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VETERINARY THERAPEUTICS

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1921

VETERINARY THERAPEUTICS

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VETERINARY THERAPEUTICS

A GUIDE TO THE TREATMENT OF DISEASE IN THE DOMESTIC ANIMALS

BY

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THIRD EDITION



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PREFACE TO THE THIRD EDITION

THE call for a third edition of this work came at a time when the author was busily engaged in the preparation of 'A System of Veterinary Medicine'; hence it was necessary to defer the matter in order to devote the amount of attention to the subject which its importance demanded. Therapeutics being a progressive science, it follows that within even a comparatively short period additions must be made to existing knowledge, views on many questions must be altered, and, as the result of further clinical experience, one is enabled to 'separate the wheat from the chaff,' to differentiate facts from imagination, and to distinguish consequences from coincidences. In order to avoid the unfortunate results which are likely to occur from an attempt to put 'new wine into old bottles,' the author deemed it advisable to rewrite the entire work. It was imperative to extend certain sections, to delete obsolete and doubtful methods of treatment, and to include new therapeutic measures whose value has either been proved clinically, or whose utility, judging by the encouraging results obtained in a limited number of instances, is likely to be demonstrated on future occasions. Owing to the criticisms expressed by a few of those who reviewed the last edition, it seems necessary to point out that the work deals with the treatment of diseases in animals, and is not intended as a textbook on Materia Medica or on Pharmacy, nor does it embrace Pharmacology further than is necessary to explain the uses of the various medicinal agents. At

the same time, the author is of opinion that the amount of information given with reference to the preparation of drugs is quite sufficient for the needs of the veterinary student. The latter is being trained for the duties of the general practitioner, an important part of whose function is the treatment of diseases in animals. He is not intended to prepare drugs from the crude material, nor should he be expected to acquire the knowledge which is essential to the pharmaceutical chemist. When attempts are made to burden the memory of the student by compelling him to remember the technical composition of the various drugs, and the details in connection with the preparation of medicinal agents, active principles, etc., the result is that such useless knowledge is rapidly forgotten, and valuable time is wasted.

In the present day the practitioner obtains the medicinal agents he requires from reliable manufacturing chemists, whose reputation is such that he need not concern himself on matters connected with the purity of drugs, or the standard of their efficiency. This does not mean that the student should neglect the subject of dispensing, or that he should rely on the chemist to supply ready-made preparations. Obviously what we intend to convey is that it is not necessary for the student to commit to memory the actual chemical composition of the various drugs, or the precise manner in which active principles and alkaloids are prepared. His time and his energy will be more than occupied with studying the actions, uses, and doses of the various agents employed in practice.

As regards the art of dispensing, this must be acquired in the pharmacy and not from lectures or textbooks.

In this edition the general plan of the work has not been altered. In Part I. the subject of *Diagnosis* and the *General Symptoms of Disease* receives full consideration, and this section has been extended. The important part which a correct diagnosis exerts on successful treatment is sufficient reason for devoting special attention to the subject.

The section on the *Care, Management, and Nursing, of Sick*

Animals has been enlarged and revised, and now includes complete articles concerning Cattle, Sheep, Pigs, Dogs, Cats, and Birds, written by practitioners who have specialized in these subjects. The value of these details as auxiliaries to medicinal treatment cannot be over-estimated, and the student who devotes attention to the simple but important instructions here given on the subject, by practitioners of extensive experience, cannot fail to enhance his utility to stockowners, and to render himself successful in his treatment of diseases.

In Part II. the actions, uses, and doses, of drugs receive consideration. All the agents which *might* be employed in veterinary practice are not included, the list being limited to those whose practical utility has been demonstrated clinically, and those which have not yet been universally accepted as useful, although giving encouraging results. The preparations have been revised in accordance with the British Pharmacopœia, 1914, but the author has not hesitated to deal with drugs and preparations which are not official, provided their utility was established. In the preparations of drugs the quantities are arranged according to the Metric System, but the doses are given in the Imperial weights and measures, as up to the present time practitioners do not employ the former method.

Owing to the increasing importance of vaccine and serotherapy a full list of the various vaccines and sera is given, and a special chapter on the subject has been written by Mr. W. M. Scott, F.R.C.V.S., which should prove of marked value to practitioners who have not yet adopted this form of treatment.

In Part III. the treatment of those diseases which are commonly met with in practice is discussed in a brief and concise manner. In order to explain the indications for treatment it has been deemed advisable to deal with the etiology and symptoms in many of these affections, and it is hoped that the synopsis of the clinical phenomena given in connection with the therapeutic measures advised may prove of assistance to the student.

The author has endeavoured all through the text to emphasize two important points: *Firstly*, The necessity for recognizing, respecting, and assisting, the natural powers of recovery. *Secondly*, The inimical effects of indiscriminate prescribing, and also of administering drenches and forcing fluid foods on patients. He is convinced that since practitioners have learned by experience to prescribe with discretion, to adopt a 'wise scepticism' with reference to the influence which drugs are able to exert on the course of diseases, and to avoid the administration of drenches as far as possible, the percentage of recoveries from all curable affections is far higher than under the old régime, in which constant 'drugging' was the order of the day.

The author desires to express his sincere thanks to the following professional friends for their valuable assistance and co-operation:

To Mr. Hugh Begg, F.R.C.V.S., for writing the article on the Care, Management, and Nursing, of Sick Cattle; also for reading the proof-sheets as they passed through the press, and suggesting many valuable additions.

To Mr. G. Mayall, M.R.C.V.S., for writing the articles on the Care, Management, and Nursing, of Sick Sheep and Pigs.

To Mr. W. M. Scott, F.R.C.V.S., for writing the chapter on Vaccine-Therapy and Sero-Therapy.

To Mr. Henry Gray, M.R.C.V.S., for rewriting the chapter on Canine Distemper, for collaborating in the section on the Care, Management, and Nursing, of Sick Dogs, Cats, and Birds, and for many valuable suggestions.

In conclusion, the author ventures to hope that the work will continue to prove useful to practitioners for the purpose of rapid reference, and to students as a textbook on the subject of Therapeutics.

E. W. H.

18, Cook Street,
Cork,
March, 1916.

CONTENTS

PART I

CHAPTER I

INTRODUCTORY

PAGES

General remarks on diagnosis—The *vis medicatrix naturæ*—Rational therapeutics—Empirical therapeutics—Specific remedies—The limitations of veterinary therapeutics - - - - - - 1—7

CHAPTER II

ON DIAGNOSIS AND THE GENERAL SYMPTOMS OF DISEASE

Various methods of treatment—Advantages of a correct diagnosis—The foundations of diagnosis—Symptomatic treatment—Objective symptoms—Importance of a well-trained faculty of observation—Necessity for becoming acquainted with the appearance and habits of healthy animals—Necessity for a practical knowledge of dietetics and hygiene—Importance of a knowledge of anatomy and physiology—Necessity for a thorough practical knowledge of the normal respiratory and cardiac sounds, and of the physical examination of healthy organs—Importance of not mistaking normal conditions for morbid phenomena—The need for improved clinical teaching—Importance of a systematic clinical examination of the patient in arriving at a diagnosis—The observation of symptoms—Diagnostic symptoms—Typical cases—Atypical cases—Difficulties in diagnosis—Value of a systematic method in diagnosis—The history of the case—The examination of the patient—Unsuspected diseases—The temperature—Use and value of the clinical thermometer—Fever—Subnormal temperature—Alterations in the character of the pulse and action of the heart—Varieties of pulse—Physical examination of the heart—Use of the stethoscope—Inspection—Palpation—Percussion—Auscultation—Varieties of murmurs—Symptoms in connection with the respiratory functions—Accelerated respirations and dyspnœa—Types of respiration—Cough—Varieties of coughs—Nasal discharge—Chronic nasal discharge and its various causes—Physical examination of the chest—Percus-

PAGES

sion—Auscultation—Normal physical signs obtained by percussion and auscultation—Abdominal sounds—Abnormal percussion sounds—Abnormal respiratory sounds—Palpation—Symptoms connected with alterations in the visible mucous membranes—Symptoms furnished by morbid conditions of the digestive organs—Loss of appetite—Abnormal appetite—Depraved appetite—Thirst—Salivation—Fœtor oris—Dry mouth—Alterations in the character of the buccal mucosa—Pain—Varieties of pain—Colicky symptoms—Physical examination of the abdomen—Palpation—Percussion—Auscultation—Tympanites—Evidences obtained by rectal exploration—Certain attitudes and postures assumed by the patient—Constipation—Diarrhœa—Vomiting—Significance of vomition in the horse—Eructations and regurgitations—Symptoms in connection with the urinary organs—Characters of normal urine in the various animals—Morbid conditions in connection with the urine and urinary secretion—Anuria—Polyuria—Albuminuria—Physiological albuminuria—Spurious albuminuria—Hæmaturia—Hæmoglobinuria—Bile pigments in the urine—Glycosuria—Pyuria—Chemical examination of the urine—Tests for albumin—Tests for hæmoglobin—Tests for bile pigments—Tests for sugar—Microscopical examination of the urine—Varieties of organized casts—Clinical significance of casts—Epithelium in the urine—General symptoms of renal diseases—Symptoms in connection with certain disturbances in micturition—Dysuria—Strangury—Retention of urine—Incontinence of urine—General symptoms in connection with the nervous system—Symptoms furnished by the surface of the body and extremities—Rigors—Profuse sweating—Coldness of the extremities—Swollen limbs—Dropsical swellings—Symptoms in connection with the general appearance of the animal—Prognosis—Difficulties in arriving at a prognosis—Errors in prognosis - - - - - - 8—75

CHAPTER III

THE CARE, MANAGEMENT, AND NURSING, OF SICK ANIMALS

General remarks—The care, management, and nursing, of sick horses—The surroundings of the patient—Clothing—Diet—Selection of suitable diet—The preparation of various foods for sick horses—Evils of forcible feeding—Water—Grooming—Exercise—The attendant and the owner: how they can assist the practitioner—Evils of patent medicines—Importance of early treatment—The care, management, and nursing, of sick cattle—Marketing of dairy cows, and its influence on diseases—The cowshed—The care of parturient animals—Diet—Water—Clothing—Grooming—Exercise—Attendants—The care, management, and nursing, of sick dogs—Evils of 'drugging' and patent nostrums—Diet—Invalid foods—Surroundings—Clothing—Bedding—General care of the patient—Exercise—The care, management, and nursing, of sick cats—The care, management, and nursing, of sick birds - - - - - - 76—119

CHAPTER IV

THE ACTIONS AND USES OF DRUGS

PAGES

The selection of medicinal agents—The influence of pharmacology on therapeutics—Circumstances modifying the action of drugs—The mode of administration—The species of animal—The influence of age and size—The effect of diseases—The dose—Frequency, toleration, and habit—Accumulation—Idiosyncrasy—The effect of climate and surroundings - - - - - - - 120—128

CHAPTER V

THE ACTIONS AND USES OF DRUGS (*continued*)

Drugs acting on the mouth and salivary glands—Drugs acting on the stomach—Drugs acting on the intestines—Drugs acting on the liver—Drugs acting on the urinary organs—Drugs acting on the generative organs—Drugs acting on the mammary gland—Drugs acting on the circulation—Drugs acting on the respiratory system—Drugs acting on the nervous system—Anæsthetics—Drugs acting on the eye—Agents acting on tissue change—Venesection—Agents acting on the skin—Agents acting on the surface of the body—Uses of counter-irritants—Cold and hot applications—Agents acting on bacteria and their products - - - - - 129—167

CHAPTER VI

ON PRESCRIBING

The selection of the remedy—Contra-indications—Chemical and pharmacological incompatibles—Physical incompatibles—The dose—Dosage for the dog—Dosage computed according to the weight of the dog—Time—The prescription—Abbreviations used in prescriptions—Weights and measures and symbols of same—Measuring by domestic utensils—The Metric System of weights and measures—Table for computing solutions of various strengths - - - 168—179

CHAPTER VII

ON THE ADMINISTRATION OF MEDICINES

Balls—Drenches—Pills—Powders—Electuaries—Inhalations—Suppositories—Hypodermic injection—Intravenous injection—Intratracheal injection—Intraperitoneal injection—Intramammary injection—Intra-uterine injection—Intraspinal injection—Pessaries—Enemata—Smith's rectum-tube—Nutrient enemata—Poultices—Fomentations—Baths—The administration of medicines to birds - - - - - - - - 180—192

CHAPTER VIII

VETERINARY PHARMACY

PAGES

Preparation of powders—Balls—Pills—Electuaries—Mixtures—Drenches—Hypodermic injections—Ointments—The medicine chest . 193—199

PART II

THE MATERIA MEDICA

CHAPTER I

Terms applied to the preparations and mode of preparation of the various crude drugs employed in medicine — Standardization of drugs - - - - - - - - 200—204

CHAPTER II

GROUP I.—ALKALIES AND ALKALINE EARTHS

Potassium and its medicinal salts—Caustic potash—Liquor potassæ—Carbonate and bicarbonate of potash—Nitrate of potash—Chlorate of potash—Acetate of potash—Permanganate of potash—Citrate of potash—Bitartrate of potash—Sodium and its medicinal salts—Bicarbonate of soda—Chloride of soda—Normal saline solution—Mode of administration — Sulphate of soda — Nitrate of soda—Hyposulphite of soda—Ammonium and its medicinal salts—Strong solution of ammonia—Solution of ammonia—Carbonate of ammonia—Aromatic spirit of ammonia—Solution of acetate of ammonia—Chloride of ammonia—Calcium and its medicinal salts—Lime—Slaked lime—Lime-water—Carron-oil—Prepared chalk—Chloride of lime—Chlorinated lime—Plaster of Paris—Phosphate of lime—Magnesium and its medicinal salts—Heavy and light carbonate of magnesia - Heavy and light calcined magnesia—Sulphate of magnesia (Epsom salt)—Barium—Chloride of barium - - - 205—227

CHAPTER III

GROUP II.—THE METALS

Aluminium—Potash alum —Ammonia alum — The employment of alum in the treatment of laminitis—Lead and its medicinal salts—Plumbism—Litharge—White lead—Sugar of lead—Goulard's Extract—Goulard water—Iodide of lead—Zinc and its medicinal salts—Oxide of zinc

PAGES

—Carbonate of zinc—Prepared calamine—Sulphate of zinc—Copper and its medicinal salts—Sulphate of copper—Silver and its preparations—Nitrate of silver—Collargol—Protargol—Argyrol—Iron and its medicinal salts—Saccharated carbonate of iron—Blaud's Pill—Solution of dialyzed iron—Sesquioxide of iron—Sulphate of iron—Strong solution of perchloride of iron—Medicinal solution of perchloride of iron—Tincture of perchloride of iron—Iodide of iron—Arsenate of iron—Phosphate of iron—Easton's Syrup—Citrate of iron and ammonia—Citrate of iron and quinine—Solution of ferric acetate—Mercury—Blue pill—Grey powder—Mercurial ointment—Mercurial liniment—Oleate of mercury—Black wash—Red precipitate—Yellow oxide of mercury—Yellow wash—Yellow oxide of mercury ointment—Calomel—Corrosive sublimate—Antidotes—Sal alembroth—Mercuro-zinc cyanide—White precipitate ointment—Biniodide of mercury—Donovan's Solution—Citrine ointment—Antimony—Tartar emetic—Antidotes—Antimonial wine—Arsenic—Arsenious acid—Fowler's Solution—Hydrochloric solution of arsenic—Atoxyl—Toxic actions of arsenic—Antidotes—Phosphorus—Antidotes—Hypophosphites of calcium and sodium—Sodium phosphate—Bismuth—Subnitrate of bismuth—Carbonate of bismuth—Thioform—Dermatol—Airol - - - - - - - - 228—264

CHAPTER IV

GROUP III.—THE NON-METALLIC ELEMENTS

Chlorine gas—Iodine and its preparations—Bromine and its preparations—Sulphur and its preparations—Charcoal - - - 265—276

CHAPTER V

GROUP IV.—ACIDS

General actions—Sulphuric acid—Nitric acid—Hydrochloric acid—Dilute nitro-muriatic acid—Chromic acid—Boric acid—Borax—Organic acids—Acetic acid—Vinegar—Tartaric acid—Citric acid—Citrate of soda—Glycero-phosphoric acid - - - 277—286

CHAPTER VI

WATER

Hot water—Cold water—Distilled water—Oxygen—Solution of hydrogen peroxide - - - - - - - - 287—290

CHAPTER VII

ALCOHOL

Various forms of alcohol—Actions of alcohol—Uses—Contra-indications - - - - - - - - 291—296

CHAPTER VIII

ANÆSTHETICS

PAGES

Remarks on action of anæsthetics—Chloroform—General actions of chloroform—Remarks on the administration of chloroform—Methods of administration—Chloroforming the horse in the standing posture—Danger-signals of chloroform anæsthesia—Precautions—Antidotal measures—A.C.E. mixture—Sulphuric ether—Nitrous oxide—Collodion - - - - - - - - 297—315

CHAPTER IX

Chloral hydrate—Chloralose—Chloralamide—Butyl-chloral hydrate—Chloretone—Sulphonal—Paraldehyde—Amyl nitrite—Sweet spirit of nitre—Formaldehyde—Lysoform—Urotropine—Helmitol—Glutol—Amyloform—Tannoform—Benzol or benzene series of carbon compounds—Benzene—Benzoic acid—Antipyrin—Antifebrin—Phenacetin—Resorcin—Salol—Pyoktanin—Methylene blue—Trypan-blue—Naphthalene—Naphthol—Scarlet red—Acetozone—Chinosol—Orthoform - - - - - - 316—331

CHAPTER X

CARBOLIC ACID AND ALLIED AGENTS

Carbolic acid—Sulphocarbolate of soda—Sulphocarbolate of zinc—Creosote—Cyllin—Jeyes' Fluid—Lysol—Klondol—Cofectant Fluid—Izal—Alcoholic solution of coal-tar—Iodoform—Aristol—Ichthyol—Paraffins—Hard paraffin—Soft paraffin—Paraffin ointment—Liquid paraffin (white vaseline-oil)—Petroleum benzine—Lamp paraffin—Phenolphthalein - - - - - 332—346

CHAPTER XI

PRUSSIC ACID

Actions—Toxic actions—Antidotes—Uses - - - - 347—350

CHAPTER XII

THE VEGETABLE KINGDOM

Aconite—Veratrine—Stavesacre—Colchicum - - - 351—359

CHAPTER XIII

THE VEGETABLE KINGDOM (*continued*)

Opium and its preparations—Morphine—Apomorphine—H.M.C.—Codeine—Heroin—Omnopon—Dionin—Indian hemp—Canadian hemp—Cocaine—Eucaine—Novocain—Stovaine - - 360—383

CHAPTER XIV

THE VEGETABLE KINGDOM (*continued*)

PAGES

Belladonna and its preparations—Atropine—Hyoscyamus—Hyoscyamine —Hyoscine hydrobromide—Stramonium—Duboisine - - 384—393

CHAPTER XV

THE VEGETABLE KINGDOM (*continued*)

Tobacco—Nicotine—Lobelia—Conine—Curare—Scoparium—Sparteine sulphate—Gelsemium - - - - - - 394—398

CHAPTER XVI

THE VEGETABLE KINGDOM (*continued*)

Calabar bean—Physostigmine—Jaborandi—Pilocarpine - - 399—405

CHAPTER XVII

THE VEGETABLE KINGDOM (*continued*)

Nux vomica—Strychnine - - - - - - 406—414

CHAPTER XVIII

THE VEGETABLE KINGDOM (*continued*)

Caffeine—Digitalis—Digitalin—Digipoten—Digalen—Strophanthus—Strophanthin—Squill—Convallaria—Cactin—Cactoid - 415—425

CHAPTER XIX

THE VEGETABLE KINGDOM (*continued*)

Ergot and its preparations—Mugwort - - - - 426—432

CHAPTER XX

THE VEGETABLE KINGDOM (*continued*)

Calumba—Gentian—Quassia—Hydrastis—Aromatic volatile oils—Oil of cloves—Oil of peppermint—Oil of spearmint—Oil of lavender—Oil of origanum—Oil of juniper—Oil of cade—Anise fruit—Oil of anise—Ginger—Oil of eucalyptus—Oil of turpentine—Terebene—Terpene—Terpinol—Sanitas—Resin—Resin ointment—Resin plaster—Thymol—Venice turpentine—Wood tar—Oil of tar—Tar ointment—Oil of birch tar—Pitch—Pitch plaster—Tallianine—Camphor and its preparations—Rose-water—Benzoin—Compound tincture of benzoin

PAGES

—Balsam of Tolu and Peru—Myrrh—Prepared storax—Arnica—Valerian—Asafetida—Senega—Capsicum—Pepper—Cubebs—Copaiba—Oil of sandal-wood—Mustard—Aurantium—Syrup of orange - - - - - - - 433—458

CHAPTER XXI

THE VEGETABLE KINGDOM (*continued*)

Vegetable Purgatives

Aloes—Rhubarb—Buckthorn—Cascara—Jalap—Scammony—Colocynth—Podophyllum—Gamboge—Elaterium—Croton oil—Castor oil—Raw linseed oil—Euonymin—Iridin - - - - 459—471

CHAPTER XXII

THE VEGETABLE KINGDOM (*continued*)

Male fern—Santonin—Oil of American wormseed—Areca—Arecoline hydrobromide—Tenaline—Kamala - - - - 472—477

CHAPTER XXIII

THE VEGETABLE KINGDOM (*continued*)

Galls—Tannic acid—Gallic acid—Tannalbin—Tannigen—Pyrogallic acid—Catechu—Kino—Krameria—Cinnamon—Oil of cinnamon—Log-wood—Hamamelis—Hazeline—Chrysarobin—Chrysophanic acid—Ipecacuanha—Ipecacuanha wine—Dover's Powder—Emetine—Buchu—Agropyrum—Cherry-laurel water - - - 478—485

CHAPTER XXIV

THE VEGETABLE KINGDOM (*continued*)

Cinchona and quinine—Quinine and urea hydrochloride—Salicylic acid—Salicylate of soda—Salicin—Aspirin—Oil of wintergreen—Methyl salicylate—Cocillana—Yohimbine—Damiana—Fibrolysin - 486—494

CHAPTER XXV

EMOLLIENTS, DEMULCENTS, ETC.

Olive oil—Soaps—Soap liniment—Ether soap—Glycerin—Treacle—Tragacanth—Gum acacia—Liquorice root—Linseed—Pearl barley—Barley-water—Wheaten flour—Starch—Marsh mallow ointment—Chaulmoogra oil—Lanolin—Hydrous wool fat—Lard—Benzoated lard—Spermaceti—Sperm oil—Gelatin—Keratin—Carbon disulphide—Cod-liver oil—Malt—Honey—Beeswax—Pepsin—Nuclein - 495—506

VETERINARY THERAPEUTICS

PART I

CHAPTER I

INTRODUCTORY

VETERINARY therapeutics is the subject which relates to the treatment of disease in the domesticated animals. Taken in its wide sense it embraces not only the application of medicinal agents, vaccines, and sera, for this purpose, but also includes such auxiliaries as hygiene, dietetics, the care, management, and nursing, of sick animals, etc. The term 'surgical therapeutics' is applied to the employment of agents for surgical conditions, and more properly belongs to the domain of surgery; hence, in the present work it can only receive brief consideration.

Pharmacology deals with the action of drugs on the body, without special reference to their application in the treatment of disease. Our knowledge of the action of drugs is obtained from experiments on animals, but the clinician has to demonstrate the practical application of medicinal agents, and decide as to their value. In this book the subject of pharmacology will only be discussed so far as it bears on the treatment of disease; in other words, we shall only deal with 'applied' pharmacology. Full information on the action of drugs and the methods by which this knowledge has been obtained will be found in works on pharmacology, such as those written by A. R. Cushny and W. E. Dixon.

Therapeutics can only be properly studied clinically, prior

to which a certain amount of pharmacological knowledge is necessary.

Materia medica deals with the origin, source, distribution, composition, and preparation, of the various agents employed by the therapeutist. In the present day this subject is of little importance to the practitioner, as it is the province of manufacturing chemists to prepare from crude drugs, according to fixed formulæ, the preparations of the various agents employed for medicinal purposes. Practically speaking, so far as materia medica is concerned, it is sufficient to be acquainted with the preparations of the drugs employed, and with the strength of these preparations. The important matter is to acquire a knowledge of their actions, uses, and doses, also their indications and contra-indications. However, as the subject of materia medica is still retained in the veterinary curriculum, it is necessary for us to give briefly details with reference to the preparations of the various drugs, so that the student may be enabled to obtain the knowledge requisite to pass the examination. Needless to remark, he will not retain this knowledge for any length of time, nor is it necessary that he should, as it belongs rather to the domain of the chemist than that of the veterinary practitioner. The latter selects the preparation of the drug which he intends to prescribe, and depends on the chemist to supply this of the proper strength and quality.

Pharmacy is the art of compounding or dispensing formulæ or prescriptions. The majority of veterinary surgeons dispense their own prescriptions, so that pharmacy is an important subject. At the same time they do not prepare medicinal agents from crude drugs to any extent, but purchase them from reliable wholesale chemists. Pharmacy is an art which must be acquired by actual practice, and cannot be attained by reading details in a textbook. (See p. 193.)

The treatment of disease constitutes one of the most important parts of the practitioner's work. No doubt the value of preventive medicine cannot be over-estimated, and of late years it has occupied a very important position and

achieved valuable results. Judging by the success of preventive measures in connection with certain diseases, it seems probable that in the future our energies will be chiefly devoted to rendering animals immune to various affections, by the use of sera and vaccines, and that curative treatment by means of drugs will occupy an inferior position. However, in our present state of knowledge, it is necessary for us, in many instances, to continue the orthodox treatment with medicinal agents.

The reputation of the general practitioner is largely built on his skill in diagnosis, prognosis, and treatment. All his professional education is directed to render him proficient in these subjects; his sphere is to ascertain the nature of the illness from which an animal is suffering, the probable result, and the most effectual means of restoring the patient to health. It is quite obvious that, in order to become proficient in these duties, an intimate knowledge of pathology is necessary, as well as a cognizance of the actions and uses of medicinal agents. The morbid changes in affected organs must be carefully studied before appropriate therapeutical measures can be prescribed. But a knowledge of pathology alone will not suffice; diseases must be studied clinically, in order to interpret symptoms, and thus to arrive at a correct diagnosis. As we shall point out later on, it is not always possible to make a correct diagnosis; hence the leading symptoms must receive consideration, as they offer important indications for treatment. There are many occasions, also, in which attention to a diagnosis alone is not sufficient for the therapeutist, and the special features of the case must be studied in order to decide the most appropriate line of treatment to be adopted. If every disease possessed a stereotyped set of symptoms, and yielded to a special form of treatment, then indeed therapeutics would be much simplified. But unfortunately the symptoms presented are frequently atypical, diagnosis is often attended with considerable difficulty, and a line of treatment which succeeds in one case may fail in other instances of the same disease. Again, our knowledge of the

action of drugs on diseased organs is far from definite, and it is often a very difficult matter to ascertain the exact influence which a certain drug or line of treatment exerts on a case of disease. One of the first lessons which the student of veterinary medicine has to learn is that natural powers of recovery exist to a greater or lesser extent in most cases. The *vis medicatrix naturæ* exerts a marked influence on the course and results of disease, and in judging of the value of medicinal agents it is necessary for him to bear in mind that recovery is not always to be attributed to the effects of the drugs administered. But he must also appreciate the fact that, in adopting any line of treatment, care should be taken to select remedies which assist the natural powers of recovery, and to avoid those likely to be antagonistic to these powers. The irrational treatment adopted in former times must be attributed to lack of knowledge of the natural means of recovery, to a firm belief in the virtues of certain potent drugs, and to the erroneous idea that practitioners possessed means of directly overcoming the effects of disease. Hence the routine employment of purgatives, blisters, and venesection, followed by repeated drugging of the patients. In the present day, although the number of medicinal agents is constantly on the increase, yet less drugs are prescribed than formerly. Attention is devoted to the natural powers of recovery, to the value of hygienic and dietetic details, and to the careful nursing of the patient. Clinical observation has shown that animals recover from many affections spontaneously, and that the indiscriminate administration of drugs tends to impede recovery.

In the chapter on nursing we refer to the practice of forcing medicaments in the form of drenches on sick animals as being not only inimical to progress, but actually dangerous, owing to the risks of portions of the fluid entering the trachea and bronchi and setting up broncho-pneumonia. Similar remarks apply to the custom of forcing fluid foods on patients which refuse to take nourishment. Again, attention to post-mortem examinations has demonstrated to the clinician the limited powers he possesses of directly

influencing diseased organs so as to bring about favourable results. He is gradually learning to distinguish consequences from coincidences, and fact from imagination. Treatment by vaccines and sera is as yet in its initial stages, but the reports from clinicians who have adopted this method are distinctly favourable, and further investigation will probably result in marked changes with regard to practical therapeutics.

Much research is still needed before therapeutics can be regarded as a science. Theoretically we recognize what is termed *rational* therapeutics, in which we can clearly explain the reasons for the adoption of a certain line of treatment. This implies a correct diagnosis, a perfect acquaintance with the etiology of the affection, so that we can act directly or indirectly on the causes which produce it, and an intimate knowledge of the actions of the drugs which we employ. Obviously, a correct diagnosis is not always possible; our knowledge of etiology often leaves much to be desired, while the real part which drugs play in bringing about favourable results is far from being definitely settled. Hence it is not surprising to find marked differences of opinion with reference to the value of medicinal agents or special lines of treatment in certain diseases. One practitioner claims successful results by adopting certain therapeutical measures, while in the hands of another these may fail, or a different line of treatment is found to be of more value.

In *empirical* therapeutics certain individual agents prove successful in a series of cases of the same disease, although it is not possible to explain their *modus operandi*. Their value has been demonstrated by experience in their employment. As an example we may take the treatment of milk-fever in cows, in which by simply inflating the udder with air a successful result obtains in the large majority of cases. Prior to the introduction of this treatment, the disease often resisted the therapeutical measures adopted, or it might be said that some cases recovered in spite of treatment. We know nothing definite with reference to the pathology of this disease, nor can we explain the manner in which the success-

ful results are brought about. A number of remedies for various diseases were formerly used empirically, but in many of these an explanation of the manner in which they act is now forthcoming. As further examples of empirical therapeutics in the present day, we may mention the employment of adrenalin in purpura hæmorrhagica and azoturia.

These so-called 'specific' remedies are not numerous, but we must admit their efficacy and recognize that they are none the less useful because their mode of action has not yet been determined.

It is important for the student to recognize that in veterinary therapeutics, so far as horses and cattle are concerned, the question of expense in treatment must be considered. In the case of horses, if the animals cannot be rendered useful for work, it is not desirable on economical grounds to prolong life, unless in those rare instances where the owners desire that treatment should be adopted. In cattle a long course of treatment is seldom desirable, as loss of condition results, and, unless there is a reasonable prospect of recovery, it is advisable to dispose of the animal to the butcher in the early stages of the case, provided, of course, that no disease exists which would render the flesh unfit for food.

In the dog, sentiment largely enters into the question of treatment. In the case of favourite animals, provided they do not suffer continuous pain, a prolonged course of treatment may be undertaken. Moreover, the cost of keep and treatment is far less than in the case of horses, and the commercial element does not enter to the same extent into canine practice.

We must point out, also, that in every species certain specific diseases occur which are communicable to man, and bring about in him fatal results; hence, destruction of the affected animals, and not treatment, is the course adopted. Again, there are infectious maladies which are known to resist every form of treatment, and cause great losses amongst live-stock; in these the 'stamping-out' process has to be adopted. A similar procedure is indicated in dealing with

foot and mouth disease, which, although amenable to treatment, spreads with such rapidity and interferes to such an extent with the cattle trade of a country, that, on grounds of economy, therapeutical measures are not desirable.

In the present work we shall first consider the subject of diagnosis and the general symptoms of disease. The care, management, and nursing of sick animals will then receive attention, and next we shall consider the actions and uses of drugs, prescribing, the administration of medicines, and finally we shall deal with the treatment of diseases of the various organs of the body. Here we must emphasize the importance of a knowledge of physiology. This subject is in reality the basis of therapeutics, and unless we are acquainted with the functions of healthy organs we cannot have a clear perception of the alterations produced by disease, or of the manner in which medicinal agents assist in bringing about a return to health.

CHAPTER II

ON DIAGNOSIS AND THE GENERAL SYMPTOMS OF DISEASE

In order to prescribe rational treatment for the sick animal, it is necessary to ascertain the nature of the illness from which the patient is suffering, and also to pay attention to the causation and the leading symptoms present. The diagnosis is based on the history of the case, on the correct interpretation of the symptoms presented, and on our knowledge of the probable causes which have produced the disease. Having formed a diagnosis, the next consideration is the selection of the line of treatment which is best calculated to assist the natural powers of recovery and bring about a return to health. In some cases we are able to act directly on the cause so as to remove it, and this procedure constitutes a very important part of therapeutics. In other instances we possess little influence over the cause, and so are compelled to treat the effects. In others, again, we have to treat the leading symptoms present, as, owing to absence of evidence pointing to the existence of a special disease, a definite diagnosis is impossible at our first examination of the patient, or even later. The advantages of a correct diagnosis are obvious, and, having decided that a certain disease is present, we seek for its probable causes (etiology), and when possible take steps to remove or overcome them. Again, from our knowledge of pathology, we decide what influences we can bring to bear on the morbid changes in the organs involved. We have already pointed out that the

general symptoms present merit consideration, and afford valuable indications for therapeutical measures. Thus, alterations in the character of the pulse and respirations, the presence of fever as ascertained by the use of the clinical thermometer, the condition of the excretions, etc., must be carefully observed and regarded as clinical guides, even when a correct diagnosis is possible.

Symptomatic treatment—*i.e.*, the treatment of symptoms without reference to their source or causation—is not a desirable course to adopt, except in cases where a diagnosis is impossible. Similar symptoms may occur in a variety of diseases, and may depend on different conditions, so that, if we attempt treatment without ascertaining their causation, we often fail to achieve satisfactory results. In some instances the therapeutical measures adopted, being on a wrong basis, exert an unfavourable and often a harmful influence on the progress of the disease. For example, abdominal pain depends on a variety of conditions, one of the most important of which is the accumulation of ingesta in the large colon associated with paresis of the bowel. If we treat the pain, irrespective of its cause, with opiates, we no doubt give temporary relief from pain, but at the same time we increase the intestinal stasis, and so help to accentuate the cause of the condition. If, on the other hand, we seek for and ascertain the cause of the pain, the rational treatment is, obviously, to adopt measures to stimulate intestinal peristalsis, and thus get rid of the retained material. Hence, instead of opiates, we prescribe agents likely to restore nerve tone to the intestinal walls, such as nux vomica and carbonate of ammonia, associated with the judicious administration of purgatives, such as aloes, eserine, or arecoline.

Examples of a similar kind are of frequent occurrence in practice. Thus, nervous phenomena are not uncommon in connection with gastric disorders, and cardiac disturbance may result from digestive derangement. If treatment be directed to the alleviation of the symptoms alone, without endeavouring to ascertain their origin, it is quite apparent that the result will not be successful.

