inflammation in the stomach is well shown by experiments upon animals, and by the often long escape of the polyphagist, who swallows knives and watches, and all sorts of heterogeneous things; and of the Indian, who passed many times daily a blunt sword into his stomach with impunity, till at last its coats were pierced and he died. The stomach, also, we find, will bear tea or coffee of an almost boiling temperature, followed perhaps shortly afterwards by a quantity of ice. One of the persons resident at the Eddystone Lighthouse, at the time it was burnt in 1755, swallowed a quantity of molten lead, which accidentally dropped into his mouth, when looking from below upwards to observe the progress of the fire. But even after this intensely hot substance had passed into his stomach, he lived several days, having been taken to the Plymouth Hospital, where he was attended by Dr. Sprey, who describes the case in the *Transactions* of the Royal Society. His attendants hardly believed his story possible, but on examining him after death a lump of lead, weighing 7 oz. 5 drs. 8 grs., was taken from the stomach.

The simplest and most frequent form of inflammation of the stomach is that which is brought about by excess in eating or drinking, especially of alcoholic drinks. It is characterized by active congestion, and an excessive secretion of mucus in the stomach, a condition which Dr. Jones describes under the name of *gastric catarrh.* Dr. H. Jones thus describes its phenomena :—

"It occurs under the same influences as catarrh of the air passages or conjunctivitis, and often either co-exists with these affections, or succeeds them. Its anatomical characters are—distension of the capillaries, and abundant secretion of an extremely tenacious, clear, whitish, bile or blood-

tinged mucus. At the commencement of the disease, or during exacerbations, the hyperæmia is a marked feature; but the presence of abnormal mucus is a more constantly observed and certain character. Congestion of a passive kind powerfully predisposes to this disease; and is commonly conjoined with it. Watery, slightly mucous, feebly acid, or neutral fluids, are secreted, and often ejected, constituting pyrosis. It does not tend to the destruction of the glandular tubes."—(*Pathological and Clinical Observations respecting the Stomach*, page 70.)

There is a comparatively rare form of inflammation, described by Dr. Budd, in which coagulable lymph is effused into the submucous areolar coat, and, hardening and contracting, forms a dense gristly mass, binding the mucous membrane to the parts beneath. Round the pyloric orifice such a morbid state often acts as a permanent stricture. It is a condition almost invariably the result of spirit drinking, and seldom occurs before the age of forty.

V. **Ulceration.**—The observations of Drs. Chambers, Gairdner, Habershon, Jones, and Brinton, have shown this lesion to be by no means uncommon. *Simple*, *chronic*, and *perforatiug* ulcers are described. The ulcer is generally solitary and deep, seldom larger than a shilling, circular or oval in shape, its edges clean, sharp and well defined, as if punched out. It is generally situated along or near the lesser curvature, and usually nearer the pyloric than the cardiac orifice, and more frequently on the posterior than the anterior wall. It is more common in women than in men, nearly in the proportion of two to one. It is especially a disease of middle and advanced life, although Dr. Budd once met with it in a girl of fourteen. Dr. Brinton records two cases under the age of ten years. It is relatively more frequent amongst the poor than amongst the rich; and is especially found in maid-servants, between the ages of eighteen and twenty-five.

It tends to prove fatal by—(1.) *perforation*; (2.) by *hæmorrhage*; (3.) by *exhaustion*.

When the ulcer eats its way through, the aperture gradually narrows as it reaches the peritoneum, to little more than a point which corresponds to the centre of the ulcer. The peritoneum inflames at this spot, and sloughs, when perforation is completed by the separation of the slough. An important sanitary effort is here made by the adhesion of the peritoneum surrounding the slough to some opposed surface, such as to the liver, pancreas, colon, or abdominal wall. Fistulous openings may then be established, so that food escapes from the stomach when such passages communicate with the alimentary canal. A most comprehensive record of such cases is published in *The Edinburgh Monthly Journal* for July and August, 1857, by Dr. Charles Murchison, assistant-physician to King's College Hospital, London. According to Dr. Brinton's observations, about 13·4 per

cent. of cases of ulceration terminate by perforation; and he considers that the liability to perforation decreases as life advances; and, as Dr. Crisp first showed, during the ages from fourteen to twenty it is most frequent. The patient may survive the first shock of the accident, ultimately to succumb to the combined effects of peritonitis and gastric exhaustion.

Hæmorrhage, while it is one of the most frequent and important symptoms of ulcer, is also a mode of fatal termination. It generally occurs soon after a full meal; and about from $3\frac{1}{2}$ to 5 per cent. prove fatal in this way.

"This long and exhausting malady," says Dr. Brinton, "predisposes the constitution to a variety of other diseases, and renders unusually fatal many of those attacks of illness which, in the course of years, very few persons altogether escape."

Symptoms of Gastric Ulcer.—"The malady is announced by disturbances of gastric digestion; at first by mere uneasiness and pain; then nausea and vomiting, or regurgitation, that expel the food previously taken, or a tasteless or acid watery secretion. At this stage of the disease it is sometimes cut short by the occurrence of perforation, with its sequel of fatal peritonitis. Failing such an accident, the dyspeptic symptoms are next complicated by hæmorrhage from the stomach; sometimes a sudden and dangerous gush, oftener a slow and intermittent drain of blood. The anæmia produced by this hæmorrhage is generally associated with a cachexia which seems to be essentially independent of it; being chiefly the result of the inanition necessarily implied by frequent vomiting of the food, or by large destruction of the gastric mucous membrane, and consequent impairment of its function. In young females, another symptom is often present, in the form of more or less complete amenorrhœa, which may be associated with either of these two states of anæmia or cachexia; in other words, may be connected with ulceration, with hæmorrhage, or with both. The gradual acquisition of all these symptoms conducts the disease, in a variable period, to a climax, whence we may next briefly trace it towards its termination. Retaining the liabilities to death by perforation, by hæmorrhage, by vomiting, and by exhaustion, which the above organic results of ulceration severally imply, the lesion often ends by one of these modes of dying, or by two or more of them in combination. In other cases, a spontaneous subsidence of these symptoms, in something like the inverse order of their occurrence, announces a recovery; or a similar amendment is only effected by a careful medical treatment, such as quite entitles us to dignify it by the name of a cure."—(*Medico-Chirurgical Review*, p. 159, July, 1856.)

The character of the pain is peculiar; at first being little more than a feeling of weight or tightness, of a dull character, and continuous. It gradually becomes intensified into a burning or gnawing sensation, which produces a kind of sickening depression. It generally comes on from two to ten minutes after the ingestion of food, and remains during one or two hours, which correspond to

the period of gastric digestion, after which it gradually subsides, or if vomiting empties the stomach, it also invariably ceases. The pain is generally expressed at the centre of the epigastrium, or at the middle line of the belly, immediately below the extremity of the ensiform cartilage, often confined to a mere spot, and rarely to a space more than two inches in diameter. A dorsal pain, first described by Cruveilhier, is also subsequently established, generally in a few weeks or months after the epigastric pain. It is expressed by a gnawing sensation interscapular, or from the spine of the eighth or ninth dorsal to that of the first or second lumbar vertebra. Pressure in the epigastric region is sometimes unbearable, and, for obvious reasons, must be applied with the utmost care and delicacy.

Vomiting usually occurs when the pain reaches its height; and, completely emptying the stomach, generally affords relief. For further details of symptoms, the reader is referred to the admirable papers of Dr. Brinton, from whom these statements have been condensed.

VI. **Carcinoma.**—The cachectic state which ulcer of the stomach ultimately induces has caused many cases of simple ulcer of the stomach to be recorded as cancer; so that it has been a popular belief that cancer of the stomach is a very common disease, till the inquisitive researches of Dr. Brinton have shown that the mortality attributed to gastric cancer is by far too great. Of necropsies performed at four of the great London hospitals, only about 1 per cent. of the total mortality is due to this lesion. The disease is thus far less frequent than ulcer of the stomach. Next to the female *breast*, the *stomach* seems, in this country, to be the part most liable to cancer; and the male is more frequently affected than the female, "a fact," writes Dr. Brinton, "which it is impossible to avoid connecting with the exclusive amenability of the female to the *mammary* and *uterine* localizations of cancerous disease."

The orifices of the stomach are the parts which are almost exclusively the seat of cancerous lesions.

VII. **Abnormal Functional States.**—These are due, *first*, to what have been called sympathetic relations with other organs, themselves in a morbid state, and which are now explained by the phenomena of "*reflex action.*" Examples of this may be referred to in the *vomiting* which attends irritation of the *lung*, *brain*, *liver*, or *uterus*.

Second, a scanty secretion of the gastric juice, characterized by slowness of digestion, and long retention of food by the stomach; prolonged distress after eating, especially of weight and uneasiness at the pit of the stomach; peculiar tendency to decomposition of food in the alimentary canal, the evolution of fetid gases, and the appearance by unaltered ingesta in the stools. Often an inheritance by birth, the conditions which tend to produce this morbid

state are mental over-exertion, prolonged anxiety, especially after meals, gluttony, drunkenness, and sedentary habits, and the consumption of more food than the system requires.

Treatment.—Congestion, catarrh, ulcer, cancer, and functional states associated with what are called dyspeptic symptoms, are the cases of stomach diseases for which the physician is called most frequently to prescribe.

When there is reason to believe *congestion* exists, a sparing and easily digested diet is to be prescribed, and total abstinence from fermented drinks is imperatively demanded; and in cases where there is reason to believe that catarrhal inflammation prevails, the blandest food must be given in very small quantities. In severe cases, leeches are to be applied over the region of the stomach, and the patient may sip iced water, or suck small pieces of ice to relieve the thirst.

For obvious reasons ulcers are most difficult to heal, and such cases are to be treated by dietetic rather than by medicinal means. The patient must eat in small quantities, and especially of milk compounded with bread, macaroni, semolina, sago, tapioca, biscuit powder, Indian meal, and oatmeal gruel. Iced milk, combined with one-quarter to one-third of lime water, is particularly recommended by Dr. Chambers; two or three tablespoonfuls of which are to be taken at short intervals, so that about two quarts of milk may be thus used during the day, so as to render regular and more bulky meals unnecessary. The lime water tends to prevent coagulation of the milk, and the milk thereby more readily passes unaltered into the intestines, to be digested by them rather than by the stomach. Next to dieting, blood-letting by two or three leeches applied to the region of the stomach about twice a-week, affords obvious benefit, the patient often gaining weight during their use. Blistering applied to the spine is also said to relieve the dorsal pain. Small lumps of ice may be swallowed if the stomach is irritable, and astringent remedies, especially the *salts of metals*, such as a combination of *iron* and *alum*, are of great benefit; and as a change, gallic acid, nitric acid, and bitter barks may be administered. Constipation is to be counteracted by enemata. When hæmorrhage occurs, Dr. Budd recommends small bits of ice to be swallowed that rest be maintained in the horizontal posture, and that astringent medicines be administered, such as *oil of turpentine, acetate of lead and opium, alum and tannic acid. Oil of turpentine* should be given in doses varying from ten to twenty minims in *cold* water, and repeated more or less frequently according to the urgency of the symptoms.

Special symptoms, common to various morbid states, require special modes of treatment. Excess of acid is best neutralized by

lime water or *magnesia*, and the gastric fermentation which is apt to be established may be checked by *brandy* and *various aromatic spirits*. Pills, containing from a quarter to half a minim of *creasote*, given with each meal, will in general counteract fetid eructations; while *conium* and *belladonna* are the medicines which better than *opium* allay general nervous irritability.

In cases of slow digestion, with deficient secretion of the gastric juice, the rules of treatment are:—(1.) To let albuminoid food be as liquid as possible. (2.) To let the day's allowance be taken in small quantities at frequent short intervals. (3.) That by the administration of alkalies, the food may pass to the intestines, and be digested there, rather than by the stomach. This latter mode of treatment by alkalies, recommended by Chambers, is contrary to that recommended by Dr. Budd. Both are consistent with physiological facts, and the course to be followed must be determined by the nature of the case.

Forms of indigestion, marked by excessive acidity and heartburn, may be relieved by bicarbonate of soda, in doses of fifteen grains, combined with a few grains of nitre, and taken two or three times a-day. At the same time, free excretions from the liver and bowels must be sustained by occasional small doses of *blue* pill, combined with extract of *colocynth*, and of *henbane;* while exercise and diet are duly attended to.

Weakened digestion, from over-fatigue, may be often restored under the use of carbonate of ammonia, conjoined with compound tincture of gentian, or with extract of gentian in the form of a pill.

Indigestion from habitual drunkenness is best relieved by bitter infusions, such as *gentian*, *quassia*, and *calumba* singly, or combined in a mixture, so that a dose may be taken two or three times a-day, an hour before each meal. Small doses of opium or of morphia may also be given at bed-time, so as to secure sleep at night.

In prescribing the acids, the following general rule, stated by Dr. Bence Jones, ought to be kept in mind, namely, that the influence of *sulphuric acid* is astringent, while that of *hydrochloric acid* promotes digestion, and of *nitric acid*, secretion.

Diseases of the Lesser Intestines.

Definition.—*Under this heading, as with stomach diseases, it is proposed to notice the more certainly ascertained or common morbid states of the lesser intestinal canal, expressed by functional disorders, lesions of texture, or both.*

Pathology.—Although *enteritis* is generally described in text-books, as a rule, it is a rare disease, and seldom affects the intestine throughout its whole extent. The several parts under which

it is anatomically described, are variously influenced by local inflammatory processes. The peculiarities of anatomical organization, such as the various forms of minute glandular parts, determine, in some measure, the forms by which these organic lesions are expressed. With some modifications, explained by such peculiarities of structure, the *organic* lesions of the lesser intestinal tract are in many respects precisely similar to those described in the stomach; while the functional disorders are indicated by the various forms in which the intestines express irritation or perverted action, such as by *spasms*, *colic*, *flatulence*, *indigestion*, *constipation*, and various forms of *fluxes* or *diarrhœa*.

I. **Softening of Tissue** has been described in the small intestines similar to that affecting the stomach, but it occurs much less frequently, and is not expressed by any recognizable clinical phenomena.

II. **Glandular Lesions and Degenerations** are a much more frequent occurrence, if not a constant one, over limited portions of the intestine. The lesions are peculiar from the structure of the parts; and the *degenerations*, as they are termed, are analogous to those described by Dr. Jones as occurring in the stomach (see page 689). As in the stomach, so in the intestines there is to be observed in some cases, on the one hand, an entire destruction of the gland tissue, with actual loss of substance and without replacement, so that when the mucous membrane is delicately dissected from the muscular parts, it may be viewed as a transparent object with a lens; on the other hand, there may be no actual loss of bulk of substance, while the structure is nevertheless greatly altered—(1.) by alterations of the contents of the tubes without change of form; (2.) by an interstitial deposit of fibrinous matter encroaching upon and ultimately obliterating the proper glandular tissue. Thus externally and in bulk the parts may seem to be unchanged, but they are found to be materially altered in specific weight, and the range of alteration is considerable. Thus through lesions or degenerations of the gland tissue, *atrophy* of the mucous membrane of the intestines becomes expressed in two ways (as originally expressed by Dr. Bucknill with reference to the nerve substance of the brain), namely—(1.) *positive atrophy*, in which the tissue of the gut wastes while the glandular texture is altered; (2.) the tissue of the gut may not have wasted, on the contrary it may have gained in bulk, but the glandular tissue has been changed, or been altogether replaced, while (3.) the two conditions may be co-existent.

The observations which appear to me to prove these statements, are alterations in the specific gravity of the mucous membrane of the intestine, associated with characteristic morbid appearances, as shown by microscopic examination of sections. These combined modes of examination not only in mucous membrane, but in all

parts in which I have applied the test, have yielded one characteristic result, namely, that atrophic states of prolonged duration, and which are generally described as *granular degenerations*, are, for the most part, of comparatively low specific gravity, and with a chemical re-action under the microscope, indicative of the presence of fat; while, on the contrary, the acute inflammatory conditions of tissue (where loss of peculiar minute structures, like the glands of the intestines, is due to destruction from exudation and replacement by it), have uniformly high specific gravities. These results are similar to those which Dr. Bucknill has expressed with reference to the brain (*Med.-Chir. Rev.*, Jan., 1855, p. 212). A specific gravity of 1·032 to 1·033 of the mucous membrane, when it is free from congestion, may be regarded as associated with the healthy state of the gland tissue. In conditions of *positive wasting* throughout, it descends to 1·030; while in conditions of *relative* wasting, where bulk is unchanged, but where glandular parts are displaced or destroyed by exudative deposits, the range of specific weight of parts examined has been as high as 1·044, and in the large intestines as high as 1·050. The specific gravity of Peyer's patches I have found to vary from 1·032 to 1·044, and even in patches from the same intestine there is often a considerable latitude in the range of the specific weights of the glands. The atrophic states of these glands are indicated—(1.) by a reticulated condition, void of all glandular elements, and which seem to occur naturally with the advance of years beyond forty; or to occur after extensive *infarction* during the progress of typhoid fever, the elimination of the product sometimes taking place without ulceration. (2.) By the remains of the cicatrices of ulceration in the form of dark granular deposits; or of a thin, clear, skin-like membrane, of a pale colour, and with a wrinkled contracted border. These morbid changes are most commonly associated with the prolonged continuance of complex morbid processes, as in constitutional diseases, such as those of anæmia (page 423), or in organic lesion, leading to impairment of the constitution generally. They are also associated and expressed more or less locally amongst the peculiarly local glands or accumulations of glands of the gut, such as the solitary lenticular glands, and the patches of Peyer, during the progress of some zymotic diseases, such as in cases of *cholera*, *dysentery*, and *typhoid fever*.

The definite morbid conditions in which the glandular apparatus may be found, are as follows:—(1.) *Intumescence*, *stuffing*, or *cramming* of the gland, by different kinds of deposit, by debris of normal elements, or of both, and associated with redness and vascular congestion of the sub-mucous tissue—conditions which correspond to the so-called "*infarction*" of the older pathologists; (2.) *Softening degeneration*, and *elimination* of the abnormal constituents in vari-

ous ways ; (3.) *Ulceration*, sometimes leading to sloughing, of whole patches of glands ; (4.) *Collapse of solitary glands*, or otherwise cicatrized remains of ulcerations of solitary and aggregate glands ; (5.) *Accumulation of melanic matter*, characteristic of pre-existent and long-continued vascular action, with changes in the tissue from hæmatine.

The cramming of the glands, associated with sub-mucous vascularity, is generally due to a milky-like exudation, with the variously metamorphosed epithelial elements. Such exudation may subsequently undergo various kinds of metamorphoses yet to be determined ; but generally it may be stated that *corpuscular* and *fibrinous* elements co-exist in the various forms in which the glands are found intumescent.

There can be no doubt, from the observations of Dr. Handfield Jones, as well as from what is consistent with daily observation, that many of these obvious changes go on independently of any expressions of the phenomena of inflammation as commonly understood. But it is now well known also that the undoubted results of the inflammatory process sometimes occur without the manifestation of symptoms, such as *pleuritic effusions*, and which yield to appropriate remedies. In such cases the inflammation has been considered and described as latent. Does it not therefore appear consistent to associate the phenomena of such latent inflammations with the phenomena described by Goodsir and Redfern, as the first stage of lesion in the cartilage cell ; with those of the early degeneration in the epithelium of the uriniferous tubes in Bright's disease ; with the degeneration of involuntary muscle described by Quain ; with the changes described by Virchow in the cornea ; by Bucknill and Skae in the brain ; with the early changes in the epithelium of the mucous surface of the bronchi where they lose their cohesion, separate with abnormal rapidity, and ultimately assume forms and characters not to be distinguished from pus ; and, lastly, with the phenomena of alteration and degeneration of the minute contents of these glandular parts now described, and consider such changes as expressions of one and the same complex morbid process, and which Virchow has described by the name of *parenchymatous inflammation ?* (See Introduction, p. lx.) The ultimate results and further expression of the inflammatory process is undoubtedly various, according to the texture of the part and other circumstances, but here we have the initiative of the process similar in all tissues, while its ultimate results we know are very various ; and while the complex state known as "fever" has found a constant expression in "the elevation of temperature," may we not be entitled to say that "the no less complex process of inflammation" has a no less constant expression in the "diminished cohesion" of minute elements of tissue ?