Diagnosis must be regarded as of great importance to the therapeutist, hence it is necessary to deal rather fully with the subject. One of the first points to be noted is that our patients, unlike human beings, are unable to describe the symptoms they feel (subjective symptoms), or to give any direct assistance to the medical attendant. Hence we have to depend on our observation of the symptoms presented (objective symptoms) in forming a diagnosis, in addition to information gained by questioning the owner or attendant with reference to the history of the case. Obviously, one of the most important attributes of the veterinary practitioner is a well-trained faculty of observation. Early training in this direction is of inestimable value to the student, and it necessitates a familiarity with the appearance and habits of animals in a state of health, as well as attendance on cases of disease. Hence the value of a proper period spent on a stock farm for students who have not been brought up in this environment. The daily observation of healthy animals, and a practical knowledge of the feeding and rearing of live-stock, are an essential groundwork for those whose vocation is to recognize symptoms and to diagnose and treat disease. Having acquired the elementary knowledge which every stockowner is possessed of, the student will be able to observe and to appreciate the altered conditions produced by disease. The earlier he becomes acquainted with anatomy and physiology, the better, and the teaching of these subjects should be associated with practical demonstrations on the characters of the normal pulse and respirations, with the physical examination of the lungs and heart, and the use of the stethoscope. Also the surface anatomy of the various organs should be carefully mapped out on the living animal. Having learned all that is possible with reference to the normal animal, he will then study cases of disease. Here we may remark that an imperfect knowledge of the normal respiratory and cardiac sounds, and of the physical examination of healthy organs, is responsible for many errors in diagnosis. The time spent on the study of this subject will be amply repaid by the facility with which abnormal con-

ditions will afterwards be recognized, and their nature understood. It is important not to overlook evidences of disease during the examination of a patient, but it is quite as essential to avoid mistaking normal conditions for morbid phenomena, and this applies to every department of veterinary practice.

We must emphasize the point that subjects of this kind cannot be taught in the lecture-room. The student must not depend on diagrams or descriptions. Familiarity with normal conditions and with the phenomena of disease must be acquired in the stable, the cowshed, the field, and the kennel. When we consider the variety of domestic animals which form the patients of the veterinarian, each with special peculiarities in health and in disease, it is obvious that the course of study mentioned is eminently necessary. Clinical teaching in the veterinary schools of the British Isles has not received the same amount of attention as on the Continent, and it has certainly not kept pace with the advances made in pathology.

In arriving at a diagnosis, a systematic examination of the patient is necessary, and also attention to other details, which will receive consideration later on.

The observation of symptoms and their interpretation—*i.e.*, the ascertaining of their significance and their cause—constitutes an important element in the art of diagnosis. Some symptoms are characteristic of certain diseases, and hence are termed *diagnostic*. Cases that present diagnostic symptoms are termed *typical*. Unfortunately, typical cases are in the minority, and, owing to the fact that in many instances symptoms common to a variety of affections are present, or because they are obscure in character, diagnosis is often attended with considerable difficulty. Hence the student must not imagine that, by committing to memory a list of symptoms said to be characteristic of certain diseases, he can successfully diagnose such affections. He will find in practice that atypical cases preponderate. When he starts to check his diagnoses by post-mortem examinations, he will learn the necessity of a careful

examination of his cases, and the wisdom of avoiding hasty conclusions.

It is not uncommon to find that at the first examination of a case a definite diagnosis is not possible, as the symptoms presented may be indefinite or general—*i.e.*, common to a number of affections. Until special or diagnostic symptoms appear, an opinion as to the nature of the case must be deferred. Speculative opinions expressed under the guise of exceptional skill are no doubt appreciated by many owners of animals, but sooner or later the veterinary surgeon who indulges in this practice comes to grief. The public should be given to understand that a correct diagnosis is founded on a careful and prolonged examination of a case, that errors will occur even with the most experienced, and that opinions expressed without a due consideration of the symptoms presented, point to the assumption of a degree of skill which is not justified. The honest practitioner is conscious of the limitations of his skill, and the more experience he gains, the more careful he becomes in offering dogmatic opinions, despite his increasing powers to diagnose correctly.

In addition to ascertaining the nature of the disease from which an animal is suffering, and prescribing suitable treatment, the practitioner is expected to give an opinion with reference to the probable result of the case (prognosis). This subject is of importance in connection with therapeutics, because it is not desirable to continue treatment in cases that present evidences of being hopeless, or not worth the cost of prolonged therapeutical measures, more especially if the disease be associated with pain and discomfort to the animal. Hence we shall have to deal briefly with the subject of prognosis later on. We shall now proceed to give an outline of the method likely to prove of service in arriving at a diagnosis, and at the same time we shall consider the general symptoms of disease.

The History of the Case.—This is a very important aid to diagnosis. We have to rely on the owner of the animal or the attendant in charge for the necessary information. Owing to the lack of intelligence, or imperfect power of

observation possessed by some individuals, it is often difficult to obtain a reliable history of a case. Moreover, the attendant may, owing to carelessness or ignorance, be a contributory factor to the illness from which the patient is suffering; hence his statements cannot be depended on. It is often necessary to cross-examine the attendant in a judicious and tactful manner in order to bring out facts. We inquire with reference to the length of time the animal has been in the present owner's possession, how long the patient has been ill, and if he has suffered from any disease on a previous occasion. We next endeavour to obtain a description of the earliest symptoms that were noticed, and inquire if any other animals are showing signs of sickness in the same building. Very often the only information we can glean is that the animal refused to feed, looked sick and heavy, and was disinclined for work. In the case of abdominal affections, we learn the time at which pain was first shown and its character—*i.e.*, whether intermittent or continuous. We may also ascertain whether rigors (shivering fits) have been manifested. If a cough and a discharge from the nostrils be present, we inquire as to the length of time they have been in existence, and we also ascertain if the bowels are acting in a proper manner, and if the amount of urine passed is diminished or excessive. If the patient be of the female sex, we inquire with reference to the existence of pregnancy. It is also necessary to question the owner or attendant with reference to any treatment that has been adopted. Not infrequently a strong purgative has been given, and may prove detrimental to the case. Moreover, it is of importance to know that such a drug has been administered, as otherwise we might prescribe a cathartic, and serious results would follow. When drenches have been carelessly administered, fluids may enter the bronchi and set up broncho-pneumonia. This is a common experience, and it is necessary to make a careful inquiry as to the occurrence of coughing and distress succeeding the administration of the medicine. As, however, the attendant is anxious to shield himself from blame, he generally denies

any knowledge of the occurrence, and we have to rely on the evidences obtained from an examination of the chest and on the observation of other symptoms suggestive of this condition. (See Mechanical Bronchitis, Part III. of this work.)

In the case of diseases of the digestive system, inquiries should be made with reference to the quality of the food and the method of feeding and watering adopted, also as to the hours of working and the nature of the work. In the case of respiratory affections, we ascertain if the patient has been recently exposed to chills or to infection.

In spite of the most careful inquiries, the information elicited may be useless or misleading. The popular idea with horsemen is to ascribe many and varied affections to 'something wrong with the kidneys,' or with the urine, and imaginary symptoms are put forward. In many districts imaginary diseases, such as 'lampas,' are regarded as being responsible for loss of appetite and allied conditions, and barbarous attempts at treatment are still carried out by farriers and empirics.

Experience of the unreliable information we receive in so many instances teaches us that we must fully exercise our powers of observation, as by paying attention to minor details we often ascertain matters of importance. 'Sherlock Holmes' methods of investigation often prove invaluable in obtaining the correct history of a case in veterinary practice. Indirect questioning not infrequently succeeds in eliciting information when direct interrogation fails.

The Examination of the Patient.—This must be carried out in a systematic manner. No doubt there are some cases which present symptoms so truly diagnostic that the disease is recognized with facility. But even in such instances it is desirable to make a careful study of the general symptoms in order to ascertain the gravity of the case, and to select the most advisable line of treatment. As already pointed out, the indications for treatment—*i.e.*, the phenomena presented which enable us to adopt treatment calculated to exert a favourable influence on the course of the disease—

are of vast importance in therapeutics. Merely giving a name to the condition is not sufficient, as we do not adopt a stereotyped treatment for each disease. Hence alterations in the normal character of the pulse, temperature, respirations, and visible mucous membranes, must be carefully noted, also the presence of a cough, abdominal pain, tympanitic condition of the abdomen, etc. A physical examination of the lungs and heart must be carried out, and in cases of abdominal affections a manual examination *per rectum* is a procedure which is essential in order to detect various abnormal conditions of the intestines. After a careful study of the general symptoms, we then look for any special phenomena which may be presented, and endeavour to ascertain their origin. It must be remembered that complications may be present which render diagnosis difficult, besides increasing the gravity of the case. Again, an animal may suffer from chronic disease of an organ, and may not manifest any apparent symptoms; but when other organs are attacked by an acute affection, a combination of symptoms arising from both sources may result. It has been truly said that a patient seldom dies as the direct result of the disease from which he is suffering; a fatal termination is more likely to occur from an intercurrent affection. Thus, it is not uncommon to observe, at autopsies, lesions that were not suspected during life. These lesions may have been the chief cause of the fatal termination, although symptoms attributable to them were not in evidence, or were masked by those of the acute affection. Hence chronic renal disease or chronic valvular disease of the heart may be an unsuspected cause of death during the course of acute attacks of various disorders.

In the following sections we purpose to consider the general symptoms of disease and their bearing on diagnosis and treatment.

The Temperature.

The presence of an elevation of temperature is popularly known as 'fever.' It is a symptom met with in a variety of diseases and surgical conditions, and in the examination

of a patient one of the first points to ascertain is the presence or absence of fever. A high temperature should not always be regarded as serious with reference to prognosis, but when suddenly occurring in a case that is progressing favourably, it indicates either a complication or a relapse, and is an unfavourable symptom. Some authors and practitioners recognize a condition termed 'febricula,' or simple fever, in which the leading symptom is a rise of temperature accompanied by loss of appetite and dulness; but there are no evidences of disease of any organ, the temperature returns to normal, and the patient becomes convalescent in a few days. Such cases are of common occurrence during epizoötics of influenza, and their real nature has not been determined. Some clinicians regard them as abortive forms of influenza or pneumonia.

Of late years our views with reference to fever have been considerably modified, and we now recognize the fact that there is a natural tendency for the temperature to return to normal in many affections without the aid of antipyretic agents. Hence, in the early treatment of cases which are accompanied by fever, we do not consider it necessary to administer full and repeated doses of antipyretics, as such drugs, unless prescribed with discretion, tend to interfere with appetite, and exert an unfavourable influence on the circulatory organs.

At the same time we must regard the use of the clinical thermometer as an indispensable aid to diagnosis and prognosis, as well as a valuable guide to the adoption of therapeutical measures. It enables us to recognize the necessity for ordering cessation from work even before symptoms suggestive of the presence of disease in any organ are manifested. Again, it shows us the progress of a case under treatment, and also often furnishes the first indications of the occurrence of complications or relapses.

In surgical conditions, an elevation of temperature to any extent is an important danger-signal.

Some of the highest temperatures are recorded in acute nervous affections, such as meningitis.

A subnormal temperature is met with in the secondary stages of septicæmic conditions and in certain infectious diseases. It has also been recorded in cases of diabetes mellitus, an affection rarely met with in the horse A subnormal temperature should always be regarded as a very grave symptom.

The temperature is registered by inserting a clinical thermometer in the rectum and retaining it there from half a minute to three minutes, according to the registering power of the instrument. Care should be taken that the bulb of the thermometer comes into intimate contact with the mucous membrane of the bowel, as otherwise the correct reading will not be taken. The average normal temperature of the horse is 100·4° F.; the ox, 102° F.; the sheep, 103° F.; the pig, 102° F.; and the dog and cat, 101° F. These figures vary to a slight degree under certain circumstances, being raised by exercise and during very hot weather. For further details on the subject of the normal temperature of animals the reader is referred to 'Veterinary Physiology,' by F. Smith

Alterations in the Character of the Pulse and of the Action of the Heart.

These are of the greatest importance to the therapeutist, and are deserving of special attention. In every case of disease a careful examination of the pulse and of the heart is essential, and neglect in this direction is certain to result in serious errors in diagnosis, prognosis, and treatment. So far as the pulse is concerned, alterations in its character cannot be regarded as diagnostic symptoms *per se;* but, taken in conjunction with the evidences obtained from an examination of the heart and with other phenomena present, the evidences obtained from the pulse prove valuable aids to diagnosis. In all affections, alterations in the character of the pulse furnish most valuable indications to the therapeutist, and must be regarded as the most important of the general symptoms of disease.

The pulse is the wave set in motion by the propulsion of blood by the heart into the arteries. Under normal con-

ditions each beat of the pulse corresponds to a contraction of the heart. Recognizing the vital importance of the heart in sustaining life, we can appreciate the gravity of a weak, failing, or thready pulse. The characters of the normal pulse should be carefully studied. In the horse the most convenient location for taking the pulse is the submaxillary artery; but in cases where the action of the heart is weak, the posterior radial artery at the internal aspect of the forearm is preferable. Under normal conditions the beats are regular, and number forty to forty-five per minute, the artery giving the feeling of a degree of firmness to the touch, which is readily recognized by trained fingers. In cattle, the normal pulse numbers forty to fifty per minute, and may be taken at the submaxillary artery, the posterior radial, the posterior aspect of the fore fetlock, or in the tail. The number of beats cannot be regarded as a reliable guide in bovine practice, because the approach of a stranger is sufficient to induce an increase in the number of pulsations, and a similar effect is observed during rumination or after taking warm food.

The pulse of the dog varies, according to the size and breed of the animal, from eighty to one hundred per minute. It is most conveniently taken at the femoral artery inside the thigh, and in judging of its character it is essential that the animal should be quietly handled and not excited. An intermittent pulse is a normal condition in the dog (see p. 20).

In drawing conclusions from alterations in the character of the pulse, it is necessary to ascertain the actual morbid condition that is present. Digestive derangements, nervous disorders, anæmia, etc., may give rise to irregularity of the pulse-beats, which might be attributed to a cardiac disease unless a careful examination of the heart be carried out.

The following varieties of pulse are met with and merit consideration:

The Frequent Pulse.—In this condition the number of beats per minute is increased above the normal. In nervous animals a frequent pulse may be coexistent with perfect health. Repletion of the digestive organs, exercise, or excite-

ment, causes a temporary frequency of the pulse. In the primary stages of fevers and in inflammations of visceral organs a frequent pulse is usual.

The Infrequent Pulse is the opposite condition to that just mentioned. It is often associated with the character of slowness, and is met with in cases of brain disorders, and also in diseases characterized by alterations in the blood.

The Quick Pulse.—In this variety each beat occupies less than the usual time, although the number of pulsations per minute may not be increased. It depends on the mode of contraction of the ventricles, and is met with in cases characterized by excessive nervous irritability, and in some forms of cardiac disease.

The Slow Pulse is the reverse of the above variety. It indicates a prolonged or slow contraction of the ventricles. It is met with in cases of aortic stenosis, and in jaundice.

The Large Pulse is characterized by a fulness in volume, and may occur either with strength or feebleness of the pulsation.

In cases of severe congestion of the lungs we have the artery full in volume, but the pulsations weak. This has been termed the 'oppressed pulse.'

The Small Pulse.—In this form the volume is smaller than normal. It may arise from feeble action of the heart or from anæmia.

The Hard Pulse.—Contraction of the muscular coat of the arterial walls causes this condition of pulse. It is incompressible to the touch, and when associated with the character of smallness it is termed 'wiry' or 'thready.' In inflammation of serous membranes, such as pleurisy, pericarditis, peritonitis, meningitis, etc., we find the pulse in the primary stages small and hard. The hard pulse may be associated with the character of largeness, as in cases of acute laminitis, in which the pulse may be described as quick, full, and bounding.

The Soft Pulse may be associated with the condition of slowness, and as such it occurs towards the termination of slow exhausting diseases; the impulse of the heart is

weak, and the amount of blood propelled at each ventricular systole is deficient.

Strength and Weakness of Pulse.—We must distinguish between *strength* of pulse and a *full but feeble* pulse. The latter is generally associated with slow action of the heart and relaxation of the arterial coats.

Irregular Pulse.—This term signifies that the pulsations occur at irregular intervals, and are usually unequal in force. In some instances it is a temporary condition arising from slight reflex irritation, such as occurs in indigestion, or from the presence of parasites in the gastro-intestinal canal. When persistent it is often associated with cardiac diseases, but it cannot be regarded *per se* as an indication of the presence of such affections.

Intermittent Pulse.—In this a pulsation is omitted from time to time. The intermittency may occur at regular intervals—*i.e.*, at the end of a certain number of beats, or irregularly, so that only an occasional omission of a beat is observed; this is termed an 'irregularly intermittent pulse.' The pulse may be irregular as well as intermittent.

In certain cardiac affections the ventricular systole is too feeble to develop a perceptible pulse-beat—*i.e.*, the pulse-wave is abortive—hence the pulse is found slow and intermittent, although the cardiac contractions are normal as regards frequency; this is sometimes termed 'false intermission.' An intermittent pulse may be compatible with apparent health in the horse, and, as already remarked, is a normal condition in the dog.

'Water-Hammer,' Collapsing, or Corrigan's Pulse is met with in aortic insufficiency and in aneurism of the aorta. The pulse-beat is sudden and abrupt, and is followed by an equally sudden collapse of the vessel.

Jugular Pulse.—This is also termed the 'venous pulse.' In the normal horse distinct pulsations are seen in the jugular veins at the root of the neck, but they do not extend any distance upwards, and are believed by some observers to depend on the pulsations in the carotid arteries. According to F. Smith, the normal jugular pulse is due to a backward

positive wave in the anterior vena cava which occurs at the moment of systole of the auricles. When horses are cast for operations a more distinct jugular pulse is observed, and Stockman suggests that it probably originates in a congestion of the pulmonary vessels. The *true* venous pulse is, however, distinct from the above. A well-marked wave passes up each jugular vein with each cardiac systole, and is followed by a retrograde wave. This is plainly visible to inspection, and the wave is double. Although a jugular pulse is stated by some authors to be pathognomonic of insufficiency of the tricuspid valve, it is also observed in cases of incompetency of the mitral valve. In many instances a distinct dilatation of the jugular veins is associated with a jugular pulse.

The varieties of pulse mentioned often offer important indications for treatment. Thus, the quick, full pulse indicates the employment of vascular sedatives, such as aconite, while the frequent, small, compressible pulse is an indication for the use of stimulants.

In gastric and intestinal affections the character of the pulse is an important guide to diagnosis and prognosis. Its frequency and its general character should be specially noted, not only in the early stages, but also during the course of the affection. In the so-called 'spasmodic colic,' the pulse becomes frequent during the paroxysms of pain; but in the intervals of ease it returns to normal. In serious intestinal diseases it is greatly increased in frequency, and also becomes irregular, fluttering, and weak; while in cases approaching a fatal termination it becomes indistinct, thready, and finally imperceptible.

Physical Examination of the Heart.—A physical examination of the heart should always be carried out, not only in the diagnosis of a case, but also during the course of a disease. If this procedure be omitted, serious errors are likely to occur, as the presence of chronic cardiac affections will be overlooked, and complications, such as acute endocarditis, will not be recognized. Hence the patient may succumb suddenly without the owner or the professional

attendant being prepared for such an emergency. Again, it is not safe to draw conclusions from the evidences furnished by the pulse alone in cases where intermittency or irregularity is present, as such conditions may occur in the absence of cardiac disease, and only a careful examination of the heart will decide the question.

Hence the student should render himself thoroughly proficient in the physical examination of the heart, by first carrying out the procedure on a number of healthy horses, and then on cases of disease. Auscultation of the heart—*i.e.*, the act of listening to the cardiac sounds is best carried out by means of an instrument termed a 'stethoscope.' This, like all instruments of precision, requires a long course of study before the technique of its successful application can be mastered. The advantages which the instrument possesses over the direct method of examining the heart (*i.e.*, by means of placing the ear over the cardiac region) are quite obvious, and amongst these must be mentioned the facility with which the points of maximum intensity of the various cardiac murmurs can be determined by the aid of this instrument. Some practitioners prefer an instrument termed the 'phonendoscope,' but after a trial of both we think that the binaural stethoscope, especially the pattern known as Haydn-Brown's, is the most useful for the purpose of auscultation. It is essential, in order to avoid erroneous conclusions, that special care should be exercised in using the instrument. Certain sounds, such as those due to the contact of the instrument with the hair, or arising from movements of the skin in the case of a nervous, irritable animal, may easily be mistaken for cardiac murmurs. Similar errors may arise in connection with the vesicular murmur arising from the lungs, or from sounds originating in the double colon (borborygmi). Constant practice in the use of the instrument will overcome these difficulties. Perfect quietness of the surroundings is essential. Another matter of importance which should not be overlooked is that, in the case of nervous or unhandled horses, the mere application of the instrument may cause disturbance of the cardiac action, if not actual palpitation, and this

must not be mistaken for evidence of disease. We must admit that errors are far more likely to occur from imagining that a cardiac murmur is present than from overlooking its presence. In well-marked cases of valvular disease the murmur is detected with comparative facility, but to ascribe it to its origin is quite another matter, and requires considerable experience.

In order to draw correct inferences, it is always advisable to make several examinations of a case at intervals before giving a definite diagnosis.

The following points in connection with the physical examination of the heart are of importance:

INSPECTION.—In equine practice the only evidences obtained from inspection are pulsation in the cardiac area, which is observed in some cases of valvular disease; also in thin, well-bred horses that are clipped, the cardiac impulse may be visible in certain cardiac affections when palpitation occurs.

Inspection also enables us to detect the presence of a jugular pulse.

PALPATION—*i.e.*, the application of the palm of the hand over the region of the heart—is employed to determine the character of the cardiac impulse, and to detect the presence of a fremitus or 'thrill.'

The Cardiac Impulse is felt between the fifth and sixth ribs. F. Smith points out that it is not given by the apex, but by the lower half of the left ventricle, as the apex practically does not move as long as the heart is retained within the pericardium. In fat horses the cardiac impulse is not felt with such facility as under opposite conditions. According to Stockman it is best felt in the fifth intercostal space, a few inches from the floor of the sternum.

Fremitus or Thrill.—This is detected in some cases of valvular disease, and, according to Cadéac, it is due to the vibration of the blood against the wall of the affected cardiac orifice. In some instances it is of a purring character (*frémissement cataire*).

PERCUSSION.—This process consists in striking lightly with

the tips of the fingers upon the surface of the cardiac region. It is applied in order to determine the presence of an increase in the area of cardiac dulness, such as occurs in cases of cardiac hypertrophy, and also in pericardial effusion and hydropericardium. Stockman[1] devoted special attention to the subject, and he concludes that, if absolute dulness be detected in the area extending from the posterior border of the fifth rib into the sixth intercostal space, one may conclude that hypertrophy of the heart is present. He has never found cardiac dulness beyond the seventh rib. In carrying out percussion the left fore-leg is drawn forward by an assistant until the lower part of the third rib is exposed.

AUSCULTATION.—This is the most important diagnostic procedure in the detection of abnormal conditions of the cardiac valves. The majority of authors state that, owing to anatomical peculiarities in the larger animals, auscultation of the heart is surrounded by marked difficulties. These peculiarities are—the heavy muscular shoulder which covers the upper and anterior region of the heart, the thickness of the thoracic walls, and the small area of the organ which is available for examination owing to the heart being to a great extent covered by the lungs. Moreover, it is difficult or impossible to examine the large vessels arising from the heart. The difficulties in connection with the employment of the stethoscope have already been alluded to.

Nevertheless, some at least of these difficulties can be overcome, and, as Stockman has pointed out, by drawing the left fore-leg of the animal well forward, so as to expose the third rib, a good portion of the cardiac area can be made available for auscultation. This writer has found that the cardiac sounds are best heard in the areas which correspond most nearly to the seat of their production. Thus the first sound is best heard at the anterior border of the fifth rib in the cardiac area, being carried well backwards and downwards over the extent of the ventricular wall. It diminishes in intensity in a forward direction until it almost disappears

[1] *Journal of Comparative Pathology and Therapeutics*, 1894.

at the posterior border of the third rib. The second sound is best heard at the anterior border of the fourth rib in the cardiac area; it decreases in distinctness in a backward direction, and is carried well down the ventricular wall.

With reference to reduplications of the sounds, Stockman has observed that such a condition may be compatible with health, and that the first sound is frequently double in the absence of any cardiac lesion.

MURMURS.—These are abnormal sounds which may precede, take the place of, or follow one or other of the cardiac sounds. They usually depend on the presence of lesions in the cardiac valves, but may also occur in the absence of valvular lesions—*e.g.*, in anæmia.

Authorities differ in their views as regards the explanation of how murmurs are produced. Stockman remarks that in valvular incompetency, owing to the column of blood passing in a backward direction and meeting with the advancing one, an eddy is produced and a murmur arises. In stenosis of a cardiac orifice the volume of blood passes through it with difficulty into a relatively wide cavity beyond, and a murmur results.

With regard to the time at which murmurs are heard, they are termed *systolic* when occurring during systole, and *diastolic* when arising during diastole. When occurring just previous to systole—*i.e.*, with the auricular contraction—they are termed *presystolic*.

In order to determine the time of the murmur, place a finger on a convenient artery, and if the murmur be found coincident with the pulse, it is systolic in time; if, on the other hand, it be heard after the pulse or after the second sound of the heart, it is diastolic in time.

One of the most difficult points in connection with the subject is to distinguish functional cardiac affections, such as palpitation, intermittent or irregular action of the heart, tachycardia (rapid action of the heart), and bradycardia (slow action of the heart), from organic cardiac diseases. The matter can only be decided by a careful physical examination of the heart, and by attention to other pheno

mena in connection with the case. Having determined the question, treatment must be adopted according to the conditions on which the symptoms depend. For full details see Part III. of this work (Special Therapeutics, under the heading of 'The Treatment of Diseases of the Heart'). For information on the diagnosis of the various forms of cardiac disease, consult our work 'A System of Veterinary Medicine.'

Symptoms in Connection with the Respiratory Functions.

Owing to the common occurrence of respiratory affections, the student should devote special attention to their symptoms and diagnosis. The general symptoms afford valuable indications to the therapeutist, and hence must be carefully studied. The special symptoms will receive a more detailed consideration in Part III. of this book (Special Therapeutics).

In the horse, under normal conditions, the ratio of the respirations to the pulse is usually one respiratory movement to three or four pulsations. In the bovine species this relation does not exist to the same extent; for example, during rumination the pulse may rise to seventy or eighty per minute, while the respirations may be about ten.

Again, in stall-fed cattle, especially during hot weather and after feeding, the respiration may be so accelerated as to lead an individual unaccustomed to these animals to the belief that they were suffering from a respiratory disorder.

Accelerated Respirations and Dyspnœa.—Exercise or exertion causes quickened respirations, which return to the normal during quiescence. Accelerated respirations vary in degree, and when assuming the character of difficult or laboured they constitute the condition known as 'dyspnœa.' Accelerated respirations, however, are not always characteristic of respiratory affections. They are also observed in various acute painful inflammatory affections of other organs, such as laminitis, enteritis, septic arthritis, etc. Dyspnœa occurring in respiratory affections may depend on various conditions, as follows:—

1. Obstruction to the entrance of air to the lungs, such as takes place in acute laryngitis and acute bronchitis.

2. Lessened area for respiration in the lung itself, as in cases of pneumonia.

3. Interference with the expansion of the lungs, caused by the presence of pleural effusion in the cavity of the chest.

4. Pleurisy, which renders the respiratory act painful, and causes shallow, quick respirations.

5. Engorgement of the lungs with venous blood, such as occurs in cases of acute pulmonary congestion.

6. Pulmonary emphysema (broken wind), in which the alveoli lose their elasticity, or a number of them become confluent, so that expiration is performed with difficulty.

Types of Respiration—1. *Abdominal Breathing.*—When this is present the movements of the thoracic walls are limited as much as possible. The ribs are fixed to a certain extent, and a hollow line is observed extending along the lower borders of the false ribs from the sternum to the anterior spine of the ilium; this is termed the 'pleuritic ridge.' The abdominal muscles then act as auxiliaries, and compensate for the limited action of the special muscles of respiration. The respirations are quick and incomplete. This type of breathing is observed in cases of pleurisy, and also in pleural effusion.

2. *Thoracic Breathing.* — This is characterized by the abdominal muscles being as far as possible in a state of quiescence, while extra movements of the thoracic walls compensate for the deficiency. It is observed in cases of peritonitis, ascites, intestinal tympany, etc.

3. *Irregular Breathing.*—In this type the inspiratory movement is performed rapidly, while expiration is accompanied by a spasmodic double action, especially of the abdominal muscles. It is observed in cases of 'broken wind.'

4. A snoring or roaring sound, accompanying especially inspiration, is met with in cases of acute laryngitis, nasal or pharyngeal polypi, the presence of pus in the facial sinuses or in the guttural pouch, etc.

Cough.—A cough may be a symptom of a respiratory

affection, in which case it usually depends on some irritation of the larynx, bronchial tubes, etc.; or it may be reflex, and as such is found in cases of indigestion, internal parasites, etc. There are varieties of coughs, with which it is necessary the student should be acquainted:

The Dry Cough occurs during the first stages of catarrhal affections. In cases of pleurisy also the cough is dry, and is short, suppressed, and painful, owing to the forced expiratory movement causing pain.

The Moist Cough is met with in the secondary stages of catarrhal affections. It indicates the presence of an increased secretion of mucus.

The Chronic Cough varies in type. In 'broken wind' it is short, shallow, dry, suppressed, and usually single. At times, however, it may occur in paroxysms. In roaring, the cough is deep and hollow, being 'half roar and half cough.'

The Paroxysmal Cough is observed in cases of acute laryngitis, or in instances where fluids gain entrance to the trachea and bronchi owing to careless drenching.

Nasal Discharge.—This varies in character and extent. It may consist of mucus or pus, or may be muco-purulent in character. In some cases of pneumonia it is rusty-coloured, and trickles from the nostrils in a fine stream, but in others it is absent. Though a nasal discharge is a usual accompaniment of those respiratory disorders daily met with in practice, its occurrence in a chronic form (nasal gleet) is symptomatic of one or other of the following diseased conditions:

1. *Chronic Catarrh of the Mucous Membrane of the Nasal Cavities.*—Discharge usually bilateral, yellow or yellowish-white, and fairly thick. No striking difference in the amount of discharge according to the position of the head, but it is usually more profuse in the mornings. Non-fœtid. Sometimes a cough and some snorting. Slight enlargement of submaxillary lymphatic glands on both sides.

2. *Chronic Catarrh of the Mucous Membrane of the Air-Cavities.*—Discharge generally unilateral, yellow, and often clotted. Frequently comes in quantity when head is held low. Usually fœtid. Snorting and cough usually absent.

Enlargement of submaxillary gland on the affected side. Exploratory puncture by gimlet will reveal the source of the trouble. Percussion may reveal dulness, and in very severe or advanced cases there may be softening and bulging of the bone.

3. *New Growths in the Air-Cavities.*—Symptoms usually similar to the previous, but on trephining the affected sinus it will be found more or less blocked by the new growth, and profuse hæmorrhage may occur.

4. *Discharge due to Diseased Molars.*—As the alveoli of most of the upper molars extend into the air-sinuses, any disease of the roots of these teeth will induce a purulent condition of these sinuses before any nasal discharge is shown. The symptoms in many cases are indistinguishable from those arising from a chronic catarrh of these sinuses, and the only diagnostic evidence will be that of the diseased tooth, which is found on examination of the mouth. Sometimes difficulty and pain in mastication are seen. In some cases particles of food find their way into the sinuses, and may be found in the nasal discharge. The discharge is usually fœtid. but not invariably so. There will be enlargement of the glands of the affected side.

5. *Discharges arising from the Growth of Tumours in the Posterior Nares.*—A tumour usually excites an abnormal amount of secretion, which it may partially obstruct. The discharge is unilateral, and may be yellowish, mucoid, or purulent. Sometimes it is brownish, and may become fœtid. There is usually a good deal of snorting, and the passage for air will be more or iess diminished, and sometimes quite blocked. A sound passed up the nostrils is a useful aid to diagnosis. There is usually enlargement of the gland on the affected side.

6. *Disease of the Turbinated Bones.*—The discharge is purulent and fœtid. It may come more profusely if the head be elevated. Very occasionally there is some obstruction to the passage of air. The discharge is usually unilateral, and there will be enlargement of the gland on the affected side.

7. *Foreign Bodies lodged in the Posterior Nares,* such as a

physic ball which has been coughed up. The symptoms will vary, but will be rather similar to those caused by tumours, while the discharge will have the distinctive odour of the medicament in the bolus.

8. *Disease of the Guttural Pouches.*—The discharge is purulent, and may be fœtid. It is intermittent, and usually much increased when the head is depressed. There is generally a swelling in the parotid region, which, if pressed on gently, increases the flow of the discharge. The latter is generally unilateral, and the gland of that side will be enlarged. There may be a cough, and sometimes there is interference with respiration. It must be remembered that both pouches may be diseased, in which case the discharge may come from both nostrils.

9. *Abscess in the Lungs.*—An open abscess in the lung may be an unsuspected cause of a nasal discharge. In this case the discharge will be bilateral (although frequently seen more on one side than the other), purulent, and fœtid. It varies very much in quantity, and it is noticed that the breath stinks even when no discharge is present. There is generally some cough, which may be violent at times. There is usually no enlargement of the submaxillary lymphatic glands. Constitutional symptoms may be present or not. Generally speaking, when the nasal discharge is most free—*i.e.*, when the abscess is discharging freely—the constitutional symptoms will be least marked.

10. *Glanders.*—In this disease the discharge is generally starchy or glue-like in appearance, and tends to adhere to the nostrils; it is accompanied by a hard, swollen condition of the submaxillary gland. Unless the characteristic glanders ulcers can be detected, the diagnosis must be based on the result of the mallein test.

Here we may remark that in all cases of chronic nasal discharges, unless the cause is fairly evident, it is advisable to carry out the mallein test.

Physical Examination of the Chest.—The general symptoms mentioned above, to which we may add a variable degree of fever, taken in conjunction with the evidences

obtained from a physical examination of the chest, enable us to recognize and to differentiate the various diseases of the lungs and pleuræ. In addition to these aids to diagnosis, we have the valuable assistance offered by the employment of the trocar and cannula in detecting the presence of pleural effusion (fluid in the cavity of the chest). From a therapeutical point of view, as we shall point out in the section on Special Therapeutics, the early employment of the trocar and cannula, and the removal of the fluid, have considerably modified the mortality from diseases of the lungs and pleuræ. A correct diagnosis of these affections is of great importance, more especially in connection with the subject of vaccine-therapy as applied to respiratory diseases.

In order to obtain correct and useful information from a physical examination of the chest in disease, the student must first be familiar with the character of the respiratory sounds in the healthy animal. He must practise percussion and auscultation on the healthy chest, and when he has educated his ear to recognize the normal sounds, he will then be in a position to appreciate the alterations in character of the sounds produced by disease, and also the presence of adventitious sounds.

In consequence of anatomical peculiarities, the horse, as compared with the dog, presents difficulties in the way of a thorough physical examination of the chest, and similar remarks apply to the ox. The thoracic walls are comparatively thick; the anterior third of the chest is covered laterally by the massive shoulders; while the contiguity of the large intestines is often responsible for sounds, which must be carefully distinguished from those originating in the lungs. Hence, not only is it necessary to recognize abnormal sounds, but we must avoid mistaking normal sounds for evidences of disease. We shall first consider the signs elicited by a physical examination of the normal chest. It is convenient to map out each side of the chest into three areas—viz., upper third, middle third, and lower third.

Normal Physical Signs obtained by Percussion in the Horse.—Percussion is carried out either with the tips of the

fingers or by means of an instrument termed a 'pleximeter.' Percussion sounds are most pronounced over those parts least covered by soft tissues, and where the bronchial sounds are most distinct.

LEFT SIDE—*Upper Third.*—From behind the shoulder to the twelfth or thirteenth rib the sound is clear; posterior to this it becomes gradually lessened.

Middle Third.—From the sixth to the twelfth rib resonance is best marked; it diminishes to the fifteenth rib.