III. **Congestion.**—There seems to be conclusive evidence to show that much of the intestinal catarrh described by the common name of diarrhœa, is associated with an *erythematous* congestion of the mucous surface of the lesser intestine, extending over a considerable extent, and rarely attended by increased arterial vascularity of the sub-mucous tissue. When the symptoms of such congestive states are manifest during the progress of other diseases which terminate fatally, there may frequently be observed, besides the congested state of the mucous membrane, a marked increase of vascularity in other parts, such as the gastro-splenic omentum, mesentery, and glands, or infarction of the gastric glands, associated with congestion of the stomach generally. These phenomena for the most part are associated with a congested state of the hepatic system, and occurring in a person otherwise in good health, give rise to symptoms which have been considered as a disease, and variously named *enteria, enteritis erythemoidea, diarrhœa mucosa,* sue *catarrhosa,* vel *catarrhale.* During the autumn and winter months in this country, it is common to meet with such cases of disordered bowels in adults; and in children at any season, characterized by frequent fluid alvine discharges, and associated with extensive superficial irritation of the mucous surface. When the irritation predominates towards the upper part of the intestine—in the duodenum, for instance—the symptoms are an inclination to sickness, speedily followed by copious feculent discharges; the surface is easily affected by cold, and the individual may even shiver. There is also thirst, and a feeling of internal heat over the epigastric region, the functions of the liver are manifestly disordered at an early period, as expressed by the dull, yellowish colour of the conjunctiva, and sallow darkness of the complexion, especially round the eyes. The tongue is generally moist, but viscid, clammy, and furred. The appetite is completely lost, in the first instance. The skin is dry, and the palms of the hands and soles of the feet become unpleasantly hot and burning. The bowels generally become distended with flatus; there is an uncomfortable sensation of distension, incapacity to expel the air, and occasional griping of the bowels, which are constantly producing a rumbling noise. The stools are at first large, feculent, and consistent, but subsequently they become watery, and even mixed with blood; then *tenesmus,* or a tendency to strain at stool, comes on and increases. Undigested articles of food are also passed, the characteristic symptom of *lientery* or *diarrhœa crapulosa* of the older authors. The belly is not painful when pressed, as in peritonitis, or acute inflammation of the bowel, but there is often a deep-seated sense of uneasiness. This state soon terminates, in general favourably. It is more especially brought on by exposure to great changes of temperature in humid and moist weather, by wet

feet, damp beds or clothing, and improper dieting at irregular times, certain articles of food, imperfectly fermented malt liquors, acid wines and sour unripe fruits, drastic purgatives, and various mineral poisons.

IV. **Inflammation or Enteritis.**—The phenomena of inflammation when they do occur, generally express themselves in the ileum.

Acute diffuse inflammation is marked by redness, thickening, and impaired cohesion. The redness is of a *deep venous red*, approaching to blackness; either partial or general in extent, and in dotted, arborescent, or striated patches. It is distinguished from mere passive congestion by the increased arterial vascularity of the sub-mucous tissue. The thickening is generally sensible, and often considerable. The impaired cohesion is not so obvious as in the stomach, but the mucous membrane may be removed much more easily than in health, from its attachment to the parts subjacent. In the chronic forms of diffuse inflammation, the colour, thickening, and the cohesion, are not greatly dissimilar; but in general the thickness is more considerable, the cohesion of parts, instead of being impaired, is often rendered more tenacious, while the dark venous hue, on subsiding, leaves a greyish or slate-coloured tint, from a deposit of melanic matter in the substance of the membrane.

Serous inflammation of the mucous membrane of the small intestines may be inferred to exist from the large quantities of serous fluid often discharged by stool, during life, at the same time that the abdomen is the seat of pain and tenderness. After death the fact may be proved by the loose diffluent fæcal matter often found in the small intestine; at the same time the mucous membrane is partially or generally inflamed.

The effusion of coagulable or fibrinous lymph in the small intestines is an extremely rare occurrence. "I have," says Dr. Baillie, "seen in violent inflammation scattered portions of coagulable lymph thrown out upon the surface of the villous membrane. This, however, is very uncommon" (p. 158). Billard has seen it but twice in the intestines of children. Dr. Handfield Jones also notices that the surface is sometimes the seat of an exudation much resembling that of croup; the attacks recurring several times, each presenting a stage of irritation, which ends in the formation and throwing off of a false membrane. This membrane sometimes forms a layer of some thickness, extending pretty uniformly over the surface, or appearing in the stools as tubular casts of the intestines, and sometimes it is as thin as a wafer, or consists merely of tattered shreds. In one case, mentioned by Dr. Copland, there were shreds of dysmenorrhœal false membrane discharged from the uterus, but not at the same time (*Pathological Anatomy*, by Jones and Sieveking, p. 526). The diphtheritic exudations described by Rokitansky

are of a similar nature. Pseudo-membranous inflammation of the bowels have also been described by Dr. W. Cumming of Edinburgh, and Dr. Simpson.

Ulceration is much more common, and is indeed by no means infrequent, especially from the action of the typhoid and the paludal poisons; and this ulceration may take place either at the free or adherent surface of the membrane. When it takes place at the free surface, the ulcer, says Andral, may form in the centre of a point of inflammation, the mucous membrane around being healthy, or it may form in the midst of an extended patch of diffuse inflammation without the follicular structure appearing to be in any degree affected. Again, the sub-mucous tissue may inflame and become the seat of a number of small abscesses, which may point like so may pustules of small-pox. The apices of these abscesses become thinned and softened, till at length the mucous membrane ruptures, and the pus they contain is poured into the cavity of the intestine. These constitute miliary vesicles entirely of morbid origin from the first, and are to be distinguished from the infarction and ulceration of solitary or lenticular glands. The form, edge, and base of these ulcers are not unlike those found in the stomach, except that the ulcer with a sharp perpendicular edge, as if made by a punch, is much more rarely seen.

Besides *inflammation* and ulceration of the membrane over its general surface, the solitary glandular structure may be either separately or conjointly with the former the seat of inflammation and of ulceration, subsequent collapse, atrophy, and obliteration.

The glands of the small intestines are thus liable to be enlarged and transparent, looking like a drop of pellucid water from serum having a small black point in the centre, which is the mouth of the duct leading to the distended follicle. When the patches of Peyer are ulcerated, the ulcer generally takes the oval form of the patch, and these ulcers sometimes burrow so deep as to rupture the intestine. As this form of disease, however, most principally occurs in typhus, dysentery, and cholera, as a result of the morbid process, the reader is referred to those articles for the more general phenomena which attend it.

Inflammation of the intestines, says Dr. Baillie, sometimes, although rarely, advances to mortification. When it does so, the mortified part assumes a dark livid colour, loses its tenacity, and is very readily torn.

Ulceration and mortification sometimes lead to the perforation or rupture of the intestine, when, the contents of the bowels escaping into the cavity of the abdomen, the patient dies of peritonitis.

The symptoms of *enteritis* partake more or less of those already

stated as belonging to *congestion*, combined with pain aggravated by pressure as a characteristic. The chief seat of pain is generally about the umbilicus or the right iliac fossa. The discharges from the bowels relieve for the moment the griping pains. The pulse is excited, and generally full and strong.

The absence of intense pain and tenderness, of vomiting, of constipation, of excessive vomiting and tympanitis, of the small and frequent pulse, all of which are characteristic of peritonitis, is sufficient to distinguish enteritis from that disease.

Treatment.—The treatment of enteritis, when not arising from a morbid poison, is by leeches to the abdomen, gentle purgative medicines combined with an opiate, fomentations, and purgative or opiated enemata. After the inflammation has subsided, mild tonics, as the compound tincture of gentian with nitro-muriatic acid may be substituted, with the prospect of recovering the lost tone of the parts.

When diarrhœa exists, if there is reason to believe that much congestion prevails connected with the hepatic region, a cathartic dose of calomel followed by castor oil may be necessary. If the stools indicate an acid re-action *magnesia* may be given with advantage. When membranous films or shreds of coagulable lymph are passed, electro-galvanic applications over the abdomen and dorsal spinal region combined with creasote or tar in the form of a pill, is quoted by Dr. Wood, on the authority of Drs. Cumming and Simpson of Edinburgh, as worthy of a trial.

Blood-letting having been considered necessary and performed, the next best remedies are those which determine towards the skin; and for this purpose combinations of Dover's with James's powder, or a solution of tartar emetic with laudanum, are the most useful medicines, and their beneficial action is very much aided by the use of the warm bath, and a flannel roller applied with firmness round the abdomen (Craigie).

The greatest care ought to be given to the management of the diet. It ought to be strictly antiphlogistic, consisting entirely of slops and light puddings.

Animal matter must be entirely withheld; and only permitted occasionally in the form of soup. The safest diets are those of arrow root, sago, tapioca, gruel of oatmeal, sowens,* barley water,

* "The husk and some adhering starch separated from oats in the manufacture of oatmeal are sold in Scotland 'under the inconsistent name of *seeds*.' These, if infused in hot water and allowed to become sourish in this state, yield on expression, a mucilaginous liquid, which, on being sufficiently concentrated, forms a firm jelly known by the name of '*sowens*.' Not less than a quart of the *seeds* are to be rubbed for a considerable time with two quarts of hot water, after which the mixture is to be allowed to rest for several days till it becomes sour. It is then strained through a

toast water, burnt oatcake water. This last substance, used as a drink, is said to allay irritation and morbid sensibility of the bowels (CRAIGIE). When the abdominal pains and stools subside and appetite increases, the diet must be, if possible, still more scrupulously attended to. Oatmeal porridge boiled to the utmost possible degree of pulpiness, and not too consistent, is one of the best of diets, which may be alternated with ground rice alone or combined with barley flour, all of which may be eaten with diluted milk from the cow, or with town milk undiluted.

DISEASES CONNECTED WITH THE LIVER AND ITS FUNCTIONS.

Definition.—*Under this heading, as with the previously considered diseases of the abdominal viscera connected with the process of digestion, it is proposed to consider some of the more definite morbid states expressed by functional disorders, lesions of texture, or both.*

Pathology and Morbid Anatomy.—The morbid states associated with hepatic disorder may be referred—(1.) to congestion of the *liver* in various forms; (2.) to *hepatitis* or inflammation of its substance, and the formation of (3.) *hepatic abscess;* (4.) *chronic enlargement* and *induration;* (5.) to *increased secretion* and *elimination of bile;* (6.) *jaundice.*

I. **Congestion of the Liver.**—This morbid state is expressed in various forms:—(1.) There may be *congestion from increased secretion of bile,* and in which the bile ducts especially are gorged with bile; or there may be (2.) *passive congestion* of the hepatic veins or of the portal veins; and (3.) *active congestion,* chiefly involving the arterial capillaries.

Morbid anatomy assigns to each of these forms of congestion peculiar and characteristic appearances.

The liver after death is found enlarged principally upwards, so as to encroach upon the capacity of the right side of the chest. The ducts are generally distended with bile, and this may arise from various causes, such as compression of the ducts from over-distended veins, as frequently brought about by intermittent and remittent fevers. It is also a condition associated with the early stages of *cirrhosis,* when the appearance of the liver is that known by the name of *nutmeg liver.* The distension of the veins seems to be of a passive kind, and to depend on recession of blood from the surface of the body. An ultimate result of hepatic biliary con-

hair sieve, and the strained fluid left to rest till a white sediment subsides. The supernatant fluid is to be poured off, and the sediment washed with cold water; after which it may be either boiled with fresh water, stirring the whole time it is boiling, or it may be dried and prepared when convenient in the same manner as arrow root. It may be eaten with wine, milk, or lemon juice ands ugar."—(Pereira *On Food,* page 326.)

gestion seems to lead to the filling of the hepatic cells with dark yellow matter, and when forms of passive vascular congestion are long associated together, ultimate atrophy and degeneration of the hepatic cells ensue.

The central part of a hepatic lobule is, in health, distinguished by a red spot, centrally situated, and measuring about half the diameter of the lobule. When this increases, it is characteristic of intralobular congestion, a morbid state in which the hepatic veins are especially engaged.

In interlobular congestion, where the *portal* veins are specially congested, the centres of the lobules are comparatively pale, while the lobules are surrounded by red vessels.

The condition known as the *nutmeg liver* is explained by the various forms and results of congestion, as well as by other morbid changes of texture. It is so named from the resemblance in combination and arrangement of colours in a section of the liver to that seen in the section of a *nutmeg*. In its most marked forms a deep red congestion forms patches and streaks which occupy the central parts of the lobules and are *partially* surrounded by patches of a greyish or dirty white colour, and which are devoid of blood. The light coloured parts may be caused either by fatty degeneration of the cells, which enlarging compress the capillaries and expel or prevent their being filled with blood, or it may be due to an increase from deposit and condensation of the glissonian capsule in the early stage of that morbid condition known as *cirrhosis*. It also is a morbid state in which the capillaries are emptied by compression and contraction of tissue.

By far the most frequent cause of hepatic congestion is organic disease of the heart; and especially obstruction to the circulation through the right side, such as results from the causes of *apnœa*. These congestions, so far as the liver is concerned, are of a passive kind; and their most marked and constant effect is to produce *ascites*, with or without *anasarca*.

The congestions of the liver are chiefly brought about by sudden chills, the cold stages of fevers, over-abundant feeding, intemperance in alcoholic or malted liquors, and excessive bodily exercise in the heat of the sun. The liver bulges, and may be accompanied by uneasiness on exploration, or of weight on getting into the erect posture. The countenance and complexion may be pale, sallow, or dusky livid; and the tongue will be found coated, the bowels constipated, the appetite defective, and there may be nausea, vomiting, and headache. The pulse is slow, compressed, and irregular, or it may be quick and feeble; and, generally speaking, the symptoms are obscure.

II. **Hepatitis.**—Diffuse inflammation of the liver is marked by

the liver being greatly gorged with blood, by its being of an unusually deep venous or livid colour, by an evident increase of its size and density, while the finger more readily perforates it. If we cut into it, the ducts present fewer yellow points than usual, and on opening them we find them congested and gorged with bile less viscid than in health. In this state the capsule of glisson, and also the duodenum, are red and injected; the mesenteric veins distended with blood, and the spleen evidently enlarged. If the inflammation be of a still higher intensity, the affected portion becomes marbled, and bile is no longer contained in the ducts, but in its stead a dark, turbid, bloody serum, while the surface of the liver is so broken down that the slightest pressure reduces it to a mere pulp like a softened spleen, and injections now neither penetrate the ducts, the arteries, nor the veins of the inflamed part. The internal membrane of the hepatic veins has been found inflamed, in recently-arrived Europeans in India who died of hepatitis, with puriform matter in the right ventricle of the heart (TWINING).

III. **Hepatic Abscess.**—The inflammation, however, may proceed, and pus be effused, at first in the centre of the darkest and most disorganized spots, forming a number of different points which enlarge, unite, and at length form one or more abscesses.

Inflammation of the substance of the liver for the most part produces inflammation of the serous membrane which covers it, by which means adhesions take place between the liver and the surrounding parts, and in this direction the abscess usually bursts. Andral has seen this accident take place into the pericardium. Not unfrequently it takes place into the stomach, duodenum, arch of the colon, or other parts of the intestinal canal. It has been known to take place into the vena cava, the infundibulum of the kidney, and in one remarkable case adhesion took place to the diaphragm at a point where the lungs also were adherent, and the ulcer penetrated them, and the matter of the abscess of the liver was coughed up and evacuated by the mouth. This is the most frequent mode of spontaneous recovery noted by Mr. Waring. In other cases no adhesion takes place, and the abscess bursts into the cavity of the abdomen, and the patient dies of peritonitis. It is seldom that the abscess points in more than one direction; but there have been instances in which it has burst not only in one, but in two and even three or more points.

Symptoms.—The symptoms of acute hepatitis, it might be supposed, were principally pain and tumefaction of the liver; but the liver is an organ of dull sensibilities, and its most acute and destructive inflammations often take place without any pain being present, certainly not severe pain, unless the peritoneal coat is affected. Practically the expression of symptoms denote either—(1.)

a superficial and adhesive inflammation of the organ; or (2.) a deep-seated suppurative inflammation of the substance of the liver.

The most prominent symptoms of hepatitis are, however, some tumefaction, pain, or uneasiness of the liver, or of the adjoining parts, as the thorax, abdomen, or right shoulder; an affection of the bowels, as diarrhœa or dysentery; and lastly, pyrexia in a continued, remittent or intermittent form.

When pain is present, it is found to be in most instances aggravated by lying on the right side, apparently from the greater weight now pressing on the liver; while, in a smaller number of instances, the pain is felt most acutely on turning on the left side, probably from adhesions having formed to the ribs. In general, however, the easiest position is on the back, or a little over to the left side, and towards the termination of the disease the patient is sometimes observed lying in a position which he had previously declared himself unable to assume. As the disease advances the pulse becomes frequent and hard, the skin hot, dry, and constricted, pain, cough, and dyspnœa increase and indicate advancing disease (MARTIN). Such a train of symptoms indicates superficial inflammation.

In a few instances acute hepatitis exists without any pyrexia. Some fever, however, is commonly present, and in general it often commences with shivering, vomiting, and purging—symptoms which gradually diminish in a day or two, leaving the patient comparatively free from fever, and the pulse nearly natural. These paroxysms, however, occur at intervals of various duration, sometimes returning as regularly as those of intermittent or of remittent fever; while, in other cases, the periods are less marked, the chief symptoms being rigors occurring at irregular intervals, frequent pulse and sweats, the latter chiefly occurring in the night, and so copious as in some instances to pour off the body of the patient.

The state of the tongue is usually furred and loaded, but in the course of a long disease it becomes clean, or is only slightly foul, till death. In some few instances, however, it becomes brown and dry. This set of symptoms are insidious in approach, and the destruction of the substance of the liver proceeds silently and rapidly.

The animal functions, as in phthisis, are often marked by the "cheerful hope" which illumines every hour the patient has to live, but in others the depression amounts to despondency, with restlessness and want of sleep. At last, however, delirium obliterates the past, and throws a veil over the future, and the patient dies, either with or without jaundice.

In the midst of the symptoms that have been mentioned, perhaps the abscess points. The patient then becomes hectic, his pulse rapid, and he is covered with a copious and clammy sweat. His life now in a great measure depends on the part where the abscess

points; if it bursts, for instance, into the peritoneal cavity, the patient assuredly dies of peritonitis; while, if it bursts into the stomach or intestinal canal, or externally, he often recovers. It is often necessary, when the abscess points externally, from the urgency of the symptoms, to open it. The operation often affords great temporary relief. Mr. Marshall found, however, in Ceylon that in the majority of cases he examined the operation would have been fatal, no sufficient adhesions having taken place to fix the liver to the abdominal walls, and thus prevent the escape of pus into the peritoneal cavity. When dysentery co-exists the opening of the abscess is generally fatal (WARING). The predisposition to abscess, according to the experience of Dr. Parkes and of Mr. Waring, is much stronger during the first year's residence in India than afterwards, about half as strong in the second and third years as during the first.

Prognosis.—Acute hepatitis, occurring in a healthy person, generally terminates favourably in this country. If, however, it occurs in an unhealthy person, or as a sequel of dysentery, it is almost uniformly fatal. In the East Indies the mortality among the European troops is $34\frac{1}{10}$ of those attacked, while of the natives seized only one-tenth die.

Treatment.—The two great experiments which have hitherto been made in the treatment of hepatitis are bleeding and the use of mercury; and it may be affirmed as a general result, that those means combined are more beneficial and are oftener followed by the recovery of the patient than either of them employed separately. In the young and sthenic European, in the East Indies, it is in general necessary to take fifteen to twenty ounces of blood, or till the skin becomes soft and relaxed or the pain abates, and then to introduce mercury so as to affect the mouth, and as soon as that is accomplished the symptoms rapidly subside. One practical rule, however, seems to be established with respect to the use of mercury in the treatment of hepatitis, which is, that after suppuration *has* taken place, mercury is not only inefficient but injurious. In Europeans, whose constitutions have been debilitated from a long residence in the East, bleeding is scarcely applicable, and mercury, from the more or less diseased state of the liver, ceases to produce its original good effects. When congestion is known to exist, leeches may be applied with benefit, combined with the internal administration of calomel, purgative extracts, and antimonials.

If suppuration should take place, the preceding treatment should be at once abandoned, and, if practicable, the abscess should be opened, for the chance of the pus being absorbed is very doubtful. As long a time, however, should be allowed to elapse as the patient's state will admit of in order that adhesion may take place. Still,

on the slightest indication of the patient's sinking, a trocar should be introduced, for at such a crisis everything must be hazarded. The abscess having burst, either externally or internally, the patient must now be supported with a moderate quantity of wine, by a nutritious diet, and by mild tonics. The time which elapses after opening an abscess till the patient's recovery is from one to two months. When convalescence is established, the functions of the liver remain torpid and its substance often indurated; and subsequently also the spleen may be enlarged. In such a state, Mr. Martin recommends the use of *nitro-muriatic acid* baths. They promote the depurative functions of the liver, kidneys, bowels, and skin.

"The form and manner of preparing and using the acid bath are as follows:—Take of hydrochloric acid, three parts; nitric acid, two parts; mix the two acids carefully and slowly so as to avoid evolution of heat; and having waited for twenty minutes, add of distilled water five parts, and mix the whole carefully.

"*For a general bath in which to immerse the whole body.*—1. Pour into the bath about five pailfuls of cold water; add two quart bottles, containing sixty-four fluid ounces of the dilute nitro-muriatic acid, prepared as above, and then sufficient boiling water to raise the temperature to 96° or 98°. The body is to be quickly and thoroughly dried with warm towels; and afterwards the patient must retire to a well-aired and warm bed. The use of the bath is only to be discontinued when tenderness of the gums or general malaise occur; and cuticular irritation from the acid is to be avoided, by diminishing its strength. Iron and other forms of tonic remedies may also be administered at the same time as well as opiates."—(*Martin on Climate*, p. 564, et seq.)

IV. **Increased Secretion and Elimination of Bile.**—This condition is brought about by some increased excitement of the liver: as by certain kinds of food or drink, but, more especially, as is now well known, it is brought about in Europeans by exposure to unusually high ranges of temperature. In summer and autumn it is a morbid state not uncommon in our own country; but to the European on first landing in India it most commonly occurs, and in either case it occasions what is termed a "bilious diarrhœa." Great increase of temperature, combined also perhaps with change of climate and mode of life, is now acknowledged to have a direct influence on the functions of the liver, expressed, in the first instance, by an unmistakable increase in its secretion. As a complication of other diseases, hepatic disorders are of most frequent occurrence, and for various reasons no true estimate has yet been made relative to the frequency of hepatic disease either in this or in other countries. Like most other exciting agents, however, the prolonged exposure to the influence of increased temperature under conditions such as are experienced by the European in India,

ceases to have a stimulant effect, and a depression in the powers of the organ results, corresponding to the previous excitement. In India the duration of the exaltation of hepatic function is not found to be of long duration, but is confined to the earlier years of residence, declining from that time. This increase of secretion and its elimination, so long as it lasts, is justly regarded as a salutary effort which nature provides to maintain the health. It is the decline of the powers of secretion, the arrest of the function, the more or less sudden suppression of the secretion which is attended with danger. It always precedes the expressions of the inflammatory tendency, and is associated with congestions of an active kind, in which the arterial system becomes prominently excited. This is consistent with what occurs in every other secreting organ. Previous to the expressions of the inflammatory process becoming developed in them, the secretion, at first flowing freely under excitement (not necessarily morbid), so soon as the inflammatory tendency becomes expressed, is at the same time dried up. This is well seen in the phenomena of a common cold, when the exciting cause at first merely stimulates the nasal passages, as marked for instance by by an increased flow of mucus from the nose, but so soon as the inflammatory state becomes fully expressed, the secretion is dried up and when re-established is unmistakably altered in its properties. So it is with the liver when the increased flow of bile is suspended, from exposure to cold or some other exciting cause, a warning is given that the inflammatory tendency is about to be expressed by congestive and exudative processes in the texture of the organ.

In persons who die soon after arriving in India, Mr. Twining remarks, that the gall bladder is commonly distended with bile.

V. **Jaundice, Icterus,** or the **Yellows,** is the absorption of bile and its circulation with the blood, whence many of the different tissues and fluids of the body become dyed yellow, but more especially the conjunctiva and the cutaneous tissue, for which the bile appears to have a great affinity.

Pathology.—Jaundice, though often a result of every organic disease of the liver or duodenum, yet often occurs when those organs are perfectly healthy or simply congested. On posthumous examination, besides the yellowness of the cutis, the serum of the blood is generally found loaded with bile and perfectly yellow. If the disease is at all chronic the fat is also yellow, as well as the bones and cartilages; the serous fluids, and even the milk expressed from the breast of the female.

The theories that have been advanced to account for jaundice are, that the bile exists formed in the blood, and is merely removed by the liver, and that, consequently, jaundice is a consequence of the non-separation of the bile. A more common opinion is, that bile is

a secretion and not a mere separation, and consequently that in jaundice the bile is first secreted and then absorbed both by the veins and lymphatics, while Portal has proved that it may be absorbed also by the lacteals.

Symptoms.—Jaundice, from the different intensities of the colour of the skin, has been divided into the *yellow*, the *green*, and the *black* jaundice.

Jaundice, arising from functional disease, may be sudden in its attack, or it may be preceded for a few days by great depression of spirits, lassitude, and somnolescence. It may also be preceded or accompanied by some slight pain in the region of the liver, but more commonly pain is not present.

The first symptom of jaundice is a yellowness of the white of the eyes, then of the roots of the nails. The yellowness next appears over the face and neck, and ultimately over the trunk and upper and lower extremities. As soon as the eyes are affected the urine becomes of a deep red colour, and stains linen steeped in it yellow, and if nitric acid be added it is changed to a deep green. The bile, however, is not always in the same state of combination in the urine, nor of the same quality; for, in some instances, where the colour of the patient is most marked, and the urine of its deepest hue, the addition of nitric acid effects no change. At the same time that the urine is thus discoloured, the stools, often abundant in quantity, are copious and white. The pulse is slow, and the patient complains of a bitter taste in the mouth, has much thirst, an absolute inaptitude for all exertion, and suffers from a lowness of spirits, amounting to hypochondriasis. In general the bowels are irritable and easily acted upon; but, in a few cases they are constipated. If the patient recovers, the first symptom is the appearance of bile in the stools, after which the yellowness fades away in the inverse order of the attack.

The duration of this affection is very various. In some cases it terminates in about ten days, but more generally it lasts from three to six weeks, and, if badly treated, oftentimes as many months.

Diagnosis.—This disease is to be distinguished from chlorosis and that sallow state which results from profuse uterine hæmorrhage. In these complaints the white of the eye is clear, the urine limpid, and the stools healthy, so that the great characteristics of jaundice are wanting.

Prognosis.—In those cases of jaundice in which no mechanical obstruction or organic disease exists, the proportion of recoveries to deaths is large. Indeed the restoration of the patient is almost certain. On the contrary, when it results from organic lesion, the death of the patient is much more usual than his recovery.

Treatment.—As a general principle, the larger number of cases of jaundice from functional disorder, perhaps four out of five, will get

well in time spontaneously, but may be aided by very trifling remedies, such as a drachm of the carbonate of soda, three times a-day, or by taking half a drachm to a drachm of the sulphate of magnesia equally often.

It was formerly the practice to treat almost every case of jaundice by mercury; and, forty years ago, hardly a case was admitted into an hospital that had not been previously salivated. It is observed also that when mercury fails, its effects are in many cases decidedly injurious; the jaundice becoming persistent and of a deeper hue. Jaundice from ague, it is said, readily yields to mercury, but resists a treatment by neutral salts.

As the cases which require mercury are few in number, it is desirable, in every instance, to treat every patient for ten days or a fortnight with neutral salts, as offering the greater chances of recovery. At the end of a fortnight, if no improvement be visible, it is then desirable to administer greater or less doses of mercury. In general five grains of blue pill once or twice a-day are sufficient, combined with some slight opiate.

In many cases the modes of treatment which have been mentioned are rendered much more beneficial if combined with some light vegetable or mineral tonic, as gentian, or the tincture of the muriate of iron. The mineral waters of Cheltenham and Leamington, in which a neutral salt is naturally combined with iron, are also known to be excellent remedies in most cases of jaundice.

Order 5. Nephritici.

Inflammation of the Kidney—*Nephritis.*

Definition.—*Nephritis, an inflammation of the substance of the kidneys.*

Pathology.—The substance of the kidney is liable to the diffuse, the suppurative, and the ulcerative processes of inflammation.

The previous healthy kidney, when diffusely inflamed, is loaded with dark venous blood, is softer than natural, and is considerably enlarged. Externally its surface is dotted with a number of dark red points, often surrounded with a vascular network, while internally the cortical substance is more loaded than the medullary, and is also dotted with dark points, which Rayer supposes to be the Malpighian bodies injected. The mucous membrane of the pelvis of the kidney is also red and injected.

The diffuse inflammation may terminate by resolution, when it leaves the kidney probably harder than usual. Subsequent contraction occurring may bring about that small contracted kidney, tuberculated on its surface, with diminished cortical substance so

often seen in old drunkards. But it may proceed, and suppuration take place, which, according to Rayer, is most frequent in the cortical substance. The pus effused may form one or more abscesses, which vary in size from a pin's head to a large cyst, formed by the entire destruction of the kidney. Rayer has given some drawings which he conceives to represent purulent infiltration of the substance of the kidney.

Besides the substance of the kidney being inflamed, the mucous membrane lining the pelvis and tubuli is also often the seat of the diffuse, the adhesive, the suppurative, and the ulcerative inflammations, and these inflammations have received the name of *pyelitis*.

Diffuse inflammation of the mucous membrane of the kidneys is marked by the deep venous red colour of the tissues, more or less general, and this redness is sometimes increased by small patches of ecchymosis. This inflammation may terminate by resolution, or it may proceed; and Rayer has given two plates in which lymph is shown to have been thrown out on the free surface. In other cases pus is secreted, and in acute pyelitis, says the same authority, we can sometimes determine the presence of pus, either by the eye or by the assistance of the microscope, in the urine contained within the pelvis. Ulceration is a possible condition of pyelitis, but is seldom met with in the acute forms of this affection.

In the chronic forms of diffuse inflammation of the mucous membrane of the pelvis, the appearances are for the most part similar to those of the acute forms, but the mucous membrane both of the pelvis and calices is more sensibly thickened, so that those canals are sometimes transformed into fibrous cords. If pus be effused and retained, the calices and pelvis often become enormously dilated, while the substance of the kidney is atrophied. Rayer has given instances of chronic abscesses of the kidney so large, that they have communicated with the liver, or have ruptured into the duodenum, or have adhered to the diaphragm, and burst into the bronchi. He has also seen them extending downwards to the cæcum, or even to the crural arch; likewise opening in the back, and discharging urine and pus through a lumbar fistula. These latter furnish instances of ulceration of the substance of the kidneys.

On examining persons who have died of pyelitis, or extensive abscess of the kidney, we often find sand, gravel, or a calculus, which has laid the foundation of the disease, contained either in the pelvis or calices. When calculi form, they are sometimes small, sometimes of great size, or composed of many small ones agglomerated together. Their form is extremely irregular, generally taking that of the dilated pelvis and calices in which they are retained, and from this cause are often knobbled, or branch out like a piece of ginger.

Symptoms.— Acute nephritis is an extremely rare disease, so

that there is much doubt whether we are thoroughly aware of its symptoms. Those mentioned by Dr. Bailey are as follows:—"When the kidneys," he says, "are inflamed, more or less pain is felt in the region of these glands, and the pain commonly shoots along the ureters. There is a sense of numbness down the thigh, and in the male there is often retraction of the testicle, or a feeling of pain in it. When one kidney is affected these symptoms are only felt on that side. The urine is voided frequently, and is sometimes of a pale, but more commonly of a deep red colour. The stomach is affected with sickness and vomiting. The bowels are at the same time often costive, and subject to colicky pains. These symptoms are accompanied by more or less fever." "When pus is formed the event may be known by the pus being mixed with the urine." Cases related by Mr. Stanley, however, by no means bear out this description. He gives the case of a man who had retention of urine in consequence of a gonorrhœal discharge being stopped by injections. In this instance the kidneys were found extremely vascular and soft, with numerous minute depositions of pus throughout the cortical and tubular parts, and the infundibula and the pelvis were likewise filled with pus. The principal symptom was severe pain at the fifth lumbar vertebra. In another similar case, but not quite so acute, the kidneys were found so dark coloured as to be almost black, and at the same time remarkably flaccid. This patient died paraplegic, the loss of motion being complete, and that of sensation nearly so.

If nephritis passes to a chronic suppurative state, the pain in the loins is often severe, the appetite impaired, while pus is found, often to a considerable amount, in the urine; and if a calculus or gravel be the immediate cause, the urine often contains large portions of those substances mixed with blood.

Prognosis.—Acute affections of the kidney are in all cases of grave prognosis. The chronic forms of these affections are perhaps consistent with life, but in every case they greatly impair it, and are ultimately the cause of premature death.

Treatment.—The treatment of acute nephritis must be according to the ordinary principles of the treatment of inflammation, by bleeding, evacuants, and opiates. Blisters, however, in these cases are dangerous, and ought to be avoided. The neutral salts, with opiates, are perhaps admissible; but most writers recommend castor oil, or other purgative substances which do not act so immediately on the kidneys. In chronic suppuration of the kidney bleeding must be omitted.

Bright's Disease.

Definition.—*A complex morbid state, characterized during life especially, but not constantly, by anasarca; an albuminous condition of*

he urine; and by certain changes in the kidney, observable after leath, and to some extent capable of being diagnosed during life, as ither—(1.) *a granular condition of the kidney, with enlargement of the ortical substance and largeness of the whole organ, which is generally ale or white on section; or* (2.) *as a granular condition in a small con-racted kidney.*

Pathology.—The most frequent as well as the most remarkable of he diseases of the kidney is that known by the name of *Bright's dis-ase*—a term which does not apply to a single disease, but to a *class* of diseases. These diseases have many varieties; and while they have been considered by some authors as so many distinct varieties, others esteem them as only so many different stages of the same disease. Dr. Bright, the distinguished physician of Guy's Hospital, who first described the disease, divided the morbid state into three stages, Martin Solon into five, and Rayer into no fewer than six; and the more recent investigators, such as Frerichs, Reinhardt, and Chambers, recognize three stages. Those who contend for the differ-ence of stages affirm that, in the first stage the kidneys are unusually large, flabby, loaded with dark venous blood, and hardly in any respect different from what is observed in diffuse inflammation, except, that externally the kidney has a granular appearance, caused by the deposition of a dark, reddish-yellow matter, which is an effusion of inflammatory products.

The second supposed stage is marked by the granular matter penetrating still deeper into the cortical substance, and which gra-dually increases till it invades the whole of the medullary substance of the kidney. This granular substance is of a greyish-red, or greyish-yellow colour, and has in many cases something of a *cheese*-like appearance. The kidney is now sometimes larger than natural, sometimes of the natural size, and sometimes, though rarely, dimin-ished. Its consistency also varies, for if enlarged it is commonly softer than the healthy kidney, but if diminished it is for the most part firmer. Its colour, viewed externally, is sometimes a pale tint of the natural hue, but more commonly it is of a greyish-yellow or yellowish-red colour, and mottled. Its surface is also strongly granulated, and even rough. In this state, if the kidney be now injected, the matter of the injection does not, according to Dr. Bright, penetrate the cortical portion. This is the stage in which it is considered that a complete and general metamorphosis of the inflammatory products into fat takes place.

The last stage is marked by the morbid granular deposit, which be-sides invading the medullary substance, attacks the tubular portions of the kidney, so that the tubuli are often to a very considerable extent obliterated, and, perhaps, with the exception of a single pencil of that structure, is entirely converted into one homogeneous

degeneration. The kidneys are now, in some instances, of their natural size, but more generally they have contracted, and are smaller than usual; their surface is also now lobulated, pale, and granular, resembling the roe of a salmon, or the vitellarium of a bird. Their consistency also is sometimes softer and sometimes harder than natural; and Dr. Bright speaks of some instances in which they cut like cartilage. This is the stage which leads to final atrophy and wasting of the kidney.

In opposition to these views, which hold that *Bright's disease* is always one morbid state passing through successive stages, the observations of Dr. George Johnson, and of Dr. Wilks of Guy's Hospital, lead to the belief that there are two at least, if not more, great classes of disease of the kidney developed independently of each other, associated with the phenomena of Bright's disease.

It is found that during acute or inflammatory forms of Bright's disease, there are various forms of exudation which may take place into the tubes of the kidneys; and that changes in the secreting cells of the kidneys are the first in the order of phenomena to occur; and that subsequently the circulation may be impeded in consequence of morbid changes primarily affecting the secreting cells and retarding their functions. A nephritis occurs, in which the early alterations express themselves by changes in the secreting cells, and especially in a diminution of their cohesion to the tube, so that desquamation occurs, more or less rapidly. A rapid formation and shedding of new cells occurs, until, in many instances, normal epithelium may be replaced by cells not distinguishable from pus. This constitutes the *acute desquamative nephritis* of Dr. Johnson.

The other form of disease consists in a kind of fatty degeneration of the kidney, in which oil globules are substituted for elements of tissue. The large granular fat kidney is that which Dr. Bright has represented in the third figure of his third plate; and is in a large proportion of cases a secondary condition, preceded by an inflammatory state of the organ (Johnson).

Symptoms.—Those which indicate the existence of this fatty form, are either—

(1.) An acute attack of general dropsy, with scanty, high coloured, albuminous and bloody urine, and an abundant desquamation of epithelium; followed after a period of three or four weeks, by an appearance of oil in some of the cells. As the disease progresses, the subsequent total amount of epithelium in the urine diminishes, and the proportion of cells which contain oil is increased, until at length nearly all the cells are more or less distended with oil, many of the cells, as well as scattered oil globules, being entangled in small transparent wax-like casts; or (2.) The disease may be chronic from its commencement, the urine highly albuminous, but fre-

quently of the natural colour, and either free from sediment, or depositing merely a light cloud, containing some of the small transparent waxy casts already mentioned. After a period varying from a few weeks to many months, these casts entangle oil partly in the form of scattered globules, and partly contained in cells. The oily casts and cells continue in the urine till the fatal issue. After death, both these forms of disease are expressed by similar appearances in the kidney, namely, enlargement, with a pale cortical substance, and characteristic yellow granulations scattered through it.

Two kinds of casts are distinguishable in the urine passed during Bright's disease—(1.) Larger casts, having a sharp, well defined outline; and averaging in diameter that of the uriniferous tubes from which the epithelial lining has been already shed. (2.) Smaller homogeneous wax-like casts, with a less definite outline than the larger, the diameter of such casts corresponding with that of the free canal in the centre of the uriniferous tube, showing that the tubes still possess their complete lining of epithelium.

Dropsy is one of the most prominent and distressing symptoms of Bright's disease; preceded or not by fever or pain in the lumbar region. The experience of Drs. Johnson and Wilks shows that pain in the loins is the exception. The urine is often greatly diminished, and sometimes suppressed for a time. Often it is so abundant in albumen, that by coagulation it may be converted almost into a jelly; and the deposit on subsiding, rarely occupies less than one-third of the bulk of the fluid.

Dropsy more frequently occurs in connection with the large white kidney, than with the small contracted kidney; and the state of the urine is almost invariably less copious than in health, and contains a large amount of albumen; whereas in cases of the small contracted kidney, the quantity of urine, as a rule, is considerably above the normal standard, while its albuminous contents are much less than in the other class of cases. The quantity of albumen thus drained off from the blood is different in the two forms of the disease, not only as to the quantity of urine, but as to the total quantity discharged in twenty-four hours. Practically, it is also observed that the risk of dropsy is in reverse proportion to the quantity of urine secreted, and in direct proportion to the impoverishment of the blood, occasioned by its loss of albumen.

A sudden diminution of the quantity of urine is a frequent precursor of dropsy, and of a speedy fatal termination to the disease.

A point of distinction between the large and contracted kidneys also exists in the *density* of the urine. The urine secreted by the large white kidney has a density rarely below 1·015, and it ranges from that point to 1·025, or even as high as 1·030. In cases of the small contracted kidney, the density is more frequently below

than above 1·015, varying from this point to 1·010, or even as low as 1·005.

The commencement of the disease is generally very obscure, and the first circumstance which leads to application for medical relief, is usually the occurrence of œdematous swelling, commencing about the face, and rapidly extending over the body. The persistence of the disease tends rapidly to the destruction of the colouring matter of the blood, and induces a highly anæmic state; so that the appearance of a patient suffering from Bright's disease is highly characteristic—the surface becomes of a waxy, yellowish-white cadaveric hue. The disease is apt to be associated during its course with various other affections, and none are more frequent than inflammation of the serous membranes, bronchitis, pneumonia, diseases of the heart, liver, and brain. Dyspeptic symptoms, such as vomiting, are also frequent and troublesome.

Diagnosis.—In the diagnosis of Bright's disease, it is of the first importance, says Dr. Johnson, to ascertain, in any case of recent acute albuminuria—whether the urine is clear and free from sediment; or whether it deposits morbid materials, and what is the nature of these materials; whether there are any forms of tube casts, and what may be their appearance; whether they are composed of blood or of pure fibrine; whether they entangle renal gland cells and contain oil; or whether they are free from that material and resemble pus. To detect the presence of albumen in urine, two tests are necessary and sufficient, namely, the application of *heat* and *nitric acid*. Heat causes albumen to pass from the fluid to the solid state at a temperature of about 160° Fahr., but when diluted it seems to require a higher temperature, so that urine containing albumen requires to be brought to the boiling point. The heat may also cause a precipitate of earthy phosphates. Nitric acid also precipitates albumen in a flaky form, and dissolves earthy phosphates, or it may cause a precipitate of nitrate of ammonia which the heat dispels.