Lower Third.—In the area over the fifth, sixth, and seventh ribs the sound is very slight or may be absent, due to the space being occupied by the heart. From the seventh to the thirteenth rib a slight resonance may be detected.

RIGHT SIDE—*Upper Third.*—Percussion sound similar to that obtained on the left side. Posterior to thirteenth rib, forcible percussion elicits increased resonance owing to the proximity of the double colon.

Middle Third.—Resonance similar to left side; posterior to fifteenth rib it becomes dull, owing to proximity of the liver.

Lower Third.—Resonance similar to left side; posterior to seventh rib it is dull, owing to proximity of the liver.

Normal Physical Signs obtained by Auscultation.—Auscultation of the chest signifies the act of listening to the respiratory sounds and detecting modifications therein, or recognizing the presence of adventitious sounds. Auscultation may be carried out by applying the ear to the side of the chest (direct method), or by employing a stethoscope (indirect method). For accuracy in diagnosis there is no doubt that the stethoscope offers marked advantages. But, as already remarked, considerable practice in the use of the instrument is essential before accurate deductions can be drawn.

In the normal chest the following sounds should be recognized and studied:

VESICULAR OR RESPIRATORY MURMUR.—This is best heard over the middle third of the chest, just behind the shoulder. It is soft in character, and is caused by the

friction of the air entering the alveoli. The expiratory sound is weaker and shorter than the inspiratory. The vesicular murmur can only be detected with difficulty, or may be impossible to recognize when the chest wall is covered with a layer of fat or marked thickness of muscle. F. Smith points out that in many perfectly healthy chests the expiratory murmur can scarcely be heard, or in some instances both inspiratory and expiratory murmurs may be obscure or even undetectable.

TUBAL OR BRONCHIAL SOUNDS.—These are blowing and harsh in character; they begin and end abruptly, are about the same duration in inspiration and expiration, and are separated by a short pause. They depend on the air passing through the larger bronchi, and are detected by auscultating the breast over the lower end of the trachea, or the upper third of the chest immediately behind the shoulder.

The following points should be recognized in the auscultation of the chest:

LEFT SIDE—*Upper Third.*—Respiratory sounds loud and somewhat harsh, being chiefly bronchial.

Middle Third.—Vesicular murmur detected from fourth to sixth rib, more distinct to the ninth rib, and gradually diminishing to the sixteenth rib.

Lower Third.—Respiratory sounds replaced by cardiac sounds over the fourth to the sixth ribs. Vesicular sounds heard over the seventh and eighth ribs, and absent over the tenth rib.

RIGHT SIDE—*Upper and Middle Third.*—Similar to those on the left side.

Lower Third.—Vesicular sounds heard over fourth to seventh ribs, and diminish to tenth rib.

Abdominal Sounds.—These are of a gurgling character, and have no relation to the rhythmical respiratory action. They may be heard over the middle and lower third, and especially over the posterior part of the chest.

Having become familiar with the normal physical signs, the student should next devote attention to abnormal respiratory sounds. These should be studied clinically in

cases of disease. The following are the chief points in connection with the subject:

Abnormal Percussion Sounds—*Increased Resonance.*—This may be general or partial. It is general in cases of extensive pulmonary emphysema (broken wind), also in pneumothorax.

Partial increase of sound is observed when portions of the lung become hepatized in cases of pneumonia, or compressed by false membranes or pleural effusion in cases of pleurisy. The unaffected portions then, owing to extra functional activity, take in a greater amount of air than normally, hence the resonance over these areas is increased.

Diminished Resonance, when general, may depend on pulmonary congestion, pulmonary œdema, the presence of a false membrane over the costal pleura or enveloping the lung itself and interfering with the normal distension of the organ.

Loss of Resonance is not general except in those cases of 'massive' pneumonia sometimes met with, when a 'wooden' dulness is elicited by percussion. Absence of resonance may be due to hepatization of the pulmonary tissue, or to pleural effusion. It is best marked in the latter condition, and commences in the inferior part of the chest. Enlargement of the liver or spleen causes dulness over the portions of the thorax with which these organs are in proximity.

Abnormal Respiratory Sounds.—These include modifications of normal sounds, and the presence of adventitious sounds. With regard to the former, the most important are —(1) Modifications in the bronchial sounds; (2) modifications in the vesicular murmur.

1. Modifications in the Bronchial Sounds.—*Bronchial* breathing is heard over those parts of the chest where normally only the vesicular murmur is audible, and is observed in cases where the lung tissue has ceased to contain air, such as consolidation in pneumonia, also in collapse or compression of the lung in cases of pleuritic effusion. In these instances the bronchial tubes are surrounded by solid tissue, hence the

sounds are well conducted, while any sounds which originate in the parenchyma are suppressed.

The bronchial sounds may be altered in character, and the modifications are described as tubular, blowing, and cavernous.

Tubular.—This is higher in pitch than the normal bronchial sound, and is heard to perfection over a hepatized lobe in pneumonia, and appears to be immediately beneath the part examined.

Blowing breathing is less concentrated. The sounds appear to be produced at a distance and in a wider tube.

Cavernous breathing is generally heard over cavities in the lung, such as occur in tuberculosis and circumscribed gangrene, but is also produced when solid tissue exists between the root of the lung and the surface. The sound resembles that made by blowing into a wide-mouthed vessel. The inspiratory and expiratory sounds are of a hollow, whiffing character, and lower pitched than in tubular breathing.

2. MODIFICATIONS IN THE VESICULAR MURMUR.—This murmur may be exaggerated or harsh over a portion of normal lung when another portion of the organ is compressed or solidified, or when the other lung is affected by the lesions mentioned. It is diminished in cases where feebleness of the movements of the thorax exists, such as conditions of weakness and prostration. In instances where the inspiratory act is attended by pain, such as in the early stages of pleurisy and in peritonitis, etc., the chest is not fully dilated, the respirations are short and quick, and the respiratory murmur is also diminished. Absence or suppression of the vesicular murmur occurs in various morbid conditions, such as hepatization of the lung in pneumonia and pleuritic effusion. In the latter case the absence of sound is observed in the lower part of the chest, and its level corresponds with that of the fluid.

Adventitious Sounds.—In the majority of diseases of the lungs and pleuræ, during some part of their course the respiratory murmur is accompanied by certain adventitious sounds. These are known as—(1) Rhonchi; (2) Râles; and (3) Friction sounds.

1. RHONCHI, OR DRY SOUNDS. — These are sometimes termed 'dry râles.' They are continuous sounds, and accompany inspiration and expiration. According to their pitch, they are classified as sonorous and sibilant.

Sonorous Rhonchi are low-pitched and of a cooing or snoring character.

Sibilant Rhonchi are high-pitched and of a whistling character.

Rhonchi are produced by the passage of air through bronchial tubes which are narrowed or constricted at some point. The constriction may depend on various alterations in the bronchial tubes, such as the presence of viscid mucus, tumefaction of the bronchial mucosa, or spasmodic contraction of the tubes as in asthma.

2. RÂLES, OR MOIST SOUNDS.—These include crepitation and various forms of moist râles.

Crepitation, Crepitant or Vesicular Râles.—These terms are applied to the crackling, or very fine sharp sounds, heard during inspiration only, and usually towards the termination of the act. They may be imitated by rubbing a lock of hair between the fingers, close to the ear. Crepitant râles are heard in the first stage of pneumonia, and depend on the sudden expansion of alveolar walls which have become glued together by viscid secretion. In this condition air can still enter the air-cells.

Mucous Râles, also known as 'simple bubbling râles,' vary in extent. They are produced in bronchial tubes or in cavities in the lung, by the passage of air through serum, mucus, blood, etc., and are modified by coughing, thus differing from the crepitant râles.

Subcrepitant Râles are small in extent, and are met with in capillary bronchitis.

Submucous Râles are medium as regards extent.

3. FRICTION SOUNDS.—These may be detected in the early stages of pleurisy, and depend on dryness of the pleural surfaces and the deposition of layers of lymph thereon. They vary from a slight grating sound to a crackling or creaking sound, such as is produced by rubbing together two pieces of

leather, and occur as a rule with each inspiration only, being best heard at the lowest part of the chest. They disappear when effusion takes place, but may reappear during the stage of absorption. They are never well marked, and are frequently overlooked in veterinary practice.

Here we may remark that, in auscultating the chest of a cow suffering from advanced tuberculosis, we can usually determine a great variety of the abnormal sounds referred to.

Palpation.—As applied to respiratory diseases this signifies a manual examination of the chest. In the early stages of some cases of pleurisy the friction produced between the pleural surfaces may be manifested by vibration of the thoracic walls, which is perceptible to the touch. Under similar conditions, firm pressure applied to the intercostal spaces over the affected region causes pain and even grunting. But it must be remembered that in nervous horses with thin skins this manipulation is resented, although the animals are perfectly healthy.

Symptoms connected with Alterations in the Visible Mucous Membranes.

An inspection of the visible mucous membranes—viz., the Schneiderian (nasal), the conjunctiva, and the buccal mucosa—gives valuable information with reference to diagnosis.

Marked Redness and Deep Congestion of the nasal mucosa and conjunctiva is observed in acute inflammatory affections. In the normal condition these mucosæ are of a pale red colour. Alterations in the appearance of the nasal mucosa and conjunctiva are not only an important aid in diagnosis, but are also of value in judging of the gravity of a case of intestinal disease. Thus, in subacute obstruction of the double colon they are of a deep red hue, and not infrequently tinged with yellow, while in acute enteritis they are of an intense livid red colour. In acute respiratory affections, when imperfect aëration of the blood is present, the visible mucosæ assume a dark, dusky, or violet hue.

Yellowness of the Visible Mucosæ may indicate an affection of the liver, or interference with the normal flow of bile

into the intestine owing to obstruction in the bile-duct. It may also depend on jaundice of obscure origin. As already remarked, a yellow tinge of the visible mucous membranes may be observed in cases of intestinal obstruction.

Pallidity of the Visible Mucosæ is met with in anæmic conditions and in certain diseases of the heart. In cases of internal hæmorrhage the pallidity occurs suddenly.

The nasal mucosa shows petechial spots in cases of purpura hæmorrhagica, and is one of the seats of the characteristic ulcers of glanders.

Alterations in the buccal mucosa will be considered under the heading of symptoms in connection with disorders of the digestive organs.

Symptoms furnished by Morbid Conditions of the Digestive Organs.

These are of great importance, and should be carefully studied.

Loss of Appetite is probably the commonest symptom met with in practice, and is usually the first sign of illness observed by the owner or attendant. It must be distinguished from inability to feed or a difficulty in feeding. Thus, an animal may be anxious for food, and yet be unable to feed owing to various abnormal conditions in connection with the mouth, pharynx, or œsophagus. Interference with the prehension of food may result from paralysis of the lips, or from spasm of the masseter muscles, such as occurs in tetanus (trismus, or 'lockjaw'), also from injuries to the tongue. Dental irregularities interfere with the proper mastication of the food, and, owing to sharp edges of the teeth wounding the tongue and adjacent parts, the animal feeds slowly and with difficulty. In severe trismus (lockjaw) mastication is impossible.

Glossitis (inflammation of the tongue), the presence of a sharp-pointed foreign body in the tongue, the various forms of stomatitis, and a foreign body lodged between the molar teeth, also interfere with mastication, and prevent the animal from feeding properly. Difficulty in deglutition

(swallowing of food) occurs in cases of acute pharyngitis and laryngitis, owing to the pain caused by the contact of food with the inflamed parts.

Deglutition may be impossible in tetanus, owing to spasm of the muscles involved in the act. Inability to swallow also occurs as the result of a foreign body in the pharynx or in the œsophagus, and in various morbid conditions of the latter organ, such as paralysis, spasm, dilatation, constriction, and rupture.

Loss of the desire for food is a symptom occurring in various diseases. The gastric functions are disturbed in all febrile conditions, and also in affections of the stomach itself. Again, diseases of other organs may interfere with the gastric circulation, and thus induce alterations in the mucous membrane of the stomach. In diseases such as influenza, the nervous mechanism of the stomach becomes disordered, and loss of appetite results. In very acute nasal catarrh, associated or not with influenza, we may presume that the horse, as in man, temporarily loses the sense of smell and taste, and this contributes to the loss of desire for food. In acute painful conditions, such as septic arthritis, etc., loss of appetite is also present, but it is not uncommon to find horses suffering from severe injuries feeding normally.

Total loss of appetite is always a serious symptom, as it soon leads to emaciation and weakness, and the practice of forcing food on patients that refuse to take nourishment is always unsatisfactory. Unfortunately, the usual tendency of owners and attendants of animals is to administer fluid foods in the form of drenches, the result being that nausea is increased; besides, there is the risk of inducing pneumonia by the entrance of some of the drench into the trachea and bronchi. The proper course to adopt is to carry out careful nursing, and to tempt the animal to feed of its own accord (see p. 80).

From the remarks we have made, the reader will gather that loss of appetite or inability to feed are symptoms which require careful consideration, and that their cause should be

sought for in a methodical manner. Unless there is clear evidence of the existence of a disease sufficient to account for the symptoms mentioned, a careful examination of the mouth and teeth should be made by means of a mouth speculum. Neglect of this simple measure is certain to lead to serious errors in diagnosis. If the thermometer indicates an absence of fever, the mouth and teeth should always be examined.

Abnormal Appetite.—This is observed in cases of intestinal parasites, and although large amounts of food are consumed, the animal remains in poor condition. In that affection known as 'broken wind' in the horse, there is a constant desire for food; the animal eats his bedding, and after a time exhibits a 'pot-bellied' appearance. It is highly probable that the starting-point of the affection is a functional derangement of the stomach (see 'Broken Wind,' Part III.).

In the dog an abnormal appetite occurs in cases of intestinal parasites, and in that disease known as 'diabetes mellitus.

Depraved Appetite.—This is observed in cases of gastric indigestion. In this condition the horse eats clay whenever opportunity offers, and may even consume his own fæces; he may also lick the walls of his stall and the manger. Such acts suggest excessive acidity of the stomach, since the administration of alkalies overcomes the condition.

In cattle a depraved appetite (bulimia) is very common, and the tendency for such animals to ingest foreign bodies of every description is well known.

Thirst is a symptom met with in febrile conditions, gastric derangement, 'broken wind,' affections of the liver, chronic lead-poisoning, and diabetes insipidus. In the dog excessive thirst occurs in acute gastritis and in diabetes mellitus. In cattle and sheep suffering from parasitic gastritis constant thirst is a prominent symptom.

Salivation.—An excessive flow of saliva is observed in various affections of the mouth such as stomatitis, glossitis, dental irregularities, foreign bodies in the tongue or in the pharynx; also as the result of irritating medicaments ad-

ministered in the form of a drench and not properly diluted, such as oil of turpentine, preparations of ammonia, and chloral hydrate.

When depending on a foreign body in the œsophagus, or on pharyngitis, laryngitis, tetanus, etc., salivation is due to the difficulty in swallowing that is present. Salivation is also induced by certain drugs, such as arecoline, pilocarpine, and by the long-continued administration of salts of mercury (hydrargyrism).

Fœtor Oris (*Fœtid Condition of the Mouth*).—This is detected by the fœtid emanations which arise from the mouth when this region is examined. It is observed in ulcerative stomatitis, alveolar periostitis, the presence of a diseased molar tooth, septic wounds of the tongue, etc. Any conditions in which difficulty in swallowing is present, so that particles of food accumulate in the mouth and undergo putrefaction, are accompanied by fœtor oris.

As the horse breathes only through the nostrils, fœtor oris cannot be termed 'foul breath' in this animal. When the breath is foul or fœtid in the equine species, the practitioner detects it by standing close to the animal's nostrils. The symptom (foul breath) in the horse may depend on nasal gleet, a diseased molar tooth, disease of the turbinated bones, septic pharyngitis, a septic condition of the bronchial secretions, septic pneumonia, or gangrene of the lung.

Fœtor oris is a common condition in the dog, and depends on a variety of morbid conditions.

Dry Mouth (*Arrest of the Salivary or Buccal Secretions*) is a symptom met with in various acute febrile conditions, in inflammatory diseases of the gastro-intestinal canal, in superpurgation, in diabetes insipidus, and as the result of administering large doses of belladonna.

Alterations in the Character of the Buccal Mucosa.—This membrane shows a sour pasty condition in cases of indigestion, disorders of the liver, etc. A coated or furred tongue, which is so common a symptom in digestive disturbances in man, is seldom observed in the horse. Some authors describe this symptom as occurring in the dog, but

in this animal a whitish or soapy condition of the organ is the abnormal condition usually met with, and in some instances the tongue may be of a copper-coloured tint.

Pain.—This is an important symptom, and one that is readily observed by the owners and attendants of animals. Pain varies in degree, depending on its origin, and to a certain extent on the temperament of the animal. In diseases of the stomach or intestines, pain is probably the most common symptom present ; hence in the lay mind it is always ascribed to this cause. But it is important to remember that so-called 'colicky symptoms' may be observed in diseases of the liver, kidneys, and in the early stages of pleurisy and of azoturia, while in pregnant females we have to bear in mind the possibility of premature labour pains.

Acute pain occurs in surgical conditions, such as acute laminitis, erysipelas, septic arthritis (open joint), severe wounds involving the deep structures of the foot, 'split pastern,' etc.; but in such instances the horse does not exhibit symptoms similar to those of abdominal pain, such as lying down, rolling, etc. Instead of these we observe greatly accelerated respirations, disinclination for movement, dilated nostrils, an anxious expression of countenance, sweating, and occasionally groaning.

At present we are concerned with abdominal pain, and at the outset must point out that a consideration of its character and type, although giving assistance in diagnosis when taken in conjunction with other symptoms, yet cannot be implicitly relied on in forming an opinion as to the nature of a case, because the symptoms indicative of pain occur in a variety of gastric and intestinal affections. Acute pain manifested by violent symptoms is not uncommon in cases that ultimately recover, while only dull pain may accompany morbid conditions that terminate fatally. In order to draw deductions from pain as a symptom, we must first observe its character—*i.e.*, whether intermittent or continuous, acute or dull—and associate our consideration of it with whatever morbid alterations we find in the pulse, respirations, and temperature. Next we add the evidences obtained from a

careful rectal exploration and other special phenomena present, and endeavour to interpret the clinical picture thus formed.

Pain may be *acute* and *intermittent*, evidenced by the horse pawing vigorously, throwing himself down violently, rolling, looking towards his flanks, stamping with the hind-feet, etc. These symptoms appear in paroxysms, and are met with in the affection termed 'simple spasmodic colic.'

Pain may be *acute* and *persistent*, no intervals of ease being observed. This variety occurs in acute enteritis and in the early stages of twist of the intestine.

Pain may be of the character known as *dull* when the animal shows uneasiness, walks about his stall, paws occasionally with the fore-feet, or stamps the ground with the hind-feet. When lying down, he does so carefully, after several crouching movements, and stretches himself out, emitting a deep sigh or a long-continued groan. The recumbent position may be assumed for a variable period, during which he looks frequently towards his flank. The inspiratory movement is prolonged, and expiration is heaving and accompanied by a sigh or groan. He next gets on his feet, and the phenomena mentioned are repeated. This type of pain is continuous, and is met with in cases of impaction of the double colon and allied conditions.

It must be remembered that acute intermittent pain may be followed by the persistent form, also that the type known as 'dull' may be altered to 'violent' during the course of an attack.

Sudden cessation of pain in a case that previously showed violent symptoms, if associated with a gradually imperceptible pulse, cold sweats, and a haggard expression of countenance, must be regarded as a fatal omen. When occurring in cases of twist of the bowl, enteritis, or allied conditions, it indicates the advent of gangrene in the inflamed or strangulated portion of intestine. It is also observed in the later stages of cases of rupture of the stomach or rupture of the intestine. As regards the actual cause of the pain in gastric and intestinal affections, we cannot speak definitely. In the so-called

'spasmodic colic,' it is assumed that spasm of some portion of the intestines is present, unassociated with impaction or structural lesions of these organs. The spasm of the muscular coat of the bowel is said to be the cause of the pain. In obstructive colic due to impaction of the large colon, the pain is believed to depend on pressure and irritation of the nerve endings in the intestinal walls. This is accentuated when tympany is present as well, owing to the occurrence of tonic spasm or cramp of the muscular coat of the affected bowel. In twists of the intestine, Caulton Reeks ascribes the pain to spasm or cramp of the bowel, either anterior or posterior to the lesion, or in both localities.

Physical Examination of the Abdomen.—The evidence obtained from an examination of the abdomen by palpation, percussion, and auscultation, often proves of value with reference to diagnosis and prognosis.

Palpation. — A hard, tense condition of the abdominal walls is met with in cases of serious intestinal affections.

Pain on pressure is regarded by some authors as a symptom of importance, but in the horse there is considerable difficulty in distinguishing the uneasiness and restlessness produced by palpation from evidences of existing pain, especially in the case of nervous animals. Owing to the thickness and firmness of the abdominal walls in the horse, and the large extent of the viscera, it is not possible to locate definite painful areas or seats of obstruction with the same facility as in the case of the dog or cat.

A contracted condition of the abdominal muscles, giving the animal a 'tucked-up' appearance, is observed in the early stages of enteritis and peritonitis.

Percussion.—By carrying out percussion with palpation, we detect the presence of tympanites. This term signifies distension of a hollow organ with gases. The condition occurs in the stomach or in the large intestines of the horse, and in the rumen of the ox, sheep, and goat. It is evidenced by a clear, drum-like sound on percussion, and by a tense condition of the abdominal walls on palpation being applied.

In extreme cases the distension is evident by simple observation. Tympanites varies in degree: in tympany of the stomach of the horse, owing to the situation and comparatively small size of the organ, the abdominal distension is not well marked, while in acute intestinal tympany (flatulent colic) it may be very extensive. It also assumes large dimensions in cases of tympany of the rumen (hoven) in the ox.

Tympanites may occur in the early stages of a case and be the most prominent symptom present, as in flatulent colic; or it may not appear until the later stages, as in acute enteritis and peritonitis. It must always be regarded as a serious symptom, especially when occurring in the later stages of a case. We must point out, however, that instances of fatal intestinal disease are met with in which tympanites may be absent either during their entire course, or it may only set in a short time previous to death. Percussion of the abdomen is a ready means of detecting the presence of ascites (dropsy of the abdomen), especially in the dog and cat. See 'Ascites,' Part III.

Auscultation.—By auscultating the flanks we obtain evidence as to the presence or absence of peristaltic sounds. Absence of these points to a paralyzed state of the intestines, such as occurs in various forms of obstruction of the bowels.

Evidences obtained by Rectal Exploration.—This procedure should never be neglected in cases of abdominal affections, and in all instances where pain of obscure origin is manifested. Owing to the large calibre of the rectum in the horse, very important evidence can be obtained by the intelligent use of this means of diagnosis, with reference to the condition of the intestines within the reach of the operator. In order to arrive at correct deductions, it is, of course, essential that the student should first be familiar with the normal condition and situation of the organs, by carrying out the procedure in a healthy animal. Rectal exploration, like all diagnostic methods, must be intelligently and carefully performed; rough manipulation is calculated to mislead, and hasty conclusions should be avoided. The hand and arm of the operator being anointed with a suitable

lubricant, all the fæces within reach are removed from the rectum, and the hand and arm are then gently inserted as far as possible, and the organs within reach carefully manipulated. The character of the fæces is to be noted—*e.g.*, whether semi-fluid, or hard and solid, or covered with mucus, or composed of undigested material. The condition of the rectum next claims attention. In cases of obstruction of the intestines depending on various causes, the rectum is found either dilated ('ballooned'), or it may exert a 'clinging' action on the arm of the operator, and severe straining on the part of the patient may also be present.

By palpation towards the left side and centre the pelvic flexure of the double colon can sometimes be located, and towards the right side the head of the cæcum and the large colon. Under normal conditions the pelvic flexure does not occupy the pelvic cavity, but is situated just anterior to the brim of the pelvis.

For full information with reference to the evidences to be obtained from rectal exploration in the various lesions of the intestines, the reader is referred to 'The Common Colics of the Horse,' by Caulton Reeks. Briefly we may remark that in subacute obstruction of the double colon the impacted intestine is found on palpation to be solid in consistence, or easily indented by pressure with the fingers, and in some instances a moderate degree of tympany is present. The rectum is 'ballooned,' and the animal may strain violently on rectal examination. In obstruction of the pelvic flexure due to impaction, this structure is found within easy reach, as a round object, hard in consistence. In severe cases the distension is so marked that the pelvic flexure extends into a more central position than is the case under normal conditions. In impaction of the cæcum the distended organ is located in the lumbar region, near the centre of the abdomen, lying mainly on the right side, but projecting slightly over the middle line. In impaction of the single colon, the impacted portion of the intestine may be located in some cases. Slight digital pressure on the intestine causes pain; the animal crouches to the ground, or may lie down if

exploration be continued. The procedure is violently resisted by the patient, and the arm of the operator is firmly clasped by the rectal walls, so that the exploration is very difficult to carry out.

Impaction of the rectum is also detected by rectal exploration.

Intestinal calculi can be located if situated in the pelvic flexure of the large colon or in the small colon.

In displacement of the pelvic flexure of the large colon, due to bends or flexions, the diagnosis is based on the presence of a soft, depressible mass in the pelvic cavity; on manipulation part of this mass can be forced forward into the abdominal cavity, but on withdrawing the pressure the pelvic flexure is returned to the pelvic cavity by constant contractions. In torsion or displacement of the pelvic flexure no portion of the colon can be located, but in many instances a distended coil of small intestine is detected in the pelvic cavity, easily mistaken for the pelvic flexure; the rectal walls exert a 'clinging' action on the arm of the operator, and violent straining is present.

The diagnosis of strangulated scrotal hernia is based on an examination *per rectum*.

In newly-born foals impaction of the rectum due to the retention of meconium is recognized by a digital examination of this region.

Amongst other conditions which are recognized by rectal exploration, we may mention distension of the bladder with urine, a vesical calculus, an abdominal tumour or mesenteric abscess, if within reach; thrombosis of the external or internal iliac artery, pelvic fractures, etc., also the existence of pregnancy.

In bovines rectal exploration is employed to determine the existence of pregnancy in the earlier months of gestation, the presence of 'gut-tie' in bullocks, while some practitioners have diagnosed tuberculosis by the detection of peritoneal tubercular lesions over the smooth surface of the rumen on the left side.

In the dog rectal exploration carried out by a digita

examination is an important aid to diagnosis, and the following conditions can be recognized: The presence of sharp portions of bones causing acute pain and straining, fæcal obstruction of the rectum, neoplasms if within reach, hæmorrhoids, distension of the bladder with urine, enlargement of the prostate gland, etc.

Certain Attitudes and Postures, etc., assumed by the Patient.—Although these are sometimes suggestive symptoms, they cannot be regarded as diagnostic of special conditions.

Turning of the Head towards the Flank is a symptom met with in a variety of cases in which abdominal pain is present.

Lying on the Back, with the feet against the sides of the stall, and maintaining this posture for a few minutes, is often observed in cases of twist of the intestine, but may also occur in instances of very acute abdominal pain not depending on a fatal lesion.

Sitting on the Haunches, which is a normal position in the dog, is a serious symptom in the horse, but not necessarily indicative of a fatal termination in every instance. Thus, in acute gastric tympany, this symptom may be present, and recovery may result. It may also be observed in cases of intestinal calculus, in rupture of the stomach, intestine, or diaphragm, and in twists of the double colon.

Lying on the Sternum with both fore-legs extended is occasionally observed in cases of acute gastritis in the horse.

Walking in a Circular Direction in the stall, also termed the 'circus mode of progression,' is commonly regarded as a symptom of persistent abdominal pain, such as occurs in cases of acute enteritis. But while admitting that horses suffering from the affection mentioned may, in many instances, walk about the stall in an aimless manner, we must point out that the most typical circular mode of progression results after large and repeated doses of opium or morphine have been administered for the relief of pain. This mode of progression is occasionally observed in cases of brain affections in the horse and ox, in the sheep as the result of

'gid' (parasitic disease of the brain), and in the dog it occurs as a symptom of various lesions of the brain.

Constant Efforts at Micturition.—This symptom is observed especially in impaction of the small colon and in some cases of intestinal calculus. It also occurs in acute nephritis, cystitis, calculus in the bladder, etc., and as the result of overdosage with drugs, such as oil of turpentine.

Forcing the Hind-quarters against the Sides of the Stall is observed in cases of impaction of the large colon.

Constipation.—This is a symptom present in a variety of affections. It varies in degree, from a condition in which the fæces are less in amount and harder in consistence than normal, to one in which fæcal obstruction of the intestine is present. In arriving at a diagnosis of intestinal affections, it is very important to ascertain the presence or otherwise of fæcal obstruction. If the fæces are passed in normal amount it is a favourable sign; on the other hand, obstinate stasis of the intestines is always to be regarded as serious. It is important to remember that fæces may be expelled in an apparently normal manner at the commencement of some fatal bowel affections, such as impaction of the cæcum, in which diarrhœa may even occur in the early stages, and an erroneous diagnosis or prognosis is likely to be given unless other circumstances are taken into consideration.

Diarrhœa.—This symptom varies in degree, and, like constipation, is met with in various intestinal diseases and disorders. In judging of its value as a symptom, it is necessary to inquire into its cause. Diarrhœa may be a premonitory symptom in enteritis, in impaction of the small intestine, and of the cæcum. It is important to point out that diarrhœa may be present in cases where a partial obstruction exists in the intestine ('spurious diarrhœa'), and thus prove a misleading symptom.

Vomiting.—In carnivora this is a symptom common to many affections. It is readily induced by gastric irritation arising from various causes, and by emetics. In the horse vomiting is of comparatively rare occurrence under ordinary circumstances, and it cannot be induced as a therapeutical

measure by the employment of emetics in the treatment of gastric disorders. Various reasons have been adduced to account for the fact that vomition so seldom occurs in the horse, and also to explain why emetics fail to act in this animal. For a consideration of these points the student is referred to 'Veterinary Physiology,' by F. Smith.

Vomiting in the horse may or may not be accompanied by nausea and distressing symptoms. In some cases, as described by F. Smith, the ingesta are discharged in small amounts from one or both nostrils, and occasionally the animal makes an effort, by depressing the head, to facilitate expulsion. In other instances the expression of the animal is indicative of extreme nausea while emesis is in progress, the amount of ingesta expelled varies, and is usually mixed with a large proportion of fluid. The amount discharged may be very considerable, or, after repeated attempts at vomition, only a small quantity of fluid is emitted. Occasionally, when the quantity is large, it is discharged by the mouth as well as by the nostrils. During the act the muscles of the abdomen and neck may be spasmodically contracted, and the head drawn towards the sternum. Sweating and a staring condition of the eyes may also be observed, and during the intervals exhaustion, trembling, and coughing may be present. In some instances attempts at vomition only are observed (straining and retching), no actual vomiting occurs, but profuse salivation is present. In others the act is preceded by frequent eructations of gases and repeated attacks of retching. Vomiting is a frequent symptom of rupture of the stomach. Authorities differ as to whether the act occurs prior or subsequent to the gastric rupture. But vomiting may be met with in conditions which are not necessarily fatal, such as impaction of the stomach, dilatation of the thoracic portion of the œsophagus, or a diverticulum close to the termination of the œsophagus in the stomach. Here we may remark that morbid conditions of the œsophagus occur in which all the phenomena of vomiting are present, but the material expelled does not proceed from the stomach, being simply food which has become lodged in the gullet.

In addition to rupture of the stomach, there are other fatal conditions in which vomiting may occur—viz., impaction of the small intestine, twists of the intestine, rupture of the intestine, and rupture of the diaphragm. Vomiting also occurs as one of the symptoms in poisoning by aconite or veratrine, and is occasionally observed after the administration of eserine, arecoline, and barium chloride.

Eructations and Regurgitation.—These are important symptoms, and their presence generally, but not always, points to the existence of a gastric disorder, as they may also be observed in some cases of twist of the double colon. Again, in cases of extreme gastric tympany, neither regurgitation nor eructations can occur, owing to the firm contraction of the cardiac orifice of the stomach which is present.

Eructations are manifested by the expulsion of small quantities of gases through the nostrils, and they may be accompanied by contraction of the cervical muscles, also by gurgling sounds in the œsophagus, which are readily audible. In some cases a distinct hiccough may be heard with each eructation; in others the symptom may be overlooked unless a careful examination be made. Auscultation over the region of the œsophagus and caput muscles will enable us to detect the presence of eructations prior to the occurrence of other symptoms. In cases of gastric tympany, eructations must be regarded as favourable, as the dangerous excess of the gases is got rid of in this manner.

Regurgitation of small amounts of fluid may accompany the eructations in some cases, and distinct waves may be observed passing upwards along the course of the œsophagus. The fluid may contain small quantities of ingesta, and be expelled through the nostrils without any effort in some instances. In others there are evidences of nausea, the head is slightly depressed during the act, and a sound is emitted. In severe cases, when relief is not obtained, the quantity of fluid may be increased, and actual vomition then takes place.

Symptoms in Connection with the Urinary Organs.

Although a variety of symptoms are met with in diseases of the kidneys, yet none can be regarded as diagnostic, and the diagnosis must be based on a chemical and microscopical examination of the urine. On the other hand, there are surgical affections of the urinary passages in which certain symptoms are present, and physical means of diagnosis are available, so that we are enabled to ascertain the nature of the disease from which the patient is suffering. Again, there are affections, such as diabetes insipidus, diabetes mellitus, and hæmoglobinuria (azoturia), in which morbid alterations occur in the urine in the absence of any primary disease of the kidneys.

Amongst the laity, diseases of the kidneys are regarded as of common occurrence, but in reality the symptoms on which such opinions are based are common to various affections. Thus, frequent attempts at micturition, an excessive or a diminished flow of urine, with alterations in the colour and appearance of this excretion, may occur in the absence of a renal affection. *Per contra*, a chronic disease of the kidneys may be present without the occurrence of any well-marked symptoms attributable to these organs, and its existence can only be determined by an examination of the urine.

Hence in the present section we shall only draw attention to the morbid changes occurring in the urine, the methods by which these can be detected, and to the general symptoms of renal diseases. Here we may remark that in all cases manifesting obscure symptoms an examination of the urine should always be carried out, as by this means only can the presence or absence of an affection of the kidneys be determined.

The student should be familiar with the characters of the normal urine of the various animals. For full information on this subject he should consult 'Veterinary Physiology,' by F. Smith.

The points in the following table are of importance to the clinician :

	Reaction.	Specific Gravity.	Quantity.
Urine of horse -	Alkaline. If fed entirely on oats, becomes acid.	Average, 1036.	Varies according to diet, amount of water consumed, season, and work. Increased on highly nitrogenous diet and in winter ; lessened in horses at work and in warm weather.
Urine of ox - -	Alkaline. In suckling calves, acid.	1007 to 1030.	Larger than in horse —10 to 40 pints in 24 hours.
Urine of sheep -	Alkaline.	1006 to 1015.	0·5 pint to 1·5 pints in 24 hours.
Urine of pig -	Acid or alkaline.	1003 to 1025.	2½ to 14 pints in 24 hours.
Urine of dog -	Acid on a flesh diet. May be alkaline on a vegetable diet.	1016 to 1060, depending on the diet.	Varies with the size of animal and the nature of the diet, usually estimated at ¾ pint to 1¾ pints in 24 hours.

It is important to note, with reference to the urine of the horse, that it is generally turbid in appearance, due to suspended carbonate of lime and magnesia, and the turbidity becomes intense as the urine cools, especially when ammoniacal fermentation takes place. The colour may be clear yellow, brownish-yellow, deep yellow, or yellowish-red; on exposure to air it rapidly changes to brown, and it is influenced by certain forms of diet. Thus, on green food it may be yellowish-white, and if large amounts of red carrots be allowed it may be of a brownish-red tint. F. Smith points out that some mares normally excrete a glairy tenacious urine containing a large amount of mucin, and, especially during œstrum, it may be found as thick as linseed-oil.

Morbid Conditions in Connection with the Urine and Urinary Secretion.

Oliguria signifies a diminution in the quantity of urine secreted. It varies in degree, and may be associated with one of the following conditions: (*a*) Diseases of the kidneys, in which, owing to shrinkage of the renal capillaries and atrophy of the glomeruli, a diminished amount of blood passes through the organs; also morbid alterations in the secretory structure of the kidneys. In both instances the amount of urine is diminished. (*b*) Diseases of the heart, in which lowering of the blood-pressure occurs and the renal circulation becomes impeded. (*c*) Pressure on the renal veins by tumours or by ascitic fluid. (*d*) The early (congestive) stage of acute nephritis. (*e*) Conditions in which large amounts of fluid escape from the body by other routes, such as diarrhœa, or in the case of extensive exudates and transudates—*e.g.*, pleural effusion, hydrothorax, or ascites. (*f*) In acute febrile conditions.

Anuria signifies total suppression of urine. It occurs under the following conditions: Obstruction of the urinary passages by calculi; intense congestion in the early stages of acute nephritis; in some cases of severe nephritis, with degeneration of the secreting epithelium, or in occlusion of the collecting tubules due to contraction of new connective tissue surrounding them; in acute poisoning by oil of turpentine, cantharides, etc.

Polyuria.—This term is applied to an increase in the quantity of urine, especially as regards the proportion of water. It is a symptom occurring in a variety of conditions, and the urine may exhibit various morbid changes according to the nature of the disease which is present. Polyuria occurs when a larger amount of blood than usual passes through the kidneys. This may depend on an increase in the general blood-pressure, without any constriction of the renal vessels, or, with a normal blood-pressure, when the renal vessels are dilated. According to some authors it may also depend on chemical stimulation of the renal parenchyma

associated with an increased permeability of the dilated renal bloodvessels occurring in a secondary manner.

Polyuria is met with in various forms of renal disease. In chronic interstitial nephritis the explanation of this symptom is not yet definitely determined. Polyuria is a prominent symptom in diabetes insipidus and diabetes mellitus. It may also be observed in certain affections of the central nervous system, in cases of pneumonia and pleurisy when copious exudates and transudates are comparatively quickly absorbed, in certain chronic infectious diseases, such as tuberculosis and glanders, and as the result of large doses of diuretic agents; also in chronic lead-poisoning. In order to ascertain the cause of polyuria, the history of the case must be considered, and a chemical and microscopical examination of the urine should be carried out. When depending on diabetes insipidus, a history of excessive thirst, loss of condition, and feeding on deteriorated or damaged fodder, will enable a diagnosis to be arrived at, especially if several horses in the same stable be affected.

Albuminuria.—Some observers hold that minute quantities of albumin may be found in the urine of healthy animals, especially in dogs and swine, to a less extent in ruminants, and very rarely in horses (Simader). This is termed 'physiological albuminuria.' Others state that the albumin found in the urine under normal conditions is chiefly nucleo-albumin and mucin. The presence of albumin in the urine generally indicates some lesion of the renal parenchyma, but it may also be associated with other morbid conditions. In the normal kidney only the water and the salts are allowed to pass from the blood. When albumin transudes, the nutrition of the epithelium of the capillaries of the tufts or of the cells surrounding the glomerulus is probably disturbed.

Albuminuria is met with in the following conditions: Acute and chronic organic diseases of the kidneys, in which the glomeruli or the epithelial cells are affected; acute and chronic renal congestion; various diseases of the blood

associated with alterations in its composition; certain affections of the nervous system, such as cerebral hæmorrhage; chronic poisoning by lead or mercury; and in that disease known as 'azoturia.'

Spurious Albuminuria is the term applied to conditions in which albumin occurs in the urine, but is not derived from the renal tissue, such as affections of the renal pelvis, ureters, and bladder, when associated with the formation of pus.

The tests for albumin will be found on p. 58.

In considering the gravity of albuminuria as a symptom, a microscopical examination of the urine should always be carried out. (See p. 63.)

Hæmaturia signifies the presence of blood in the urine. This may occur under a variety of conditions, as follows: It may be met with in cases of piroplasmosis, in purpura hæmorrhagica, and in certain cachectic states of the system; also in connection with morbid alterations in the kidneys, such as acute renal congestion, acute nephritis, renal infarction, rupture of the kidney, new growths, renal calculus, and the presence of parasites. Certain toxic agents, such as oil of turpentine in large doses, carbolic acid, and cantharides, also cause hæmaturia. Affections of the urinary passages, such as calculus in the ureter, vesical calculus, and urethral calculus, tumour or ulceration of the bladder, also the careless passage of a catheter, may be associated with the presence of blood in the urine. It also occurs in cases of hæmorrhage of the bladder.

Characters of the Urine.—It may be smoky, bright red, or of a dark porter colour. In many instances, in addition to red blood-corpuscles, the urine contains hæmoglobin in solution, owing to the destructive action of the urinary constituents on the corpuscles. This is said to occur more readily in ammoniacal urine, or when the latter is of low specific gravity. The sediment is light or dark red in colour, and may contain red blood-corpuscles. In some cases blood-clots are present. On microscopical examination, the blood-corpuscles can be recognized with facility; they may retain their colour, and be free or aggregated in masses and of a

crenated appearance, or they may occur as simple shadows, or they may be imbedded in casts of the uriniferous tubes.

It is of importance to ascertain the source of the hæmorrhage, but this is not always an easy matter. When originating from the kidneys, the blood and urine may be intimately mixed. But clots may be present, especially in the case of profuse renal hæmorrhage, and occur in the form of moulds of the pelvis of the kidney, or of the ureter. When the bladder is the source of the hæmorrhage, blood may only be found with the last portion of urine passed, or be observed at the termination of micturition; but in some well-marked cases of this nature the blood may be intimately mixed with the urine. If the bladder be washed out by instrumental means, the fluid is found more or less blood-tinged; but if the source of the bleeding be the ureter or kidney, the fluid withdrawn is clear. Another diagnostic feature of importance is that, when the hæmorrhage is renal, epithelial cells and various casts may be detected in the urine. When the bleeding occurs from the urethra, due to the presence of a calculus, the blood may escape in the intervals between the acts of micturition, or may appear as a small clot at the commencement of the act, or it may be passed during the straining attempts to urinate.

Hæmoglobinuria.—In this condition hæmoglobin occurs in the urine. It is observed as one of the symptoms in that affection known as 'azoturia,' and also occurs in connection with piroplasmosis ('red-water' in cattle), more rarely in trypanosomiasis, and as the result of administering large doses of potassium chlorate, phenacetin, naphthalin, etc. Hæmoglobinuria is believed to depend either on a breaking down of the red blood-corpuscles, or on the elimination of the pigment from the blood-cells, or on a combination of these processes. The source of the hæmoglobin in the urine in azoturia is not yet definitely determined. In hæmoglobinuria the urine may be red, brownish-red, or porter-coloured, and shows a heavy brownish-red sediment. The tests for the presence of hæmoglobin in the urine will be found on p. 61.

Bile Pigments in the Urine.—This phenomenon occurs in certain diseases of the liver, and in cases where jaundice is a symptom, such as in piroplasmosis. The presence of bile-pigments in the urine is an important indication of hepatic disorder. The tests for this condition are described on p. 61.

Glycosuria.—This signifies the presence of sugar in the urine, and is one of the leading features in the disease known as 'diabetes mellitus'—an affection of very rare occurrence in the horse, but not uncommon in the dog. The tests for sugar will be found on p. 62.

Pyuria signifies the presence of pus in the urine. It is met with in cases of renal abscess, purulent nephritis, cystitis, urethritis, uterine or vaginal catarrh, and pyelitis; also in instances where a pelvic or perirenal abscess ruptures into the urinary passages. Pyuria may be intermittent in the case of large renal abscesses, and continuous in calculous pyelitis. When a pelvic or perirenal abscess ruptures into the urinary passages, a large amount of pus appears in the urine within a short time, and then rapidly diminishes or may cease abruptly. In pyuria the urine is of a white or a yellowish-white appearance, and may be strongly ammoniacal, and the sediment may be ropy in character. On microscopical examination a large number of pus corpuscles are detected; these, when the pus originates in the bladder, are well formed. Associated with the pus are epithelial cells from the bladder and pelves of the kidneys, but, as these cells resemble each other very closely, it is extremely difficult to discover the source of the pus.

Examination of the Urine.

(A) Chemical.

Tests for Albumin.

Heat and Nitric Acid Test.—A small amount of urine is boiled in a test-tube over a spirit-lamp, and a drop of nitric acid is then added. If on boiling a cloudiness occurs, which is not dissolved on the addition of an acid, albumin is

present. It is generally said that a precipitate which dissolves is due to earthy phosphates or carbonates, but, as already remarked, F. Smith states that phosphates are practically absent from the urine of the horse. Acetic acid may be substituted for nitric acid in the above test.

Heller's Ring Test.—Pour a small quantity of fuming nitric acid into a test-tube, and with a pipette allow the urine to flow gently down the side of the tube upon the acid. At the line of junction of the two fluids a white ring is formed, the depth of which varies according to the amount of albumin present. This test is reliable and convenient for clinical work, and is said to demonstrate the presence of 0·02 per cent. of albumin. A coloured ring may form at the junction of the acid and the urine, and is due to oxidation of the colouring matters in the urine.

Ferrocyanide of Potassium and Acetic Acid Test.—To a test-tube half full of urine add 5 or 6 c.c. of a 5 per cent. solution of ferrocyanide of potassium. Mix thoroughly and add 10 to 15 drops of acetic acid. If albumin be present, a cloudiness or a flocculent precipitate will be produced, the degree of which varies according to the amount of albumin present. This test precipitates all forms of albumin, but not mucin or other substances, and is regarded as very reliable.

Magnesium-Nitric Test.—Mix 1 volume of strong nitric acid with 5 volumes of a saturated solution of magnesium sulphate. This reagent is to be used in a similar manner to the nitric acid in Heller's test.

Millard's Fluid Test.—This is an extremely delicate test for the detection of minute traces of albumin. The reagent is prepared thus: Glacial carbolic acid (95 per cent.), 2 drachms; pure acetic acid, 7 drachms; liq. potassæ, 2 ounces and 6 drachms. Mix. It is employed by the contact method as in Heller's test.

Trichloracetic Acid Test (after Raabe).—This is also advised for the detection of minute traces of albumin, and is carried out as follows: Add a small crystal of trichloracetic acid to 1 c.c. of urine. If albumin be present, a sharply defined

turbid zone occurs at the point of contact. For urine-testing in horses and cattle, this test is advised by Henn.

Salicyl-Sulphonic Acid Test (of Roch).—This is also advised by Henn for testing the urine of horses and cattle. Add a few crystals of salicyl-sulphonic acid to 2 or 3 c.c. of urine. If albumin be present, turbidity results. A very convenient method of applying this test has been introduced by Messrs. Fletcher and Co., Holloway, London. The reagent is contained in an 'endolytic' tube. A few drops of the suspected urine are transferred to a quarter-sheet of note-paper by means of a folded strip of paper. The end of the endolytic tube is allowed to touch one of the drops of urine, when the latter will be absorbed into the reagent by capillary attraction. If a precipitate forms, heat the tube in boiling water or by means of a wax vesta. If the precipitate remains, albumin is present; if it disappears, we may conclude that albumose forms the precipitate, and is not attributable to a renal affection.

Spiegler's Test.—This is recommended by Henn for the testing of the urine in cattle. The reagent is prepared as follows: Perchloride of mercury, 8 parts; tartaric acid, 4 parts; glycerine, 20 parts; water, 300 parts. A test-tube is filled one-half with this mixture, and the suspected urine is allowed to run down the side of the tube drop by drop. If albumin be present, a white ring is formed.

Metaphosphoric Acid Test.—Add an aqueous solution of metaphosphoric acid to the suspected urine. If albumin be present, opalescence or cloudiness results.

For urine-testing in the dog, Henn advises the heat and nitric acid test, the ferrocyanide of potassium and acetic acid test, and the metaphosphoric acid test.

Quantitative Estimate of Albumin.—For an accurate estimate, Esbach's albuminometer must be employed. (See works on urinalysis.)

A rough method consists in boiling a certain amount of acidulated urine in a test-tube, and allowing it to stand until cool. By comparing the depth of the deposit with the whole amount of urine in the tube, an approximate idea

may be gained of the amount of albumin present, such as 'a mere trace,' 'one-fourth,' 'one-half,' etc.

Source of the Albumin.—To distinguish renal albuminuria from the spurious type, a microscopical examination of the urine must be carried out (see p. 63). In the renal type, tube casts, epithelial casts, etc., will be present in addition to albumin. In the spurious type a copious organic sediment, containing epithelium derived from the urinary passages, is present, with only a small amount of albumin. But both forms may be combined. The microscopical appearance of epithelial cells when detached without change of form may enable us to ascertain the seat of desquamation (see p. 64).

Tests for Hæmoglobin.

Spectral-Analytic, or Heller's Test.—This is specially suitable for demonstrating the presence of oxy-hæmoglobin and methæmoglobin. In the case of the former two absorption bands will be present, while in the latter three absorption bands will be observed, the one in the red being characteristic. For details of the application of this test, and also of the other tests for hæmoglobin—viz., Schlesinger's benzidine test and Schumm's guajac oil of turpentine test—consult works on urinalysis.

Tests for Bile-Pigments.

Gmelin's Test.—A portion of the suspected urine is slowly added to some nitric acid containing a few drops of nitrous acid, so that the urine forms a layer above the acid. If bile-pigments be present, a play of colours is observed where the liquids meet, green being most marked.

According to Latschenberger and other observers, the presence of bile-pigments in horse's urine is difficult to demonstrate by Gmelin's test, as a dark brown zone is formed which obscures to a great extent the green tint. The above-named observer advises that the urine be diluted with water, and then mixed with a solution of baryta, and allowed to stand for twelve to twenty-four or forty-eight hours.

Gmelin's test is then applied to the clear supernatant fluid. The colour reaction, however, is not well marked.

Rosenbach's Test.—This is a modification of Gmelin's test. A portion of filter-paper moistened with the suspected urine is placed upon a white porcelain slab, and is touched with a glass rod previously dipped in fuming nitric acid. If bile-pigments be present, a ring of colours is observed at the point of contact. These colours from within outwards are yellow, violet, brown, and green. The green colour only is obtained in some cases.

Tests for Sugar.

Fehling's Test.—The following solution is employed: Sulphate of copper, 90½ grains; neutral tartrate of potassium, 364 grains; solution of caustic soda, 4 ounces; distilled water to make 6 ounces. One drachm of this solution is placed in a test-tube and boiled, and to this is added 1 drachm of the suspected urine. The mixture is boiled again. If sugar be present, the yellow suboxide of copper is thrown down as a precipitate. The solution should be freshly prepared, as it is apt to decompose.

Trommer's Test.—One drachm of the suspected urine is placed in a test-tube, and a few drops of a dilute solution of sulphate of copper are added, also 1 drachm of liq. potassæ. The resulting mixture is then boiled, and if sugar be present, the copper is reduced, forming a yellow or orange-red precipitate of suboxide of copper.

It must be remembered that in the dog traces of glycuronic acid are normally present, and after the administration of drugs, such as chloral hydrate, morphine, phenacetin, chloroform, or camphor, this substance occurs in well-marked quantities, and has the power of reducing salts of copper; hence Fehling's and Trommer's tests may prove fallacious in the examination of the urine in this animal.

Fermentation Test.—This is recognized as the most accurate and reliable test. A small fragment of yeast is placed in a test-tube full of the suspected urine. The test-tube is then inverted over a glass vessel also containing urine. If sugar be

present, fermentation occurs, and carbon dioxide is formed, which accumulates in the upper part of the tube, and expels the urine therefrom. Specially devised fermentation-tubes can be obtained for carrying out this test.

Polariscope Test.—This is adopted for quantitative determination of glucose. Glucose being dextro-rotatory, the percentage of sugar is estimated by the degree of rotation.

Nylander's Bismuth Test.—Nylander's solution is prepared as follows:

Rochelle salts, 4 grammes ... ...
Solution of caustic soda, 10 per cent. ... } 100 c.c.

Dissolve.

Next add 2 grammes of bismuth subnitrate, and digest in a hot-water bath until as much as possible of the bismuth salt is dissolved.

To Apply the Test.—Add 1 c.c. of this solution to 10 c.c. of the suspected urine, and boil for five minutes. If sugar be present, a black deposit of bismuth occurs, this being due to the reduction of the subnitrate to the metallic bismuth.

(B) Microscopical.

This procedure is carried out in order to detect the presence of organized casts, epithelium, etc. The presence of pus or blood in the urine is also determined by this means.

Organized Casts in the Urine.—A 'cast' is the term applied to a model of a hollow organ, such as a renal tubule, and is formed by effused plastic material. The presence of organized casts in the urine points to the existence of an acute or chronic inflammation of the kidneys. The following variety of casts are recognized:

Blood-Casts are filaments of coagulated fibrin enclosing blood-corpuscles. In some instances the red or white corpuscles may amalgamate to form a cast, but more frequently they are found irregularly studding a fibrinous mould.

Epithelial Casts are formed of columnar renal epithelium or of round cells. The cast is generally composed of coagulable material containing epithelial cells.

Fatty Casts are made up of material consisting largely of fat-globules. They are transparent or of a dark granular appearance, and are dotted over with minute oil-drops.

Hyaline Casts are nearly transparent, and are composed of a homogeneous proteid material, which is slightly refractive. Darker-looking hyaline casts are sometimes called 'waxy'; they appear solid, and are highly refractive.

Granular Casts are dark-coloured renal casts, of a granular, cell-like substance; they represent a degenerated form of hyaline or waxy casts. Sometimes blood-discs or fat-drops are seen on their surface.

Renal Casts are cylindriform bodies derived from any of the collecting tubes or loops of Henle.

Spiral Casts are renal casts having a spiral or twisted shape.

Tube Casts.—This term is applied to any casts of a renal tubule found in renal diseases.

Spurious Casts signify mucous casts, and are also termed 'cylindroids.' They may occur in the urine of normal animals, as well as in cases of renal disease. They are irregular in shape, and very elastic and mobile.

Clinical Significance of Casts.—A consideration of the prevailing type of casts found in a given case, after several examinations of the urine, is of assistance in diagnosis. If epithelial and blood casts, with a large amount of renal epithelium, be found, they point to the presence of an acute nephritis; oil-drops in the epithelium, or scattered over hyaline casts, indicate fatty changes in the kidney. The presence of casts in hæmaturia or pyuria suggests a renal origin for the blood or pus.

Epithelium in the Urine.—This may be derived from the renal pelvis, the uriniferous tubules, the ureters, the bladder, the urethra, or the vagina. The source may be determined by the prevailing type of cell, by the presence or absence of casts, and by the accompanying symptoms. When the epithelial cells are detached without change of form, the seat of desquamation may be ascertained by microscopical examination of the urine. Thus, when numerous, large, and

squamous, the epithelial cells probably come from the bladder. If they originate from the renal pelvis or ureters, they are also squamous, but not so large or so numerous. If polyhedral with large nuclei, or columnar, they probably come from the uriniferous tubules; and if from the male urethra they are generally columnar. But in cases of catarrhal inflammation of the mucosa these cells are generally passed in large amounts, and tend to assume a common form—viz., globular with large nuclei—so that their source cannot be definitely determined. Again, after the cells have become soaked in the urine, it is not possible to differentiate them.

General Symptoms of Renal Diseases.—Although the symptoms presented in renal diseases in the horse are generally obscure, yet there are certain phenomena observed in some cases which suggest an affection of the kidneys, and lead the practitioner to examine the urine. The diagnosis must be based on the results obtained from an examination of the urine, as the symptoms are common to a variety of conditions. Moreover, the effects of renal disease are often far-reaching, and disturbance of the digestive, circulatory, respiratory, or nervous system may occur as a complication. It is necessary to carry out several examinations of the urine, as it may happen that in one sample but slight morbid alterations may be present; also it is important to ascertain whether the morbid alterations discovered by analysis of the urine are temporary or permanent. In obtaining samples of urine for examination, precautions should be adopted to avoid contamination which may arise from an unclean catheter or from a dirty vessel or bottle.

The following symptoms may be presented in diseases of the kidneys: A stiff or straddling gait in the hind-limbs, difficulty in lying down or rising, or in turning round; arching of the back, obscure colicky pains. In the early stages of acute nephritis, small amounts of high-coloured urine may be passed at frequent intervals, or suppression of urine may occur. In chronic nephritis, frequent micturition and the passage of large quantities of urine of low specific gravity may

be observed. In the later stages of various diseases of the kidneys, the animal may assume the recumbent position and be unable to rise. Convulsions may occur due to uræmia. Pain on palpation of the region of the kidneys is popularly considered to be a symptom of renal disease; but it is deceptive, as many healthy horses will flinch if pressure be applied to the lumbar region. Rectal examination will in some cases enable us to detect enlargement of the kidneys and tenderness on palpation. Amongst the constitutional symptoms which may be observed, we may mention a capricious appetite, thirst, emaciation, evidences of dyspepsia, swollen limbs, debility, anasarca in the sternal and abdominal regions. Ascites is rarely met with in the horse.

In the dog, chronic renal disease is frequently present, and no apparent symptoms are manifested.

In the cat, when the kidneys are enlarged, the abnormal condition can be detected by palpation of the abdomen.

Symptoms in Connection with Certain Disturbances in Micturition.

Dysuria signifies difficulty in micturition. It depends on any condition which interferes with the passage of urine, such as a calculus in the bladder or in the urethra, stricture of the urethra, paraphimosis, phimosis, etc. It is evidenced by frequent attempts at urination, and a varying degree of restlessness and pain. Frequent attempts at micturition may also be observed in cases of intestinal obstruction, especially in impaction of the small colon, and impaction of the pelvic flexure of the double colon in the mare.

'**Strangury**' is the term applied to painful imperfect micturition, accompanied by straining and the frequent passage of small amounts of urine. It is observed in acute inflammation of the bladder, especially when the affection is due to the toxic effects of oil of turpentine or cantharides.

Retention of Urine signifies an abnormal accumulation of urine in the bladder. It may occur in connection with various disorders, such as calculi in the bladder or urethra, polypoid tumours obstructing the neck of the bladder,

enlargement of the prostate gland, paralysis of the bladder, spasm of the sphincter vesicæ, tetanus, and in some cases of so-called spasmodic colic. In male animals, inability to assume the attitude necessary for micturition may lead to retention of urine, such as paraplegia (paralysis of the hind-limb), or any cause which forces the patient to remain in the recumbent position. The condition is evidenced by complete absence of micturition (ischuria), or very small amounts of urine may be passed, accompanied by pain and associated with frequent attempts at micturition. In the dog and cat urgent symptoms may be absent, and the condition may be overlooked, with serious consequences, unless a careful examination of the abdominal cavity be carried out by palpation. In 'milk fever' in cows, retention of urine readily occurs if recovery be slow.

Incontinence of Urine.—In this condition the bladder is unable to retain the urine, and the latter is passed in an involuntary manner, causing excoriation of the regions with which it comes in contact, especially in the case of female animals. The condition is met with in certain forms of cystitis, certain spinal diseases accompanied by paralysis of the sphincter vesicæ, distension of the sphincter by a polypoid tumour, etc.

Symptoms in Connection with the Nervous System.

A variety of general symptoms is observed in nervous diseases, but very frequently a definite diagnosis cannot be determined owing to the fact that similar phenomena occur in a number of different affections. Our knowledge of diseases of the nervous system in animals is very limited, and much investigation, both clinical and pathological, is needed before we can claim the degree of proficiency attained by the human physician.

To the therapeutist the subject is not one of marked importance, as, so far as the horse is concerned, little can be done in the way of successful treatment. If a horse suffers from a nervous disease which interferes with his working powers, and cannot be benefited by treatment, on

economical grounds destruction and not therapeutical measures is indicated. In the case of favourite dogs, provided the nervous affection does not entail continued suffering, treatment has to be attempted, and in some instances it proves successful.

In considering the general symptoms of nervous disease, it is important to point out that nervous phenomena are often manifested in the absence of any organic affection of the brain. As examples we may refer to the nervous symptoms observed in cases of impaction of the stomach in the horse (the so-called 'stomach staggers'), to the excitement and delirium manifested in some cases of acute gastritis in cattle, the nervous phenomena of milk fever, and to the convulsions ('fits') that may occur in the dog as the result of parasites in the intestines.

Many of such instances probably depend on reflex nervous irritation or the absorption of toxic products, and great care is essential in order to avoid giving an erroneous diagnosis, and mistaking a curable affection for an incurable one.

In the horse, acute diseases of the brain may present the following symptoms: Excitement, interference with vision, a staggering gait, delirium, sometimes amounting to a maniacal condition during which it is dangerous for the attendant to approach the animal. The horse next goes down, is unable to rise, and struggles violently with fore and hind feet. The stage of excitement is followed by a comatose condition. Chronic brain lesions are more likely to occasion a dull, sleepy condition, a staggering gait, a tendency to push the head against surrounding objects. Spinal lesions are often associated with disease of the brain, and it is difficult to determine which was the primary condition.

Inability to rise, violent convulsive movements of the fore and hind limbs, and ocular phenomena, such as nystagmus (rolling of the eyeballs), may be observed in a variety of conditions, such as acute inflammation of the brain and its membranes, uræmia resulting from disease of the kidneys, and in that affection known as 'azoturia.'

Paraplegia (paralysis of the hind-limbs), inducing inability

to rise, may depend on a variety of conditions, such as diseases and injuries of the spinal cord, fractures of the vertebræ, diseases of the brain or a combination of cerebral and spinal lesions, certain pelvic fractures, azoturia, strain of the psoæ muscles, parasitic aneurism of the posterior aorta or one of its large branches, etc. In the dog, paraplegia is one of the symptoms of the spinal affection known as 'chronic pachymeningitis' (see Part III.), and is also observed as one of the sequels of distemper.

In many instances there is marked difficulty in deciding with reference to the cause of inability to rise or to maintain the standing posture. The history of the case must be taken into consideration, and a careful examination of the patient is essential. The history of a fall or an injury is very suggestive, and a rectal examination may reveal the presence of a pelvic fracture. It is not uncommon to find a horse, whose previous history was healthy, unable to rise in the stall even with assistance, and with no other symptoms present. In such a case great care must be exercised in arriving either at a diagnosis or prognosis. A diagnosis of fracture of a vertebra ('broken back') should not be hastily given, as the symptoms of this condition are by no means clear in many instances. (Consult 'Veterinary Surgery,' by Möller and Dollar, for the differential diagnosis of fractures of the vertebræ.) Practical experience in such cases suggests caution in expressing an opinion that a fracture of a vertebra, or a hopeless spinal lesion, is present, as instances have occurred in which destruction has been advised, and the horse has got on his feet and recovered. It must also be remembered that inability to rise may be observed in the later stages of cases of acute or chronic nephritis and in plumbism (lead palsy).

In other animals as well as in the horse a guarded diagnosis is necessary in cases presenting paraplegia, and in many instances it is safer to adopt treatment for a reasonable time before expressing an opinion that a case is hopeless. These remarks apply to cases of certain gastric affections in cattle, associated with inability to rise, milk

fever, and also instances of chronic pachymeningitis in the dog.

Finally we may emphasize the point that in all cases manifesting nervous phenomena the prognosis must be given with extreme caution, in order to avoid unpleasant consequences and damage to reputation.

Symptoms furnished by the Surface of the Body and the Extremities.

The skin under normal conditions presents a smooth and glossy appearance. In cases of indigestion, disorder of the liver, and as the result of parasites in the alimentary canal, the skin is dry, inelastic, scurfy, and adheres to the ribs, and the horse is described in popular language as being 'hide-bound' or 'out of condition.' A similar appearance of the skin is observed in connection with chronic wasting diseases such as tuberculosis, and is associated with emaciation.

In the clinical examination of a case the skin may offer important aids to diagnosis. The eruption of urticaria (nettle-rash) is very characteristic, but it must be remembered that a similar eruption may occur in the early stages of some cases of purpura hæmorrhagica. Eruptions may be present in various diseases, and their character must be noted. The diagnosis of the various affections of the skin is carried out by attention to the special phenomena presented, assisted by a microscopical examination of 'scrapings' taken from the affected parts.

Rigors (*Shivering Fits*) occur at the commencement of many affections, and are often the first symptom observed by the owner or attendant. Thus, influenza, pneumonia, enteritis, lymphangitis, and peritonitis, may be ushered in with this symptom, accompanied by a 'staring coat' and coldness of the extremities.

Profuse Sweating occurs in a variety of diseases in the horse, such as the early stages of azoturia, also in cases accompanied by very severe pain, such as acute enteritis, twists of the intestine, laminitis, etc., and in the later stages of tetanus and meningitis. Sweating is not uncommon in

nervous, irritable horses when cast for operations, especially if chloral hydrate be given as an anæsthetic agent. Full and repeated doses of opium or morphine also induce profuse sweating.

'Cold sweats' distributed over the body indicate a fatal termination, and are observed in the later stages of acute enteritis, septic peritonitis, twists of the bowel, rupture of the stomach, etc.

Coldness of the Extremities is observed in various affections, and, if associated with other phenomena, such as a haggard expression of countenance, a weak pulse, etc., must be regarded as a very unfavourable symptom.

Swollen Limbs is a condition which varies in degree and in importance. Thus, it may result from lack of sufficient exercise, and be slight in degree ('filled legs'), or it may be well marked, and depend on debility or on a renal or cardiac affection. It is also met with as a prominent symptom in a certain type of influenza ('pink-eye'), and in purpura hæmorrhagica. In the latter affection the swelling is characteristic, as it ceases abruptly and gives an appearance as if a cord had been applied to the limb above the affected region.

Dropsical Swellings on the dependent parts of the body —*i.e.*, along the sternum, the inferior abdominal region, and in the prepuce of the male animal—may be due to debility, or, if more marked, may depend on cardiac or renal diseases, or on hydrothorax, ascites, or purpura hæmorrhagica. In this latter affection the lips, nostrils, etc., are also much swollen.

In cattle a dropsical swelling in the region of the dewlap, if associated with recurring attacks of tympany of the rumen, suggests an examination of the heart for the presence of traumatic pericarditis (due to a sharp-pointed body having migrated from the reticulum to the pericardial cavity).

Symptoms in Connection with the General Appearance of the Animal.

We have already remarked that the student should be familiar with the appearance of healthy animals, in order to recognize readily the presence of symptoms. Much

important information can be gleaned by the preliminary general glance at a patient, and to be a successful clinician it is essential that the faculty of observation should be carefully trained. In some instances the symptoms are so pathognomonic that at the first glance the practitioner is able to arrive at a diagnosis, such as, for example, a well-marked case of tetanus. But we must point out the necessity for caution in diagnosing diseases in this rapid manner, and it is advisable to make a proper examination before expressing an opinion.

In the horse, a bright eye, glossy skin, good condition, erect ears, alertness, regular breathing, and an easy attitude, are indications of health. But some horses are naturally dull-looking in their appearance, while others fail to put on condition, although no distinct evidences of ill-health are apparent. The expression of the animal's countenance should be observed. Thus, towards the termination of fatal abdominal affections, the haggard and anxious look and sunken eye are significant omens of approaching dissolution, especially if associated with cold sweats over the body. In pneumonia we observe a hanging head, drooping ears, and a distressed expression. In tetanus the extended head, the retracted eyeballs, the protrusion of the membrana nictitans, and the general stiff appearance of the animal, are suggestive symptoms.

By observing the general appearance of the animal, we are enabled to detect signs of improvement, or otherwise, during the course of a case, also symptoms may be discovered which are significant of the occurrence of complications. In fact, in every disease careful observation is essential to a correct diagnosis. The educated eye enables the observant practitioner to detect symptoms which are readily overlooked by one who is not a trained clinician.

The attitude and movements of the patient are suggestive of certain conditions in some cases, but a manual and physical examination is necessary before a definite diagnosis can be given. From the general remarks we have already made in connection with the symptoms furnished by the

various organs of the body, the student will gather that any attempt to index symptoms as a clue to diagnosis would end in failure, as it is only by a careful examination of individual cases, and a consideration of all the symptoms presented, that accuracy in diagnosis is possible.

Prognosis.

This signifies our opinion as to the probable result of a case. To the owner of an animal it represents a more important matter than diagnosis. His first query usually is, 'What is wrong with the animal?' followed by, 'Is the case going to recover?' In other words, Can the animal be cured?

A correct diagnosis is generally a difficult matter to arrive at, but the ultimate result is surrounded by many speculations. The prognosis depends to a certain extent on the diagnosis. Many affections are of necessity either fatal in a variable period of time, or, in the case of the horse, they may render the animal useless for work, although his life may be prolonged for an indefinite time by careful treatment. But in arriving at a prognosis, the leading symptoms must receive careful consideration, as we cannot ignore the fact that death more frequently results from complications or the development of an intercurrent affection than from the primary disease. Moreover, we must remember that a latent affection of some organ may be in existence prior to the occurrence of the fatal attack, the fatal issue being in great measure due to the influence of the pre-existing affection. Hence the difficulty of giving a definite prognosis, and the necessity for caution in ordering the destruction of the patient on the grounds either that he is incurable or will be permanently useless for work. It is not uncommon to find symptoms present which appear to indicate a fatal termination, yet, to the surprise of owner, attendant, and practitioner, the patient recovers. On the other hand, caution is just as desirable in giving an opinion that a case manifesting apparently favourable symptoms will recover. The unexpected death of patients that appear to be progressing favourably, and the surprises presented at post-mortem examinations, should

lead the practitioner to exercise great caution in expressing a definite opinion with reference to the prognosis of a case.

Individuals who do not understand the difficulties attached to diagnosis expect the veterinary practitioner to be competent to express a definite and correct opinion with reference to the result of a case; and when a guarded or doubtful prognosis is given, they are inclined to regard it as evidence of incapacity. The experienced clinician, however, is well aware that, although attention to diagnosis and a careful consideration of the symptoms present are valuable aids to prognosis, still errors will occur in spite of all precautions. He is also aware that practitioners who claim to possess special skill in this direction make quite as many errors as those who admit the limitations of their powers of diagnosis and prognosis. This assumed skill is far too frequently in evidence, and it leads the owners of animals to expect in practitioners prophetic powers which no mortal can possess.

Nobody can deny that more careful examinations of cases would result in fewer errors in prognosis, as the presence of intercurrent affections and complications would be more likely to be detected. Every practitioner must, if he be candid, admit that he has experienced the unfortunate results of hurried and incomplete examinations of cases, and learned much from errors of omission. Careful observation, and a fixed rule to carry out a complete examination even in what appear to be slight cases of disease, prove of valuable assistance in diagnosis and prognosis, and reduce materially the percentage of erroneous conclusions.

On the other hand, the idea that the intricate processes of disease can be recognized by a glance and a superficial examination of a case, is certain to lead the practitioner into pitfalls out of which he cannot escape, even by the aid of the highest degree of tact.

One cannot but marvel at the practitioner who, in attending a case exhibiting evidences of abdominal pain, is able from a casual examination to predict the result, or, in a case of circulatory disturbance, ventures to give an opinion as to whether a functional or an organic affection of the

heart is present, without a careful examination by means of a stethoscope. Speculative opinions are not in reality evidence of skill, for they can be offered by one devoid of clinical knowledge. Our duty to our patient and to our client is to employ all means in our power in order to avoid erroneous conclusions. If, as so often occurs, we are unable at the time to give a definite opinion as to the nature of the illness and its probable result, we should not hesitate to admit the limitations of our skill. We should also point out that, until further symptoms develop, it is not possible to express a definite opinion as to diagnosis and prognosis.