Prognosis.—Generally favourable in the acute stage; less favourable if fatty degeneration is established; and when advanced, or of insidious progress, it is incurable. The test of perfect recovery is a steady and persistent improvement of the urine; and the danger seems to be in proportion to the reduction of the daily discharge of solids.

Treatment.—The nature of Bright's disease being still undetermined, the line of treatment can be but vaguely indicated. If symptoms of an acute febrile inflammatory character have ushered in the more ominous symptoms, the abstraction of blood may be beneficial, so long only as pain and fever exist. As to the dropsy, it is considered unwise to attempt its removal by diuretics, seeing that the functions of the kidneys are themselves impaired. The

bowels or the skin must be the outlets through which the areolar tissue is to be unloaded. Those measures, such as the warm and hot air baths, combined with remedies which act especially on the skin without stimulating the kidneys, are to be adopted. If diarrhœa does not exist, purgatives may be combined with diaphoretics. Diuretics are not to be adopted for the relief of the dropsy, except as a last resource, and those which stimulate the kidneys the least are to be preferred, such as the *bitartrate of potass*, or *digitalis*, or both combined. Dr. Johnson suggests, that in cases of chronic nephritis abundance of *pure water* should be indulged in as a drink, with the prospect of its washing out the obstructed tubules, by the copious elimination of water, which is still readily transmitted through the diseased gland.

The benefits of mercury are very doubtful. Its physiological effects on the system tend to favour some of the morbid conditions induced by the disease, such as destruction of the red part of the blood; while, on the other hand, it undoubtedly may promote interstitial absorption of morbid products. When medicinal agents fail to relieve the dropsy, the large unwieldy limbs may be relieved by perforating the integuments here and there with a fine needle (acupuncture); or if the peritoneal cavity be distended, it may be relieved by a trocar. But these remedies have peculiar and serious dangers which attend their use.

Protection from cold and from vicissitude of weather, must be sedulously adopted in this disease; and the diet should be nutritious, without being unduly stimulant.

Diabetes Mellitus—*Melituria.*

Definition.—*A complex form of disease characterized especially by an excessive discharge of urine more or less constantly saccharine.*

Pathology.—From the time of Charles II. of England, when Dr. Thomas Willis first observed the saccharine character of diabetic urine, no disease has had its nature more inquisitively examined, and with more interesting and instructive results. The abnormal state of the urine naturally at first led the inquiry towards the kidneys. They have been industriously examined both as to their structural and functional relations, but without elucidating the nature of the change in the urine. Dr. Matthew Dobson, of Liverpool, in 1779, first established by experiment the fact, that the sweetness was due to the presence of sugar. The next step in the inquiry was the detection of sugar in the blood of the diabetic patient. Ambrosiani, of Milan, in 1835, and Dr. Charles Maitland, in 1836, obtained crystals of pure sugar from the serum of the blood, and a large portion of fermentable crystallizable syrup. The late Dr. Robert

Macgregor, of Glasgow, in 1837, confirmed these observations by experiments, followed by those of Dr. G. O. Rees, of London, and Dr. Christison, of Edinburgh. Thus inquiry regarding the essential character of the disease was removed from the urine and the kidney to the blood; and research took a new direction, so as to ascertain if possible the source of the sugar in the blood and in the urine.

Although this disease has hitherto found a nosological place under diseases of the kidneys, the researches of Bernard and others very clearly show that here it is misplaced. If the disease is to be regarded as a local one, it should rather come under *hepatic* than *nephritic diseases.* But, further research may show that diabetes mellitus belongs to the *constitutional* class of diseases.

The unusual discharge of urine in this malady was originally ascribed by Mead to a morbid state of the liver and bile; but subsequently, nutritive and assimilative functions connected with the digestive canal were considered by Cullen, Home, and Dobson, to give rise to the morbid state. That the process of digestion and assimilation in the stomach was the source of the evil, has been the prevailing theory hitherto regarding the nature of this disease. The belief received confirmation especially by the ingenious experiments of the late Dr. Robert Macgregor, of Glasgow, who ascertained that sugar was formed in the stomach of diabetic patients during the process of chymification, even when no saccharine matter had been swallowed. Sugar has now also been detected in the saliva, the sweat, and in the stools. To the ingenious M. Claude Bernard, of Paris, the science of medicine is indebted for the elucidation of the nature of the normal generation of sugar in the animal economy (glycogenesis); and thus we have been provided with data for the comparison and study of its morbid generation in melituria. He has shown us that one of the natural functions of the liver is to generate sugar; and thus the sagacious speculations of Mead, which referred the phenomena of diabetes to a morbid state of the liver and bile, are now curious and interesting. While our knowledge regarding the formation of sugar by the liver, its physiological relations to the animal economy in health and in disease, have been especially illustrated by Bernard in France, it is to be observed that Dr. George Harley, of University College, and Dr. Pavy, of Guy's, London, have also confirmed many points, and especially elucidated the interesting doctrines of Bernard. Much is still unsettled, as to the significance of phenomena, and the following is a summary of the present position of the inquiry regarding glycogenesis, condensed from an interesting review of the subject in *The Medico-Chirurgical Review* for January, 1857:—

From the experiments just referred to, the fact was considered as an established and general one, that the nature of the food, and

more especially its amylaceous and saccharine elements, had the power of forming sugar, which then passed into the blood and urine from the alimentary canal. The experiments of Bernard and others, however, have now demonstrated that the animal organism has the power of forming sugar altogether irrespective of the nature of the food; and that sugar exists in a certain part of the circulation, namely, from the hepatic veins to the pulmonary capillaries, both in carnivorous and herbivorous animals. The liver is found to be this sugar-producing organ; and it is the only organ of the body which, in the normal state, is found to be impregnated with sugar—a fact established by Bernard, by observations on a large number of animals in almost every department of the zoological series. In man, he examined especially the liver of five executed criminals, of a man who was killed by a gun-shot wound, and of a diabetic patient, who died suddenly from pulmonary apoplexy. In four of these he determined the absolute and relative amount of sugar in the liver. The total weight of the three healthy livers was 4,205 grammes, which yielded of sugar a total of 66·074 grammes; so that the average weight of each liver being 1,401·2 grammes, the weight of sugar yielded was 22·037 grammes, to compare with the liver of the diabetic case, which weighed 2,500 grammes, and yielded 57·50 grammes of sugar. He shows that the relative quantity of sugar varies little when the system is in a normal condition, very seldom exceeding 4 per cent. He especially demonstrated that sugar was secreted in the liver and entered the blood from that organ; for by a comparative analysis of the blood of the portal vein as it enters, and the blood of the hepatic veins as they emerge from the liver, he found sugar in the latter, but not in the former. Sugar is also not only found in the liver of adult animals, but it has also been found in the livers of the human fœtus, the fœtal calf, and the unhatched chick, thus proving that it does not merely accumulate there as a product from the digestive canal.

Further, it has been determined that the sugar is undergoing perpetual destruction and renovation. It can be observed to disappear, and its further formation may be prevented under the following conditions:—(1.) By causing an animal to die slowly, by starvation, or by dividing the pneumogastric nerve; (2.) When the function of the liver is disturbed by severe, and especially by acute diseases.

The following is the course described by Bernard as that taken by the sugar, secreted in health by the hepatic cells:—

"It passes with the blood of the capillaries into the hepatic veins, and from thence into the vena cava ascendens. It is at the point of discharge of the last-named vessel that the blood is the most strongly saccharine; it then becomes mixed with the blood from the lower parts of the body,

and passes up to the right auricle, where the sugar undergoes a new dilution from its admixture with the blood of the vena cava descendens. From the right auricle it passes into the right ventricle, and thence to the lung. In the whole of the route from the liver to the lung, the blood is constantly saccharine, but the amount of sugar varies extremely, and is least at the greatest distance from the liver. In the lung, the sugar, being brought into contact with the air and mixing with the whole mass of the blood, sometimes completely disappears.

"These two organs, then—the liver and the lung—stand in an inverse relation to one another, in so far as the saccharine matter is concerned. In a fasting animal, for example, the blood which arrives at the liver contains no trace of sugar, while that which leaves it is distinctly saccharine. Inversely, the blood which arrives at the lung contains sugar, while that which leaves it contains no traces of this constituent. The sugar, in this physiological state, remains hidden between the liver and the lung, and this is the reason why its existence and formation within the animal body were not earlier discovered. The analysis of blood drawn from superficial veins would fail to detect it under these conditions."—(*Medico-Chirurgical Review*, p. 32, January, 1857.)

But under some conditions even in health, and therefore called "physiological conditions," sugar may be found in the blood beyond the lungs. The activity of the glycogenic function being increased with an augmented flow of blood to the liver, such as what takes place after a meal, it is found that *four* or *five* hours after the commencement of intestinal digestion, the production of sugar in the liver attains its maximum. For three or four hours at this time, the production of sugar exceeds its destruction, so that "at this period of digestion we find sugar in all the vessels of the body, both arteries and veins; and we find it in the renal arteries, but in too small quantity to pass into the urine. This active and increased flow of blood through the liver thus displaces the sugar previously found there, and projects it into the circulation, and at the same time acts as a stimulus to the liver, which is still further excited by the nervous system under the influence of digestion. This increase of sugar is thus altogether independent of the nature of the food."

The cases of so-called "intermittent diabetes" are explicable by this interesting observation, in which the urine of digestion is saccharine, while no sugar can be detected at other periods.

The influence of diet is thus far remarkable, that the formation of sugar diminishes when fatty kinds of food are used, a fact supposed to be explained by the circumstance that the fats are absorbed directly by the lacteals, and thus do not affect the portal blood. It is also observed that in health the ingestion of amylaceous or saccharine matter does not augment the quantity of sugar in the liver, nor in the animal economy generally; although

in cases of diabetes the use of these saccharine substances commonly causes a great and immediate augmentation of the sugar in the urine.

It does not yet appear clear how the sugar is destroyed in the blood in health. The destruction has been ascribed—(1.) to the oxidation or combustion of sugar in the lungs ; (2.) to its combustion effected through the agency of an alkali ; (3.) to the influence of extreme division in the blood, through which it may be converted into lactic acid by a simple molecular change.

Connected with the formation of sugar in the liver, Bernard shows that two substances are concerned—(1.) one soluble in water ; (2.) a substance slightly soluble in water, and which remains fixed in the hepatic tissue after all blood and sugar have been removed by prolonged washing.

The ultimate result of Bernard's investigations, shows that the increased formation of sugar by the liver, and its presence in the blood, is the result of some exciting cause which acts by reflex action, conveying the stimulus to the medulla oblongata, whence it is propagated by the spinal chord and filaments of the great sympathetic nerve to the liver, and so excites its glycogenic function. This doctrine is supported by the following experiment of Bernard :—

"When we prick the mesial line of the floor of the fourth ventricle in the exact centre of the space between the origins of the auditory and pneumogastric nerves, we at the same time produce an exaggeration of the hepatic [saccharine] and of the renal secretions; if the puncture be effected a little higher, we very often only produce an augmentation in the quantity of the urine, which then frequently becomes charged with albuminous matters, while if the puncture be below the indicated point, the discharge of sugar alone is observed, and the urine remains turbid and scanty. Hence it appears that we may distinguish two points, of which the inferior corresponds to the secretion of the liver, and the superior to that of the kidneys. As, however, these two points are very near to one another, it often happens that if the instrument enters obliquely, they are simultaneously wounded, and the animal's urine not only becomes superabundant, but at the same time saccharine."—(*Medico-Chirurgical Review*, l. c., p. 42).

He found also that in cutting the pneumogastric nerves the secretion of sugar was stopped, but that it still took place when the floor of the fourth venticle was irritated, after the division of the pneumogastric. Any irritation conveyed through this nerve may thus induce the diabetic state. The following are the general circumstances under which the phenomena of melituria became developed. (1.) Any agents or conditions which cause a suspension of the functions of animal life, while the purely nutritive or organic functions

remain intact, may bring about melituria. Thus the Indian worari poison acts ; so does apoplexy produced by a blow on the skull. Local irritation of the liver itself, as Dr. Harley has shown, also may induce the condition. The internal use of arsenic and quinine has also been said to have induced saccharine urine; and thus it is not improbable that irritant substances absorbed from the bowels by the mesenteric veins, may also sometimes bring about the morbid state.

Symptoms.—The early symptoms of diabetes mellitus are obscure. Dr. Prout believed that there is a stage which precedes the formation of sugar, and which is marked by a superabundant and highly dense urine, loaded with an excess of urea. But much uncertainty prevails on this point, and nothing is assured except that the constitution is not greatly affected till the saccharine matter forms. In some very few instances the quantity of urine passed is hardly greater than in health, but more commonly it is in great excess, amounting to eight, ten, sixteen, thirty, and even more pints, so that the patient is incessantly disturbed in the night, and loses his sleep, while the urethra and prepuce are inflamed and sore.

At this period his health begins to give way, his thirst is intense, and he often drinks many quarts, or even gallons, in the course of the day. But as the quantity drank is generally less than the quantity of urine passed, being in some instances only as one to four, his bowels are costive, and his fæces hard and dry ; his appetite is capricious, his skin harsh and dry, and he becomes greatly emaciated, loses all sexual desire, and all sexual power. In advanced cases, the drain upon his constitution is so great that the alveolar processes are absorbed, and his teeth, loosened in their sockets, fall out. These symptoms are much relieved by medicine, and life much prolonged ; but often, when the case appears most favourable, tuberculosis becomes apparent, and he sinks under this disease.

When the diuresis is considerable the urine should be examined, and its constituents determined. A faint sweetish odour may be perceptible in diabetic urine, comparable to fresh hay or milk. The chamber-vessel should be examined for crystals of sugar which may have been formed. The best evidence, however, is that derived from chemical tests.

A portion of urine, which is usually of a light straw colour, should be taken, and its specific gravity determined ; and if greater than 1·020 it should be evaporated, and if sugar be present we shall have a dark brown residue, something like treacle. This extract, like the natural sugars, consists of crystallizable matter and of an uncrystallizable syrup ; and to separate them Dr. Christison ecommends that the extract be agitated with rectified spirit, and the residue boiled in another portion of the same fluid, when, on cooling,

the crystallizable sugar will separate in light greyish grains like grape sugar. Again, if sugar should be suspected to exist, even in minute quantity, a small portion of yeast should be added to a small quantity of the urine, when, if sugar be present, fermentation will ensue, and each square inch of carbonic acid given off corresponds nearly to one grain of sugar. This test is so delicate that one part of diabetic urine, according to Dr. Christison, may be detected in 1,000 parts of urine of the density of 1·030. The most certain and approved test is that known as "*Trommer's test*," based on the re-action of the salts of copper. A portion of urine in a test-tube is to be treated with *one* or *two* drops of a solution of *sulphate of copper*, and afterwards a considerable excess of *potash* is to be added. A dark-blue solution, which results, is then to be held over the spirit-lamp and boiled for a moment, when a yellowish-brown *precipitate* of the sub-oxide of copper is produced. For the application of further tests, see Dr. Beale's Tables, p. 21.

The density of diabetic urine, however, is one of the best indications. This fluid varies in density from 1·020 to 1·055; and when the urinometer stands above 1·030 we may suspect that sugar is present. The quantity of sugar present has been calculated by Dr. Henry in urine of density 1·020, to be ʒ vj. scr. ij. gr. ij. in every pint, while at 1·050 it contains ℥ j. ʒ vij. scr. ij. grs. xviij. of sugar—the increment being, as he conceives, one scruple, or nearly so, for every degree of specific gravity between the extremes that have been mentioned. If these data be correct, a person passing sixteen pints of urine daily, of specific gravity 1·050, actually passes nearly two pounds avoirdupois of sugar. Dr. Christison gives the following formula for ascertaining the amount of solid matter:—"Multiply the excess of the specific gravity over 1·000 by 2·33, the result is the number of parts of solid matter in 1·000 of urine."

Prognosis.—The ultimate issue of every case of diabetes is probably fatal; at least the number of cases in which the urine is rendered natural is extremely small, and many of them, at the moment the disease seems to have yielded, die of phthisis; even when the presence of the saccharine principle has been so far conquered that it alternates with lithic acid deposit, or that lithic acid becomes the prominent feature, the circumstance is anything but favourable, for I have noticed, wrote Dr. Prout, that such individuals generally die of some sudden and overwhelming attack of internal inflammation or of apoplexy.

Treatment.—There are few diseases in which the treatment has been more varied than in diabetes mellitus. The emaciated state of the patient would seem to present an insurmountable obstacle to bleeding; but, nevertheless, this mode of treatment has often been practised, and as much as 160 to 170 ounces of blood have been

taken in a few weeks. Mercury has been used as an adjunct to bleeding, and separately; first as an alterative, then to touch the gums, and lastly to produce profuse salivation. But neither bleeding nor mercury, separately or conjointly, have been found of any benefit. Opium has been given to the extent of 100 grains in the twenty-four hours; but with an equal want of success. The whole materia medica has been exhausted in search of a remedy for this disease; and the metals, the fixed and the volatile alkalies, the vegetable and mineral acids, all the astringents, purgatives, tonics, diaphoretics, and diuretics, have in their turns been administered, and each has, perhaps, afforded some relief; but the disease has proceeded, and finally it may be said nearly every patient dies. Dr. Prout, who considered it merely as a form of dyspepsia, conceived that each case requires a different treatment.

The little benefit derived from medicine induced Dr. Rollo to try the effects of an entirely azoted or animal diet; and out of nineteen cases two are said to have been cured by this means. A full and generous diet is unquestionably useful in these cases; but the patient soon gets disgusted with mutton or beef, or both, for breakfast, dinner, and supper; he consequently nauseates it, and abandons it altogether. A diet of salt fish was attempted in one instance; but the patient in a short time so loathed it that it was given up. A mixed diet, therefore, if contra-indicated by theory, is at least the best to adopt in practice, and is consistent with the remarks made under pathology. It will be evident, however, that those vegetables which contain a large quantity of saccharine matter should be avoided in some degree, as potatoes, grapes, or other very ripe fruit, and, *à fortiori*, sugar itself. Consistently, however, with the experiments of Bernard, "cod-liver oil holds out some prospect of a natural plan of treatment by its use." Opium, combined with ipecacuanha, is eminently useful as a sedative; while exercise, warm clothing, friction of the surface, hot bathing, and diaphoretics improve the cutaneous functions. The nitro-muriatic baths, and the internal administration of the acid, might also be employed with some prospect of benefit. The administration of alkalies, as recommended by Miahlè and Contour, is also occasionally successful.

PART III.

MEDICAL GEOGRAPHY; OR, THE GEOGRAPHICAL DISTRIBUTION OF HEALTH AND DISEASE OVER THE GLOBE.*

This department of the science of medicine treats of the manner and endeavours to investigate the conditions under which diseases are distributed over the world, or are confined to certain districts. It embraces a consideration of topics which constitute the basis of hygieology, and which are of the greatest importance to practical medicine, of the utmost interest to science, and of inestimable value in political economy.

When the laws which regulate health and disease among the human family began to be elucidated by the facts of *physical geography* combined with those of *vital statistics*, this new branch of medical etiology was opened up. It has been variously named Medical Geography or Noso-Geography.

Geographical Distribution of Disease-Realms.—In proportion as the physiological conditions of plants and animals vary according to different degrees of latitude, or rather with the different lines of equal temperature and moisture north and south of the equator, so do the pathological characters of diseases differ; and races of men are influenced as to health in proportion as they migrate from the land of their birth. It is the ascertained facts in meteorology and climatology of our globe which will help to explain the geographical

* Our knowledge on this subject is as yet only beginning to assume a shape; and the limits of this handbook merely permit the most faint outline to be given. To Alexander Keith Johnstone, F.R.S.E., the medical profession in this country is indebted for bringing the subject prominently before them, in a communication to the Epidemiological Society of London, published in their *Transactions* for 1856, p. 25, and also in his *Physical Atlas of Natural Phenomena*, where his observations at p. 117 are illustrated by a map. "No scholar out of the domain of medicine has contributed documents more valuable than these to medical literature." That map Mr. Johnstone has reduced to a scale suited to this handbook, and thus liberally permits me to use it in illustration. The more important bearings of this subject may also be seen in a paper in *The Medico-Chirurg. Review* for April, 1857; as well as in *The Sanitary Review* for October of this year. The first of these reviews refers to a work in German by Dr. Mühry, on the *Outlines of Noso-Geography*, in two volumes; the latter reviews a treatise by M. Boudin on the same subject. An important paper on Acclimation by Dr. J. C. Nott, in a work entitled, *The Indigenous Races of the Earth*; Sir Alexander Tulloch's *Army Statistics*, and Mr. Martin's work on the *Influence of Tropical Climate*, are the sources from which the outline here given has been compiled.

limits of particular diseases, and their regulated distribution, according to atmospheric temperature and moisture, the density and electricity of the air, and the vegetation with which they are surrounded. Such causes determine some of the laws by which diseases may be geographically distributed, but other concurrent causes must also be taken into account in considering the special diseases of countries. For example, topographical situation, geological nature and elevation of the soil and state of the vegetation; in short, *physical climate* generally and properly so called, combined with the habits of the people, all concur to stamp the diseases of certain countries with a special character.

There are facts which show that certain miasmatic and other diseases are so completely under the influence of temperature, that they are susceptible of being arranged systematically in zones of geographical distribution. The diseases susceptible of being thus classified, are those of a self-generated, and often contagious type, which require a certain fixed amount of temperature for their maintenance and prevalence. They are chiefly *remittent fevers*, *yellow fever*, *plague*, *typhous fever*, and *cholera*. The geographical distribution of these diseases into zones, north and south of the equator, appears to be regulated, in a great measure, by relative degrees of temperature and humidity, in the several places where they prevail in America, Africa, and Europe. The causes of these diseases, however, has not been found to be solely or exclusively atmospherical; either as regards diseased actions being due to temperature and humidity of the air, or to its relative daily and annual states of density and electricity. Such diseases as have been mentioned, and whose realms are bounded in a great measure by isothermal lines, are not only associated with locality and the vegetation produced by atmospheric causes of heat and humidity; but they also follow the physiological action of food and the habits of the several animal inhabitants of the different latitudes. *Malarious fevers*, the *yellow fever*, *plague*, and *typhous fevers*, have particular climates or zones where each predominates, and beyond the limits of which the disease is never produced, unless change of seasons gives rise to a state of climate analogous to that which is due to the latitude and position of these localities.

Isothermic Zones bear a most prominent part in relation to the geographical distribution of diseases. They connect the different places on the earth which have the same mean temperature, and which Humboldt was the first to indicate. *Insect-realms* have been similarly indicated by Latreille. The late Professor Edward Forbes, described *homozoic belts* of marine life. Cuvier, Blumenbach, Morton, Latham, Pritchard, and others, have indicated *homoicephalic* zones or *realms* of *men;* and following out these ideas, we have now

the realms of disease defined by Dr. Mühry and Mr. Keith Johnstone.

Realms of Disease and Description of the Map. — These zones, belts, or realms of particular types of disease thus marked out on the globe by these observers, are intimately associated with temperature, and may be generally indicated by the regions of the *tropical*, *temperate*, and *polar* zones, distinguished on the map by the respective colours of *brown*, *green*, and *blue*.

I. The northern limit of the tropical zone unites with the southern limits of the temperate zones, and the lines of union of the two colours on the map (green and brown) indicate Humboldt's mean annual isothermal line of 77° Fahr. or the 19° Reaumur. It passes through Cuba and Florida in America ; skirts the Cape de Verd Islands to Africa, where, extending beyond the usual limits of the tropics, it passes the northern part of the great desert (Sahara) below Algiers, runs through Egypt, Northern Arabia, and Persia into China, where it is lost in the Pacific Ocean, below the limits of the northern tropic. The limiting line of this zone ascends somewhat in summer, when the sun is north of the equator; and descends again in winter when the sun is to the south of it. To the south of the equator the same *isothermal line* (77°) marks the southern limits of the tropical *disease-realm* where it joins with the northern limits of the *south temperate* zone. It crosses South America near the Amazon district, and approaching southwards in Africa towards the Cape, crosses over, and embraces the northern half of Australia. This is the *realm* of tropical diseases ; and is coloured *brown* on the map. The class of diseases which characterize this realm are the worst forms of *malarious*, *intermittent*, *remittent*, and *yellow fevers*, associated more especially with *dysentery*, *diarrhœa*, *cholera indica*, *hepatic affections and their results*. Our summer and autumnal affections, characterized by *biliousness*, *diarrhœa*, *and bilious*, *gastric*, *or typhoid fevers*, approach, by the phenomena they express, the type of the *tropical* diseases. The paludal fevers of this tropical *disease-realm* prevail in their greatest intensity in flat low-lying countries in the vicinity of marshes, the borders of lakes, shores of rivers and of the sea, and especially where the soil is damp underneath, and of certain geological formation. Mr. Martin has clearly shown how the various soils affect powerfully the temperature and humidity of a place. Argillaceous and ferruginous soils appear in this realm to be especially insalubrious. The malarious fevers of this region make their appearance soon after the setting in of the rainy season, or when overflowed grounds, such as rice-fields, the partially dried-up beds and mouths of rivers, or irrigated plains, begin to dry up and leave portions of the surface of the land, whose subsoil is constantly wet, exposed to the rays of a tropical sun. From such a surface the

belief is now universal, that a miasm (the specific nature of which we know nothing) emanates and acts as a poison upon the blood; and is apt to be developed under similarity of climate, season, and soil, and to produce diseases whose symptoms and course express a constancy and similarity of type. The great centres of these malarious diseases in the different continents are—(1.) In America—the shores of the Gulf of Mexico, the West India Islands, and the northern portion of South America; (2.) In Asia—India, China, Borneo, Ceylon; (3.) In Africa—the countries round the Gulf of Guinea on the west, Madagascar and Mozambique on the east, Algeria and the shores and islands of the Mediterranean on the north.

As far as can be ascertained, as estimated by Mr. Johnstone, the mortality within this realm of disease amounts to 75 per cent. annually, but it tends to decrease with the lowering of temperature during the seasons of increased prevalence.

II. A *realm* in which varied forms of *continued febrile* disease takes the place of the *malarious* or *paludal* fever of the torrid zone. The region where diseases of this type prevail, embrace *realms* to the north and south of the equator, which may be generally described as in the north and south temperate zones. The southern boundary of the northern realm corresponds to the northern boundary of the tropical *disease-realm*, as already indicated by the isothermal line of 77°. In a northern direction it extends to latitude 60° north, and includes the British Isles, Norway, and Sweden, while in America its northern limit includes part of Nova Scotia and Newfoundland. Its boundary line to the north passes from 60° north latitude in a south-eastern direction on both continents, till it gradually declines towards the borders of Asiatic Russia in the Old World, and to the district between Boston and Philadelphia on the eastern shores of the New, and corresponds nearly with the annual isotherm of 41°. In the southern hemisphere it embraces the southern two-thirds of South America, the district of the Cape of Good Hope, and the southern half of Australia. It embraces the most healthy regions of the world; and in which the prevailing causes of ill health are mostly due to the *condensation of people in towns*, and the insalubrious and depressing conditions which necessarily arise from that cause. Emanations from nuisances tend to accumulate, where mechanical and chemical arrangements of a sanitary kind do not remove the concentrated impurities. But where proper sanitary measures exist for the supply of pure water and free air, the artificial disadvantages inseparable from town life may be greatly modified in their influences, so much so, that in our country (the least unhealthy of all) the mortality may range from 1·7 to 3·6 per cent. annually (Reg.-Gen. Rep. for 1853, p. 15). Nearly every

type of disease has a representative in this realm; but, generally speaking, the ZYMOTIC and CONSTITUTIONAL diseases are the classes which furnish the greatest mortality. *Typhous fever* prevails between the parallels of 44° and 60° in Western Europe; *yellow fever* has prevailed on the southern shores of Spain and Northern Italy; *intermittent fever* in the Netherlands, Sweden, and Central Italy, and generally where marshy undrained lands exist. *Small-pox* especially prevails where vaccination has not checked its ravages; *leprosy* and *elephantiasis* prevail in Scandinavia; *pellagra* in Italy, France, and Spain; *plica polonica* in Poland and Tartary; and *consumption* and *rheumatism*, everywhere. While therefore this temperate zone embraces on the one hand the extremes of temperature of the torrid and the frigid zones, in the seasons of summer and winter, it is also observed to have representatives of the types of disease which prevail in both these realms; and according as we approach its northern or its southern limits, we find that the characters of disease become so modified, that their types are found so to mingle together on the confines of these disease-realms, that the *continued* type of febrile diseases peculiar to the temperate zones, tend, as we approach the tropics, to merge into and to participate in those irregular intermittent characters which are peculiar to the type of the tropical malarious districts. It is only to a limited extent, however, that such modifications are found to occur; and there are some diseases which rarely tend to pass their geographical boundaries unless especially favoured by *tropical* identity of climate on the one hand, or *temperate* identity on the other. Under the former circumstance, yellow fever has been met with at Gibraltar and Cadiz; and has also extended in America southwards beyond its usual limits; but so soon as the temperature falls below 55° Fahr., the importation of yellow fever into *this zone*, and its persistent existence in it, becomes impossible. Diarrhœa also and dysentery are apt to prevail during the summer and autumn months, while under bad diet, defective ventilation, and generally imperfect sanitary measures, *contagious typhus fevers* are generated in crowded localities, of towns, and in huts, hospitals, and barracks. The typhous fevers seem to have their special habitation in this zone, especially between 30° and 40° of north latitude, and likewise the true glandular plague; and which, though occasionally propagated beyond these limits, by a secondary and specific poison generated from human bodies, and propagated by human intercourse, they seem to have also a distinct primitive origin from local and atmospheric agencies. The zone, therefore, which we inhabit, while it may be said to exhibit the greatest variety of disease processes and types of disease, may, nevertheless, be considered a highly favoured district of the globe, inasmuch as the development and progress of disease and of

epidemics are much more manageable, less intense, and on the whole less fatal, than similar types of disease in the tropical realm, or even than they were centuries ago. Under proper sanitary regulations typhous and many other zymotic diseases in this country are greatly under control. Cholera may be said to be the only scourge which occasionally, as an epidemic, becomes rapidly destructive to life. But by scientifically directed sanitary measures, and the increasing experience of an enlightened age, the spread of the *plague* in this country is now unknown. In this realm "history records the existence of diseases of former days, now happily unknown; while scourges unknown to ancient times devastate modern populations" (PLINY, SYDENHAM, BOUDIN). In the sixteenth century, the Oriental plague, "like the destroying angel, spread its wings on the blast," and added to the miseries of that stormy and bloody time. Our physician-poet tells us that when the fate of England was about to be decided on "Bosworth's purple field," that plague, of most gigantic arm,

> "Rushed as a storm o'er half the astonished isle,
> And strewed with sudden carcases the land."

Congregated together, then, as now, with pestilential disease, our standing armies and bodies of men especially suffered. It thinned the ranks of Henry's victorious army, that few were left to see the conqueror crowned with Richard's diadem. Asiatic cholera may now be said to have taken the place of the Oriental plague, and is often no less destructive and important in its results, sternly demonstrating how one dread year may perform the work of ages when the pestilence mocks in his fury the slow hand of time."

III. To the northward of this temperate zone in the northern hemisphere, there is another disease-realm where *catarrhal affections*, *influenza*, *scurvy*, *erysipelas*, *diseases of the skin* and *digestive organs*, and *various* CONSTITUTIONAL *affections* more especially prevail, to the exclusion of *malarious febrile diseases*, except on very rare occasions in summer, when *cholera* and *dysentery* may prevail. This *disease-realm*, in the polar isothermal zone, rejoices in a climate directly opposite to that of the tropical zone. Its southern limits are the northern boundaries of the previously defined region, namely, the isothermal line of 41° Fahr., or 2° or 3° of Reaumur. Commencing on the western coasts of North America above Sitka, it extends southward across the district of the Canadian lakes, sinking south and east into Canada and Newfoundland to Boston and New York or Philadelphia. Thence it continues north-west nearly on 41° Fahr. annual temperature, when it crosses to Europe and ascends till near the borders of Iceland, whence it sinks towards Norway and Sweden, and, running above St. Petersburg and Moscow,

crosses to Siberia. Iceland being the best known locality of this district, Mr. Johnstone takes its peculiar diseases as the representatives of this realm. Every year in spring, or in early summer, it is visited by catarrh ; and at short intervals it is visited by catarrhal fever—a true influenza which has usually a great effect on the mortality. The majority of Icelanders are said to die before the age of fifty from asthmatic or catarrhal affections, which are also prevalent in Greenland and Labrador.

Acclimation, or the Influence of Climate on Man.

Definition.—*Acclimation consists in "a profound change in the organism, produced by a prolonged sojourn in a place whose climate is widely different from that to which one is accustomed, and which has the effect of rendering the individual who has been subjected to it similar in many respects to the natives of the country (indigènes) which he has adopted"* (Rochoux).

It is found that the white races reach their highest physical and intellectual development, as well as most perfect health and greatest average duration of life, above 40° in the western, and 45° in the eastern hemispheres ; and whenever they emigrate many degrees below these lines, they begin to deteriorate, from increased temperature, either alone or combined with other morbific influences, incident not less to change of climate than to habits of life—to evils social, civil, and more or less remediable.

The laws of climate show that each race of mankind has its prescribed salubrious limits. All of them seem to possess a certain degree of constitutional pliability by which they are able to bear to a certain extent great changes of temperature and latitude ; and those races that are indigenous to temperate climates support best the extremes of other latitudes. The inhabitants of the arctic regions, as also of the tropics, have a certain pliancy of constitution ; and while the inhabitants of the middle latitudes may emigrate 30 degrees south or 30 degrees north with comparative impunity, the Esquimaux, in the one extreme, or the Negro, Hindoo, or Malay, in the other, have no power to withstand the vicissitudes of climate encountered in traversing the 70 degrees of latitude between Greenland and the equator. The fair races of Northern Europe below the arctic zone find Jamaica, Louisiana, and India to be extreme climates ; and they and their descendants are no longer to be recognized after a prolonged residence there. When an Englishman is placed in the most beautiful part of Bengal or Jamaica, where malaria does not exist, and although he may be subjected to no attack of acute disease, but may live with a tolerable degree of health his threescore years and ten, he nevertheless ceases to be the same

healthy individual he once was; and, moreover, his descendants degenerate. He complains bitterly of the heat, and becomes tanned; his plump, plethoric frame becomes attenuated; his blood loses fibrin and red globules; both mind and body become sluggish; gray hairs and other marks show that age has come on prematurely—the man of forty looks fifty years old; the average duration of life is shortened (as shown in life insurance tables); and the race in time would be exterminated if cut off from fresh supplies of emigrants from the home country. Our army medical historians tell us that our troops *do not become* acclimated in India. Length of residence in a distant land affords no immunity from the diseases of its climate, which act with redoubled energy on the stranger from the temperate zones. On the contrary, the mortality among officers and troops is greatest among those who remain longest in those climates (Johnson, Martin, Tulloch, Macpherson, Boudin). Dr. Macpherson also makes the significant remark, that the small mortality among officers, compared with soldiers, in India is due to the greater facilities they enjoy of obtaining change of climate when they fall sick. Although the constitution of the man may be so modified that comparative health may be retained, yet there is a *morbid degradation* of the physical and intellectual constitution. If, however, he or his descendants are taken back to their native climate, they may yet revert to the healthful standard of their original types. The good effects of limiting the period of service of our troops abroad to three years, has shown this in sustaining for a greater period the strength of the regiments; a protracted residence of the European regiments in India having been followed by the most disastrous results. "European regiments in India have melted away like the spectres of a dream. A thousand strong men form this year a regiment—a year passes, and *one hundred* and *twenty-five* new recruits are required to fill up the broken column,—and eight years having come and gone, not a man of the original thousand remains in the dissolving corps." With regard to the Bombay fusilier European regiment, for instance, Dr. Arnot has shown that its losses average 104 per 1,000 per annum,—a loss equivalent to the entire absorption of the regiment in nine years and seven months. In Bengal also it is an ascertained fact, that a British regiment of 1,000 men dissolves entirely away in eleven years, even in favourable times and with all the improved conditions of the service. Dr. Arnot's statistics show that the Bengal army loses annually 9 per cent. of its numbers, giving a total loss in eight years of upwards of 14,005 men out of an army of 156,130 men." (See *Trans. Med. Ph. Soc. of Bombay* for 1855, *Indian Annals of Medical Science*, and *Sanitary Review* for Oct., 1857, whence these statements are quoted.)

The natives of this country who are now scattered throughout Hindostan, and the Indian Archipelago, on both sides of Africa, a few hundred miles north of the Cape, along the southern shores of the Mediterranean, in the West Indies, South America, and elsewhere, also illustrate this fact by their habits. Few of them ever return to their native land with constitutions unimpaired; and in no cases do the British natives, whose means are not absolutely insignificant, attempt to rear up their children in any of those tropical regions. If they do so, "parents soon mourn over the graves of lost offspring, or sigh on beholding the sickly appearance of those who survive." Of them the adults, and especially the females, suffer under hourly increasing morbific influence, and are destined at length to succumb, far within the average limits of longevity that would have been accorded them by any assurance agent in England. On the contrary, when means permit, every sacrifice is made by parents in India, under the name of "*education*," to send their children homeward, that their constitutions may become *retempered*, before they are once more exposed to deleterious intertropical influences. It is a significant fact, says Nott, from whom I quote these statements, that the oldest purely English regiment in India, the "Bombay Tufts," notwithstanding that marriages with British females are encouraged, has never been able, from the time of Charles II. to the present hour, to rear, from births in the corps, *boys* enough to supply its musical band with drummers and fifers. The same rule holds good with the Dutch in Batavia and other Indian islands. In Algeria also the French are beginning to find out that unless the indigenous Arab or Kabyle will plough the fields for them *colonization* is hopeless (Boudin). At Madagascar the Frenchman, and at Sierra Leone the Englishman die off in any prolonged attempt at *colonization* (Bryson). With the Negro races the same phenomena are observed. The Negro is evidently killed by cold. He is the native of the hottest region of the globe, where he goes naked in the scorching rays of the sun, and can lie down and sleep on the ground in a temperature of 150° Fahr.; but if removed from such latitudes to places beyond 40° north, he steadily deteriorates and ultimately becomes exterminated. The statistics of New England, New York, and Philadelphia prove this, where the mortality is double that of the white population (Nott).

There is, however, an acclimation, although an imperfect one, against moderately high temperature; and it is also equally true that persons who have gone through this process, and more especially their children when grown up, are less liable to violent attacks of paludal fevers when exposed to them than fresh immigrants from the temperate regions. The course of diseases upon fresh arrivals—new comers—is more rapid as a rule, and more severe.

The statistics of Sir Alexander Tulloch show very strongly that certain races cannot become acclimated in certain realms, though they may in others far removed from their original birth-place. British soldiers and civilians, for instance, enjoy even better health at the Cape Colony than in Great Britain; while the Negro in most regions out of Africa, whether within the tropics, as in Antilles, or out of the tropics, as at Gibraltar, is gradually exterminated. He further makes the impressive remark, "that before a century has passed the Negro race will almost have disappeared from the British Colonies in the West Indies." The American statistics of the United States confirm the conclusions of Colonel Tulloch (Carrey, De Bow, Nott).

In the island of Ceylon, during a series of years, the comparative ratio of mortality has been noted among five different races of which the troops are composed;—and the following are the significant results illustrating the statements now made (Boudin):—

	Annual deaths per 1,000 men.
Native troops of Bengal and Madras,	12
Troops recruited on the Coast of Ceylon,	23
Malays,	24
Negro troops,	50
English troops,	69

The most minute and reliable information we possess regarding the influence of tropical climates on European races, is to be found in the statistical reports of Colonel Sir Alexander Tulloch and the works of Mr. Ranald Martin and of M. Boudin, already frequently noticed. A report of the former writer, which includes the stations of Western Africa, St. Helena, the Cape of Good Hope, and the Mauritius, shows that during a period of eighteen years, every soldier was thrice under medical treatment annually, and nearly half the force annually perished; and when the mortality was at its height three-fourths of the troops perished annually. About 300 white troops were landed at different times in 1825, and in detachments; nearly every one died or was shattered in constitution; and what is remarkable, during the whole of this dreadful mortality, a detachment of from forty to fifty black soldiers of the 2d West India regiment only lost one man, and had seldom any in the hospital. No length of residence acclimates the whites in Africa; on the contrary, it tends to their extermination. In like manner it has been shown that the *native* troops on the Bengal establishment are particularly healthy, while the imported English are the reverse. In the interior they show that during a period of five years only one man of every 131 has died annually—a degree of healthfulness unknown to any troops in Europe.