If we were more candid with our clients on matters of this kind, much benefit would result. Unfortunately, there is a tendency on the part of some practitioners who enjoy a high reputation to lead the public to believe that, owing to a superior degree of skill, they can not only diagnose cases on a first and cursory examination, but also foretell the result. We would impress on the junior practitioner not to follow such examples, but instead to adopt every means at his command in solving the problems of diagnosis and prognosis. He should remember that to give a disease a name in a casual manner is an easy matter, because the owner of the animal has not sufficient knowledge to test the accuracy of the opinion. But, on the other hand, an opinion expressed with reference to the result of a case can be tested, and if an error be committed it is palpable to the owner and attendant. More especially should caution be exercised before giving the opinion that a case is hopeless or incurable, as the prescribing of the 'friendly bullet' is one of the most dangerous measures which can be adopted, unless there are ample grounds to justify its employment. Probably there are few practitioners who cannot recall instances in their experience in which a case condemned as incurable recovered in other hands, or by the agency of the *vis medicatrix naturæ*. The prevention of such errors consists in devoting more attention to symptoms and to diagnosis, avoiding hasty conclusions, and refusing to express definite opinions as to results unless there is ample evidence present to justify us in arriving at a prognosis.

CHAPTER III

THE CARE, MANAGEMENT, AND NURSING, OF SICK ANIMALS

In former times the most important part of the practitioner's duty was deemed to be the prescribing of drugs. The natural powers of recovery were not sufficiently recognized, and when cases terminated favourably the result was too often attributed to the medicinal agents employed. Little attention was devoted to hygiene, dietetics, and careful nursing; and if the patients refused to feed, fluid foods and alcoholic stimulants were administered in the form of drenches. The beneficial effects of pure air were ignored, hence proper ventilation of the surroundings was neglected. In the present day a marked change has been brought about in the details of treatment; drenching with either medicinal agents or fluid foods is avoided as much as possible, and we recognize the importance of careful nursing in all species of patients, as well as the necessity for adequate ventilation and attention to the general comfort of the animals. Medicines are now more commonly given in the form of electuary, or in the drinking-water, or by hypodermic injection, and the risks of administering drenches are fully recognized. Modern practice in this respect has exerted a very beneficial effect on the results obtained, and it is an established fact that less drugs are prescribed in the present day than formerly, more especially agents which, by their powerful action, produce drastic and nauseating effects.

For convenience of description it is desirable to consider

the care and management of each species of animal separately as follows.

The Care, Management, and Nursing, of Sick Horses.

The horse, when ill, requires careful management and nursing. Unfortunately, this fact is not universally recognized, and, except in high-class stables and well-managed studs, it is difficult to obtain skilled attendants as nurses. In other stables we can never insure that our instructions will be intelligently obeyed. Too frequently we find that owners and attendants are firm believers in promiscuous 'drugging,' and regard the administration of potent medicines as the main consideration in treatment. Prejudices of all kinds have to be overcome, and it is often with the greatest difficulty that we are able to get even the simplest details of nursing carried out. Hence the veterinary practitioner is placed at a great disadvantage compared with the human physician, and he has to exercise much tact and patience in order to obtain the co-operation of the owner and attendant in the nursing and management of sick animals. The craze for patent medicines and 'cure-alls' is everywhere in evidence, and the harmful results of amateur doctoring are met with daily.

The Surroundings of the Patient.—The proper ventilation and drainage of stables exert an important influence on the course of diseases, more especially in the case of respiratory affections and in the treatment of wounds. Unfortunately, little attention is devoted by the owners of animals to this subject, and the popular idea is to exclude fresh air as much as possible. Of late years we have learned the value of free ventilation in the treatment of pneumonia, and we recognize that if this matter be neglected therapeutical measures are of little avail. The evil effects of a vitiated atmosphere, the impurity of which is increased by emanations arising from lack of efficient drainage, are well known to the practitioner. But it is not an easy matter to obtain desirable hygienic surroundings for our patients, and we are often

compelled to treat cases under the most unfavourable conditions. The exercise of tact and common-sense is necessary if we would gain the co-operation of the owner in the matter of neutralizing the defects of the surroundings. Ventilation can be secured by simple measures, and a constant and thorough cleansing of the floors, followed by the liberal use of disinfectants, proves of marked assistance. In cold, stormy weather it is advisable to avoid the occurrence of draughts, but we cannot agree with those who hold that cold fresh air is harmful. The value of free ventilation is demonstrated by the success which attends the 'open-air' treatment of pneumonia, as advised and practised by some veterinary surgeons. The usual tendency is to err in the opposite direction, and, in the attempt to avoid draughts, it is often the case that proper ventilation is not secured.

The results which are observed in respiratory affections, and also in wounds, when these are treated in a properly drained and ventilated infirmary, are in marked contrast to those obtained in ordinary stables, even when the cases receive the best of care and attention. The importance of hygienic surroundings is no doubt becoming more universally recognized, but much remains to be done before the owners and attendants of animals become convinced of the necessity for serious attention being given to the subject.

A clean, dry straw bed is an important essential for the sick horse, and the straw should be properly laid so as not to hamper his movements. A loose-box should always be selected in preference to a standing stall, and whenever possible it should be provided with a half-door, so that the horse may have access to fresh air.

In cases that assume the recumbent position for long intervals, or that are unable to rise, a good bed of straw is essential in order to prevent the occurrence of bedsores. In all cases of 'decubitus' it is necessary to change the position of the patient from side to side, at proper intervals, and to employ the catheter to draw off the urine.

In a case of abdominal pain, where violent symptoms are manifested, means should be adopted to prevent the animal

from injuring himself during his struggles, and similar remarks apply to acute affections of the brain. Every infirmary should be provided with a suitable box-stall having padded walls, for this purpose. The advantages of having a well-equipped hospital in connection with large horse establishments are now recognized by practitioners, and also by owners. The hospital should be separate from the main stables, and should have a sufficient number of box-stalls for the accommodation and treatment of infectious cases. The floors should be made of concrete or of fire-bricks, special attention being given to perfect drainage; the walls finished so that efficient disinfection can be carried out; and the ventilation arranged on the most approved system. Such a hospital will amply repay the cost of its erection, as the prevention of disease is one of the most important considerations in stable economy. It will also be found that in the treatment of wounds the best results are obtained by having the animals in a properly constructed hospital.

Clothing.—Coldness of the surface of the body and extremities, and the presence of rigors (shivering fits), are indications for the employment of extra rugs and the application of woollen bandages to the legs. Clothing judiciously applied promotes cutaneous circulation, and tends to overcome the effects of chill. Excessive clothing is oppressive, and causes sweating and fatigue. In cases accompanied by high fever discretion is necessary with reference to clothing. If the surroundings are cold, more clothing is required than under opposite conditions, but it should not be too heavy. Care should be taken that the clothing used is dry, that the surcingle is not fastened too tightly, and that the bandages are properly applied, and removed twice daily. It is advisable to wrap the limbs in a layer of cotton-wool before applying the bandages; this assists in overcoming coldness of the extremities.

In country practice suitable rugs and bandages are seldom available; then we have to make use of ropes formed of twisted hay in place of woollen bandages, while blankets or bed-quilts may have to be requisitioned in lieu of rugs.

During convalescence the extra clothing should be *gradually* removed, so as to avoid any risks of a chill occurring.

Generally speaking, it is well-kept horses, accustomed to be sheeted, that require special attention with regard to clothing when ill.

In unclipped horses—kept under more or less rough conditions—the need for clothing is by no means so marked.

Usually the owners of animals err on the side of applying an excessive amount of clothing. It is not uncommon to find a case of influenza or pneumonia in a farmer's stable, so heavily weighted with a miscellaneous collection of blankets, etc., that actual distress and sweating are produced; while every opening in the building through which air might enter is carefully blocked with a bundle of straw. Under such conditions, it is not surprising that the mortality from these diseases is high.

Diet.—The feeding of sick animals is one of the most important details in nursing. The appetite for food is in most instances a fair index of progress. When food of every description is refused for any length of time, the case must be regarded as serious, as total abeyance of appetite in the horse soon leads to exhaustion. But much can be done by intelligent nursing to tempt the animal to feed. It is necessary to impress on the owner and attendant the fact that food partaken of voluntarily will be digested and afford nourishment to the system, while the practice of forcing gruel, whisky, etc., on the animal cannot be too highly condemned. Mechanical feeding of this kind annoys and distresses the patient, causes gastric derangement, and still further decreases the natural appetite for food. Besides, there is the risk of careless drenching to be considered—viz., the entry of the fluids into the trachea and bronchi, setting up broncho-pneumonia. The mortality from such irrational treatment may easily exceed that due to disease *per se*, yet it is a difficult matter to convince the owners and attendants that, if attention be given to simple details, there is no necessity for mechanical feeding of patients. A careless, lazy, or ignorant attendant always complains that the animal under his care

will take no food. On inquiring into the matter, we often find a quantity of sour food left before the patient, the manger and feeding utensils in a dirty condition, while the proper preparation of the food is neglected, and no attempt is made to vary the diet.

Now, the sick horse is most fastidious in his appetite, and considerable tact is necessary in order to induce him to feed. The first essential is to render the manger and feeding utensils perfectly clean. This is a simple matter, but one that is usually neglected. If the fixed feeding trough be an unsuitable place from which to feed a sick horse—and this is often the case—it is advisable to make use of one or more flat-bottomed basins securely fixed to prevent upsetting. These are preferable to deep stable buckets, as it is desirable to allow small feeds at a time, and they prove valuable in cases associated with difficulty in respiration or deglutition, as in respiratory affections, strangles, pharyngitis, etc., also in instances where prehension of food is interfered with, as in tetanus. Moreover, they should be so placed as regards height that the animal may be able to feed with the minimum of exertion and discomfort. Again, in respiratory diseases, or in affections accompanied by profuse nasal discharge, it is advisable that the animal be fed at a low level, so as to facilitate the escape of discharges from the bronchi and nasal passages.

The selection of the food is the next consideration. A diet which is easy of digestion, nourishing, and slightly laxative, is indicated. A highly nitrogenous food is contra-indicated, especially in febrile conditions; hence, when it is considered advisable to allow oats, only small quantities should be given, preferably prepared by scalding or steaming, so as to render them more digestible. Full amounts of oats are liable to induce serious derangement of the kidneys, or other complications. Obviously it is essential that the quality of all foods supplied should be beyond reproach.

The following may be mentioned as useful foods in case of sickness: Bran mash, linseed and bran mash, oatmeal porridge, oatmeal gruel, linseed tea, hay tea, grass in modera-

tion, carrots, mangolds, and boiled Swedish turnips (allowed with discretion), good hay, small quantities of steamed oats, and milk *ad lib.* Directions for the special preparation of foods will be found on p. 83.

It is important to remember that the animal should be fed little and often. Too large feeds are either left unfinished and turn sour, or, if eaten, are apt to cause derangement of the digestive organs. During convalescence from various diseases the animal may become eager for food, and if allowed full feeds, digestive disturbance is likely to result. Care in the selection of the diet is necessary during convalescence from gastric and intestinal affections, in order to avoid a recurrence of the attack. Until the digestive organs have been restored to a normal condition, it is advisable to interdict solid foods, and to allow only a diet of a sloppy nature. In cases recovering from diseases such as azoturia, lymphangitis, etc., a highly nitrogenous diet should be avoided.

In cases where the appetite is totally in abeyance, the attendant should be instructed to tempt the animal to feed by offering small amounts of various kinds of food freshly prepared. Discretion is necessary in allowing roots, grass, etc., to horses unaccustomed to such diet. In small amounts they cannot prove harmful, and it must be remembered that food partaken of voluntarily is likely to prove of benefit to the patient. Small amounts of grass, carrots, a few raw or boiled potatoes, etc., may be offered, so that by easy stages we may succeed in getting the animal to take ordinary food. When a sick horse, especially in town, refuses grass, his condition may be regarded as very serious.

The following details with reference to the preparation and value of various foods for the sick horse are important:

Bran Mash is perhaps the most commonly known of all diets for sick horses. Its nutritive value is little; but it acts as a laxative, and as such is useful. Most horses quickly tire of bran, and it is a mistaken idea to regard it as an all-sufficient article of diet. Careful preparation renders it more palatable.

To prepare a bran mash: Get a *clean* stable bucket, scald it, and pour out the water. Put in 3 pounds of best bran and 1 ounce of salt, and add 2½ pints of boiling water; stir up well and cover over, allow it to stand for fifteen or twenty minutes until well cooked, and place before the animal when it is sufficiently cool. The addition of a little treacle to the bran mash is relished by some horses.

Bran and Linseed Mash.—Take 1 pound of linseed and 3 quarts of water and boil slowly for about three hours, so that about 2 quarts of thick fluid will remain. Add 2 pounds of bran and 1 ounce of salt, stir thoroughly, cover over, and allow it to stand until sufficiently cool.

Linseed Tea.—Boil 1 pound of linseed in 2 gallons of water until the grains are soft.

Oatmeal Porridge.—Take 1 pound of oatmeal and put it into a gallon of cold water; bring this to boiling-point, stirring it well; then allow it to simmer over a slow fire until it becomes thick. Some horses will take this readily if mixed with milk and sweetened with a little sugar.

Oatmeal Gruel.—This is prepared by scalding the oatmeal with boiling water, stirring well to break up any lumps that may form, then adding a little salt and a sufficiency of cold water.

Hay Tea.—Scald a clean stable bucket; fill it with the best hay, and cover this with boiling water; cover and allow to stand until cold, then strain. This drink is readily taken by some horses.

Scalded Oats in small quantities may be allowed during convalescence, and gradually increased when walking exercise is permissible.

Hay should be fresh and sweet, and allowed in small amounts at a time, not in the large mangerful that we see so frequently left in front of a sick horse.

Milk is a form of food of the highest value in all cases of sickness. Unfortunately, all horses will not drink it, even with the addition of a little sugar and water; but a large number take to it readily, and with marked benefit. It is important to insist that the vessel containing the milk be

kept scrupulously clean, also that the milk should always be supplied fresh. Some horses prefer milk when it is diluted with water, while others take it more readily when it is sweetened by the addition of sugar.

In addition to the above list, we may vary the diet by allowing small amounts of boiled foods. Although the latter are found to be a dangerous form of diet for horses in health, yet in small quantities they are sometimes relished by sick animals. Let us repeat that in nursing it often becomes necessary to tempt the appetite with various kinds of food, and not to indulge in the vicious custom of forcing fluid foods and stimulants on the animal in the form of drenches.

Cases are met with in which all our efforts fail to persuade the animal to feed, and in such circumstances the prognosis is very serious. But before ordering the forcible administration of nutriment, we must consider the risks of drenching. Moreover, there are conditions such as pharyngitis, laryngitis, etc., in which drenching would readily prove fatal, as, owing to the difficulty in deglutition, the fluids would gain entrance to the trachea and bronchi. The rational course to adopt in such affections is to apply suitable treatment, and we usually find that coincident with improvement in the local conditions the animal begins to feed. Nutrient enemata should also be prescribed if considered necessary (see p. 189). Instead of ordering alcoholic stimulants, we now find that subcutaneous injections of large amounts of normal saline solution prove far more safe and efficient, while necessary medicinal agents are also administered by the same method.

Some practitioners still believe in the necessity of administering nourishment in the form of drenches, and prescribe milk and eggs combined with brandy or whisky. We are, however, convinced that, so far as the horse is concerned, this forcible method of feeding cannot be recommended, as the risks and disadvantages far outweigh any problematical benefit that might result. Judging by clinical experience, and also the fact that the horse cannot vomit, and hence is unable to get rid of the ingesta forced on him when it sets

up digestive derangement, we consider that far more successful results are obtained by avoiding forcible feeding.

Water.—Much ignorance prevails amongst the owners and attendants of horses with reference to the necessity of supplying sick animals with a plentiful supply of water. The common idea seems to be that cold water is capable of causing various disorders, and it is difficult to persuade the attendant to carry out our instructions in the matter. Hence we find it essential to see for ourselves that a bucket containing pure cold water is always left within reach of the patient. Water assists in reducing fever, allays thirst, is necessary for digestion and assimilation, and promotes the action of the excretory organs.

Salines can be conveniently administered in the drinking water; but the practice of attempting to give large doses of agents, such as Epsom salt, in this manner is to be condemned, as the bitter taste often prevents the patient from taking sufficient fluid.

Grooming.—In acute respiratory affections grooming should not be carried out; it annoys the patient, pollutes the air, and unduly exposes the surface of the body. The clothing ought to be removed once a day and rearranged, the legs and ears hand-rubbed, and the surface of the body gently rubbed over with a soft cloth. The mouth, nostrils, eyes, and forehead, may be lightly sponged with lukewarm water. In cases associated with a nasal discharge the nostrils should be frequently cleansed. In cases of strangles the attendant ought to be instructed not to permit any of the discharge to come into contact with the eyes of the animal, as there is risk of a purulent ophthalmia occurring as the result of neglect in this direction. The feet should be carefully cleaned, and in cases where the animal stands for long periods the shoes should be removed.

Exercise.—During the course of febrile affections the patient should not be exercised. When the temperature falls to normal and all evidences of acute disease have disappeared, gentle walking exercise will prove of advantage. But the increase of this exercise must be gradual, and on no

account must the animal be distressed or made to sweat. During convalescence from gastric and intestinal disorders, walking exercise ordered with discretion proves beneficial. But we must point out the danger of sending a horse that has just recovered from a severe attack of colic several miles home, as laminitis may supervene. Both in ordering exercise and in sending convalescent patients back to work, discretion is necessary in order to avoid the occurrence of a relapse. Want of care in this respect is responsible for serious if not fatal consequences. In spite of the solicitations of the owner to return an animal to work, the practitioner should be cautious in the matter, and point out the dangers that may result if his advice be ignored.

The Attendant.—In order to carry out therapeutical measures successfully, a trained attendant is essential. Needless to remark, it is the exception rather than the rule to find the ordinary attendant or groom skilled in the art of nursing and in the administration of medicines. In large establishments and in veterinary infirmaries no doubt we are able to obtain the assistance of a trained attendant, but in country practice, more especially, we have often to depend on an individual who is stupid and totally ignorant of the simplest details of the nursing and care of sick animals. In many instances both owner and attendant have an exalted idea of their own skill, and imagine that constant drugging and the forcing of food on patients constitute the important essentials of successful treatment. It is with great difficulty that we get our instructions carried out, even with careful supervision. But, just as in the case of unfavourable surroundings, we must be content with the assistance at hand, and by the exercise of tact and patience endeavour to do the best for the sick animal. In a large infirmary the attendant should be taught how to use a clinical thermometer, and also to note down the amount of food taken by each patient. A good nurse is able to give the practitioner marked assistance, and if the instructions be carried out faithfully the effects on the progress of cases are readily apparent. In the treatment of surgical cases similar remarks apply. Here

strict attention to cleanliness is an important detail. The difficulties in educating the attendant to appreciate the necessity for sanitary surroundings, clean vessels and hands, and avoiding contamination of the dressings and wounds, are well known to every practitioner.

It is quite obvious that, whenever possible, both medical and surgical cases should be removed to a properly equipped veterinary infirmary for treatment. The advantages of having the patients directly under the supervision of the practitioner, and cared for by skilled attendants, are now becoming more apparent to the owners of animals.

The Owner.—There are many occasions on which the owner of an animal can prove of marked assistance to the practitioner. Owners as well as attendants may be intelligent or the opposite. In far too many instances the owners of carriage-horses or hunters rely too much on their coachmen and grooms in matters pertaining to health and sickness, with the result that the necessity for professional assistance is left to the discretion of the attendants. Very frequently under such conditions the veterinary surgeon does not come into contact with the owner, and so has to depend altogether on the willingness of the attendant to carry out his instructions. The latter individual reports to his master the progress of the case, and, unless he is in full co-operation with the practitioner, he is likely to convey wrong impressions, tending to damage the reputation of the veterinary surgeon. Whenever possible the veterinary surgeon ought to have an interview with the owner, in order to explain the nature and gravity of the case, and also to point out the details of treatment. Common-sense will dictate that at such an interview the practitioner should be careful to avoid making any remarks which might be construed into 'finding fault' with the attendant. Probably there are occasions when an obstinate or careless attendant deserves to be reported, but we must not forget that an unwilling nurse is detrimental to a case, and it is far better to lead than to force him to carry out our instructions. Tact in dealing with owners and attendants is a very important attribute to successful practice, and

experience teaches us how to avoid unpleasant scenes, with the resulting unfortunate consequences to reputation and to the patient.

It is important for the owner to recognize the necessity for seeking professional assistance during the early stages of a case, and not to delay until serious complications or sequelæ set in. In order to obtain the services of the veterinary surgeon quickly, it is advisable to send instructions as early as possible in the day for him to attend, so that he may be able to arrange his engagements. Neglect of this matter often involves considerable delay, besides wasting the practitioner's time, as he may have passed through the district during the early part of the day while attending another case, and thus has to perform two journeys when one would have sufficed. Unless in urgent cases, attendance should not be sought at night-time or on Sundays. The owners of animals are sometimes very unreasonable in this respect, and seem to forget that the practitioner requires some rest, and cannot be expected to work both by day and by night. A little consideration on the part of clients would greatly facilitate the practitioner's work, and in reality prove beneficial to their own interests by insuring expeditious attendance and treatment. Some clients delay seeking professional assistance for many days, and then suddenly decide to send for the veterinary surgeon ; should he happen to be engaged on another case, they become annoyed, and imagine that he should be at home at all hours to suit their convenience.

Clients should remember that the practitioner's time is not his own, and that he is liable to be called to attend urgent cases a long distance away at any hour, and must economize time as far as is possible. The injunction to ' send early ' is of great importance, and, if observed, would save much delay, worry, and anxiety, both to client and practitioner.

In asking for professional attendance, whether by verbal message, letter, telephone, or telegram, the client ought to state the nature of the case as far as he is able to do so, and also the species of animal affected. This will enable the practitioner to come prepared with the necessary appliances and medi-

cines—a matter of great importance when the patient is a long distance from the surgery.

Another matter to which we may draw attention is in connection with amateur treatment of cases. The client should clearly and openly state if any treatment has been adopted, and be careful not to conceal any points bearing on the case from the practitioner. Details which to the owner may seem trivial may have an important bearing on diagnosis and treatment.

It occasionally happens that a client ignores the existence of professional etiquette, and imagines that he is doing the best for his animal and himself by calling in a practitioner, without informing the latter that another veterinary surgeon has been in attendance on the case. We must point out not only the injustice, but the inutility, of such a procedure. If benefit is to result from two practitioners being in attendance, they should act in consultation, as one can assist the other to carry out the most advisable line of treatment.

Frankness between client and practitioner is a *sine quâ non* for successful treatment. If this were more fully recognized it would assist in smoothing the misapprehensions, and imaginary ideas of neglect and incompetence, which not infrequently result in the veterinary surgeon losing his client.

Another point which merits attention is in connection with the evils resulting from the use of patent medicines. Clients should be informed that to administer mixtures or drenches of unknown composition is an irrational and harmful course to pursue; moreover, when the practitioner arrives on the scene, he is unable to ascertain what drugs have been given. If a client insists on having a supply of medicines in his possession for emergency cases, then he will be well advised to ask his veterinary surgeon to supply them. There are occasions on which this course is desirable, as, for example, when the client resides at a long distance from the veterinary surgeon, and may have to wait some time for professional assistance.

But we cannot insist too strongly on the necessity for early

professional attendance, and we should impress on the client that every case requires to be treated on its merits. Amateur diagnosis is usually incorrect, and as a result the treatment adopted by the owner is seldom beneficial to the case; while in many instances it proves distinctly harmful.

The Care, Management, and Nursing, of Sick Cattle.

By HUGH BEGG, F.R.C.V.S., Hamilton.

The gradually advancing and national importance of milk- and beef-producing animals is such that it constitutes a direct invitation to the veterinary profession—which we cannot afford to neglect—to devote more time and study to the problems pertaining to the welfare of bovines in health and disease.

The higher estimate which we must now attach to the dairy cow particularly, as a veterinary patient, demands an enlightened review, on our part, of our present knowledge, not only of the diseases to which she is liable, but of all the conditions that have any bearing on the daily routine of her existence.

Too often is it the case that even the therapeutical treatment of many of the disorders affecting dairy cows is empirical, unscientific, and, what is more, perfunctory, because of our lack of interest in them, and the reluctance which many have to carry out with care any measures which are troublesome and involve the soiling of hands, etc. For these reasons, too, the sum of our knowledge of many bovine pathological conditions is not what it should be. Nor can it be said that sufficient attention has hitherto been paid to the prevention of diseases incident to the critical period of parturition. If we are not sufficiently interested, and fail to recognize and counteract seemingly minor indications of disease in animals to which our attention has been called, need we wonder at the apparently fatalistic carelessness of many owners in neglecting to seek professional skill for many cases amenable to efficient veterinary treatment? It is not to our credit that the list of bovine maladies for which the majority

of stock-owners seek veterinary skill is so limited, nor need we complain in that respect if we have failed to prove our economic utility in the treatment of other types of cases that in too many byres receive little or no scientific treatment. And while it may be urged with some reason that it is no part of a clinician's duty to devote attention to any other member of the herd than that or those to which he is especially called, it must be conceded that when opportunity offers he can, by making a general survey of others in the herd, find many instances of various important abnormalities, deemed trivial by the owner, for which he can advise useful treatment. In this way the practitioner enhances his value to his client and his client's value to himself, through the resultant extension of the list of cases to which he is likely to be subsequently called. Keeping that end in view, and whether we regard it from an economic or humanitarian standpoint, it must be allowed that sound practice embraces also a thorough knowledge of the proper nursing of sick animals, and the anticipation and prevention of disease in the cowshed by judicious care in the feeding, nursing, handling, and treatment, of the inmates.

The practitioner who is so obsessed with the importance of good nursing that he cannot tolerate slipshod methods of carrying out his instructions secures in results a rich reward daily.

In short, nothing that will add to the welfare and comfort of the dairy cow in health or disease should be beneath the notice of the practitioner, and when called in, his duty is not to be limited to prescribing and administering drugs, but should include the giving of carefully considered instructions—written if necessary—as to feeding, general and special nursing, hygiene, etc.

For various reasons the practice of bovine medicine has not been attractive to many veterinary surgeons, and the neglect it has suffered in favour of equine and canine medicine is responsible for its comparative lack of advancement as a science.

The successful cattle practitioner understands the need of

doing for his patients very many things with his own hands if maximum results are to be obtained.

And, while the performance of many of these duties may involve soiling of the hands and clothing, it is eminently true that the experienced practitioner who is deft at his work, and knows how to prepare and garb himself for its proper performance, escapes scatheless, where the inexperienced and ill-equipped clinician would encounter vexation through the pollution of his clothing, etc., that invariably attends unpractical and imperfect methods of procedure.

Though we meet many noted exceptions, it may be said, in a general sense, that cattle attendants are nondescript, irresponsible, and less capable than horse attendants, of satisfactorily carrying out the orders of the practitioner, who is therefore compelled to perform the more essential duties connected with the case in hand, and has to demonstrate clearly the minor details of nursing that must fall to the attendant.

Oxen as patients are considered by many to be refractory and uninteresting animals that are unresponsive to therapeutic measures, and ill requite the practitioner's care and treatment.

Stolid they may be in temperament and less intelligent than other species, but they are just as interesting as we make them, the problems their ailments supply are not less seductive to the willing mind, nor do the results of good practice compare unfavourably with those of equine or canine medicine.

They are liable to many disorders so urgent that, if a fatal issue is to be avoided, the immediate attendance of the practitioner is imperative—*e.g.*, obstruction of the gullet with roots (choking), tympany, engorgement of the rumen, milk fever, stomach staggers (so called), epileptic seizures, etc.

Though our knowledge of many physiological processes and pathological conditions of their digestive apparatus is defective, it cannot be said that their internal organs are less amenable to examination than those of the horse. It is comparatively easier to explore their mouth, pharynx, and gullet,

and to pass the probang, to restrain them for the treatment of eye affections, to determine disease of thoracic organs, and to examine and treat the female genital organs; and though many diseases of the stomachs are in need of greater precision, their intestines are not prone to such a variety of important disorders as those of the horse.

Unless in cases associated with cerebral disturbance, they can be more easily and quickly drenched with medicine, etc., than the horse; and this is well, considering that the quantity to be given is often greater. They are scarcely less sensitive than equines in exhibiting symptoms that guide us in diagnosis, etc.; and though larger doses, given orally, are necessary to induce the physiological action of most drugs—because a certain amount loses immediate effect through admixture with the contents of the rumen—they are equally responsive to the subcutaneous, and intravenous, etc., use of many medicaments.

Unlike more intelligent animals of other species, bovines learn nothing from chastisement, and so great is their instinct in self-defence that harsh treatment only serves to make a supposed fault more pronounced. The best results can only be got when they are treated kindly and quietly, avoiding all measures likely to cause excitement.

Marketing of Dairy Cows.

It is regrettable that calving cows are seldom offered for sale until their period of gestation is almost up, when they are in full bloom and likely to reach top market value when put to auction. Sellers of such animals know well that the keenest and best buyers are the dairymen, who have to maintain by contract a certain steady supply of milk, and who, when they attend the mart, must procure animals as near to their work as possible.

In the case of cows that have already calved, the appearance of the udder is often so deceptive through the practice of 'over-stocking,' that it is difficult to be sure that they are as recently calved as has been represented; while, on account of the absence of legislation for the control of epizoötic abortion, which would prohibit the public exposure of victims to this disease, an animal so affected may unwittingly be brought home and pollute the buyer's herd.

Nevertheless, the purchase of uncalved cows only cannot be con-

sidered a perfect guarantee against the introduction of an animal affected with specific abortion so long as the owners of such animals will stoop to the practice of exposing them for sale as 'time up and correct' when the signs of the approaching, though premature, birth of the calf are imminent. The buyer's risk of introducing the disease to his herd can be avoided by keeping all new purchases isolated until proved. Because of the greater safety in this connection that attaches to the buying of uncalved cows, the great demand for calves, and the departure of the bogie of milk fever in the face of successful treatment, the cow 'just at the drop' commands nowadays a higher price than the animal said to be a few days calved. But against these advantages in purchasing uncalved cows we must place the probable delay of parturition, and therefore of the animal's utility, and the possibility of some parturient disorder resulting, especially those dangerous affections that are intimately associated with the movement to and from the markets of animals about to calve.

Much might be written regarding the numerous defects of the mammary gland that constitute a breach of warranty, and which, if the cow is to be returned, must be detected and notified at once in terms of the auction mart bye-laws, despite the difficulty that so often exists from the presence of a great amount of œdema of the udder. But their consideration belongs more to the domain of forensic medicine than of nursing and prophylaxis. Seeing that it is not yet illegal to subject cows, newly calved or about to calve, to the dangers of the marketing process, and that the present exigencies of the dairy industry make this appear unavoidable, it is the duty of veterinary surgeons at all times to urge the necessity of transporting all such animals in horse-drawn floats, unless the distance to and from the mart is so short as to render the use of a float unnecessary.

The employment of these humane vehicles means the saving of the health, and it may be even the lives, of the animals. Country practitioners frequently meet with cases illustrating the dire effects of the ignorant and cruel treatment which dairy cows suffer in the process of marketing, and the most culpable individual is the quasi-dealer who contrives to earn a livelihood by buying at one mart and selling at another.

Too often is it the case that the parturient animal with gravid womb, turgid, throbbing udder, and with heart, lungs, and locomotory apparatus, out of tone, owing to some months of inertia in a warm byre, has had to do several long journeys—often dog-hunted to the point of collapse—ere she arrives at her ultimate home. No cow due to calve can suffer such treatment with impunity, and a common result is premature calving, followed by retention of the fœtal membranes—which in such cases defy safe removal—septic metritis, and death; while many other serious and fatal diseases to which in-calf and newly calved cows are predisposed find an exciting cause in this over-driving.

The Cowshed.

To discuss in complete detail the properties of the ideal dairy byre is beyond our purpose, though it will be necessary to refer to some phases of the subject. In addition to the common byre for the milking cows, there should be one or more small and separate byres on all dairy premises for hospital and isolation purposes. A small byre of this kind, comprising three or four stalls and a loose-box, equipped for nursing purposes, makes an ideal reception-house for newly purchased or brought-in grazing cows due to calve. There they can be kept and specially fed and nursed till safely through the calving period, when they may be put into the common byre and share the ordinary rations of the milch cows. If they should be unfortunate and suffer from one or other of the diseases common to the calving period, and be in need of midnight nursing, the benefit of being able to give the necessary attention without disturbing the milch cows is inestimable. Moreover, the advantage of such accommodation for the isolation of contagious and infectious cases is so apparent that the wonder is so few farms are thus equipped. Owing to the lack of these isolation premises on most farms, it is not uncommon to find in the common byre cases of contagious abortion, Johne's disease, advanced tuberculosis, septic metritis, retention of fœtal membranes, infectious foot-rot, mammitis, or sore teats, etc. Obviously, the attendant who nurses and handles cows isolated because of infectious disease should, if possible, take no part in the work of the common byre. Needless to say, all isolation premises, as well as the main byre, should conform as near as possible to the model bye-laws issued by municipal and county authorities as to cubic space, ventilation, light, the construction of floors and walls, water-supply, etc., without which the health and utility of the inmates are liable to suffer prejudice. When the cow has safely passed the dangers of parturition, and is ready to take her place in the herd, she should be put into a stall the length of which so suits her requirements that soiling of her udder and hips by her own excreta will be avoided.

It is unquestionable that the unsuitability of stalls for their occupants, either from being too long or too short, is the prime factor operating in so many byres to produce soiling of the hind-parts of milch stock. Yet we find, in the great majority of even our best cowsheds, that though the cows vary greatly in length of body, the stalls are practically uniform in measurement; and though the constant attention of the byreman may remedy the evil during the day, many of the cows get into a filthy state when he is absent during the night. The production of clean milk is impossible under these circumstances, and it would be an undue stretching of our faith in dairymen to believe that, in the hurry caused by a late rising on a winter morning, due attention is paid to the cleansing of udders before milking. The demand for some variety in the length of the stalls is always greatest where the stock is reared on

the farm, and where two-year-olds and three-year-olds are yielding milk in company with full-grown animals. The best methods of acquiring the object in view readily suggest themselves to those who are interested in the matter. Trevasses dividing double stalls should also be of proper length ; if too short the cows have too much latitude, and the milker is at the mercy of a restless animal ; while if too long, and the double stall is occupied by two pregnant cows, the attendant has a difficulty in squeezing his way through to the feeding troughs at each meal-time, and the cows may suffer in some way on that account.

The outstanding excellence of granolithic floors is marred only by the unsafe footing which they afford, especially to animals unused to them, but this objection is easily met by giving the floor a meagre sprinkling of sand before the cows are turned out. Sliding doors only are permissible where stock enter or leave the byre ; hinged doors have been responsible for many accidents occurring when cows crowd together in leaving or entering the premises.

The Care of Parturient Animals.

Diseases incidental to parturition are of such frequent occurrence in cows that we deem it advisable to offer some remarks on the subject of the care and nursing of animals during this period.

(*a*) **In the Field**.—The chief disadvantage of allowing cows to calve in the field is the difficulty or impossibility of giving them proper supervision. Because of this, untoward results sometimes occur through malpresentations, many of which, if noticed early, are easily rectified ; or the cow may be found down, and perhaps in the last stages of milk fever. Or, again, prolapse of the womb may have occurred, and the animal's misfortune may not be noticed till she is in a hopeless condition.

Nevertheless, when at grass in temperate or warm weather, cows which have gone the full period of gestation usually accomplish the act of parturition successfully.

If it is not intended that the mother should suckle her offspring, she should be taken in until the fœtal membranes have been ejected, and for a further day or two according to the weather and the progress of the case.

If it be evident that a newly calved cow has passed the placenta in the field, it should be searched for, and when found, buried. Many cows, if they have the opportunity, show a disposition to lick at, pick up, and swallow, their fœtal membranes in canine fashion. Many cases have been known of cows being choked in a vain effort to swallow the bulky mass, while others that have managed to swallow it have suffered serious digestive trouble through the presence of the abnormal material in the gastric compartments.

In deep-milking animals, prone to milk fever, it occasionally happens that the signs of an attack become manifest before, during, or soon

after labour ; and if the animal be in the field, and these early symptoms pass unnoticed, she may be found recumbent, and so helpless that she cannot be moved to the cowshed without the employment of means that would probably mar her chance of making a perfect recovery.

Unless in very exceptional circumstances it is both practicable and advisable, in view of the quick results obtained from up-to-date treatment of milk fever, to deal with these cases where they lie, clothing the animal properly, and providing temporary shelter by the erection of a few posts over which a tarpaulin is spread. A couple of posts driven into the ground at the animal's shoulder, and faced with a truss of straw, serve to keep her on her sternum, while the head is supported by a halter tied to a post fixed in the ground a little distance from the other shoulder. If the recovering cow contrives to get up before she is quite fit and ready to walk, she is much safer in her attempt in the field than in the stall of the cowshed. When a manual examination reveals that the uncalved, semi-conscious cow is well prepared for parturition, which has been delayed by the onset of paralysis, manual delivery should be effected, so as to insure that while the animal is under treatment she will not, when recovering consciousness, be disturbed by the recurrence of labour pains. Moreover, the removal of the calf, by lessening the rotundity of the abdomen, facilitates respiration and the keeping of the animal in proper position.

It is advisable thereafter to put on a West's clamp to prevent prolapse of the uterus. This sequel readily occurs if the animal be subject to post-partum pains, because of the ultra-relaxation of the genital organs and accessories that has resulted from her unduly prolonged preparation for the birth of the calf, a relaxation which for a time is not followed by normal retraction, owing to the onset of milk fever.

Should it be deemed advisable at any time to convey a recumbent cow from the field to the byre, the proper vehicle is a hay-trolley or rick-lifter.

(*b*) **In the Cowshed.**—It is unfortunately the case that in the great majority of dairy farms, owing to the lack of additional premises, pregnant cows are housed in the dairy byre, where they are brought forward to, and pass through, the trials of the parturition period disturbed by their neighbours, and in turn the cause of much disturbance to them, owing to the necessary and often untimely visits of attendants.

Under these circumstances, when several cows are due to calve, the supervision and operations entailed during the night, when the milch stock should be resting, are of considerable moment. Moreover, the strain which this attention entails on those who are in charge of cows liable to calve at any hour is such that it is surprising, in large herds at least, the expedient is not adopted of having a capable night attendant, who could go on duty before the evening, and come off duty after the morning milking.

When a pregnant cow shows premonitory signs of premature parturi-

tion, she should be isolated at once, and if a dead fœtus be born it should be destroyed immediately by fire, or buried with the use of disinfectants; and all measures necessary for the treatment of the cow, the disinfection of premises, and the prevention of the spread of what is possibly the commencement of an outbreak of epizoötic abortion, should be adopted.

Smears should be made at once of uterine discharges, so as to determine microscopically the presence or absence of the bacilli of specific abortion. If these are found to be positive, the known scientific methods of testing and safeguarding the rest of the herd should be put into operation. It is now generally considered that this disease should be scheduled and dealt with under the Contagious Diseases of Animals Acts.

In order to avoid the numerous defects that attach to the housing of all animals in a common byre, every pregnant cow should be removed to a separate house as soon as she has gone dry, and kept there till she has safely entered her next lactation period.

The great majority of cows perform the act of parturition in the recumbent position, but those of a nervous disposition, if much disturbed, may deliver the calf in a standing position, in which case, especially if the presentation be a posterior one, the calf is sometimes killed through its head coming into violent contact with the floor.

The attendant should keep watch unseen, and be ready to assist as soon as the cow has gone down and presented the calf sufficiently for delivery, so that his presence and actions will not interfere with the continuance and completion of labour.

If the parturition has been troublesome, or the genital organs seem abnormally relaxed, a West's clamp should be put in position for twelve hours or so *if the animal is to be left untended*. Its application is a most effective preventative of uterine prolapse, and those who have experience know that complete prolapse of the womb is a serious matter for the cow, and the returning of it a task not to be coveted by the practitioner.

This precaution need not be neglected on the plea that it may hinder the fall of the placenta, for if the membranes are ripe for expulsion a delay of twelve hours is of no moment, and we have often seen them voided while the instrument was *in sitû*.

If there be any evidence of the onset of milk fever, such as awkward attitude of the animal, want of co-ordination in movement, or occasional paddling with the hind feet, it is advisable to put a string link in the iron binding chain, and fill up the dung channel to the level of the floor. These measures materially reduce the dangers involved in an awkward backward fall of the helpless animal. If in risk of choking on the chain, the string link can be cut, while the levelling up of the grip serves to a great extent in removing the chance of injury to the udder and posterior limbs. Indeed, these precautions should be adopted in all cases where there is difficulty in getting up or down—*e.g.*, acute 'foul of the foot,' pyæmic arthritis of the hocks, stifle lameness, etc.

Diet.—The dieting of sick cattle is a most important consideration, but because much bovine sickness, accompanied by loss of appetite, depends on digestive disturbance directly due to careless, improper, or over feeding, the complete withholding of food for a time is frequently imperative, and attendants must resist the temptation, so often a duty with the nurse of sick horses, of enticing the satiated animal's appetite with choice concentrated foods. When a heavily fed cow begins to falter in her appetite, and particularly if she has recently calved, a halt should be called at once, and, according to the danger apprehended, she should, apart from medicines, be allowed nothing but a little chilled water for a time, and her return to ordinary rations should be preceded by a few days on short supplies of easily digested food. The desire of the owner to prevent any decrease in the milk yield is his only excuse for the culpable tempting of the animal's capricious appetite with highly nitrogenous foods, which is so often resorted to with disastrous results in bovines prone to fatal nervous disorders. Again, circumstances calling for the forcible drenching of cattle with fluid nourishment are exceptional to a degree, though in cases of persistent diarrhœa the administration of boiled flour gruel, and in red-water, of milk and eggs, is often necessary.

The danger of careless drenching referred to in the section on horse nursing (p. 80) applies equally, if not with greater force, in the case of cattle, and especially in recently calved cows showing signs of lassitude, and whose ability to swallow safely is impaired.

As in the case of some stables, we occasionally find in byres that the feeding troughs and their surroundings are so defective and soured with decomposing material as to be a sufficient reason why several animals fail to clean up their rations properly. Deficient light in the byre and carelessness on the attendant's part are contributing factors, but the chief remedy is to provide proper troughs set in cement, the upper surfaces of which on all sides slope towards the edge of the troughs, so that, even with deficient light, the contents of a carelessly emptied pail will be sure to reach the trough.

It is seldom that dairymen knowingly supply their stock with food of inferior quality, because of the economic results that follow, and in the majority of cases in which it is found that a number of the herd have failed to lick their troughs clean there is usually the history that a too sudden change has been made from one kind of food to another in the pail-fed rations, and for which a taste has been acquired.

Suitable foods for sick animals comprise gruels and mashes of bran, or linseed and bran, oatmeal gruel, mixtures of boiled turnips, oat or linseed chaff, cut hay, bran, malt dust, brewer's grains, etc., hay-tea, mangolds or turnips sliced or pulped and given alone or mixed with dry bran or grains, a few raw potatoes, cabbages, green grass in season, and a sufficiency of good hay.

All soft food for sick cattle should be salted more or less according to the patient's taste, and in some cases it is of advantage to create thirst by the use of salt, so as to secure the mechanical and other effects of the water which the animal drinks, on the contents of the digestive apparatus.

It should also be remembered that the digestive functions in sick ruminants cannot be thoroughly restored so long as they receive fluid food only ; and should the appetite for hay be wanting, the other rations should very early be changed from fluids to a consistency that will require mastication, and be fit for rumination, by the addition of coarse material—*e.g.*, cut hay, chaff, pulped turnips, etc. Animals with defective appetite should only be allowed easily digested food in small quantity—not put into the trough, but offered in a shallow vessel ; and if the dish is not licked quite clean, a lesser quantity should be given on the next occasion.

If warm food be refused, it may be allowed to remain before the animal till it is cold, but not longer. Various changes are advisable, and it is the attendant's duty to find out what the animal cares for, in the list of easily digested foods.

And, because the chief consideration, with the exception of cases of wasting diseases, is not to procure the immediate introduction into the system of highly nourishing material for the repair of tissue waste, but the perfect re-establish-

ment of the digestive functions, no concentrated food should be allowed, such as bean, pea, soya, gram or other meals that the animal would readily take, and as a result have her powers of digestion overtaxed, her indisposition increased, and her appetite for lighter food decreased.

If the animal be not feverish, and the weather is suitable, the turning out of the patient, with a rug on, where a bite of green grass can be got is helpful. Indeed, in spring-time many cases of inappetence that have defied the nurse's arts find their charm in being turned out for a little, as soon as the grass begins to grow.

The preparation of bran mash, oatmeal gruel, etc., will be found at p. 83.

Milk.—When animals under four months old sicken on artificial foodstuffs, a complete or partial return to milk diet is advisable. But the giving of milk to sick adult cattle is destructive of their appetite for more suitable materials, though it is admissible uncooked or after boiling in cases of persistent diarrhœa, and it is often prescribed along with eggs in cases of red-water.

Flour Gruel is useful in diarrhœa, and is prepared as follows: Put a bowlful of flour into a pot, add a little water, and mix well with a spoon; then add two tablespoonfuls of warm water starch and fill the pot three-fourths full with milk and water in equal parts, and boil for ten minutes. Some of the pasty mixture, liquefied with water or boiled milk, is to be offered to the animal three times a day. If this be refused, a few quarts diluted with boiled milk should be administered very carefully two or three times a day.

Water.—The need for an adequate supply of pure water for cattle is well recognized.

If the field-supply be got by gravitation, the trough should be raised above the surface of the ground, so that animal excreta, in a fluid state on the ground, can have no access to it.

Many cows will drink water polluted with organic matter quite readily, and often suffer thereby. When there are unfenced stagnant pools in the pasture-land, or when the

watering trough is set so low that it receives surface-water, these constitute favourable means for the spread of such affections as Johne's disease, contagious abortion, etc. House-fed animals require large quantities of water, but in many dairy herds the amount of fluid food given is so great that few of the animals will take a drink of plain water. On the contrary, if cattle be fed on cake, or if the meal rations be given in a dry state, they require regular supplies of water.

If watered in the house in frosty weather, some warm water must be added to the supply; but when the animals are put outside to water, the exercise in going to and from the watering-place seems to make safe the drinking of icy-cold water.

In cases of sickness unassociated with diarrhœa, water should be allowed frequently, care being taken to avoid producing a chill in fevered animals by giving very cold water in too great quantity.

In cases of diarrhœa, dysentery, etc., everything the animal drinks should be lukewarm, as any excess of heat or cold is liable to increase the irritability of the bowels. Great thirst is usually associated with diarrhœa, and advantage should be taken of this to get the patient to take flour gruel.

The water allowed to a sick animal is a ready vehicle for the administration of simple febrifuges, common salt, etc., and it must be kept in view that, without a sufficiency of water the digestive functions cannot be properly performed.

Clothing.—At calving time it is usual to put a rug of some kind on housed animals for a few days. All sick animals should likewise be clothed, because of their greater susceptibility to chill, and on no account should a saline purge be given to an unclothed animal.

Clothing should always be securely applied. The common practice of throwing two or three sacks loosely on an animal's back is worse than useless, because they are more often among her feet than on her back.

Speaking generally, shaped horse-rugs are unsuitable for

cattle; they hamper the fore-limbs and are easily torn. A covering for a cow should be, in size, the square of the length of the animal from withers to croup, and be made of material not easily torn. A couple of soft sacks, sewn with string edge to edge throughout their length, serve the purpose well, and, if necessary, this covering can be lined with a piece of blanket securely stitched to the outer fabric. The rug should be secured by means of a soft rope crupper, a breast rope, and two fastenings below the body.

If necessary, another bag may be placed below the chest, and fastened over the spine on the top of the rug by pieces of rope attached to the corners, etc., of the bag.

All clothing should be taken off, shaken out, brushed clean, and readjusted, daily, unless in very exceptional cases.

Grooming.—All dairy animals should be groomed daily, and this should be done soon after milking or just before they are turned out to water, so that the dust raised may have time to settle before the next milking period.

The appearance of milch cows is greatly enhanced, and the production of clean milk facilitated, by having the udders and tails, excepting the end tuft, clipped bare; and in the case of heavy-coated animals housed in ill-ventilated byres the clippers should be applied along the spine and over the shoulders. When this has been done, grooming is more easily carried out.

The proper grooming of animals recovering from sickness is a matter of greater importance than is generally supposed. The stimulating effect of active grooming, amounting to massage of the body, is often remarkable, and materially hastens the return to health.

The grooming of a clothed animal is preferably done by two attendants, one on each side, and the clothing should be immediately reapplied.

Exercise.—In many cases of sickness in which there is no rise in temperature, judicious exercise in fine weather is of great advantage, care being taken that the animal does not lie down and contract a chill. Moreover, the practitioner's examination of certain cases is not complete until the animal

has been observed walking. This is a ready means of discerning the subtle signs of want of co-ordination of muscular movement that portend a possible nervous catastrophe. The early adoption of treatment in such cases is so imperative that, when in doubt, the animal should be made to leave her stall. The ability she shows in performing the necessary movements is of great diagnostic value. If this test be not applied to animals examined towards evening, the serious nature of the case may not be recognized, and the cow may be found beyond hope of recovery in the morning.

Attendants.—The duty of an attendant embraces everything that is conducive to the comfort and well-being of the patient. He must prepare suitable and palatable food, served in scrupulously clean vessels, in proper quantity according to the patient's need, and with such variations as are deemed necessary. He must see that the animal is properly clothed and groomed, and exercised if necessary, and keep her surroundings tidy.

He must also be able to administer medicines in a safe and gentle manner, appreciating the dangers involved in the operation.

He will also attend to the atmospheric condition of the cowshed, regulating ventilation and temperature so as to avoid draughts, and thus secure for the animals the maximum amount of fresh air in the safest manner which the means available will allow.

Bearing in mind the high temperature in which so many herds have to live, it is at once apparent how easily draughts are created at different periods of the day, when doors must be opened and the incoming currents of cold air operate as exciting causes to produce disease in susceptible animals, or augment it in those already indisposed.

When a sick cow is treated in the byre, she should be placed in a stall as far as possible removed from draughts.

It is worthy of note that, whereas in horses chills occasioned by draughts or sudden changes of temperature usually result in the production of respiratory affections, it is in most cases the mammary gland that suffers in the case of

dairy cows. The importance that attaches to the proper performance of these multiple duties of the sick cattle attendant is so great that it very often supersedes that of mere therapeutic treatment.

The Care, Management, and Nursing, of Sick Dogs.*

In the present day canine medicine occupies a very important position in connection with veterinary practice. A sentimental value is often attached to the dog which does not obtain in the case of horses or cattle, hence it is not uncommon to find that no expense or trouble is spared by the owners in order to relieve or cure canine ailments. In the case of favourite animals the property of wealthy owners, it can truly be said that, both in nursing and in treatment, the attention given compares very favourably with that accorded to human beings when ill. Hence the canine practitioner has marked advantages in dealing with his patients as regards surroundings and careful nursing; moreover, he is not concerned with the commercial aspect which is so intimately associated with equine or bovine medicine and surgery. If the favourite dog when ill can be restored to a condition free from pain or discomfort, although remaining more or less an invalid, the practitioner receives due credit for his skill and attention. Again, the relations between practitioner and client are on a more satisfactory basis in the treatment of canine patients, as the owner meets the veterinary surgeon personally, and is enabled to judge more readily of his capabilities and attention than it is possible to do in connection with equine practice, where the groom often acts as an intermediary.

Generally speaking, diagnosis in the dog can be carried out in a more thorough and efficient manner than obtains in the larger animals, and careful clinical study is rewarded by more satisfactory results. The increasing importance of

* In the preparation of this section, and also of those on Cats and Birds, the author desires to acknowledge the valuable assistance of Mr. Henry Gray, M.R.C.V.S., Kensington.

the subject has rendered specialism a necessity, and it is now fully recognized that, although a veterinary surgeon may be skilled in the diagnosis and treatment of equine and bovine diseases, it is by no means an indication that he is competent to practise canine medicine.

In former times the treatment of canine diseases was largely in the hands of empirics and kennel-men, whose ignorance was quite in keeping with the irrational and harmful remedies they employed. The veterinary surgeon devoted little or no attention to the subject; the canine patient was regarded as rather a nuisance that only required the tender mercies of a yard-man, the time-honoured concoction of castor-oil and syrup of buckthorn, with a very abstemious diet, and confinement in a corner of the stable, in order to cure any ailment from which he might be suffering. Dog-owners were not slow to recognize this casual form of treatment, with the result that amateur specialists in canine medicine, game-keepers, and kennel-men, were more frequently entrusted with the medical and surgical treatment of dogs than the qualified veterinary surgeon. The lack of knowledge of canine ailments displayed by the average practitioner did not even escape the observation of the writers of fiction. Gradually the profession awakened to the fact that the treatment of canine diseases afforded a wide and lucrative field for practice, and the advent of the specialist in canine medicine resulted in withdrawing the subject from obscurity and placing it in its proper position. We cannot ignore the fact that, owing to the serious curtailment of equine practice caused by the advent of motor traction, city practitioners have been forced to take up the study of canine diseases. The net result is that in every large city specialists in canine medicine are now to be found, and dog-owners are gradually losing faith in the assumed skill of the empiric, in the capability of the veterinary editors of papers devoted to dogs to diagnose diseases and prescribe without examining the patients, and in the virtues of patent nostrums.

Much yet remains to be done in educating the public in

these matters, and to convince them that rational and successful treatment is not accomplished by simply giving a disease a name, and administering 'something out of a bottle.' The enormous trade that is carried on by proprietors of patent canine medicines is an indication of the necessity for enlightening the owners of dogs with reference to the baneful effects of using agents of unknown composition, and attempting the impossible feat of diagnosing diseases. Practitioners could accomplish much in this direction if they devoted more attention to the diseases of dogs, or, as an alternative, they should advise the owners to consult members of the profession who specialize in the subject.

Even under present conditions, when the owners are not led astray by the wiles of empirics and the advertisements of patent medicine vendors, or the advice of editors of the veterinary column in 'doggy' papers, the mortality from canine ailments has been reduced to a marked extent. The subject of canine pathology has advanced, and our clinical knowledge has largely increased, in recent years. Attention to post-mortem examinations has led to more accurate diagnoses, and shown us the fallacy of many therapeutical dogmas and ideas. Hygiene, dietetics, and careful nursing, are just as important in the treatment of canine diseases as in human therapeutics. To such an extent is this recognized that it is not uncommon to provide trained nurses for canine patients in the case of valuable or favourite animals whose owners are wealthy. The advantages of skilled nursing are very marked, more especially when the patients are delicate, highly bred, and accustomed to luxury, and when the owners are incapable of carrying out the duties.

Through mistaken notions of kindness and zealous attention, the owners of dogs not infrequently adopt an irrational system of nursing. They not only allow improper diet during illness, but continually force nourishment on the patient when the appetite is in abeyance, forgetting the fact that abstention from food is a natural instinct in the sick animal. Again, the craze for frequently administering stimu-

lants and medicines is quite as common in connection with the treatment of dogs as in the case of horses.

There are two important points which it is difficult to impress sufficiently on the minds of dog-owners. One is that proper food voluntarily taken is likely to be assimilated and to prove beneficial, while nourishment forced on the patient against his will is frequently not digested, creates nausea, and tends to induce vomiting. If the patient shows even a slight appetite for food, every means should be adopted to tempt him to feed of his own accord.

The next point is that the attempts of the amateur to prescribe suitable treatment are likely to do more harm than good; professional assistance should be obtained as early as possible, and the instructions of the practitioner should be faithfully carried out. The use of patent nostrums is responsible for many fatalities, far more, indeed, than would result if no treatment were adopted. The popular craze that exists with reference to the presence of 'worms' being capable of causing a number and variety of ailments, leads to a system of 'drugging' with well-advertised concoctions, which not only prove inimical to recovery, but, by reason of the nausea and distress they produce, must be regarded as cruel treatment. Thus, we frequently find cases of distemper in the early stages subjected to harmful and irrational treatment with patent 'worm' medicines, and the nausea and irritation of the gastro-intestinal canal which is produced often precludes any chance of a successful termination. We cannot too earnestly impress on the owners of dogs that by avoiding the usual tendency to dabble in drugs either of known or of unknown composition, and by devoting attention to the details of nursing, they will be far more likely to save the lives of their favourite animals.

The modern practitioner of canine medicine is well aware of the evils resulting from the indiscriminate drugging of patients, and only prescribes what he considers essential to assist the natural powers of recovery. Clinical experience has taught him that successful results depend far more on careful nursing and suitable surroundings than on the effect

of medicinal agents. More especially is he convinced of the detrimental influence of frequently administering medicines, a process which not only annoys the patient, but disturbs digestion and interferes with appetite. The success attending the modern treatment of canine distemper is a striking example of the advantages of careful nursing and suitable surroundings over the old-time régime, which consisted of the frequent administration of potent drugs.

It behoves the junior practitioner to be thoroughly acquainted with the principles of nursing and the subject of dietetics, also with the selection of invalid foods.

Diet.—In considering the question of diet for the sick it is necessary to remember that variations must be made according to the stage of the malady from which the patient is suffering, and also the food must be modified in cases where irritability of the stomach is a prominent condition.

In the early stage of a febrile disease, abstinence from food should not be regarded as a serious symptom; natural instinct prompts the animal to refuse ordinary food, or to take only a small amount. Fats, starchy and highly nitrogenous foods, are contra-indicated in febrile disorders and in catarrhal conditions of the stomach and intestines. In such cases milk is the ideal diet. It contains all the elements necessary for nutrition, and is readily digested. In most instances dogs will take it readily after abstinence from food for a day or two. It may be necessary to dip the finger in milk and rub it on the dog's lips; the animal will then generally lick the finger, and afterwards may be induced to lap milk from a saucer. All feeding utensils should be kept perfectly clean, and only a sufficient amount of milk should be allowed at a time. Large amounts of milk or of any other food when left before the animal become sour, and tend to interfere with appetite.

In cases where all food is obstinately refused, great discrimination is necessary before forcing nourishment on the animal. Before this is resorted to, a trial should be given to some of the invalid foods mentioned on p. 111. If, however,

all measures fail, the best agents to administer are milk diluted with lime-water or soda-water (about equal parts), and Brand's essence of beef (or chicken). Small quantities of the diluted milk should be given at proper intervals, by drawing out the side of the animal's cheek with the finger, and thus forming a pouch, into which the fluid should be very carefully poured by means of a spoon, so that any danger of it entering the larynx may be avoided. During administration the pouch must not be filled, only very small amounts should be poured in, and sufficient time allowed for the animal to swallow.

Brand's essence of beef (or chicken) may be given by placing small amounts of it in the mouth, and the animal may then swallow it voluntarily. Otherwise it may be melted and given as directed above. In serious cases nourishment should be given at proper intervals during the night as well as by day, but discretion must be exercised so as not to annoy the patient or overload the stomach. In cases of acute gastritis, or in any conditions characterized by irritability of the stomach, where vomiting is a prominent symptom, chief reliance must be placed on milk diluted with lime-water or soda-water, and Brand's essence of beef. If these are rejected, even after the administration of gastric sedatives such as chloretone, it is useless to persist further, and the animal's strength must be maintained by the employment of nutrient enemata or nutrient suppositories. Nutrient enemata may be composed of peptonized milk or peptonized beef-tea. Suppositories of peptonized beef are, however, the most convenient and effectual method of carrying out rectal feeding. The suppository should be carefully inserted into the rectum, and repeated every four hours. The rectum must be cleared of its contents by means of an enema of warm water every second day. Subcutaneous injections of normal saline solution are indicated as stimulants in conjunction with the above treatment. It must be admitted that in cases of gastritis, when Brand's essence of beef, and milk with soda-water, are not retained, the prognosis is very grave.

Invalid Foods.—In the secondary stages of various diseases, and during convalescence, it is necessary to prepare food in such a manner that it will tempt the patient to feed voluntarily, and also be readily digested. Here we may point out that, in renal disorders, or in cases where the patient is unable to stand up or move about, a highly nitrogenous diet is contra-indicated. We have already mentioned that such diet should not be allowed in febrile conditions. In cases where diarrhœa is a prominent symptom, meat-juices should be avoided, as they exaggerate the condition, and the same may be said in connection with disorders of the bladder and in inflammation of the urethra. Milk with lime-water is a suitable diet for such cases.

A large variety of invalid foods can be prepared by simple means, and prove useful when the febrile stage has passed, and also during convalescence. The selection of the most appropriate of these foods must be determined by the nature of the case, and also by the special fancy of the animal for certain articles of diet.

The white of an egg added to 6 or 8 ounces of milk is readily taken by some dogs.

White fish, boiled, or stewed with rice, also fish soup, made by stewing white fish in milk for some time, and then passing the material through a strainer, are often relished by sick dogs.

Beef-tea may be prepared by cutting up half a pound of raw beef and stewing it slowly for three hours in a pint of water. Various forms of meat-juices, etc., are on the market, and are found to be convenient and valuable as invalid foods. Many authorities, however, consider that the most nutritious part of beef-tea is got rid of if the product be put through a strainer, hence the home-made article is to be preferred to meat extracts, etc.

Raw meat chopped fine, or preferably scraped into fine pulp, may be allowed in small and repeated quantities, in cases where such a diet is not otherwise contra-indicated. The juice expressed from raw beef is also useful.

Rabbit jelly is often relished by the sick dog. It is pre-

pared by cutting up the body of a rabbit in small pieces, stewing in a pint of water for a few hours, straining off, and setting it aside to cool.

Amongst other foods which prove useful in the dietary of the sick dog, we may mention sheep's brains boiled in milk, boiled sweetbreads, grilled chicken's liver, Benger's food with milk, milk puddings, etc.

With regard to the employment of alcoholic stimulants in cases of weakness and debility great discretion is necessary. Much harm is done by the indiscriminate administration of whisky, brandy, port wine, etc., nausea and vomiting often occurring as a result. There are cases in which small repeated doses of brandy given in milk prove of service, but when the stomach is irritable, and vomiting occurs, it is a useless and reprehensible practice to continue the administration. We much prefer, when, owing to cardiac weakness and general prostration, stimulants are indicated, to rely on the administration of normal saline solution by subcutaneous injection. This is also very useful in cases of shock, post-operative or otherwise. For the technique of administration of this agent see p. 214.

The Surroundings of the Patient.—Good hygienic surroundings, kept at a proper temperature, are essential in the treatment of sick dogs. The canine infirmary should be thoroughly equipped for this purpose, with arrangements for heating, so that in cold weather the temperature may be kept at about 60° F. A moderate temperature is best, and the body should be suitably clothed, so as to keep the patient comfortably warm. It is a mistake to have the apartment too hot. Proper ventilation, with the avoidance of draughts, is very important.

It is hardly necessary to remark that sick house-dogs, accustomed to every luxury, cannot be expected to make good recoveries if treated in cold, draughty kennels. The importance of this subject is now well recognized, and practitioners who specialize in canine medicine find it essential to fit up an infirmary on the most approved principles.

When the patient has to be treated at home, a well-

ventilated room should be selected, free from draughts, and kept at a proper temperature. The box or basket for the patient to sleep or rest in should be raised from the floor, and not placed close to the fire. The floor of the room may be covered by sheets of brown paper, and on these pine sawdust can be sprinkled, so as to keep the apartment in a sanitary condition.

There are conditions characterized by collapse or shock, in which a high temperature of the surroundings is essential. This should be supplemented by warm clothing and placing hot-water bottles close to the patient.

Clothing.—Suitable clothing is necessary in the fine-coated breeds of dogs, especially in cases of respiratory affections and distemper. The weight of the covering is to be regulated according to the weather and the nature of the case. A jacket made of flannel or of Gamgee wool can be easily made to fit closely over the body, without causing the animal any inconvenience or discomfort.

During convalescence it is necessary to remove the clothing gradually, so as to avoid any danger of a chill resulting.

Bedding.—In the case of small dogs, a shallow basket containing a cushion is to be preferred. The cushion should be covered by a towel, and the latter is to be changed daily. For large dogs a wide bench, raised a few inches from the floor, should be provided, and for bedding pine shavings are preferable to hay or straw. Wood fibre is also useful for this purpose. Hay makes a more comfortable bed than straw. Whichever bedding is used, it should be changed at proper intervals.

General Care of the Patient.—There are many minor details in connection with the nursing of the sick dog which are essential in order to render the animal comfortable, and to prevent the occurrence of troublesome sequelæ. Although we advocate careful attention to these matters, we must at the same time point out the evils of meddlesome interference, as many owners of dogs have a tendency to annoy the patient by 'over-nursing,' and thus interfere with rest and sleep, which are important aids to recovery.

The eyes should be cleansed with a weak lotion of boric acid, and the mouth and teeth washed with a solution of peroxide of hydrogen. In cases where forced feeding is resorted to, the lips and teeth, especially the molar teeth, should be thoroughly cleansed, after feeding, with a weak solution of Condy's fluid, or with solution of peroxide of hydrogen. In cases of distemper these precautions are of special importance. The anus and prepuce should also be cleansed at proper intervals. The ears often require care, especially in distemper cases, as they may become attacked by catarrh or an eczematous eruption. Parasites in the ear often become prolific, and cause much irritation when the system is weakened by distemper.

In cases of paraplegia or other nervous affections, and in extreme weakness, it is necessary to direct attention to the condition of the bladder, so that distension of this organ may be recognized and relieved by the use of the catheter. In many of such cases, if the patient be held in the natural position for micturition, and very gentle pressure be applied to the region of the bladder, urination will take place. Some dogs of clean habits will not urinate if confined in a small kennel; hence, they should be placed on the floor for a few minutes at proper intervals, care being taken to avoid chills.

In cases of paraplegia, or in instances where the animal is unable to assume the standing posture, the tail, anus, quarters, and hind limbs, should be kept thoroughly clean. It is also necessary to change the patient from side to side at proper intervals.

Careful nursing includes more than the feeding of the patient. The trained attendant should be able to recognize the occurrence of unfavourable symptoms, and of conditions requiring the immediate attendance of the practitioner.

Sick dogs should not be washed all over, as serious consequences readily result owing to the occurrence of chills. The patient's coat should be kept clean by careful brushing, and if fleas be present an insecticide powder should be applied to the skin.

Exercise.—This should on no account be permitted in distemper, and must be very limited in cases showing vomiting and diarrhœa. Many cases in the convalescent stage of distemper suffer from serious relapses owing to being exercised or permitted to run about too soon, more especially in cold weather. Owners of dogs are often very careless in this respect.

The Care, Management, and Nursing, of Sick Cats.

The remarks on the management of the sick dog are also applicable to the sick cat.

The cat, however, being a far more highly nervous animal than the dog, is much more difficult to handle unless one acts intelligently and gently with it. Rough usage will be forcibly resented, but with patience and gentle but firm handling, the cat is the easiest animal to administer medicine or nourishment to. It is generally a maligned animal because it is not understood by those who adopt coarse methods. 'Force begets force' is not only a law in physics, but also in Nature. This is very noticeable in the cat. Therefore, the more gentle one is in the examination of this animal, or in the administration of medicine (which should preferably be in the form of pill, capsule, tablet, or powder) and of liquid nourishment, the greater the success one will have.

Sick cats usually prefer great warmth (unless when suffering from gastric or intestinal diseases, when they generally lie in cold and hard places), sunshine, and obscurity; therefore it is preferable to confine them in suitable kennels free from draughts rather than to allow them their liberty in a large room.

Nauseous or bulky medicaments and large amounts of nourishment should not be forced on a sick cat. In the case of absolute abstinence from food for several days, boiled milk or Brand's essence of beef should be given in small and repeated quantities, taking care to observe that the pharynx is not paralyzed, as such may occur in the case of diphtheria.*

* In cases of paralysis of the pharynx, liquid foods or medicines should be administered through a rubber stomach-tube. A suitable gag

The liquid should be allowed to trickle from the spoon into the angle of the mouth, the head being gently held somewhat obliquely, so that the fluid can gravitate between the molars into the mouth and then be swallowed. The mouth should not be opened during the procedure—an error that is usually committed; this brings on resentment and protrusion of the claws.

A heap of sawdust, granulated peat, or gardener's tan, or even dry mould, should be put into a tray for the animal to defæcate or urinate in.

Codliver-oil, fat, and iron compounds, should not be given in cases where there is loss of appetite, catarrh of the stomach or intestine, or in febrile maladies.

The Care, Management, and Nursing, of Sick Birds.

The veterinary surgeon is often asked to prescribe for sick birds when these are of marked commercial or sentimental value. Hence it is necessary for him to be acquainted with the care and management of avian patients as well as with the pathology, diagnosis, and therapeutics, of bird diseases. This subject has been greatly neglected by the veterinary practitioner, with the result that bird fanciers having no knowledge of medicine are often regarded as authorities and consulted on avian ailments. It is quite true that, in order to treat the diseases of birds in a rational and successful manner, special attention must be devoted to the subject, and it cannot be expected that the general practitioner can be as skilful as the specialist who devotes much time and thought to the study of avian diseases. But there is no reason why the veterinary surgeon should not be competent to diagnose and treat the common affections of birds, if he has sufficient energy to study the subject, to make post-mortem examinations, and to use his power of observation.

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is employed to keep the mouth open, and the tube should then be gently passed down the œsophagus into the stomach. A funnel is fixed to the proximal end of the tube, and the fluid in small amounts is slowly poured in.

From the commercial aspect, the diseases of poultry are of vast importance in the present day, and offer a wide field of usefulness for the practitioner. Then we have the diseases of cage birds, a department in which there are many opportunities for observation and research. Owing to the advent of motor traction and the rapid decline of equine practice, it is essential that veterinary surgeons should embrace every opportunity of adding to their sphere of utility. Those who devote attention to avian medicine find that the fees are remunerative, and it is quite apparent that the members of the profession have permitted empirics to annex a useful source of income owing to the apathy displayed with reference to this matter. Here we can only afford space to consider an outline of the subject. Further information will be found in Part III. (Special Therapeutics) of this work, and also in 'A System of Veterinary Medicine.' In the latter the most important diseases of birds are fully discussed.

The general principles laid down for the management of sick dogs and cats are in the main applicable for sick birds. We must point out, however, that the normal dietary and habits of birds vary according to the species or genus. Thus, graminivorous birds, including domestic poultry, game-birds, and the finches, such as the canary, although living chiefly on grain, are generally omnivorous. Pigeons, poultry, and game-birds, swallow their grain whole; but the finches decorticate it prior to swallowing. In the case of sick birds of this class, the grain may be given boiled either in whey, milk, water, or in a liquor containing flesh. Scalded granulated dog biscuit may also be offered.

Sick birds of the insectivorous class should be offered live meal-worms, well-cleansed maggots, or other larvæ or insects, especially spiders. Many of them will partake of banana, orange, pear, or other ripe and luscious fruit.