The gloom that is now (1857) thrown over our Indian affairs is

not by any means diminished by such lessons, and which are taught us by the study of the geographical distribution of health and disease. Nevertheless, these stern realities must one day or another be grappled with face to face. With the existing provisions for the sanitary state of our army, "the field of distinction in India has hitherto been a great grave-ground — a British Juggernaut." But the science of medicine and sanitary science teach us that much may yet be done. The climate of the East merely exaggerates the causes of disease which exist there, and which have been fostered rather than obviated by the military economy of our troops. The annals of warfare and of campaigns teem with abundant illustrations which show that the humanizing influence of the science of medicine is not sufficiently felt and appreciated by the commanders of armies. In his *History of England* Lord Macaulay observes of William Henry, Prince of Orange, "that it was too much the habit even of the most humane and generous soldiers, to think very lightly of the bloodshed and devastation inseparable from great martial exploits; and the heart becomes steeled, not only by professional insensibility, but by that sterner insensibility which is the effect of a sense of duty." From the days of Nero to those of Lord Raglan, the most humane commander that ever lived, this historical truth has been sufficiently verified. The sufferings of the soldier are apt to be forgotten and lost sight of in the excitement which attends our brilliant martial achievements. The humanizing influence of our profession may yet effect a change for the better, when it enjoys a higher position in the organization of the army than it has hitherto done, when a high standard of professional education is demanded of the student who would enter the service, and when the head of the medical department of the army in the field shall have a seat in the Councils of War, and a voice in that assembly where the sanitary position of the army may be compromised.

Sufficiently authenticated examples are now also on record, which prove the persistent pernicious influences of malaria both on races of mankind and on bodies of men subjected to their influences for periods of time beyond six or eight weeks, and especially under a temperature above 60°. It is known, that after the Walcheren expedition, our troops continued to suffer from paludal fevers for five, six, eight, and eleven months after their return to this country, although located in as salubrious quarters as could be procured for them. M. Boudin, also, in his "*Lettres sur l'Algérie*," fully shows the persistent pernicious influence of paludal poison on the French and English colonists there. During the recent war against Russia, the persistent pernicious influence of the residence of the troops in Bulgaria during a period of three of the hottest months of the year, continued to make itself more or less manifest throughout the whole of the campaign in the Crimea.

The enduring influence of marsh malaria on a race, finds abundant illustration in the Campagna, Maremma, Pontines, and other insalubrious localities in classic Italy. Every traveller in these districts can testify that the following description by the late Dr. James Johnson is a faithful one :—

"From the mountain of Viterbo we have the first glimpse of the widespread Campagna di Roma. The beautiful lake of Vico lies under our feet, its sloping banks cultivated like a garden, but destitute of habitations, on account of the deadly malaria, which no culture can annihilate. From this spot till we reach the desert, the features of poverty and wretchedness in the inhabitants themselves, as well as in everything around them, grow rapidly more marked. We descend upon the Campagna, . . . but no human form meets the eye except the gaunt figure of the herdsman, muffled up to the chin in his dark mantle, with his gun and his spear—his broad slouched hat over the ferocious and scowling countenance of a brigand. As we approach within ten miles of Rome some specks of cultivation appear, and with them the dire effects of malaria on the human frame. Bloated bellies, distorted features, dark yellow complexions, livid eyes and lips,—in short, all the symptoms of dropsy, jaundice, and ague united in their persons. That this deleterious malaria did exist in the Campagna from the very first foundation of Rome to the present moment, there can be no doubt.

"A glance at the inhabitants of these districts shows, that the range of disorders produced by the poison of malaria is very extensive. The jaundiced complexion, the stunted growth, the stupid countenance, the shortened life, attest that habitual exposure to malaria saps the energy of every mental and bodily function, and drags its victim to an early grave. Fever and ague, though two of the most prominent features of malarious influences, are as a drop of water in the ocean, when compared with the other less obtrusive but more dangerous maladies, that silently but effectually disorganize the vital structures of the human fabric under the operation of the deleterious and invisible poison.

"What are the consequences? Malarious fevers; or, if these are escaped, the foundation of chronic malarious disorders is laid; in ample provision for future misery and suffering. Compare the range of human existence as founded on the decrement of human life in Italy and England. In Rome, a twenty-fifth part of the population pays the debt of nature annually. In Naples, a twenty-eighth part dies. In London, only one in forty, and in England generally, only one in sixty falls before the scythe of time or the ravages of disease" (Dr. James Johnson). See also Appendix Table at the end of this Section.

Conclusion.—The limits of this volume do not permit of further remarks on the geography of disease. Enough, perhaps, has been written in illustration of some of the more important directions which the study may take, and to show that the subject presents a vast field for investigation, and claims the united exertions of every one in its exploration who is interested in the progress of the science of medicine and the promotion of social health. The immediate object of the study is to ascertain the laws by which

disease is distributed, or the manner in which certain conditions inimical to health are found to prevail in certain localities or regions; and how many of the phenomena relative to the regional distribution of disease are elucidated by the facts of *physical geography*. The pages of this handbook from 25 to 41 on *endemic and epidemic influences* ought to have found a place here. The sources of information on the subject exist in reliable tables of sickness and mortality, a knowledge of the physical conformation of the earth's surface, and the meteorological agencies to which it is exposed.

Similarity of geological formation indicates a similarity to a certain extent, in the diseases of a country, as seen in the localities visited by malarial fevers. A certain amount of heat, and a sufficient time for its manifestation, are necessary for the development of certain maladies. In the West Indies, the period of disease follows the course of the sun, the unhealthy season occurring at opposite times on the northern and southern sides of the equator. As the sun proceeds northward in the ecliptic, so the sickly season advances from the southern to the northern islands. In the Mediterranean the mortality is doubled in the hot season between July and October; and in the Northern States of North America the posts of the army are regularly abandoned as the hot or sickly season approaches. In temperate regions this order is reversed. Throughout Europe generally, the maximum mortality occurs at the end of winter, and the minimum in the middle of summer. The Registrar-General of England calculates that a fall of the mean temperature of the air from 40° to 4° or 5° below the freezing-point, destroys from 300 to 500 of the population of London. The agency of the wind is manifested in the distribution of heat and moisture, and in the comparative density of the air, as well as by its direct influence as a distributor of malarial poison. The absence of wind was uniformly noted as a concomitant of cholera, which, in Britain and elsewhere, has been observed to be developed and to be most virulent when the calm was the greatest, and often began to abate when the wind rose.

It may not be out of place merely to indicate some definite and practically important subjects and sources of study relative to this interesting department of medical science:—

(1.) A study of the climatology and the diseases of the different quarters of the globe illustrate most clearly that the morbid conditions produced by certain pathological states, while they are of a fixed character, are more intense in their severity, more continuous in their development, and more prolonged in their existence in some places than in others.

(2.) A study of the climatology of towns and such circumscribed districts is of the greatest practical importance to the physician in

all questions relative to change of air for the invalid. On this subject the work of Sir James Clark on Climate, with its inestimable series of meteorological tables, is the classic source of reference; while many monographs have also been written of late on particular localities.*

(3.) Our medical officers of health are industriously mapping out the realms of disease, which often too definitely manifest themselves amongst the vilest purlieus of our cities. Systematically and energetically, many of the causes of diseases are thus more effectually exterminated. Does it not therefore behove those who have to care for the sanitary state of our armies and our fleets, to consider whether similar means of preventing disease may not be successfully applied abroad? For this purpose a study of the geographical distribution of diseases, and of the causes which lead to their special distribution, obviously becomes of the greatest practical use. By it we learn that certain classes of diseases rather than others, are mainly under the influence of terrestrial and meteorological causes, namely, those of the ZYMOTIC class, and which are stamped with special *miasmatic* characters. In proportion, therefore, as we become capable of knowing that particular diseases of this class are limited to certain portions of the earth, and can trace the meteorological laws of their geographical distribution and diffusion, we necessarily obtain clearer conceptions of their causes and modes of propagation, as well as more practical knowledge of the means of their prevention and of cure.

By such knowledge, large masses of men may be more successfully cared for in foreign countries; the topographical position and construction of habitations may be determined upon, with a certain definite knowledge to guide the chooser. Military barracks and hospitals may be judiciously provided for abroad, and with all the aids of scientific knowledge, the diet, the clothing, and the military exercising of the troops may be arranged and suited to the physical climate of the place in which armies are to campaign or garrisons to be located.†

* Of these the following may be referred to:—

Diseases of the New Zealanders. By Dr. Arthur Thomson. *Med.-Chir. Rev.*, commencing April, 1854.

On the Climate of Algiers. By Dr. Arthur Mitchell. *Med.-Chir. Rev.*, commencing January, 1856.

A Comparative Inquiry as to the Preventive and Curative Influence of the Climate of Pau and other Places. By Dr. Alexander Taylor.

Change of Climate, and an Account of the Climates of Spanish Towns. By Dr. Francis.

On the Climate of Spain and Australia. By Dr. Burgess. *Med.-Chir. Rev.*, October, 1854.

Climatology of the United States. By Blodget.

† The most valuable information we possess on this subject is to be found in the work of Mr. Ranald Martin on *The Influence of Tropical Climates on European Constitutions.*

APPENDIX.

TABLE EXHIBITING THE ANNUAL MORTALITY IN DIFFERENT COUNTRIES AND PLACES.

(Moreau de Jonnès, in Pritchard's *Physical History of Mankind.*)

Localities.	Latitudes.	Dates.	Mortality.
Sweden	62°	1821—1825	One death in 45
Denmark	55°	1819	,, ,, 45
Germany	45°	1825	,, ,, 45
Russia	45°—65°	1821—1824	,, ,, 39
Austrian Empire	45°	1825—1830	,, ,, 43
Holland	52°	1824	,, ,, 40
Great Britain	50°—59°	1800—1804	,, ,, 47
Scotland	...	1821	,, ,, 50
France	43°—51°	1825—1827	,, ,, 39·5
Canton de Vaud	...	1824	,, ,, 47
Lombardy	...	1827—1828	,, ,, 31
Roman States	42°	1820	,, ,, 28
Batavia	6° 10′	...	,, ,, 26
Trinidad	10° 10′	...	,, ,, 27
Sainte Lucie	13° 54′	...	,, ,, 27
Martinique	14° 44′	...	,, ,, 28
Guadaloupe	15° 59′	...	,, ,, 27
Bombay	18° 36′	...	,, ,, 20
Calcutta	22° 33′	...	,, ,, 20
Havana	23° 11′	...	,, ,, 33

In approaching the equator, the mortality increases, and the average duration of life diminishes.

When the nature and origin of the inhabitants are taken into consideration, it appears that the mortality is due—(1.) to strangers coming from a different climate, and incapable of being acclimatized; (2.) to endemic insalubrity.

Localities.	Dates.	Mortality.			
Batavia	1805	Europeans	One death in		11
		Slaves	,,	,,	13
		Chinese	,,	,,	29
		Javanese, viz., natives	,,	,,	40
Calcutta	1817—1836	Europeans and Eurasians	,,	,,	28
		Portuguese and French	,,	,,	8
	1822—1836	Western Mahommedans, Bengal, Moguls, Arabs	,,	,,	36
		Western Hindoos, Bengal Hindoos, Low Castes, Mugs	,,	,,	16
Bombay	1822—1836	Europeans	,,	,,	18·5
		Mussulmans	,,	,,	17·5
		Parsees	,,	,,	40
Guadaloupe	1811—1824	Whites	,,	,,	22
		Free Men of Colour	,,	,,	35
Martinique	1825	Whites	,,	,,	24
		Free Men of Colour	,,	,,	23
Granada	1815	Slaves	,,	,,	22
Sainte Lucie	1802	Slaves	,,	,,	20

INDEX.

Abdominal complication in typhus, 187.
respiration, 613.
Abscess, lxxi.
chronic, lxxiv.
cold, lxxiv.
hepatic, 706.
hepatic, in dysentery, 209.
pointing of, lxxiv.
of lung, 660.
Absolute weight of brain, 481.
Absorption, interstitial, lxxv.
Acclimation, 733.
Acid, free in urine, xxxix.
phosphoric, in urine, xxxix.
sulphuric, in urine, xxxix.
Acidity of urine increased in fever, xlvi.
Active congestion, liv., lviii.
Addison's disease, definition of, 419.
early symptoms of, 421.
morbid appearances, 423.
pathology of, 419.
symptoms of, 423.
Adynamic type of fever, lxxxii.
Agony of death, lxxxvi.
Ague, 264.
Aidoici, 3.
Aim of the science of medicine, xvii.
Albumen diminished in blod, xlvi.
Albuminous tissue, destruction of, xliv.
Alcoholismus, alcoholism, 333.
Alkaline remedies in rheumatism, 395.
salts diminished in blood, xlvi.
Anæmia, causes of, 413.
death by, lxxxvii.
definition of, 410.
pathology of, 410.
symptoms of, 411.
treatment of, 413.
Anæsthesia, causes of, 612.
diagnosis of, 611.
facial, 611.
symptoms of, 671.
Analysis of morbid structures, xxv.
of tubercle, 446.
Anasarca, 679.
Ancyclostomum duodenale, 362.
Androphomania, 576.
Animal malaria, 40.
Antimony, sanative influence of, civ.
Antiphlogistic treatment, xcvii.
Anxietas, lxxxvii, 625.
Aortic murmur, 622.
Apnœa, death by, lxxxviii.
Apoplexy, 510.
causes of, 520.
definition of, 511.
dietetic treatment of, 525.
from congestion, symptoms of, 515.
from hæmorrhage, symptoms of, 517.
pathology of, 511.
prognosis of, 521.
serous, 511.
treatment of, 523.
Arachnoid hæmorrhage, 519.
Ascarides, 360.
Ascites, 678.
active, 681.
and Bright's disease, 679.
causes, 682.
definition of, 678.
diagnosis, 683.
passive, 681.
pathology of, 678.
prognosis of, 683.
symptoms of, 680.
treatment of, 684.
Asthenia, death by, lxxxvii.
death by, lxxxiii.
Asthenic type of fever, lxxxii.
Atrophy of brain in the insane, 567.
lung and collapse, 654.
Auscultation, 614.
Autophomania, 577.

Bile, increased elimination, 709.
Blastema, xxxv.
Blood affected in fever, xlvi.
albumen diminished, xlvi.
alkaline salts diminished, xlvi.
altered in inflammation, lv.
crystals, 513.
determination of to head, 511.
effusions, lxiii, lxiv.
in fever, xlvi.
loss of, xcix.
poisoned in some diseases, 22.

Blood, uric acid in, xlvi.
Blood-letting, xcvii.
general rules, c.
in rheumatism, 391.
Blood-red corpuscles diminished, xlvi.
Blood-vessels, enlarged, lii.
in inflammation, liii.
Boil, lxxi.
Bone and muscle diseases, 3.
Bowel diseases, 3, 774.
Brain, absolute weight of, 481.
and nerve, constituents of, 480.
and nerves, relation of, 483.
atrophy of, 508, 567.
bulk of, 481.
central ganglia of, in chorea, 527.
chemical composition, 480.
congestion of, 511.
death beginning at, lxxxvii.
diseases, 3, 478.
diseases, diagnosis of, 485.
in the insane, atrophy of, 567.
morbid conditions of, 487.
softening of, 499.
Breathing, stertorous, lxxxix.
Bright's disease, 714.
definition of, 714.
diagnosis of, 718.
pathology of, 714.
prognosis of, 718.
symptoms, 616, 716.
treatment of, 718.
Bronchial complications in typhus, 156.
Bronchitis, definition, 651.
diagnosis of, 657.
pathology and morbid anatomy, 652.
physical signs, 656.
symptoms of, 655.
treatment of, 657.
vesicular collapse, 653.
Broncho-pneumonia, 645.
Bubo, treatment of, in plague, 129.
Bulk of brain, 481.

Cachexia, 477.
associated with cancers, 425.
associated with tubercle, 439.
signs of, in tuberculosis, 454.
Cancer, 425.
areolar, 435.
colloid, 435.
epithelial, 435.
melanoid, 435.
soft stages of, 433.
stages of soft, 433.
Cancerous cachexia, 425.
Capillary force, lviii.
Carbuncle, treatment of, in plague, 129.
Carcinoma, 425.
colloid or areolar cancer, 435.
definition of, 425.
Carcinoma, diagnosis of, 436.
epithelial, 435.
melanoid cancer, 435.
pathology of, 426.
prognosis of, 436.
soft stages of, 433.
species described, 431.
treatment of, 436.
Carcinoma of stomach, 694.
Cardiac dilatation, symptoms, 641.
hypertrophy, symptoms, 641.
lesion in typhus, 158.
sounds, 615.
Cardiaci, 3, 626.
Carditis, 640.
Catalepsy, definition of, 539.
pathology of, 540.
prognosis of, 541.
Cause of anæmia, 413.
croup, 179.
glanders, 305.
gout, 399.
hydrophobia, 296.
plague, 121.
scurvy, 323.
tuberculosis, 460.
Causes of anæsthesia, 612.
apoplexy, 520.
ascites, 682.
cerebritis, 503.
cholera, 241.
chorea, 530.
disease, xix.
dysentery, 213.
endocarditis, 642.
epilepsy, 547.
erysipelas, 110.
fever, xlvii.
green sickness, 415.
hydrocephalus, 559.
hysteria, 537.
insanity, 569.
leucocythæmia, 419.
measles, 77.
myelitis, 599.
neuralgia, 603.
paludal fevers, 255.
pleurisy, 650.
rheumatism, 389.
scarlet fever, 93.
small-pox, 55.
typhous fever, 142.
whooping-cough, 188.
Central ganglia of brain in chorea, 527.
Cephalici, 3, 478.
Cerebral diseases, 490.
substance, hæmorrhage into, 517.
theory of insanity, 564.
vomiting, 488.
Cerebritis, causes, 503.
definition of, 499.

Cerebritis, diagnosis of, 509.
pathology of, 499.
prognosis, 509.
symptoms, 504.
treatment of, 509.
Cestoidea or tape-worms, 345.
Change in the name of disease, xxiii.
of tissue, measured by urine, xl.
Chemical composition of brain and nerves, 480.
investigations, xxxiii.
Chest, physical examination of, 612.
Chicken-pox, diagnosis, 69.
pathology, 68.
symptoms, 68.
treatment, 70.
varicella, definition, 68.
Chlorine in urine, xxxix.
Chlorosis, green sickness, 413.
Cholera, causes, 241.
definition, 223.
diagnosis, 243.
forms of, 229.
origin of, 233.
pathology, 223.
prognosis, 243.
propagation of, 233.
propagation of, by human intercourse, 240.
susceptibility to, 243.
symptoms of, 229.
treatment, 244.
Chorea, definition of, 525.
causes of, 530.
central ganglia in, 527.
pathology, 525.
prognosis, 531.
specific gravity of central ganglia, 528.
specific gravity of urine in, 529.
symptoms of, 529.
treatment of, 531.
Choreic hemiplegia, 609.
Chrotici, 3.
Classification of diseases, xx.
Registrar-General's, adopted, xxiii.
special, of disease, 2.
Climate, influence of, on health, 733.
in relation to typhous fever, 145.
Climatology, practical value of, 739.
Clinical instruction, xix.
Clonic spasm, 491.
Coagulable lymph, xxxv, lxv.
protein compounds, xxxvi.
Cod liver oil, 469.
Co-existence of diseases, 14.
small-pox, 55.
Collapse of lung and emphysema, 659.
lung, atrophy, 654.
lung in bronchitis, 653.
Colliquative diarrhœa, lxxxiv.
sweating, lxxxiv.
Colouring matter increased in urine, xlvi.
Coma, 490.
death by, lxxxiii.
Complex morbid states, xxxvii.
vital processes in disease, xxxvi.
Complications, abdominal, of typhus, 137.
in small-pox, 51.
of typhus, 152.
thoracic, in typhous, 136.
Compound granule cell, function of, lxx.
Congestion, active, liv, lviii.
hepatic, 705.
of brain, 511.
intestine, 700.
stomach, 690.
symptoms of, 515.
Consolidation of lung, 665.
Constitution, state in tuberculosis, 451.
Constitutional diseases, 375.
description of, 377.
pathology of, 375.
symptoms, lxxix.
tendencies, lxxxiv.
Convulsion, 491.
Convulsions in typhus fever, 152.
Cord, membranes, inflammation of, 592.
Corpuscular elements of lymph, lxix.
Cough, 625.
Crisis, xlii, xlviii.
Critical day, xlii.
Croup, cause of, 179.
definition, 172.
diagnosis, 178.
pathology and history of, 173.
prognosis, 179.
propagation of, 179.
symptoms of, 177.
treatment, 179.
Crystals of blood, 513.
Cysticerci and tape-worms, 351.
Cysticercus cellulosæ, 358.