In the case of carnivorous birds when sick, scalded granulated dog biscuit and scraped raw meat are useful; also freshly killed mice, unskinned, but ripped open, are often relished.

Some sick birds are fond of honey, honey and milk com-

bined, or even condensed milk. Many relish scalded currants, raisins, prunes, or even fresh grapes. Milk or whey may be given *ad lib.* instead of plain water.

Sick parrots frequently refuse all kinds of food in spite of coaxing. In such cases it may be imperative to feed them forcibly with small and repeated quantities of sweetened boiled milk or condensed milk, or even Brand's essence of beef.

For canaries or other small birds, portions of sponge-cake moistened with sherry or other alcoholic stimulant may be offered. In some instances a hard-boiled egg may readily be relished when all other food is refused. Lettuce, water-cress, groundsel, cabbage, and other vegetable food, should be placed within reach of the patient.

In some birds, food made into pellets or enclosed in capsules may be gently forced down the throat. Of course, this method is out of the question in the case of parrots and small cage birds.

Here we may point out that the seed-eating finches cannot live many hours (twenty-four to thirty-six) without food. Flesh-eating birds may abstain from food for many days, even for a week, without a fatal result. Parrots and poultry come midway between these two classes as regards capability of abstaining from food. Fruit-eating birds can last a little longer without food than the seed-eating variety. The smaller the bird, the sooner it is likely to perish from want of nourishment.

Sick birds should be kept in a warm, dry place or in a cage. In many instances they are much benefited by the apartment being kept at a high temperature by artificial heat. Birds can withstand a much higher temperature than could be supported by man or by domestic animals. No doubt this depends on the fact that birds in general have normally a much higher internal temperature than mammalia. Small birds in a state of collapse from chill, egg-binding, etc., often rapidly recover if wrapped in a piece of flannel and exposed to a high temperature.

Birds should be kept out of draughts, and during the

cooler months of the year should be placed at proper intervals in a genial sunshine.

Carnivorous birds ought now and again to be allowed as prey furred animals, such as mice. Although the skins are vomited, yet experience teaches that such dietary plays a useful part in the economy of this species. Graminivorous birds require pebbles, broken china, granulated flint, or broken oyster-shells, in order that gastric digestion may be carried out in a normal manner. Many birds die when denied access to this material, as it is necessary for the trituration of grain in the gizzard. For further details on these points the reader is referred to Part III., and also to 'A System of Veterinary Medicine,' vol. ii., p. 514.

Stimulants are sometimes necessary in the treatment of avian diseases. Small quantities of sherry, brandy, or other alcoholic fluids, may be given in the food or in the drinking water.

With reference to the administration of medicines to birds, see p. 191.

Absolute cleanliness of cages, drinking utensils, etc., is essential for birds both in health and in disease. It must be remembered that birds in a state of nature lead the most sanitary lives.

Poultry should be fed out of high troughs, which can be thoroughly cleansed by boiling water. The practice of sprinkling their food on the ground must be condemned, as it may lead to infection derived from excreta containing coccidia, parasitic larvæ, or pathogenic micro-organisms.

(For the Care and Management of Sick Sheep and Pigs, see Part III.)

CHAPTER IV

THE ACTIONS AND USES OF DRUGS

It is desirable to have a clear perception of the manner in which drugs exert a favourable action on the course of a disease, and assist in bringing about the recovery of the patient. The so-called 'specifics' for certain affections are diminishing in number as our knowledge increases with reference to the actions of drugs, and to the morbid changes produced by disease. In selecting a medicinal agent for the treatment of a case, rational therapeutics demands that we should be aware of the effects which it is likely to produce, and also know the alterations in structure and function present as the result of the disease, so that by administering the drug we may hope to assist the natural powers of recovery. Unfortunately, the science of pharmacology has not yet reached such a stage that we can say we are in possession of a full and definite knowledge of the action of drugs, while there is still much to be learned with reference to pathology. Hence, even in the treatment of simple diseases there still exists an element of uncertainty as to the real part which drugs take in bringing about recovery, and also as regards the superiority of one line of treatment over another. The thoughtful practitioner becomes sceptical as to many of the virtues attached to drugs, and the more experience he gains the more likely he is to challenge the dogmas associated with orthodox therapeutics. To such an extent have fallacies in connection with the value of drugs been exposed, that in the present day the number of

medicinal agents regarded as really useful is considerably reduced.

Formerly in works on materia medica and therapeutics, many pages were devoted to the consideration of the actions and uses of a large number of drugs, which in the light of modern knowledge have been superseded and are regarded as useless. Many of these agents, owing to mistaken ideas of pathology and imaginary conceptions as regards our power and influence over the course and progress of diseases, were prescribed, and successful results were claimed without good reason, for in several instances, instead of promoting recovery, they retarded it.

Each decade shows more prominently that, although the number of new drugs introduced is enormous, the scientific practitioner finds the list of medicinal agents really useful for his needs is a very limited one. Moreover, as already remarked, he is aware of the part played by the *vis medicatrix naturæ* in the successful results of his cases, and recognizes the value of hygiene and dietetics in therapeutics; while it seems highly probable that vaccine-therapy will in the future supersede treatment by drugs to a large extent.

It is quite evident that, as our knowledge of the action of drugs and of pathology increases, marked changes will follow in therapeutics. A careful study of morbid anatomy leads us to consider seriously the problem of how many of the lauded remedies really exert beneficial effects. Too frequently there is a tendency to follow routine methods and employ set prescriptions for the treatment of stated diseases, instead of adopting therapeutical measures according to the indications furnished by each case.

On the other hand, we must remember that, however useful the science of pharmacology may be, it does not always follow, because a drug exerts certain actions in the healthy animal, that it is capable of producing beneficial results in a case of disease. Its value must be tested clinically on a large number of cases before correct deductions can be obtained. Hence the necessity for the alliance of the pharmacologist, the pathologist, and the clinician, in the attempts made

to render therapeutics both scientific and useful. Pharmacology may be extensively studied by the specialist who devotes a lifetime to it, but without clinical experience he may not be able to treat a case of disease, or, in other words, to apply his knowledge of the action of drugs to therapeutics.

In studying the actions of a drug it is advisable to adopt a more or less definite plan regarding—(1) Its local action on the skin and mucous membranes; (2) its action on the stomach and intestines prior to its absorption into the system; (3) its specific action—*i.e.*, the effect which, after reaching the blood, the drug may produce on special tissues or organs, or the alterations it may induce in the blood itself. Some drugs show a predilection for certain tissues or organs—*e.g.*, strychnine affects certain regions in the spinal cord, eserine has a special action on the muscular coat of the stomach and intestines, etc.; (4) its remote local action—*i.e.*, the effects produced by it on the excretory organs during the elimination of the drug from the system.

Circumstances modifying the Action of Drugs.

As already remarked, the actions of drugs have been ascertained by experiments on animals. Certain facts have been established, but there are many matters on which marked differences of opinion still exist.

From a therapeutical point of view we accept a number of broad statements with reference to the actions of the drugs we employ; and having tested these agents clinically, we regard them as useful in the treatment of certain diseases. But there are circumstances and conditions that exert a modifying influence on the action of drugs, and with these it is necessary for the student to be acquainted, so that he may prescribe remedies in a safe and effectual manner.

1. The Mode of Administration.

Drugs administered directly into the blood-stream act more rapidly than by any other mode of administration; moreover, smaller doses suffice. This is exemplified by

intravenous injection (see p. 185), which is adopted in the case of certain drugs for therapeutical purposes. In this method a solution of the drug is injected into the jugular vein.

Hypodermic or Subcutaneous Injection is also a rapid mode of administering certain medicinal agents (see p. 185). They are quickly absorbed from the capillaries and lymphatics of the subcutaneous tissue, and enter the blood. Smaller doses than those administered by the mouth exert their specific action when given hypodermically.

By the Mouth.—Drugs administered either in the liquid or solid form are absorbed by the vessels of the gastro-intestinal mucosa and enter the blood. It is a doubtful matter whether absorption occurs in the stomach of the horse, but in the small intestine it is very active. The rapidity of absorption depends on the nature of the drug, the form in which it is administered, and the condition of the stomach and intestines. If given in the solid form, and if the alimentary canal contains a large amount of ingesta, absorption will be slow and the general effects somewhat uncertain.

By the Respiratory Tract.—(1) By 'inhalation,' absorption is very active and rapid, as is exemplified by the inhalation of chloroform or ether for anæsthetic purposes; (2) by 'intratracheal injections'—*i.e.*, the injection of solutions of certain drugs slowly into the trachea (see p. 186).

By the Peritoneum.—Drugs administered by intra-peritoneal injection become rapidly absorbed (see p. 186).

By the Skin absorption is slow and uncertain. Examples of this mode of action are seen in the effects produced by the application of ointments containing drugs such as mercury, cantharides, iodoform, etc., also from the use of dressings containing carbolic acid or coal-tar products.

If the epidermis be removed, absorption takes place more actively. In veterinary practice this mode of administration is not employed, as applications to the skin are only intended to produce a local action. When, however, ointments or dressings containing too large a proportion of the

agents mentioned are used, or if preparations of ordinary strength be applied over too extensive a surface of the skin, toxic symptoms will develop.

By the Rectum.—Solutions of active drugs administered in the form of enema are comparatively slowly absorbed. When chloral hydrate is given in this manner, it takes about one hour to produce sedative effects.

2. The Species of Animal.

Owing to anatomical and physiological differences in the nervous, digestive, and cutaneous systems of the horse, ox, and dog, the actions of many medicinal agents on these animals are not uniform. Hence it is necessary to study the effects of the various drugs on these different species.

In the Horse emetics do not induce vomiting, the explanation being, according to some authors, that the vomiting centre is not developed in this animal. In consequence of the large extent and volume of the intestines in the horse, ordinary purgatives take a considerable time to act; and unless the animal be suitably prepared by feeding on laxative diet, an ordinary dose of aloes may produce no cathartic effect. Saline purgatives, such as Epsom or Glauber's salts, are very erratic in their action on this animal, even when administered in large doses. Opium or morphine often fail to exert sedative effects, and, if given in full or repeated doses, produce nervous excitement, delirium, and a tendency to walk in a circular direction, these actions probably depending on the higher development of the spinal cord as compared with the cerebrum in the equine species. Diaphoretics have little or no action on the skin of the horse.

Cattle require large doses of most drugs. Medicinal agents administered by the mouth act slowly owing to the fact that they have to reach the fourth division of the stomach (abomasum) before absorption begins. The large amount of ingesta present in the rumen tends to interfere with the action of drugs, while derangement of one division of the stomach is soon followed by inertia of the remaining com-

partments. Owing to the dull, lymphatic temperament of these animals, large doses of stimulants and of agents such as nux vomica are tolerated.

Dogs are very susceptible to the action of purgatives and emetics, the mucosa of the stomach and intestines being highly sensitive. The nervous system is well developed, and hence is readily acted on by sedatives, narcotics, and agents such as nux vomica.

3. The Influence of Age and Size.

Young animals are more susceptible to the action of drugs than adults. In old animals the vital organs become weakened and impaired, hence ordinary doses may exert too energetic an effect.

Animals of the same species vary in size, especially in the case of dogs, so that the doses must be regulated accordingly. In canine practice the weight of the patient must be taken into consideration.

4. The Effect of Diseases.

Alterations of the structure and function of any organ influence the action of drugs. Thus, in the horse, in cases of impaction of the stomach, medicinal agents administered by the mouth produce no effect. Similar remarks apply to cases of acute gastric tympany in this animal. In such instances the normal gastric movements are absent, and the drugs administered do not reach the intestines. In impaction of the colon with paralysis of its walls, purgatives such as aloes fail to act, and it is necessary to rely on the hypodermic injection of agents such as eserine or arecoline, in order to stimulate peristaltic action by causing contractions of the muscular coat of the bowel. In acute enteritis large doses of sedatives or anodynes may fail to relieve the pain, even when administered by hypodermic injection. In acute inflammation of the brain and its membranes, very large doses of sedatives may produce little or no effect on the convulsions present.

In debilitating affections such as influenza, the alimentary canal is very sensitive to the action of purgatives, and a moderate dose of aloes may produce serious effects, such as superpurgation.

In the gastric affections of cattle which are accompanied by atony of the muscular walls of the various compartments of the stomach, very large doses of Epsom salt do not induce purgation.

5. The Dose.

The amount of a drug administered has a material effect on its action. Thus, small repeated doses of Epsom salt produce a laxative, febrifuge, and diuretic action, while in a full dose it acts as a purgative, especially in cattle; but its action in this respect is uncertain in the horse.

Many drugs, if administered in a judicious manner, are safe and effectual, but if given in excessive doses poisonous effects will result. The *physiological* action of a drug signifies the marked and distinct effect in the patient which results from the administration of full doses. This is exemplified by the muscular twitching produced by full doses of strychnine, the gastric irritation and conjunctivitis caused by the continued administration of arsenic, and the phenomena of iodism brought about by repeated full doses of iodine or its compounds.

H. Gray has observed that in the dog a single large dose of arsenic is less likely to cause poisonous effects than repeated dosage with smaller amounts, as in the former instance the drug is got rid of by the vomiting which it produces.

In therapeutics, as a rule, we do not desire to induce the physiological action of a drug; but there are occasions on which beneficial results will not be obtained until the administration of the medicinal agent is pushed to its limits. As examples the following may be cited: Strychnine in the treatment of various forms of paralysis, potassium iodide in cases of actinomycosis or botriomycosis, and arsenic in trypanosomiasis.

6. Frequency, Toleration, Habit, Accumulation.

Frequency.—When the administration of a drug is repeated at frequent intervals the effect is to continue its action.

Toleration and Habit.—Certain medicinal agents if administered for a period of time in gradually increasing doses lose their effect on the system, or, in other words, the animal acquires a tolerance to such agents. Thus, arsenic if given in this fashion does not cause poisonous effects, even in doses that would prove toxic if given at first. Again, dogs with a tendency to constipation, when treated with frequent doses of agents such as castor-oil, acquire a tolerance to the drug, so that after a time ordinary amounts produce no laxative effect.

Accumulation.—Certain drugs are said to be *cumulative* in their action—*i.e.*, small doses constantly repeated may show no injurious effects for a time; then suddenly their physiological action is manifested in a marked or even dangerous degree. This phenomenon is believed to depend on accelerated absorption or on deficient excretion, or both. Cumulation is observed in connection with digitalis, mercury, strychnine, iodides, and lead.

7. Idiosyncrasy.

Some animals possess a peculiar susceptibility, others a resistance, to the action of certain drugs, so that ordinary doses produce severe and well-marked effects in one individual, while in another of the same species little or no action is observed. This is termed 'idiosyncrasy,' and not infrequently it is a source of trouble to the therapeutist. Examples are found in the case of aloes, which in an ordinary dose may, in spite of all precautions, induce superpurgation in one horse, while it may fail to act in another.

Again, the application of an ordinary blister may occasionally cause marked irritation and constitutional disturbance. Some animals show a marked susceptibility to the action of strychnine. Occasionally we find that in the horse 1 ounce of chloral hydrate will produce a staggering gait and

a sleepy condition, while in other instances no perceptible effect is produced. Idiosyncrasy in most instances cannot be explained; but on occasions it will be found that the condition may depend on alterations in the amounts of active constituents contained in certain drugs, or on deterioration of the latter due to long keeping (apparent idiosyncrasy). Again, cumulation, depending on deficient excretion such as occurs in renal disease, may account for idiosyncrasy.

8. The Effect of Climate and Surroundings.

Narcotics act quicker in hot than in cold climates. Anæsthetics produce their effects more rapidly in hot weather than in cold; and grass-fed animals are more quickly brought under the influence of chloroform than those that are stable-fed and in hard condition. Ill-fed, overworked horses kept in badly ventilated stables are more susceptible to the action of drugs than those subject to opposite conditions.

Horses in Scotland require larger does of aloes than those in England and Ireland.

CHAPTER V

THE ACTIONS AND USES OF DRUGS (*Continued*)

DRUGS may be classified according to their effect on the organs and functions of the body, as follows:

Drugs acting on the Mouth and Salivary Glands.

Sialagogues increase the secretion of saliva.

Aromatic bitters, dilute mineral acids, etc., acting in a reflex manner through the sensory nerves of the mouth, act as sialagogues.

Specific Sialagogues stimulate the terminations of the nerves in the salivary glands, and cause an increased flow of saliva by whatever channel they enter the system.

Examples.—Pilocarpine, physostigmine, nicotine.

Certain drugs, such as potassium iodide and mercury, act as sialagogues, by acting both reflexly on the sensory nerves of the mouth, and, after absorption, by stimulating the secretory nerves of the salivary glands during excretion from the body.

Some emetics, such as antimony and ipecacuanha, also increase the flow of saliva in carnivora.

Antisialics diminish the secretion of saliva.

When salivation depends on an irritated condition of the buccal mucous membrane, substances such as chlorate of potash and borax reduce the abnormal irritability and act as antisialics.

SPECIFIC ANTISIALICS act by depressing or paralyzing the terminations of the secretory nerves.

Example.—Belladonna and its active principle atropine.

Demulcents are substances of a mucilaginous nature, which have the property of protecting mucous membranes when irritated or inflamed from any cause

Examples.—Syrups, honey, gums, glycerin, linseed-tea, etc.

Drugs acting on the Stomach.

1. Agents influencing the Flow of Gastric Juice.

Alkaline Stomachics lessen the flow of gastric juice when administered before feeding. They are represented by alkalies such as bicarbonate of soda. Formerly, alkalies were believed to increase gastric secretion when given before feeding, but experiments have shown this view to be erroneous.

Digestive Adjuvants assist digestion, and are employed when the constituents of the gastric juice are deficient.

Examples. — Dilute hydrochloric acid and pepsin, administered with the food or after feeding.

2. Agents influencing the Nerves of the Stomach and the Gastric Circulation.

Gastric Stimulants. — These increase the sensibility of the gastric nerves, stimulate both the local and the general circulation, cause an augmented flow of blood through the gastric vessels, increase the activity of the glands, and promote appetite.

Examples.—Vegetable bitters, such as gentian, ginger, calumba, etc., and preparations of these agents; also nux vomica, alcohol.

Gastric Sedatives reduce the sensibility of the gastric nerves.

Examples.—Opium, belladonna, bismuth, chloretone, and dilute hydrocyanic acid.

Gastric Astringents depress the local gastric circulation, and are indirectly gastric sedatives.

Examples.—Opium, lead, tannic acid, etc.

3. Agents influencing the Movements of the Stomach.

Gastric or Stomachic Tonics.—These, by increasing the acidity of the chyme, stimulate the movements of the stomach.

Examples.—Dilute mineral acids—viz., hydrochloric, nitric, and nitro-hydrochloric acids.

Nervo-Muscular Gastric Stimulants.—These impart tone to the gastric nerves, restore impaired nerve power, and stimulate the movements of the stomach.

Examples.—Nux vomica and its active principle, strychnine.

4. Agents influencing the Condition of the Contents of the Stomach.

Antacids correct excessive acidity of the ingesta, and are administered after feeding.

Examples.—Alkalies, such as the bicarbonates of soda and potassium, carbonate of magnesia, lime-water.

Gastric Disinfectants.—These are employed to correct decomposition in the contents of the stomach, to prevent the formation of gases, and to neutralize and cause expulsion of the latter when present.

Examples.—Carbolic acid, salicylic acid, cyllin, formalin, oil of turpentine, terebene, creosote, thymol.

Emetics.—Emetics are agents which produce vomiting when administered. In consequence of physiological peculiarities the normal horse does not possess the power of vomition; hence, emetics produce no effect on this animal. Similar remarks apply to the ruminant. Vomiting is very readily induced in the dog. Many drugs exert an emetic action if given in excess of the usual doses. Emetics are of two classes:

1. Direct, Peripheral, or Local Emetics act by irritation of the nerves of the pharynx and stomach, vomiting being produced in a reflex manner.

Examples.—Sulphate of zinc, from 10 to 15 grains in 2 ounces of tepid water; a teaspoonful each of common salt and mustard in 3 ounces of tepid water; ipecacuanha, sul-

phate of copper. With regard to tartar emetic, there is a difference of opinion as to whether it should be classed as a direct or an indirect emetic. According to Dixon, there is no evidence sufficiently satisfactory to place it amongst the central emetics.

2. General, Central, or Indirect Emetics produce emesis by stimulating the vomiting centre through the medium of the blood, and act in this manner by whatever channel they enter the system.

Example.—Apomorphine injected hypodermically in a dose of from $\frac{1}{20}$ to $\frac{1}{10}$ of a grain is the quickest and most effectual emetic, and is invaluable in cases of irritant poisoning, as it promptly expels the contents of the stomach.

Indirect emetics produce a greater degree of nausea and depression than local emetics. They stimulate the respiratory centre, promote expectoration in the early stages of bronchitis, and, by the expiratory effects produced, tend to clear the bronchial tubes of the inflammatory products interfering with respiration.

Indirect emetics are also employed to overcome engorgement of the stomach in the dog, and to cause expulsion of foreign bodies from the cervical portion of the œsophagus.

Anti-Emetics arrest or prevent emesis and relieve nausea.

Examples.—Chloral, opium, etc., which reduce the irritability of the vomiting centre. Bismuth, chloretone, dilute hydrocyanic acid, and dilute alkalies, such as lime-water, which act as sedatives to the afferent nerves of the stomach.

Drugs acting on the Intestines.

Purgatives or **Cathartics** cause evacuation of the intestinal contents. Formerly purgatives were believed to act in two chief ways—viz., (1) by increasing the peristaltic movements of the intestines and inhibiting the absorption of liquid; (2) by increasing the secretion of fluid from the intestinal walls. In recent years experiments have demonstrated that we must considerably modify our views with reference to the stimulant action of vegetable cathartics on the secretory glands of the intestine, and also in connection

with the action of saline purgatives. Although the vegetable purgatives produce catharsis chiefly by increasing peristalsis, yet they also induce an increase of fluid in the fæces. This latter effect is now believed to depend on the increased peristaltic action, which accelerates the passage of the intestinal contents, including the secretions, so that absorption does not take place. According to Dixon, the increased peristalsis is caused by direct irritation of the intestines. A minute amount of the drug is taken up by the epithelial cells, and acts as a strong stimulus to the peripheral sensory nerve-endings in these cells. A local reflex results through the nerve cells in Auerbach's plexus, and leads to increased peristalsis, and little, if any, of the drug is absorbed into the system. Certain agents, however, if injected subcutaneously or intravenously, act as purgatives by increasing peristalsis.

With reference to saline purgatives, their action is brought about by an increase in the amount of liquid in the alimentary canal: distension of the bowel is produced, and results in a moderate increase of peristalsis. Formerly saline purgatives were believed to act by causing increased secretion from the intestines, while, owing to the low diffusibility of the agents, the absorption of the secreted fluid was impeded. It is now held that the increased amount of fluid is derived by osmosis—*i.e.*, by withdrawing water from the blood and surrounding tissues through the medium of the intestinal wall. Experiments show that the fluid is not an exudation from the vessels. Owing to the presence of the salts in the intestine, absorption is prevented. The purgative effect of saline agents is in proportion to the rapidity of their absorption. Magnesium sulphate is slowly absorbed, and hence exerts marked osmotic effects; but, as already remarked, it is uncertain in its action on horses.

Various attempts have been made to classify purgatives, but an ideal classification has not yet been discovered. The following groups have been recognized by many authors; *Simple* or *Ordinary Purgatives*, *Laxatives*, *Drastic Purgatives*, and *Saline Purgatives*.

It must be remembered that large doses of a laxative will produce purgation, while an excessive dose of an ordinary purgative will induce a drastic action. Raw linseed-oil, which is generally regarded as a simple and safe aperient, may in full and repeated doses cause superpurgation in some horses.

Simple or **Ordinary Purgatives** are represented by aloes, full doses of castor-oil, and raw linseed-oil. They produce frequent, softened, or fluid evacuations. As already remarked, the purgative effect does not depend on stimulation of the secretory glands of the intestine, but is due to increased peristalsis and inhibition of absorption. Aloes is the purgative agent usually selected for the horse, and, provided special precautions be taken, it is tolerably safe in many instances. Even in horses suitably prepared it is slow in its action, seldom producing effects before ten or twelve hours. Raw linseed-oil is largely used as a mild aperient, but is unsuitable for producing full purgative effects, being uncertain in its action. Castor-oil is seldom given to adult horses, but is a valuable purgative for foals. It is largely employed in canine practice.

Laxatives render the intestinal contents soft in consistency and promote the action of the bowels. As examples, small doses of raw linseed-oil or of Epsom salt may be mentioned. Roots and green food have a similar effect. For dogs, preparations of cascara act as useful laxatives, also white vaseline oil.

Drastic Purgatives are represented by croton-oil, podophyllin, gamboge, elaterium, eserine, arecoline, and barium chloride. They stimulate the muscular coat of the intestine, and cause energetic intestinal contractions with griping pains. In large doses they induce an inflammatory transudation from the intestine, and may even bring about enteritis. These agents require careful discrimination in their employment and in dosage. Eserine and arecoline are largely employed in equine practice in the treatment of impaction of the colon associated with paralysis of its walls. Croton-oil is seldom prescribed in the present day for horses, and

similar remarks apply to podophyllin, gamboge, and elaterium. Barium chloride must be regarded as a dangerous agent, although sometimes giving good results.

In canine practice drastic carthartics should be avoided.

Hydragogue Purgatives.—This term is sometimes applied to cathartics which produce copious fluid dejecta. Elaterium, gamboge, and large doses of Epsom or Glauber's salt, have this effect in cattle and dogs.

Cholagogue Purgatives.—See p. 138.

Saline Purgatives.—These are represented by Epsom salt and Glauber's salt. Their mode of action has been already explained (see p. 133). Saline cathartics act in an uncertain manner in the horse, but are largely employed in ruminants. They are not suitable in canine practice, and are likely to produce vomition. In administering saline cathartics to ruminants, the agents should be dissolved in a large amount of water, and a pound of treacle should be added; also a carminative, such as 1 ounce of powdered ginger. Purgation generally takes place in from twelve to sixteen hours.

The General Effects of Purgatives.

In addition to causing evacuation of fæces, bile, and deleterious substances, such as the products of imperfect digestion, etc., purgatives lower the blood-pressure by withdrawing fluid from the system and by relieving pressure in the abdominal veins. In acute congestion of the brain, an active cathartic relieves the cerebral blood-pressure by causing an increased flow of blood to the intestinal vessels.

Drastic cathartics in large doses may exert a secondary action—viz., in a reflex manner they may induce uterine contractions, and thus bring about abortion in a pregnant animal.

Here we may remark that it is not desirable in the case of vegetable purgatives for absorption to occur. When such takes place, as in the case of aloes, free purgation does not follow, and marked nausea and depression result.

Uses of Purgatives.

(*a*) In cases where the action of the intestines is sluggish, purgatives are useful to expel excrementitious material retained in the intestinal canal.

(*b*) To clear out bile and the products of imperfect digestion from the intestine.

(*c*) In cerebral disorders to relieve blood-pressure in the brain by directing a flow of blood to the intestinal vessels.

(*d*) In azoturia and in renal affections to remove effete products from the system.

Stimulants to the Nervo-Muscular Structure of the Intestine.

Certain drugs, such as nux vomica and its active principle strychnine, stimulate the nerve-supply of the intestine, and restore nerve power when this is deficient or absent, as in cases of impaction associated with atony of the intestinal walls. This action is increased when the above agents are combined with full doses of a general stimulant, such as carbonate of ammonium. Small repeated doses of eserine, administered by subcutaneous injection, have a similar action.

Sedatives to the Nervo-Muscular Structure of the Intestine.

These inhibit the peristaltic movements of the bowels and check intestinal secretion.

Examples.—Opium and its preparations.

Intestinal Astringents.—These agents limit the action of the bowels and correct excessive fluidity of the intestinal contents.

These effects are produced in different ways. Some act as vascular astringents by contracting the walls of the intestinal bloodvessels and lessening the amount of fluid excreted.

Examples.—Dilute mineral acids and metallic salts.

Others lessen peristaltic movements of the intestine.

Examples.—Opium and its preparations.

Antacids, such as prepared chalk, check excessive action of the intestines by diminishing the acidity of the ingesta.

Bismuth reduces the irritability of the intestinal mucous membrane and gives it a protective coating.

Catechu and substances containing tannin cause coagulation of albumin and contraction of the small bloodvessels of the mucous membrane, and thus arrest discharges of mucus and blood.

The chief uses of intestinal astringents are in the treatment of diarrhœa, superpurgation, and dysentery.

Intestinal Antiseptics or Disinfectants.—These agents prevent undue fermentation, and are believed to diminish the activity and virulence of bacteria in the intestine. They are sometimes prescribed in cases of diarrhœa, dysentery, and allied conditions thought to depend on the presence of pathogenic bacteria.

Oil of turpentine, terebene, oil of eucalyptus, carbolic acid, cyllin, naphthalin, creosote, etc., are examples of intestinal antiseptics usually employed. Small doses of calomel possess a similar action.

Carminatives assist in the expulsion of gases from the stomach and intestines. These gases usually arise from excessive fermentation of the ingesta, depending on interference with normal digestion.

Carminatives tend to produce a healthy action of the muscular coat of the stomach and intestines. They also lessen spasm and pain depending on irregular or spasmodic contraction of the stomach or intestines. By removing flatus pain is also relieved, as the distension arising from the presence of gases causes pain and distress. In tympanites of the stomach, carminatives lessen the contraction of the pyloric orifice and allow the gases to escape. Carminatives may thus be regarded as belonging to a class of drugs termed 'antispasmodics' (see p. 153).

Aromatic oils, oil of turpentine, terebene, alcohol, sweet spirit of nitre, spirit of chloroform, etc., are examples of carminatives. Preparations of ammonia neutralize carbonic acid gas, and may also be regarded as carminatives.

Agents employed to Destroy and Eradicate Parasites.

Anthelmintics are agents employed for the eradication of parasites from the alimentary canal. They include *vermicides*, which kill the parasites, and *vermifuges*, which expel them, the latter being usually of a purgative nature.

The therapeutist has also to direct measures for the eradication of parasites from other organs of the body, such as strongyles infesting the bronchi of calves and lambs (hoose), and flukes in the liver and bile-ducts of sheep, and occasionally of cattle.

Certain drugs are found to be efficacious in exterminating special parasites. Thus, for tape-worms, oil of turpentine, oil of male fern, and areca-nut, are useful. For round-worms, santonin, areca-nut, or oil of chenopodium, are employed.

For full information the reader is referred to the section on 'The Treatment of Parasitic Diseases' in Part III.

Drugs acting on the Liver.

Cholagogues increase the secretion of bile. Formerly many purgative agents were credited with being cholagogues, as following their administration an increased amount of the bile constituents occurred in the fæces; hence such drugs were termed 'cholagogue' cathartics, and were represented by calomel and saline purgatives. It is now held that such agents by increasing intestinal action prevent absorption of the bile constituents, so that the latter are found in increased amount in the fæces. The number of true cholagogues has therefore been limited, and even in these the special action on the secretion of bile is moderate. These agents are—Sodium salicylate, sodium benzoate, euonymin, podophyllin, and oil of turpentine. Nitro-muriatic acid is believed by many to possess cholagogue actions, but according to Dixon there is no proof that it acts in this manner. Bile itself (*fel bovinum*) has a marked cholagogue action, and it in-

creases the liquid and solid constituents of the bile proportionally.

In therapeutics, although cholagogues are often prescribed in a routine manner in hepatic disorders and in cases manifesting evidences of jaundice, it is not possible to offer a rational explanation with reference to the object desired in increasing the secretion of bile. Experiments have demonstrated that a slight increase of pressure inhibits the flow of bile, so that cholagogues cannot prove useful in cases of biliary obstruction.

Jaundice being a symptom which may depend on a variety of conditions, it is not surprising that the routine administration of cholagogues produces no beneficial effects on this condition. On the other hand, it is easy to understand the good effects of agents such as calomel and saline purgatives in cases where an excess of bile becomes stagnant in the small intestine, because by the action of such agents the bowel becomes flushed out, and the bile is thus removed from the system. Obviously, in extensive disease of the liver cholagogues can only exert a feeble action on the secretion of bile.

Here we may mention that the presence of bile in the intestine is essential for the full action of purgatives such as aloes, and some observers have noted that the addition of glycerin or soap subserves the action of bile in this respect.

Drugs acting on the Urinary Organs.

1. On the Kidneys.

Diuretics increase the flow of urine. Cold, by checking the secretion of the skin, acts as a diuretic. The ingestion of large amounts of water increases the secretion of urine and the excretion of nitrogen. Subcutaneous or intravenous injections of full amounts of normal saline solution cause diuresis.

It is now regarded as doubtful by some authorities whether any diuretics act by a specific effect on the renal epithelium. Three classes of diuretics are recognized :

1. Salines: These increase the fluidity of the blood, cause dilatation of the renal vessels, with a rise of venous and capillary pressure and an increased rate of blood-flow; as a result diuresis occurs.

Example.—Nitrate of potassium.

Some authors consider that the diuretic action of drugs, such as acetate of potassium, is due to the agent causing an excess of fluid in the blood without directly affecting the renal circulation, this excess being removed by the kidneys.

2. Agents which cause dilatation of the renal vessels without lowering the general blood-pressure to any material extent.

Examples.—Sweet spirit of nitre, oil of turpentine, caffeine.

The essential oils act as diuretics during their excretion from the body by the kidneys.

Oil of turpentine in excessive doses causes suppression of urine owing to intense vaso-constriction; nephritis and hæmaturia may also result.

3. Agents which only act as diuretics in certain pathological conditions, and do not cause diuresis in normal animals.

Examples.—Digitalis and strophanthus.

This action is observed when these drugs are administered in certain cases of cardiac valvular disease (especially disease of the mitral valve) which are associated with ascites and venous congestion, so that only a small amount of urine is passed daily. The result is a free secretion of urine, which depends on the drugs improving the circulation, so that the venous congestion is gradually overcome and a normal flow of arterial blood through the kidneys is re-established.

Large doses of digitalis given to a healthy animal may induce constriction of the renal vessels, so that the secretion of urine may be decreased or even inhibited.

Uses of Diuretics.—In certain renal diseases there are occasions on which it is desirable to increase the flow of urine when the functions of the kidneys are impaired. In such cases diuretics hasten the expulsion of waste products from the system, and by increasing the proportion of water they flush out the kidneys, especially when diluents are allowed freely.

In acute inflammation of the kidneys, irritating diuretics, such as oil of turpentine, are contra-indicated. In febrile disorders diuretics assist in removing the products of tissue waste. In cases of pleural effusion, hydrothorax, and ascites (abdominal dropsy), diuretics assist in removing the fluid from the tissues and serous cavities. When ascites is associated with cardiac disease, digitalis proves useful by its action in overcoming venous congestion, and also by inducing diuresis.

2. On the Bladder.

Vesical Sedatives relieve irritability of the bladder, whether depending on catarrh of the mucous membrane of this organ or other causes. They are represented by alkalies, such as bicarbonate of soda or bicarbonate of potash; also by hyoscyamus, belladonna, demulcent fluids, such as barley-water or linseed-tea. A combination of such agents is employed in cystitis (inflammation of the bladder) or in irritability of the bladder arising from any cause.

Vesical Tonics increase the muscular tone of the bladder. They are prescribed in cases of incontinence of urine (inability to retain urine in the bladder) in order to restore normal contractile power to the organ. Cantharides stimulates both the fundus and the sphincter of the bladder. Belladonna lessens the irritability of the fundus by its sedative action on the sensory nerve-endings, but does not interfere to any extent with the functions of the sphincter vesicæ. These agents are sometimes prescribed together, in order to overcome involuntary escape of urine. Strychnine is also a vesical tonic.