Death, agony of, lxxxvi.
beginning at brain, lxxxvi.
heart and lungs, lxxxvii.
Death by anæmia, lxxxvii.
apnœa, lxxxviii.
asthenia, lxxxvii.
coma, lxxxix.
decay of life, lxxxvi.
from injnry, lxxxvi.
modes of, lxxxv.
old age, lxxxvi.
starvation, lxxxviii.
Degeneration of lymph, lxviii.
Delirium tremens, definition of, 336.
diagnosis of, 339.
pathology, 336.
prognosis of, 339.
symptoms of, 336.
treatment of, 340.

Delusion, definition of, 571.
Dementia, 579.
Dengue, definition of, 104.
pathology, 104.
prognosis of, 105.
symptoms, 104.
treatment of, 105.
Departments of science of medicine, xvii.
Deposit of tubercle in typhus, 157.
Deposition and site of tubercle, 447.
Deposits, inorganic, xxxvi.
organic, xxxvi.
of pigment, xxxvi.
Determination of blood to head, 511.
Development of small-pox, 43.
zymotic diseases, 23.
Developmental diseases, 4.
of children, 11.
old people, 4.
women, 11.
Diabetes mellitus, 719.
definition of, 719.
pathology of, 719.
prognosis of, 725.
treatment of, 726.
Diagnosis between endocardial and exocardial sounds, 629.
Diarrhœa, colliquative, lxxxiv.
definition, 219.
from increased vascular action, 220.
forms of, 220.
of irritation, 220.
pathology, 220.
symptoms of, 220.
treatment of, 221.
with discharges of ingesta, 221.
Diathetici, 377.
Dietetic treatment in plague, 129.
of scarlet fever, 98.
of typhous, 166.
of whooping-cough, 193.
Dietic diseases, 309.
Dietici, 309.
Diets, nutritive value of, 311.
Diffuse suppuration, lxxiv.
Dilatation and hypertrophy, forms of, 641.
and hypertrophy of heart, 640.
of the heart, 635.
Disease, cerebral, 490.
diathetic, 3.
dietic, 3.
elucidated, xxiv.
meningeal, 491.
miasmatic, 3.
naming of, xxiii.
nature of, 9.
of spinal cord, 589.
relative nature of, xix, xx.
types of, lxxxv, lxxxix.
Disease-poisons, 15.
peculiar action of, 18.
Disease-realms, 727.
Diseases, brain, 478.
classification of, 1.
co-exist, 14, 18.
constitutional, 3.
developmental, 4.
enthetic, 3.
grounds of classification, xx.
inbred, 476.
local, 3, 478.
nomenclature, 1.
parasitic, 3.
specific, 475.
tubercular, 439.
zymotic, 3.
Diseases of bowels, 3.
brain, 3.
kidney, 3.
lesser intestine, 696.
lungs, 3.
nerves, 586.
nutrition, 4.
old age, 7.
skin, 3.
spinal cord, 586.
the bowels, 674.
the liver, 704.
Doctrines, exclusive, untenable, xxxi.
Dying, modes of, lxxxvii.
Dyscrasiæ, 477.
Dysentery, acute, 201.
acute, morbid anatomy of, 202.
causes of, 213.
chronic, 201.
chronic, morbid anatomy of, 203.
complex, 201.
complex, morbid anatomy of, 206.
definition, 199.
diagnosis, 216.
effects of diet, 215.
hepatic abscess in, 209.
minute lesions in, 205.
pathology, 199.
prognosis, 216.
propagation of, 213.
symptoms of, 211.
treatment, 216.
types and forms of, 211.
Dyspnœa, 625.

Echinococci, 359.
Effects of deficient food, 314.
diet in dysentery, 215.
disease, xxxiii.
overfeeding, 314.
Effusion, lxiii.
purulent, lxxiv.
Elimination of excreta, xl.
Embryo tape-worms, 358.
Emphysema, 647.
and collapse of lung, 654.

Encephalitis, definition of, 499.
Endemic influences, 25.
Endocarditis, 633.
causes of, 642.
murmurs in, 636.
pathology of, 633.
prognosis of, 643.
symptoms of, 635.
tendency of, 635.
treatment, 643.
Enteric fever, 130.
Enterici, 674, 3.
Enteritis, 701.
treatment of, 703.
Enthetic diseases, 289.
Enthetici, 289.
Entozoa, cestoid, 345.
cysticerci, 351.
cystoid, 352.
helmenthoid, 342.
jointed, 345.
nematoidea, 359.
trematodea, 363.
Epidemic influence, 40.
Epileptic hemiplegia, 609.
Epileptiform attacks, 490.
Epilepsy, 553.
causes of, 547.
definition of, 541.
diagnosis in, 550.
pathology of, 542.
prognosis in, 552.
symptoms of, 544.
Epiphytes, vegetable parasites, 368.
Epitheliomata, 435.
Equinia, 301.
Ergotism, pathology of, 332.
symptoms of, 332.
treatment of, 333.
Ergotismus, ergotism, definition of, 332.
Eruption, cutaneous, in typhus fever, 134.
of small-pox, 44.
Erysipelas, cause of, 110.
definition of, 105.
diagnosis, 110.
gangrenosum, 110.
in typhus fever, 154.
pathology, 105.
period of latency, 112.
phlegmonodes, 109.
prognosis, 112.
propagation of, 111.
symptoms, 107.
treatment, 112.
Essential symptoms of fever, xxxviii.
Etiology, xix.
Exclusive doctrines untenable, xxxi.
methods of investigation prejudicial, xxxi.
Excreta diminished in fever, xli.
elimination of, xl.
Excreta increased in fever, xli.
retained, relation to local lesions, xliii.
retained in fever, xlii.
Excretions of body, relation to heat, xxxix.
relation to febrile heat, xxxix.
Expectoration, 625.
Experiments on living animals, xxxiii.
Exudation, xxxv, l, lxiii, lxv.
cancerous, lxv.
corpuscle, lxix.
fatty molecules, xxxv.
gaseous, xxxv.
granular, xxxv.
transition forms, xxxvi.
tuberculous, lxv.
vaccine, xxxvi.
variolous, xxxvi.
Exudation of cancer, xxxvi.
glanders, xxxvi.
melanosis, xxxvi.
syphilis, xxxvi.
tubercle, xxxvi.
typhus, xxxvi.
Exudations, aplastic, lxvi.
aqueous, xxxv.
consolidated, xxxv.
corpuscular, lxvi.
croupous, lxvi.
fibrinous, lxvi.
molecular, xxxv.
plastic, xxxv, lxvi.
results of, lxvi.
simple, lxv.
soft fluid, xxxv.
specific, xxxvi.
typical forms of, lxvi.

Facial anæsthesia, 611.
Faint, lxxxvii.
False membrane, lxvii, xxxv.
Favus, scald head, definition of, 371.
Febricula, definition, 172.
pathology, 172.
Febrile heat, relation to excretions, xxxix.
Fever, xxxvii.
abdominal complications, 137.
acidity of urine increased, xlvi.
blood in, xlvi.
causes of, xlvii, 142.
cerebral affections in, 152.
characters of urine in, xlv.
co-exists, 146.
constitutional, lxxxi.
crisis, xlviii.
cutaneous eruptions, 134.
definition of, xxxvii, 148.
diminution of excreta in, xli.
distinction of tissue in, xliv.
duration of, 147.
enlargement of mesenteric glands, 137.

Fever, enlargement of Peyer's glands, 137.
enteric, 130.
erysipelas in, 154.
essential symptom of, xxxviii.
expectant treatment. 163.
foreign products in, xlv.
geographical relations, 133.
hectic, type of, lxxxiii.
increase of excreta, xli.
indications of treatment in, xlix.
inflammatory, lxxix.
in relation to climate, 145.
latency of, 146.
lesions in and complications of, 152.
litoral, 247.
lysis, xlviii.
maculæ, 134.
malarial, 247.
miliary eruption in, 135.
modified forms, 133.
natural favourable terminations of, xlviii.
nervous system in, xlvi, xlvii.
paludal, 247.
pathology of, xxxvii.
perspiration in, xlv.
prognosis, 146.
relapsing, 167.
retention of water in, xlv.
rose spots, 134.
scarlet, 81.
secondary, in small-pox, 40.
suppuration, in small-pox, 43.
symptomatic, lxxix.
symptoms of, 149.
thoracic phenomena in, 136.
treatment, xlviii.
typhoid, lxxxii.
typhoid or enteric, 130.
typhous, 130.
typhous, pathology of, 131.
typhus, convulsions in, 152.
Fevers, idiopathic, xxxviii.
primary, xxxviii.
specific, xxxviii.
Filaria medenensis, or Guinea worm, 360.
Fluke-like worms, 360.
Food, effects of, 309.
nutritive value of, 311.
Forms assumed by constituent elements, xxxiv.
of cholera, 229.
diarrhœa, 220.
dysentery, 211.
insanity, 570.
leucocythæmia, 417.
or species of carcinoma, 431.
scarlet fever, 86.
small-pox, 46.
typhous fever, 133.
Fremitus, 613.
Friction sound in pericarditis, 620.
sound in pleurisy, 649.
Function of compound granular cell, lxxi.

Gangrene of lung, 660.
in typhus, 155.
Gangrenous erysipelas, 110.
Gastric softening, 687.
ulcer, 693.
vomiting, 488.
General rules in blood-letting, c.
Gennetic diseases, 3.
Geographical distribution of diseases, 727.
relations of typhous fever, 133.
Geography, medical, 727.
Glanders, cause of, 305.
definition of, 301.
diagnosis, 307.
pathology, 302.
period of latency, 307.
preventive treatment, 308.
prognosis, 307.
symptoms, 303.
treatment, 308.
Glandular degeneration of stomach, 689.
lesions of lesser intestine, 697.
Globus hystericus, 531.
Glycogenesis, 720.
Gout, cause of, 399.
definition of, 396.
diagnosis of, 405.
hereditary transmission of, 399.
influence of malt liquors, 401.
pathology of, 396.
prognosis of, 406.
symptoms of, 401.
treatment of, 406.
Granulation, lxxvi.
Green sickness, causes of, 415.
definition of, 413.
diagnosis of, 415.
pathology of, 413.
symptoms of, 413.
treatment of, 415.
Grey hepatization, 659.
Grounds of classification of diseases, xx.
Guinea worm, 360.
Gyratici, 7.

Habit illustrated, 13.
Hæmorrhage into arachnoid, 519.
cerebral substance, 517.
ventricles, 518.
Hallucination, 571.
subjective nature of, 572.
Head, determination of blood to, 511.
Healing of the lung in phthisis, 453.
Health, relative nature of, xix, xx.
Heart affection in rheumatism, 383.
death beginning at, lxxxvii.
and lung diseases, diagnosis of, 612.

Heart, dilatation of, 635.
disease, 3.
diseases, 626.
hypertrophy and dilatation of, 640.
hypertrophy of, 635.
valvular disease, 635.
Heart's sounds, 615.
morbid, 621.
Heat, indicated by concentration of urine, xlv.
relation to excretion, xxxix.
Hectic flush, lxxxiv.
type of fever, lxxxiii.
Helminthoid entozoa, 342.
Hemiplegia, chronic, 609.
epileptic, 609.
lesions which produce, 606.
Hepatic abscess, 706.
abscess in dysentery, 209.
congestion, 705.
vomiting, 488.
Hepatitis, 705.
prognosis, 708.
symptoms, 706.
treatment of, 708.
Hepatization, 659.
Hereditary origin of insanity, 570.
transmission of gout, 399.
origin of tuberculosis, 464.
Humoralists, xxvi.
Hydrocephaloid disease, 561.
Hydrocephalus, acute symptoms, 558.
causes of, 559.
definition of, 555.
diagnosis, 560.
morbid anatomy in, 557.
pathology of, 555.
prognosis of, 561.
spurious, 560.
treatment of, 561.
Hydrophobia, cause of, 296.
definition, 296.
diagnosis, 299.
pathology, 291.
preventive treatment of, 301.
prognosis, 299.
rabies, 290.
symptoms, 294.
treatment, 299.
Hygienic treatment of tuberculosis, 477.
Hygiology, or hygiene, xvii.
Hypertrophy and dilatation of heart, 640.
forms of, 641.
of heart, 635.
Hypochondriasis, definition of, 575.
Hysteria, causes of, 537.
definition of, 532.
diagnosis of, 535.
pathology of, 532.
prognosis of, 538.
symptoms of, 532.
treatment of, 538.
Idiopathic fever, xxxviii.
Inbred diseases, 476.
Inductive examination of facts, xxx.
Inflammation, xlix.
adhesive, lxvii.
blood in, lv.
blood-vessels in, li.
definition of, xlix.
destructive effects, lxiii.
effects of, lxii.
events of, lxii.
local symptoms of, li.
of stomach, 691.
parenchymatous, lx.
pathology of, l.
phenomena of, li.
productive effects, lxiii.
products of, lxii.
resolution of, lxii.
symptoms of, lxxix.
theory of, lvi, lviii.
Inflammatory affections, secondary, xlii.
globules, lxix.
Influence of nerves in fever, xlvii.
solid organs, xxv.
the humours, xxv.
Influenza, causes of, 197.
complications of, 195.
definition of, 193.
diagnosis of, 197.
latency of, 197.
pathology, 194.
propagation of, 197.
susceptibility of, 197.
symptoms of, 195.
treatment, 198.
Ingesta, discharged by diarrhœa, 221.
Injury, death from, lxxxvi.
Inorganic murmurs, 621.
Insane, paralysis of the, 580.
Insanity, causes of, 569.
cerebral, theory of, 564.
definition of, 564.
diagnosis of, 581.
forms of, 571.
hereditary origin, 570.
metaphysical theory of, 564.
morbid anatomy, 564.
nature of, 565.
premonitory indications of, 560.
prognosis of, 583.
specific gravity of brain, 567.
symptoms of, 571.
treatment of, 583.
Inspection of thorax, 612.
Institutions or theory of medicine, xviii.
Instruments and means of research, xxxiii.
Intermittent fever, definition of, 264.
symptoms, 264.
treatment, 267.
Interstitial absorption, lxxv.

Intestine, congestion of, 700.
diseases of, 696.
glandular lesions, 697.
Invasion of disease, order of, xxxiv.
Irritation a cause of diarrhœa, 220.
Isothermic zones, 728.

JAUNDICE, 710.

KIDNEY diseases, 3.
Kleptomania, 578.

LATENCY of erysipelas, 112.
glanders, 307.
influenza, 197.
plague poison, 127.
whooping-cough, 189.
Latent period of typhous poison, 146.
Lesions, elementary constituents, xxxiii.
in relapsing fever, 168.
rheumatism, 381.
rötheln, 101.
rubeola, 101.
typhus fever, 152.
Leucocythæmia, causes of, 419.
definition, 416.
diagnosis of, 418.
forms of, 417.
pathology of, 416.
prognosis of, 419.
symptoms of, 419.
treatment of, 419.
Leukæmia, 416.
Lientery, 221.
Life, relative nature of, xix, xx.
Litoral fevers, 247.
Liver, diseases of, 704.
forms sugar, 721.
Lobular pneumonia, 654.
Local diseases, 478.
Loss of blood, effects of, xcix.
Lung, abscess of, 660.
consolidation of, 665.
diseases, 3.
gangrene of, 660.
gangrene of, in typhus, 155.
grey softening, 659.
healing in phthisis, 453.
hepatization of, 659.
red softening, 659.
Lungs, death beginning at, lxxxvii.
Lymph, lxv.
cells, lxix.
degeneration of, lxviii, lxix.
exudations, lxiii and lxv.
fatty degeneration of, lxix.
pigmental degeneration, lxix.
inflammatory, lxviii.
liquefaction of, lxix.
withering of, lxviii.
Lysis, xlviii.

MACULÆ in typhus fever, 134.
Malaria, animal, 40.
enduring influence of, 738.
nature and source of, 28.
neutralization of, 28.
removal of, 28.
Malarial fevers, 247.
Malarious places, 26.
poison, 26.
Malt liquors, influence on gout, 401.
Mania, 579.
Material of complex kind, xxxvi.
concretions, xxxvi.
hypertrophy, xxxvi.
media of repair, xxxvi.
tumors, xxxvi.
Means and instruments of research, xxxiii.
which elucidate disease, xxiv.
Measles, forms of, 74.
morbilli, definition, 71.
pathology, 71.
propagation by contagion, 78.
symptoms, 74.
treatment of, 79.
Measurement of thorax, 613.
Medical geography, 727.
Medicine as an art and science, xvii.
systematic, 1.
Melancholia, 579.
Melasma, supra renal, 419.
Melituria, 719.
Membrane, false, lxvii.
pyogenic, lxxiv.
Membranes, dysmenorrheal, lxvii.
Meningeal disease, 491.
Meningitis, definition of, 491.
diagnosis of, 495.
pathology of, 491.
symptoms of, 494.
tubercular, 496.
tubercular, symptoms of, 497.
tubercular, diagnosis of, 448.
tubercular, treatment of, 498.
Mercury, sanative influence of, civ.
Mesenteric glands, enlargement in typhous, 137.
Metamorphici, 4.
Metaphysical theory of insanity, 564.
Metastasis, lxii.
Miasmata infecting distances, 36.
influence of soil on, 33.
Miasmatic disease, characteristics of, 25.
diseases, 25.
Miasms, evolution of, 35.
Microscope, application of, xxxiii.
opens up new fields of labour, xxvi.
Microscopic constituents of tubercle, 443.
Miliary eruption in typhous, 136.
definition, 70.
pathology, 70.
symptoms, 70.

Minute lesions in dysentery, 205.
Mitral murmurs, 622.
Modes of death, lxxxv.
  dying, lxxxvii.
Monomania, 575.
Monorganici, 3.
Morbid anatomy, xix, xxiv.
  Addison's disease, 423.
  a record of facts, xxiv.
  chronic dysentery, 202.
  complex dysentery, 206.
  conditions of brain, 487.
  in acute dysentery, 202.
  insanity, anatomy of, 564.
  paludal fevers, 251.
  poisons, 15.
  poison in blood, 22.
  province defined, xxxi.
  respiratory sounds, 616.
  vocal sounds, 618.
  whooping-cough, 182.
Morbid elementary products, xxxv.
  histology, xix.
Morbilli graviores, 76.
  graviores, causes, 77.
  graviores, diagnosis, 76.
  graviores, prognosis, 77.
  mitiores, 74.
Morbus, Addisonii, 419.
Mortification, lxxviii.
Mucous exudation, lxiii.
Murmur, pulmonary artery, 622.
Murmurs, aortic, 622.
  cardiac, 621.
  organic, 621.
  mitral, 622.
  pericardiac, 623.
  tricuspid, 622.
Myelitis, diagnosis of, 599.
  pathology of, 595.
  prognosis of, 599.
  symptoms of, 596.
  treatment of, 600.
Myostici, 3.

Names of diseases change, xxiii.
Naming of a disease, xxiii.
Nature of tubercle, 441.
  yellow fever, 253.
Nematoida round worms, 359.
Nephritici, 3, 712.
Nephritis, 712.
  definition, 712.
  pathology of, 712.
  symptoms, 713.
  treatment, 714.
Nerves, diseases of, 586.
  influence in fever, xlvii.
Nervous force, 483.
  system in fever, xlvi.
Neuralgia, causes of, 603.
Neuralgia, definition of, 600.
  diagnosis of, 603.
  pathology of, 601.
  prognosis in, 603.
  symptoms of, 601.
  treatment of, 603.
Nitrogen passed off by urea, xl.
Nitrogenous tissue, destruction of, xliv.
Nosologies referred to, 2, xxi.
Nosology, definition of, 1.
  its divisions, 1.
  of Dr. William Farr, 3.
  present state, 1.
Nutrition, conditions of, altered, li.
Nutritive value of coffee, 312.
  diets, 311.
  food, 311.
  force, lviii.
  salted meat, 312.
  tea, 312.

Old age, death by, lxxxvi.
Opening of dead bodies, xxxiii.
Order of invasion of disease, xxxiv.
Organic chemistry, xxvi.
  murmurs, 621.
Organizable matter in inflammatory products, lxiv.
Origin of cholera, 233.
Ova of tape-worms, 347.
Over-feeding, 314.
Oxidation of sulphur, xl.

Palpitation, 613, 625.
Palsy, definition of, 604.
Paludal fevers, 247.
  causes of, 255.
  morbid anatomy in, 251.
  pathology of, 247.
  predisposition to, 259.
  propagation of, 261.
  susceptibility, 259.
Paracentesis, 633, 685.
Paralysis, conditions causing, 605.
  condition of muscles in, 607.
  definition of, 604.
  of the insane, 580.
  pathology of, 604.
  treatment of, 609.
Paraplegia, 607.
Parasites, vegetable, 368.
Parasitic diseases, 341.
Parasitici, 341.
Parenchymatous inflammation, lx.
Pathogeny, xix.
Pathological anatomy, xxiv.
  histology, xxiv.
Pathology, 593.
  anæmia, 410.
  and history of croup, 73.
  and morbid anatomy of ascites, 678.

Pathology of apoplexy, 511.
Addison's disease, 419.
Bright's disease, 714.
bronchitis, 652.
carcinoma, 426.
catalepsy, 540.
cerebritis, 499.
chicken-pox, 68.
cholera, 223.
chorea, 525.
constitutional diseases, 375.
delirium tremens, 336.
dengue, 104.
diabetes mellitus, 719.
diarrhœa, 220.
dysentery, 199.
endocarditis, 633.
epilepsy, 542.
ergotism, 332.
erysipelas, 105.
febricula, 172.
fever, xxxvii.
general, xvii, xix.
glanders, 302.
gout, 396.
green sickness, 413.
hydrophobia, 291.
hydrocephalus, 555.
hysteria, 532.
in a transition state, xxv.
inflammation, l.
influenza, 194.
insanity, 564.
jaundice, 710.
leucocythæmia, 416.
measles, 71.
meningitis, 491.
miliaria, 70.
modern, xxx.
myelitis, 595.
nephritis, 712.
neuralgia, 601.
paludal fevers, 247.
paralysis, 604.
pericarditis, 626.
peritonitis, 674.
plague, 115.
pleurisy, 646.
purpura, 328.
relapsing fever, 167.
rheumatism, 178.
ringworm, 369.
scald head, 371.
scarlet fever, 82.
scurvy, 318.
small-pox, 43.
special, xvii, xix.
spinal arachnitis, 593.
stomach diseases, 685.
study of, embraces, xvii.
tuberculosis, 439.
Pathology of typhous fevers, 131.
whooping-cough, 182.
zymotic diseases, 9.
Pericardiac murmurs, 623.
Pericarditis, definition of, 626.
friction sound, 629.
general symptoms of, 627.
morbid anatomy of, 626.
Pericarditis, prognosis of, 631.
treatment of, 631.
Period of latency of plague, 127.
Peritonitis, 674.
diagnosis of, 677.
prognosis of, 677.
symptoms of, 676.
treatment of, 678.
Perspiration in fever, xlv.
Pertussis, 185.
Pestis, 115.
Peyer's glands in typhous fever, 137.
Phenomena of inflammation, l, li.
Phlegmon, lxxi.
Phlegmonodes, erysipelas, 109.
Phrenitis, see *Cerebritis*.
Phthisici, 3, 437.
Phthisis, definition and symptoms, 668.
healing of lung, 453.
Physical examination of chest, 612.
signs in bronchitis, 656.
signs in pleurisy, 649.
signs of pneumonia, 662.
Physiology indicates the doctrines of disease, xxv.
study of, embraces, xvii.
Pithing, 588,
Plague, 115.
cause of, 121.
contagion of, 125.
definition of, 115.
diagnosis of, 121.
dietetic treatment in, 129.
first and second degree of, 119.
modes of absorption of poison, 127.
modes of propagation of, 122.
pathology and history of, 115.
poison, period of latency of, 127.
preventive treatment of, 129.
prognosis in, 127.
symptoms of, 118.
third degree of, 120.
treatment of, 128.
treatment of bubo in, 129.
treatment of the carbuncle, 129.
Pleurisy, 645.
causes of, 650.
pathology of, 646.
prognosis of, 650.
symptoms of, 647.
treatment of, 650.
Pleuritis, physical signs, 649.
Pleuro-pneumonia, 645.

Pneumonia, definition of, 586.
in typhus fever, 155.
lobular, 654.
physical signs, 662.
symptoms of, 661.
treatment of, 665.
Pneumonici, 3.
Podagra, gout, 396.
Poison of plague, modes of absorption, 127.
Poisons, actions of, 9.
cumulative, 12.
morbid, 15.
morbid, in blood, 22.
of erysipelas, latency of, 112.
of plague, latency of, 127.
their specific action, 15.
typhus, latency of, 146.
Presentiment of death, 17.
"Pretubercular stage" of phthisis, 457.
Preventive treatment in plague, 129.
of scarlet fever, 98.
Primary fever, xxxviii.
Principles of classification, xx.
Probation, characteristic of the period, xxx.
Prognosis in catalepsy, 541.
cholera, 243.
chorea, 551.
delirium tremens, 339.
epilepsy, 552.
erysipelas, 112.
hydrocephalus, 561.
hydrophobia, 299.
influenza, 147.
jaundice, 711.
measles, 77.
neuralgia, 603.
pericarditis, 631.
plague, 127.
typhus, 146.
yellow fever, 283.
Prognosis of apoplexy, 521.
ascites, 683.
Bright's disease, 718.
carcinoma, 436.
cerebritis, 509.
croup, 179.
dengue, 105.
diabetes mellitus, 725.
dysentery, 216.
endocarditis. 643.
glanders, 307.
gout, 406.
hepatitis, 708.
hysteria, 538.
insanity, 583.
myelitis, 599.
peritonitis, 677.
pleurisy, 650.
rheumatism, 389.
rötheln, 103.
scarlet fever, 94.
scurvy, 322.
Prognosis of small-pox, 57.
spinal arachnitis, 594.
whooping-cough, 189.
Propagation of cholera, 233.
by human intercourse, 240.
croup, 179.
dysentery, 213.
erysipelas, 111.
measles, 78.
Propagation of paludal fevers, 261.
plague, 122.
scarlet fever, 93.
typhous fever, 142.
whooping-cough, 188.
Pulmonary artery, murmur, 622.
complications in typhus, 154.
Purgatives in rheumatism, 393.
sanative influence of, civ.
Purples, the diagnosis of, 331.
pathology of, 328.
symptoms of, 330.
treatment of, 331.
Purpura, the purples, definition of, 328.
Purulent effusion, lxxiv.
infiltration, lxxiv.
Pus, formation of, lxxii.
Pyelitis, 713.
Pyogenic membrane, lxxiv.
Pyrexia, xxxvii.
Pyromania, 578.

Rabies, hydrophobia, 290.
Rales, 616.
Ramollissement, 499.
Rattles, 616.
Realms of disease, 727.
Red hepatization, 659.
corpuscles diminished in blood, xlvi.
softening of brain, 499.
softening of lung, 659.
Reflex action, 587.
Relapsing fever, definition, 167.
diagnosis, 168.
lesions in, 168.
pathology, 167.
symptoms, 168.
treatment, 171.
Remittent fever, definition of, 270.
symptoms of, 270.
treatment of, 271.
Reproduction of parts, lxxvii.
Research, means and instruments of, xxxiii.
Resolution of inflammation, lxii.
Respiration, abdominal, 613.
in health, 625.
thoracic, 613.
Respiratory sounds in health, 615.
sounds, morbid, 616.
Retention of excreta in fever, xlii.
relation to local lesions, xliii.
water in fever, xlv.
Rheumatic carditis, 635.

Rheumatism, 377.
alkaline remedies, 395.
blood-letting in, 391.
causes of, 389.
definition of, 377.
diagnosis of, 389.
duration of, 387.
lesions in, 381.
pathology of, 378.
prognosis of, 389.
prone to heart affection, 383.
purgatives in, 393.
symptoms of, 385.
treatment of, 391.
Rigor, a peripheric phenomenon, xxxix.
of suppuration, lxxxii.
Ringworm, definition of, 369.
of the scalp, 369.
pathology of, 369.
symptoms of, 370.
treatment of, 370.
Ronchi, 616.
Rötheln, definition of, 98.
diagnosis, 101.
lesions in fatal cases, 101.
pathology, 98.
prognosis, 103.
symptoms, 99.
treatment, 104.
Round worms, 360.
Rubeola or rötheln, definition of, 98.

Salted meat, nutritive value of, 312.
Scald head, pathology of, 371.
symptoms of, 372.
treatment of, 373.
Scarlatina anginosa, 88.
latens, 91.
maligna, 90.
rheumatica, 104.
sequelæ of, 91.
simplex, 87.
Scarlet fever, 81.
cause, 93.
definition of, 81.
diagnosis, 93.
dietetic and preventive treatment, 98.
modified forms of, 86.
pathology, 82.
prognosis, 94.
propagation, 93.
symptoms, 86.
treatment, 94.
Scorbutus, scurvy, definition of, 318.
Scurvy, cause of, 323.
diagnosis, 322.
pathology, 318.
prognosis, 322.
symptoms, 321.
treatment, 326.
Seats or localities of disease, xix.
Secondary inflammatory affections, xlii.
Semeiology, xix.
Sequelæ of scarlatina, 91.
Serous apoplexy, 511.
effusions, lxiii.
Signs, physical, of phthisis, 673.
Sinuses, lxxiv.
Skin diseases, 3.
Sloughs, lxxiv.
Small-pox, 4.
Small-pox after vaccination, 54.
cause of, 55.
co-existent with, 55.
confluent, 45.
confluent, symptoms, 49.
definition, 42.
development, 43.
diagnosis, 58.
dietetic treatment of, 60.
distinct, 45, 46.
eruption, 44.
horn, 45.
inoculated, 50.
inoculated, complications of, 51.
inoculated, symptoms, 50.
pathology, 43.
prognosis of, 57.
pustule, 44.
secondary fever, 40.
stages of, 43.
suppurative fever, 43.
susceptibility to, 55.
symptoms, 46.
the operation of vaccination, 67.
the prophylactic or preventive treatment of, 63.
therapeutic treatment of, 60.
treatment of, 59.
vaccination, 65.
vaccination tests, 67.
varieties of, 46.
without eruption, 46.
Softening, lxxv.
gastric, 687.
of brain, 499.
symptoms of, 507.
of tubercle, 445, 449.
Solidists, xxvi.
Sounds, cardiac, 618.
endocardial and exocardial, 629.
respiratory, 615.
vocal, 615.
Sources of worms, 357.
Spasms, clonic, 491.
tonic, 491.
Spastic contractions, 490.
Specific diseases, 475.
weight of brain in the insane, 567.
weight of cerebral substance, 481.
Specific fevers, xxxviii.
gravity of urine, xxxix.
weight, xxxiii.
Specific gravity of brain in chorea, 528.

Specific gravity of spinal cord, 591.
gravity of urine in chorea, 529.
Spinal arachnitis, 593.
diagnosis of, 594.
prognosis of, 594.
symptoms of, 593.
treatment of, 595.
Spinal cord, disease of, 586.
physiological discoveries, 587.
specific gravity in, 591.
Spurious hydrocephalus, 560.
Sputa, 625.
Stages of small-pox, 43.
Starvation, lxxxviii, 17, 314.
death by, lxxxviii.
Stasis, liv, lviii.
Statistics, xxxiii.
Stertorous breathing, lxxxix.
Sthenic type of fever, lxxxii.
Stomach, carcinoma of, 694.
congestion of, 690.
diseases, definition and nature of, 685.
diseases, treatment of, 695.
glandular degeneration of, 689.
inflammation of, 691.
ulceration of, 692.
Strongylus gigans, 363.
St. Vitus's dance. See *Chorea*.
Sugar in the liver, 721.
urine tests, 725.
Sulphuric acid in urine, xxxix.
Suppuration, lxxii.
diffuse, lxxiv.
marked by rigor, lxxxii.
superficial, lxxv.
Supra renal melasma, 419.
Susceptibility to cholera, 243.
influenza, 197.
paludal fevers, 259.
small-pox, 55.
Sweating, colliquative, lxxxiv.
Symptomatic fever, lxxix.
Symptomatology, xix.
Symptoms, constitutional, lxxix.
local, of inflammation, li.
of fever, essential, xxxviii.
Syncope, lxxxvii.

Table for diagnosis in rötheln, 102.
of thoracic sounds of respiration, 615.
morbid respiratory sounds, 616.
morbid vocal sounds, 618.
relative to excreta in fever, xliii.
Tape-worms, 345.
and cestoid entozoa, 352.
development of, 355.
probable source of, 357.
structure of ova, 347.
Temperament illustrated, 13.
Temperate regions, nature of research, xxxi.
Temperature, natural, represented by excretions, xxxix.
Temperament of body in health, xxxix.
Tests for sugar in the urine, 725.
Theory, cerebral, of insanity, 564.
metaphysical, of insanity, 564.
of inflammation, lvi, lviii.
Therapeutics, study of, embraces, xvii.
Tissue, albuminous, destruction of, xliv.
destruction of, in fever, xliv.
elements, altered, lxi.
nitrogenous, destruction of, xliv.
Thoracic complication in typhous, 136.
respiration, 613.
sounds, 615.
Thorax, measurement of, 613.
inspection of, 612.
Tonic, spasm, 491.
Treatment, antiphlogistic, xcvii.
dietetic, in plague, 129.
dietetic, of apoplexy, 525.
dietetic, of influenza, 199.
dietetic, of small-pox, 60.
hygienic, of tuberculosis, 477.
indications of, in fever, xlix.
Treatment, preventive, in glanders, 308.
in plague, 129.
of hydrophobia, 301.
of small-pox, 63.
Trematodea, 363.
Trichina spiralis, 362.
Trichosis furfuracea, 369.
Tricocephalus dispar, 362.
Tricuspid murmurs, 622.
Tropical regions, nature of research, xxxi.
Tubercle, analysis of, 446.
microscopic constituents of, 443.
nature of, 441.
site of, 447.
softening of, 445.
Tubercular meningitis, 496.
diagnosis of, 498.
treatment of, 498.
Tuberculosis betrays itself, 459.
cachexia, 439.
causes, 460.
constitutional state, 451.
definition of, 439.
diagnosis of, 457.
early symptoms of the cachexia, 454.
hereditary, 464.
pathology of, 439.
phenomena of softening, 449.
treatment of, 467.
Tuberculous diseases, 437.
Type of disease changed, evidence of, xciv.
Type of fever, adynamic, lxxxii.
asthenic, lxxxii.
sthenic, lxxxii.
typhoid, lxxxii.
Types of disease, lxxxv, lxxxix.
changed, xciii.
dysentery, 211.
Typhoid fever, lxxxii.

Typhoid fever, definition of, 158.
or enteric fever, 130, 158.
or enteric fever, symptoms of, 158.
type of fever, lxxxii.
Typhous, enlargement of mesenteric glands, 137.
Typhous fever, abdominal complications, 137.
causes of, 130, 142.
cutaneous eruption, 134.
dietetic treatment, 166.
duration of, 147.
enlargement of Peyer's glands, 137.
eruption in miliary, 135.
existence with other diseases, 146.
expectant treatmeut, 163.
geographical relations, character, and form of, 133.
influence of climate on, 145.
modes of propagation, 142.
modified forms of, 133.
poison, latency of, 146.
prognosis of, 146.
rose spots, 134.
the maculæ, 134.
thoracic phenomena in, 136.
treatment of, 160.
Typhous fevers, pathology of, 131.
Typhus, bronchial complications, 156.
cardiac lesion in, 158.
deposit of tubercle in, 157.
gangrene of the lung in, 155.
lesions in, and complications of, 152.
Typhus fever, 154.
cerebral affection in, 152.
convulsions in, 152.
definition of, 148.
erysipelas, 154.
pneumonia in, 155.
symptoms, 149.

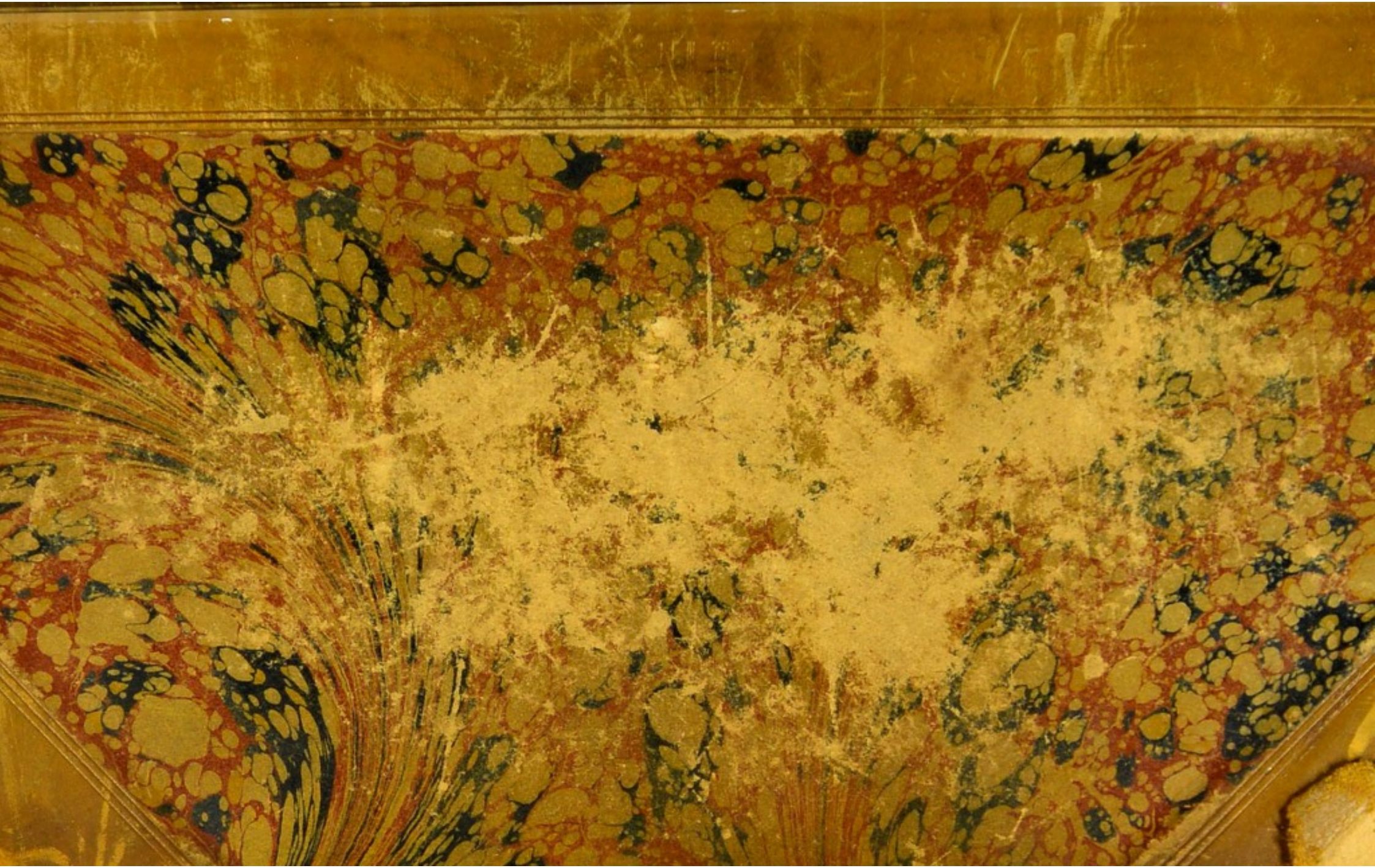
Ulceration, lxxvi.
of stomach, 692.
Urea, in urine, average amount, xxxix.
Uric acid in blood, xlvi.
Urine, acidity augmented in fever, xlvi.
a measure of, metamorphosis, xl.
characters in fever, xlv.
chlorine in, xxxix.
concentration of, an index of heat, xlv.
free acid in, xxxix.
in fever, colouring matter increased, xlvi.
phosphoric acid in, xxxix.
specific gravity, xxxix.
urea, average amount in, xxxix.

Vaccination, 65.
tests, 67.
the operation, 67.
Valvular disease of heart, 635.
Varicella, chicken-pox, 68.
Vascular action in diarrhœa, 220.
Ventricles, hæmorrhage into, 518.
Vital agency, xxv.
force, lviii.
processes, complex, in disease, xxxvi.
Vitalists, xxvi.
Vocal sounds in health, 615.
sounds, morbid, 618.
Vomit, black, in yellow fever, 281.
Vomiting, gastric, 488.
cerebral, 488.
hepatic, 488.

Water, retention of, in fever, xlv.
Weight, absolute, of brain, 481.
of brain in the insane, 567.
specific, of brain, 482.
White-cell blood, or white blood, 416.
Whooping-cough, 185.
causes, 188.
definition, 182.
diagnosis, 188.
dietetic treatment, 193.
latency of, 189.
morbid anatomy, 182.
pathology of, 182.
prognosis, 189.
propagation of, 188.
symptoms, 185.
treatment, 190.
Worms, 342.
jointed, 345.
prophylactic treatment of, 367.
round, 359.
symptoms of, 364.
treatment of, 365.

Yellow fever, 275.
definition, 275.
nature of, 281.
prognosis, 283.
symptoms, 276.
treatment, 284.
white and black vomit in, 281.

Zones of disease, 728.
isothermic, 728.
Zymotic disease, deaths from, 24.
diseases, 4, 9, 23.
pathology of, 9.

97/27

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