3. Agents exerting a Modifying Action on the Urine.

(*a*) **Those modifying the Reaction of the Urine.**—In the horse the reaction of the urine in health is alkaline, and is seldom rendered acid by disease. In the dog the reaction is acid, and excessive acidity of the urine occurs in certain morbid conditions. It is overcome by the administration of alkalies,

such as bicarbonate of soda or bicarbonate of potash, and also by acetates, citrates, or tartrates of potassium, sodium, or lithium. The organic salts, such as acetates, etc., produce this effect by being oxidized in the body and excreted as carbonates.

(*b*) **Those preventing the Deposit of Solids from the Urine or promoting their Removal.**—These deposits may occur in the form of sediment, gravel, or as a calculus, their commonest seat being in the bladder; but they may also be found in the kidney or the urethra. In the horse these deposits are composed chiefly of calcium and magnesium salts. When they occur in the form of a calculus, medicinal agents are powerless to produce any effect, and surgical measures must be employed in operable cases.

In the prevention of such conditions a sufficient supply of pure water should be allowed for drinking purposes, and in cases where urination is not carried out in a normal manner the cause should be sought for, and suitable measures adopted. Calcareous sediment in the bladder necessitates surgical interference; the organ must be flushed out with tepid water by means of a syringe and flexible catheter. Diluents such as barley-water or linseed-tea should be allowed *ad lib.*

In the dog, deposits of uric acid and acid urates sometimes occur in the bladder or urinary passages. To prevent such deposition lithium carbonate is prescribed. This agent forms a soluble salt with uric acid.

When it is desirable to render the urine acid (see below), the most effectual agent is acid sodium phosphate.

Urinary Antiseptics.—These agents prevent the multiplication of organisms in the urine and on the mucosa of the bladder and urinary passages. In cystitis associated with alkaline decomposition of the urine, the following drugs are prescribed: Benzoic acid, salicylic acid, and urotropine. All urinary antiseptics act more efficiently in an acid urine, and urotropine has little or no antiseptic action except the urine be first rendered acid by administering acid sodium phosphate (sodium dihydrogen phosphate). The pyogenic cocci and

putrefactive organisms which cause the decomposing alkaline urine in acute cystitis are inhibited in their rate of growth when the urine is rendered acid. In chronic inflammatory conditions of the bladder and urinary passages, agents such as copaiba, cubebs, oil of juniper, terebene, and buchu, are prescribed. These drugs are excreted mainly by the kidneys in combination with glycuronic acid, and during their passage through the bladder and urethra they exert an antiseptic action on the urino-genital mucosa and on the urine.

Drugs acting on the Generative Organs.

Aphrodisiacs increase sexual desire by improving general bodily vigour, and also by stimulating the spinal sexual centres. Strychnine, yohimbine, and iron, possess these actions. Yohimbine is said to increase pelvic reflexes only, and of late years has been frequently prescribed in cases of deficient sexual activity. Cantharides acts as an aphrodisiac by causing irritation of the urino-genital mucosa, but is not employed therapeutically for this purpose.

Anaphrodisiacs diminish sexual desire. They include bromide of potassium, purgatives, a low diet, increased work.

Ecbolics cause contraction of the uterus and expulsion of its contents in pregnant animals. The most important are ergot and pituitrin (pituitary extract). The latter drug is now largely employed in cases of parturition in the bitch when uterine inertia (deficient expulsive power) is present. Ergot, in the form of intramuscular injections of ergotin, is also employed in cases of post-partum hæmorrhage (bleeding from the uterine bloodvessels after parturition). The drug arrests hæmorrhage by causing contraction of the flaccid uterus. Hot water injected into the uterus also acts as a stimulant to the muscular fibres of the organ, and assists in checking hæmorrhage. Ergot in combination with stimulants is often prescribed in cases of retention of the placenta, but its efficiency in this direction is open to doubt, more especially as powdered ergot is notoriously uncertain in its action, and only standardized preparations of the drug can be relied on.

Drugs acting on the Mammary Glands.

Galactagogues.—This term is applied to agents which are believed to increase the secretion of milk, but there are no drugs which are of practical value in this respect. Jaborandi increases the secretion of milk, but only in a temporary degree, and is not employed as a galactagogue. A healthy condition of the dam and good feeding are necessary for the proper production of milk, and a liberal milk diet assists lactation in animals nursing their young.

Certain drugs administered to the dam impart to the milk either their flavour or their medicinal properties; these are exemplified by purgatives, essential oils, iodides, etc.

Agents which Check or Diminish the Secretion of Milk.—It has been held for many years that belladonna diminishes the secretion of milk, whether given internally or applied to the udder. This drug paralyzes the terminations of certain nerves, especially those supplying secretory glands, and hence is said to inhibit the secretion of milk; but some authors doubt its action in this respect. When it is desirable to hasten the 'drying of cows,' the most effectual measures are, to administer a purgative, to allow dry food, and to gradually lengthen the periods between milking. The internal administration of alum is said to prove effectual for a similar purpose.

Drugs acting on the Circulation.

1. On the Heart.

Medicinal agents influence the beat of the heart either by altering its rate or modifying the force of cardiac contraction.

The heart-beat may be slowed by agents which stimulate the vagus, either by exciting the nerve at its centre in the medulla, or through its endings in the cardiac muscle. Strychnine, and the sudden inhalation of a large amount of concentrated chloroform vapour, cause direct stimulation of the vagus centre in the medulla. This structure is excited in a reflex manner by the inhalation of strong ammonia, which acts by irritating the sensory endings of the fifth nerve in the nostrils, and of the pulmonary terminations of the vagus.

Drugs, such as digitalis, which stimulate the vagus through its terminations in the cardiac muscle, also slow the heart-beat.

The heart-beat may be accelerated by the following: (*a*) Agents which stimulate the sympathetic accelerator mechanism. These generally increase the force as well as the rate of the heart. *Examples:* adrenalin, cocaine. (*b*) Agents which depress the inhibitory mechanism, by acting either centrally on the medulla, or peripherally on the nerve-cells in the heart or on the nerve-endings. Chloral hydrate, and chloroform administered so as to produce safe anæsthesia are examples of agents which depress the medulla and cause acceleration of the heart's action. A counter-irritant applied to the skin causes quickened cardiac action by acting in a reflex manner through the medulla. Any agent which induces a lowering of blood-pressure tends to induce acceleration of the heart's action by modifying the circulation in the medulla. Agents which depress the nerve-cells in the course of the vagus are represented by nicotine and conine; and examples of those which depress the nerve-endings of the vagus are found in atropine and hyoscine. (*c*) Agents acting on the cardiac muscle can also produce acceleration of the heart-beat by stimulating the excito-motor area in the heart. If given in toxic doses, the action of the heart becomes quickened to such an extent that the beats become rapid and incomplete, and the condition known as 'delirium cordis' is produced. *Examples;* Caffeine, aconitine.

Agents modifying the Force of Contraction of the Heart.—The force of contraction is increased and the heart-beat strengthened by agents which stimulate the cardiac muscle or the sympathetic accelerator mechanism. The force of the heart-beat may be modified by altering the peripheral resistance in the arterioles (see p. 146). Drugs which depress the cardiac muscle, such as full amounts of chloral hydrate and chloroform (deep anæsthesia), diminish the force of contraction, and thus act as cardiac depressants.

Cardiac Stimulants are employed where there is a tendency

to failure of the heart's action, such as may occur in cases of influenza, pneumonia, acute pulmonary congestion, surgical shock, excessive hæmorrhage, etc. They cause a more forcible heart-beat, and if the pulse be quick, irregular, or weak, it is rendered slower, more regular, and stronger; also blood-pressure is raised. Of recent years the views held with reference to cardiac stimulants have been considerably modified. At one time alcohol, in the form of whisky or brandy, was regarded as the sheet-anchor in cases where stimulants were indicated; but in the present day agents such as strychnine, digitalis, and the subcutaneous injection of normal saline solution, are found to be far more effectual and safer than alcoholic stimulants administered in the form of drenches.

Dixon demonstrated that alcohol in moderate doses exerts a small but definite stimulant action on the heart, causing a greater force of contraction, but inferior to that produced by cardiac tonics, such as digitalis. Slight acceleration of the heart's action is produced, but if very large doses are given the cardiac action becomes slower. The superficial vessels become dilated, but the internal vessels are not much affected. If large doses of the agent be given, general dilatation of the vessels of the body occurs. After moderate doses of alcohol the blood-pressure generally rises, this being due to vaso-constriction both central and peripheral in origin, and to the increased cardiac output (Dixon, 'A Manual of Pharmacology'). According to this author, alcohol has some title to the term 'circulatory stimulant,' and it probably produces its action on the heart by providing this organ with an easily assimilable source of energy. Strychnine in small doses increases the strength of the cardiac beats, but not to any great extent, and this effect is believed to be due to a direct action on the cardiac muscle. The improvement in the pulse produced by this drug in cases of threatened cardiac failure is to be attributed to increased blood-pressure depending on vaso-constriction due to stimulation of the medulla. The vaso-constriction is believed to be partly peripheral in origin. Caffeine increases the rate of the heart,

and to a lesser extent the force of contraction, and also raises blood-pressure. It is sometimes combined with strychnine as a cardiac stimulant in cases of surgical shock.

Cardiac Tonics.—These are sometimes classed with cardiac stimulants, but for clinical purposes it is desirable to discuss them under a separate heading. Their action in medicinal doses is less marked and more gradual than cardiac stimulants. They regulate the action of the heart in certain cases of cardiac disease, prolong the period of diastole, render systole more vigorous and prolonged, and slow the cardiac contractions. Many of them cause contraction of the muscular coat of the bloodvessels. They are represented by digitalis, strophanthus, and squill.

The uses of cardiac tonics may be illustrated by considering the indications for treatment in a case of incompetency of the mitral valve. Here, in consequence of the imperfect closure of the mitral valve, a portion of the blood regurgitates through it when the left ventricle contracts, and enters the left auricle. The pulmonary circulation becomes impeded, and the right side of the heart suffers from distension, general venous congestion resulting. In the early stages a compensatory hypertrophy of the left ventricle occurs, and while this continues the circulation is maintained and no symptoms are manifested. But when compensation fails, circulatory disturbances take place, the cardiac wall becomes weakened, and dilatation of the ventricle occurs; the cardiac action is rapid, but ineffectual to empty the cavities of the heart completely. It is when compensation commences to fail that a cardiac tonic is indicated, and a drug such as digitalis produces beneficial effects by increasing the force of contraction and improving the tone of the cardiac muscle. Digitalis, by stimulating the vagus, also increases the period of diastole, and renders the systole more vigorous and prolonged, the action of the heart at the same time becoming slower and more regular.

Further details on this subject will be found in Part III., under the heading of 'The Treatment of Cardiac Diseases.'

Strychnine in small doses is also employed as a cardiac tonic in certain cases of disease of the heart.

Cardiac Depressants (or cardiac sedatives) diminish the force of cardiac contraction and lessen the frequency of the heart's action. They are represented by aconite, and by large doses of chloral hydrate and narcotic agents. Cardiac sedatives are indicated in cases manifesting a quick, full pulse, such as acute laminitis, and aconite in small doses, frequently repeated, is the drug usually selected for this purpose.

2. On the Bloodvessels.

Before considering these it will be of advantage to discuss briefly the subject of blood-pressure. The blood-pressure can be modified in various ways. It can be reduced by venesection (bleeding); by cardiac depressants, such as aconite; and by diminishing the resistance in the peripheral circulation by vaso-dilators, such as amyl nitrite; also by purgatives and rest.

The blood-pressure can be raised by perfusion of normal saline solution into a vein, or injecting this agent in large quantities subcutaneously or *per rectum*; also by cardiac tonics, and by agents which induce vaso-constriction (caffeine, strychnine, adrenalin).

Vaso-Constrictors cause contraction of bloodvessels by bringing about contraction of their walls, and thus altering their calibre and lessening the flow of blood passing through them. The small arterioles are the vessels which are especially affected by such agents. Vaso-constriction may be brought about in various ways: Strychnine, caffeine, and preparations of ammonia, produce this effect by stimulating the vasomotor centre in the medulla; digitalis causes vaso-constriction by acting directly on the muscular coat in the walls of the bloodvessels; adrenalin constricts the vessels by stimulating the peripheral nervous mechanism. But all vessels are not similarly affected by adrenalin. Thus, the splanchnic vessels, being well supplied with nerves and muscular tissue, are capable of marked alterations in volume.

After the injection of adrenalin, these vessels become constricted, and the blood-pressure rises to a marked extent; but owing to this increased pressure the vessels of the limbs may become dilated. Again, the vessels of the brain and lungs are deficient in vasomotor nerves and in muscle; hence adrenalin, or other agents which cause a rise in blood-pressure, do not cause constriction of these vessels. On the contrary, they tend to produce dilatation. This is a point of importance, as it indicates that such agents are of no practical value in the treatment of pulmonary or cerebral hæmorrhage, and, in fact, may prove harmful.

Ergot is also a vaso-constrictor which acts on the peripheral arterioles.

Vaso-constrictors which act by stimulation of the peripheral nervous mechanism, such as adrenalin, are indicated in cases of surgical shock. This condition, according to some authorities, depends on the effects of very prolonged and intense sensory stimuli, such as those arising from surgical manipulation or section of sensitive structures. Marked vaso-dilation, especially in the splanchnic area, results, a very large amount of blood enters the dilated vessels in this region, and the general blood-pressure falls to such an extent that death may take place. This view, however, is not universally accepted, and, according to certain investigators, the effects are to be attributed to special changes brought about in the central nervous system by impulses which are carried thereto in spite of the patient being under the influence of an anæsthetic.

Local vaso-constriction may be produced by the application of ice or refrigerant lotions to a circumscribed area of the skin. The hypodermic injection of a solution of adrenalin causes local vaso-constriction; hence this drug is employed in combination with local anæsthetics, as it prevents the latter from extending beyond the area of injection, and thus precludes the occurrence of absorption and toxic effects resulting therefrom. Adrenalin injected in the vicinity of the digital arteries proves useful in the treatment of acute laminitis by lessening the supply of blood to the feet.

Vaso-Dilators.—These cause dilatation of the peripheral arterioles. They are represented by chloral hydrate and narcotics, which act by causing depression of the vasomotor centre in the medulla; also by nitrites, which produce relaxation of involuntary muscle.

Nitrites cause dilatation of the vessels of the skin, lower blood-pressure, quicken the action of the heart, and induce diuresis. Sweet spirit of nitre is prescribed in cases of chill and exhaustion, in order to equalize the circulation and prevent congestion of internal organs. Its action is assisted by warm clothing and a suitable temperature of the surroundings.

Alcohol also causes dilatation of the superficial vessels, and, as already pointed out, it exerts a moderate stimulant action on the heart, but in moderate doses generally causes a rise in blood-pressure.

Drugs acting on the Respiratory Organs.

Expectorants act on the bronchial mucous membrane, and cause either an increase of secretion or render it more fluid, and thus facilitate its expulsion; or they may have the effect of lessening excessive bronchial secretion.

In the horse, expectoration does not occur in the same sense as in the human subject. The expectorate reaches the pharynx from the air-passages as the result of coughing, and may be swallowed, or, in the form of a muco-purulent discharge, portion of it may escape by the nostrils. In pneumonia there may be a discharge of a rusty-coloured material from the nostrils. In the dog the expectorate, when coughed up, reaches the pharynx and is swallowed.

Expectorants which increase secretion from the bronchial mucosa act in various ways. In the dog, emetics administered in small doses act as expectorants of this class. Thus, ipecacuanha, squill, and ammonium carbonate, increase secretion from the bronchi in a reflex manner by causing irritation of the stomach. Apomorphine in small doses (not sufficient to induce vomiting) increases the secretion of mucus from the respiratory tract, but without causing gastric irritation.

Drugs which are excreted by the bronchial mucosa act as expectorants. These are represented by potassium iodide, terebene, camphor, and compound tincture of benzoin.

Drugs which decrease expectoration are represented by belladonna, hyoscyamus, and acids. Inhalations of steam medicated with terebene, oil of eucalyptus, carbolic acid, etc., are largely employed in cases of laryngitis and bronchitis to lessen bronchial irritation, and to favour expulsion of retained secretion in the respiratory passages. They also exert an antiseptic action.

For the special uses of expectorants see section on 'The Treatment of Bronchitis' in Part III. of this work.

Respiratory Stimulants increase the irritability of the respiratory centre, and increase the depth and the number of the respirations. These are represented by strychnine, ammonia, atropine, and caffeine. The sudden application of cold water to the surface of the body causes deep inspiratory efforts in a reflex manner. The inhalation of the vapour of ammonia causes excitation of the nerve-endings in the nasal passages, and reflexly induces increased depth of respiration.

Strychnine administered by hypodermic injection is sometimes prescribed in respiratory affections with a view to overcoming depression of the respiratory centre, but its beneficial effects probably result from its action on the heart and circulation. It is also employed as a respiratory stimulant in cases of chloroform anæsthesia when evidences of respiratory failure present themselves, but its value in such a condition is doubtful.

Respiratory Sedatives lessen the irritability of the respiratory centre or depress it. They include agents such as chloral hydrate and opium, and are employed in cases where an irritable persistent cough is a prominent symptom.

Agents acting on the Bronchial Muscular Tissue.—Barium chloride and veratrine cause constriction of the bronchial muscular tissue in a direct manner. Eserine, digitalis, and pilocarpine, produce a similar effect by exciting

the terminations of the vagi. Veratrine is sometimes employed in the treatment of pulmonary emphysema (broken wind), and is combined with strychnine; the combination is said to assist in restoring muscular tone to the alveolar walls and bronchioles. They prove useful in mild cases, but cannot be expected to exert beneficial effects in well-marked emphysema of the lungs.

Certain drugs have the power of relieving spasm of the bronchioles, a condition on which bronchial asthma is believed to depend. Chloral hydrate produces this effect by directly depressing the bronchial muscular tissue. Belladonna, stramonium, and hyoscyamus, act in this manner by depressing the pulmonary terminations of the vagi.

Drugs acting on the Nervous System.

1. On the Brain.

Cerebral Stimulants.—These are represented by caffeine, cocaine, and atropine. The inhalation of ammonia vapour stimulates the nasal branches of the fifth nerve, and causes reflex stimulation of the vasomotor centre. The general blood-pressure is increased, and the brain is stimulated by the alteration in the cerebral circulation. The latter effect is also produced by other drugs which act as circulatory stimulants.

Cerebral Sedatives lessen the functional activity of the brain. They include chloral hydrate, bromides, Indian hemp, etc. Opium in full doses acts as a cerebral excitant in the horse, but in the dog it acts as a cerebral sedative.

Hypnotics or **Soporifics** are agents which induce sleep. They belong to the group of cerebral sedatives. In the horse, owing probably to the relative lack of development of the cerebrum, hypnotics act in an uncertain manner.

The most reliable drug for this purpose in equines is chloral hydrate. It acts by exerting a depressing effect on the cerebrum, and lessens the excitability of the brain cells, and also causes dilatation of the bloodvessels throughout the body. In the dog, morphine, bromides, chloralose, chlore-

tone, etc., act as efficient hypnotics. Hypnotics are indicated when sleep is interfered with by the presence of pain from any cause, or when nervous irritability is a prominent symptom.

Narcotics include a large number of medicinal agents which exert a disturbing influence on the functions of the brain, and their actions in this respect vary according to the doses given and the species of animal.

Anodynes or **Analgesics** are agents employed for the relief of pain. Many of them belong to the group of narcotics. Pain may accompany various conditions, and in seeking to relieve it we must endeavour to ascertain its cause.

In the horse, pain arising from various disorders and lesions of the stomach and intestines (termed 'abdominal pain') is the type most frequently met with. In prescribing measures for its relief, care should be taken not to administer agents such as opiates in cases depending on the presence of irritating ingesta in the intestines, or on gastric or intestinal tympany, as such drugs inhibit peristaltic movements and bring about paralysis of the viscus involved, and thus exaggerate the primary condition. The most efficient and least harmful anodyne for the horse is chloral hydrate (see p. 154).

In the dog, opium or morphine acts as a safe and effectual anodyne. For the various forms of painful rheumatic affections in this animal, agents such as salicylate of soda or aspirin prove of value.

When pain depends on local conditions, local anodynes, such as belladonna, are employed. The application of heat and moisture, such as a cataplasm composed of kaolin and glycerin, heated to the proper temperature, is indicated in some cases.

Antispasmodics relieve or overcome muscular spasms, whether general or local. Spasms occur in tetanus, epilepsy, and strychnine-poisoning, and may be favourably influenced by bromides and chloral hydrate. Spasms or cramp of the muscular coat of some portion of the intestines is assumed to occur in so-called 'spasmodic colic' in the horse, and to depend

on the presence of irritating ingesta. Many of such cases are relieved by a dose of oil of turpentine or terebene given in raw linseed-oil. In several instances spontaneous recoveries are observed, which point to the presence of spasm, the duration of which is brief.

Formerly opium or morphine was regarded as the sheet-anchor in such cases, but clinical observation has shown that such agents inhibit peristalsis, and hence are contra-indicated. The rational treatment is to get rid of the cause—viz., the irritating ingesta—by means of a purgative; and if the pain be so severe that an anodyne appears to be indicated, chloral hydrate can be given. This drug does not interfere with peristalsis; it relieves the pain, and, moreover, has an antiseptic action which tends to prevent tympany. In acute intestinal tympany (so-called 'flatulent colic') an antispasmodic such as oil of turpentine or terebene mixed with raw linseed-oil gives good results. Agents of this nature, besides relaxing spasm, check fermentation of the ingesta, and assist in causing expulsion of the gases *per anum*. Similar remarks apply to the treatment of gastric tympany.

Anæsthetics belong to the group of drugs known as 'narcotics.' They are employed to produce a condition of insensibility to pain during the performance of surgical operations, and are also useful in cases of difficult parturition. Of late years we have largely increased our knowledge with reference to the precise action of anæsthetics, and also in connection with their safe administration to animals. Anæsthetics are classified as general and local.

General Anæsthetics are represented by chloroform and ether administered by inhalation. Chloroform is the anæsthetic usually adopted for the horse. Ether produces a prolonged period of excitement in this animal, and is uncertain in its action. For full details of the employment of chloroform in the horse the reader is referred to p. 302.

Ether is regarded by many practitioners as safer than chloroform for the dog, but a large number of specialists in canine surgery have demonstrated that with careful administration chloroform is safe and reliable. Full doses of morphine

are often employed as an anæsthetic in canine surgery (see p. 371).

Chloral hydrate is largely used as an anæsthetic for the horse by Continental practitioners, being administered either by the mouth, by intravenous injection, or in the form of enema (see p. 318).

Local Anæsthetics are agents which, if injected subcutaneously or into the deeper tissues, produce local loss of sensibility by causing paralysis of the peripheral endings of sensory nerves. Strong solutions painted on mucous membranes exert a similar action. Local anæsthetics are represented by cocaine, eucaine, novocaine, and stovaine. They are largely employed in minor surgical operations, and by careful infiltration of the deep tissues it is possible to perform even major operations in a painless manner with these agents. The addition of a solution of adrenalin to any of the drugs mentioned has the advantage of retaining the material at the seat of injection by the constriction of the capillaries which is produced, the part being thus rendered anæmic. A further advantage is that, in the case of a toxic agent such as cocaine, there is less tendency to absorption; also adrenalin prevents hæmorrhage from capillary vessels, and thus facilitates surgical procedure.

Whenever possible, local anæsthetics should be injected as close as possible to the nerves supplying the part which it is desired to render anæsthetic. For further details of the technique, see Cocaine, p. 379, and Eucaine, p. 381.

2. On the Spinal Cord and Medulla.

Some drugs act specially on the spinal cord, but in most instances agents having this action, if administered in full doses, affect other regions of the central nervous system as well.

Spinal Stimulants.—These include strychnine, caffeine, and ammonia. In medicinal doses they increase conductivity and heighten reflex excitability, but in large doses clonic convulsions are produced. Toxic doses eventually bring about exhaustion and paralysis.

Spinal stimulants are indicated in conditions of collapse, in certain forms of paralysis, and in cases of paralysis of the intestine associated with impaction of the bowels.

Spinal Depressants.—Narcotics, hypnotics, and anæsthetics, depress the brain as well as the medulla and spinal cord. Hydrocyanic acid, physostigmine, antipyrin, and phenacetin, have a special depressant action on the spinal cord.

Spinal depressants are indicated in cases where increased excitability of the spinal cord is present, such as tetanus and chorea. For this purpose chloral hydrate, bromides, and cannabis indica, are sometimes prescribed.

3. On the Nerves.

Drugs which act on nerves may produce their effects by acting on the nerve-centres, the nerve-trunks, or the nerve-endings in muscles, glands, or on the surface of the skin. The nerve-endings are more susceptible to the action of drugs than the nerve-trunks, the latter only being affected when strong solutions of medicinal agents are directly applied to them.

Motor Nerves.—Physostigmine and aconitine increase the excitability of motor nerve-endings in striped muscle, and, when injected hypodermically, produce spasmodic twitching in the voluntary muscles.

Curare causes paralysis of the motor nerve-endings, and conine acts in a similar manner. The nerve-endings in secretory glands and unstriped muscle are excited by pilocarpine and physostigmine, while atropine and hyoscyamine have the opposite effect—*i.e.*, they paralyze the nerve-endings mentioned.

Sensory Nerves.—Aconite, veratrine, atropine, carbolic acid, and chloroform, also antifebrin and antipyrin, diminish the excitability of sensory nerves. Cocaine, eucaine, and allied agents, temporarily paralyze the terminations of cutaneous nerves, and also the sensory nerve-trunks when injected locally and sufficiently deep, and thus are local anæsthetics. Ether spray, cold in the form of ice or freezing mixtures, applied

locally, also reduce the sensibility of sensory nerves in the area to which they are applied. Topical irritants increase the excitability of sensory nerves.

Electricity in the form of galvanism is sometimes employed in the case of certain forms of paralysis in canine practice, and acts as a stimulant to both motor and sensory nerves, and also to muscles.

Sympathetic Nerve-Endings.—Adrenalin has a special action in stimulating the sympathetic nerve-endings.

Drugs acting on the Eye.

Mydriatics cause dilatation of the pupil, and are represented by belladonna, atropine, hyoscyamine, and allied agents.

Myotics cause contraction of the pupil.

Examples.—Calabar bean, physostigmine, and pilocarpine.

For the special uses of the above the reader is referred to the description of the drugs mentioned, in Part II.

Agents acting on Tissue Change.

Tonics are agents which tend to restore normal tone or strength to parts or organs on which they specially act. They bring about increased functional activity, and restore vigour to the system when from any cause an animal suffers from muscular or nervous depression and shows a diminished capacity for work. These agents may be classified as follows:

Cardiac Tonics.—See p. 147.

Hæmatic Tonics or **Hæmatinics** improve the quality of the blood by increasing the number of red corpuscles and the amount of hæmoglobin. They are represented by the various medicinal preparations of iron, and are employed in the treatment of anæmia.

Stomachic or **Gastric Tonics** increase the appetite and promote digestion.

Examples.—Vegetable bitters such as gentian and calumba.

Nerve Tonics restore tone to the nervous system.

Examples.—Nux vomica, arsenic, and quinine.

Intestinal Tonics restore nervous power to the intestinal canal, and stimulate peristalsis when this is deficient.

Examples.—Nux vomica and strychnine.

Alteratives.—This term is applied to agents which produce favourable changes in the processes of nutrition and repair. Owing to the fact that their mode of action is not readily explained, some authors propose to exclude the term from therapeutics. The use of these agents is purely empirical, as is evidenced by the time-honoured 'alterative' or 'condition' powders, which are much in demand to improve the health and appearance of horses when the animals are out of condition. As, however, loss of condition may depend on a variety of causes, such as defective mastication owing to irregularities in the molar teeth, indigestion, irrational feeding, the presence of intestinal parasites, etc., it is clear that a correct diagnosis should be made before treatment is prescribed.

The term 'alterative' has been applied to arsenic, iodide of potassium, sulphur, mercury, and tartar emetic.

Arsenic and sulphur are largely prescribed in cases of skin affections, iodide of potassium in cases of chronic rheumatism and in diabetes insipidus, and tartar emetic in cases where horses are hide-bound and out of condition. We admit that these agents often prove successful in the affections mentioned, although it is difficult to explain their *modus operandi*.

Febrifuges or **Antipyretics** are agents which lower abnormal temperature. Quinine reduces temperature by lessening the production of heat in the body, and this action is believed to depend on its power of lessening tissue change. Aconite acts as a febrifuge by depressing the circulation, and thus preventing the formation of heat.

A number of agents lower temperature by increasing the loss of heat. Antipyretics of the coal-tar series (antipyrin, antifebrin, phenacetin), also salicylates, produce this effect by acting on the heat-regulating centre, and also by causing

dilatation of the cutaneous vessels. Sweet spirit of nitre and alcohol act as febrifuges by dilating the cutaneous vessels, and thus increasing radiation.

Diaphoretics (agents which induce sweating) act as febrifuges, as, by promoting the secretion of sweat, the evaporation of the latter exerts a cooling effect. Diaphoresis, however, is difficult to bring about in animals (see p. 160).

Sponging the skin with tepid water, and then thoroughly drying and judiciously clothing the patient, assists in lowering abnormal temperature by directly abstracting heat and restoring the functions of the skin.

Febrifuges are chiefly employed when the internal temperature is high. In the present day we know that the decline of an abnormal temperature is not always to be attributed to the drugs administered, as it is a natural process. When, however, a very high temperature is present (hyperpyrexia), we administer antipyretics in the form of electuary or in the drinking water. The custom adopted in former days, of ordering alcohol or other agents in the form of drenches, was responsible for many fatalities, owing to portions of the fluid entering the bronchi. In many cases of influenza, pneumonia, and allied conditions, we find that by simply giving salines, such as Epsom salt, with nitre in the drinking water, the temperature gradually returns to normal. Such agents probably act beneficially by causing the removal of morbid and deleterious products from the system by way of the bowels and kidneys.

Venesection or **Blood-letting** may be regarded as a procedure which exerts a direct action on tissue change. When venesection to a full extent is carried out, blood-pressure is lowered and the force of the heart is lessened. In acute congestion of the lungs, the right side of the heart, the venæ cavæ, and the pulmonary vessels are engorged with blood, and the pulse is small and indistinct. In such a case blood-letting relieves the cardiac distension and venous engorgement, and the pulse shows a marked improvement as regards volume and frequency. In former days blood-letting was extensively practised for all varieties of diseases,

but is now seldom employed, and, except on rare occasions, is not necessary. There seems little doubt, however, that, in cases of very acute pulmonary congestion in plethoric horses, blood-letting employed with discretion in the early stages would prove of benefit.

Some practitioners still advise blood-letting in cases of acute laminitis, lymphangitis, meningitis, and azoturia.

The amount of blood usually taken varies from 6 to 8 pints, and the requisite amount is to be determined by the effect produced on the pulse. The vessel selected is the jugular vein. The horse's head is raised, and the vessel is distended by means of pressure applied by the fingers to its lower end, and a point between its upper and middle third is selected. The edge of the fleam is brought into contact with the skin at this point, and the back of the instrument is struck a smart tap with the 'blood-stick,' sufficient to cause the blade to cut through the skin and vein, when the blood issues in a full stream. If a fleam is not available, a lancet may be employed, but the former is safer. When sufficient blood has been taken, the edges of the wound in the skin are brought together and secured by a pin, around which a piece of aseptic suture thread is wound. Surgical cleanliness should be observed in the procedure, so as to avoid any risks of phlebitis (inflammation of the vein).

Local blood-letting is not now employed in veterinary practice.

Agents acting on the Skin.

Diaphoretics or **Sudorifics** increase the cutaneous secretions. In horses and cattle the action of diaphoretics is uncertain, and copious sweating as the result of drugs is seldom to be obtained. The application of heavy clothing, placing the animals in warm surroundings, and administering small and repeated doses of sweet spirit of nitre with solution of acetate of ammonium, may succeed in some cases in causing diaphoresis.

In the dog and cat, as sweat glands do not occur in the skin, and are only found on the hairless pads of the feet,

diaphoresis cannot be induced in these animals. Experiments show that in carnivora pilocarpine causes sweating from the pads of the feet. In horses and cattle the Turkish bath may be employed to produce sweating. The luminous heat bath is successfully used by Mr. C. Hartley, of Lincoln, to bring about diaphoresis for therapeutical purposes.

Diaphoretics, such as sweet spirit of nitre and acetate of ammonia, produce their effect by acting as vaso-dilators and increasing the cutaneous circulation.

Pilocarpine causes profuse diaphoresis in man by stimulating the peripheral nerve endings in the sweat glands. In animals profuse salivation occurs instead. F. Smith states that the sweat glands of the horse are perfectly insensible to the action of pilocarpine.

Diaphoretics are indicated in cases manifesting rigors (shivering fits), and also in cases of renal disorder. In the latter the promotion of cutaneous secretion assists in removing injurious waste products from the system.

Anhydrotics lessen the secretion of sweat. Atropine produces this effect by paralyzing the terminations of the nerves to the sweat glands. In cases of debility following diseases such as influenza, abnormal sweating is sometimes observed, due to a venous condition of the blood. In such instances nux vomica and strychnine, by stimulating the respiratory centre, are believed to overcome this condition of the blood, and thus act as anhydrotics.

Drugs acting on the Surface of the Body.

Counter-Irritants, when applied to the skin, cause either stimulation or inflammation of this structure, the effects produced depending on the agent employed or on the strength of the application. Counter-irritants may be classified as follows:

(*a*) RUBEFACIENTS produce congestion of the cutaneous vessels. They are represented by mild applications of mustard paste, and liniments containing ammonia and oil of turpentine. The reddening of the skin which occurs in man as the result of the application of rubefacients is only

observed in animals in parts where the skin is not pigmented.

(*b*) VESICANTS or EPISPASTICS cause the formation of vesicles or blisters of various sizes on the skin. These contain an albuminous fluid and a small amount of fibrin. In a variable period of time they rupture and dry up, the part becomes scaly, and a new epidermis is produced.

Examples.—Preparations of cantharides and strong applications of mustard paste.

(*c*) SUPPURANTS or PUSTULANTS cause inflammation of the deep-seated structures of the skin and the formation of pustules.

Examples.—Biniodide of mercury ointment, croton-oil. Vesicants, if applied too strong and repeated, have a similar effect.

The *actual cautery* is a powerful counter-irritant, and is frequently employed in the treatment of diseased joints, ligaments, and tendons. The thermo-cautery has now superseded the old-fashioned firing-iron. Various patterns are on the market, but the most convenient is Dechery's auto-cautery. The advantages of the thermo-cautery are—a constant and equable degree of heat can be maintained, there is neatness in operation, and very little blemish as the result of its employment.

Uses of Counter-Irritants.—In former times counter-irritation was largely employed in the treatment of respiratory affections. Mustard paste or even preparations of cantharides were freely applied to the thoracic walls in cases of pneumonia and pleurisy, and beneficial results were claimed. W. Williams pointed out that such measures were not only useless, but inimical to the patient, and largely owing to the result of his teaching and observations the practice has now been abandoned by many practitioners (see 'The Treatment of Respiratory Affections,' Part III.). Various theories have been advanced, by those who still adopt counter-irritants, to explain how these agents act in respiratory affections, but there is no advantage to be gained by discussing the question.

In the early stages of pneumonia and pleurisy a moderate application of mustard paste to the thoracic walls often exerts a favourable effect, probably by causing dilatation of the superficial vessels, and thus relieving pulmonary congestion. In acute laryngitis and pharyngitis the application of a cantharides blister to the external region of the throat gives excellent results, although it is not easy to explain the *modus operandi* of this therapeutical measure. In cases of strangles, when the abscess in the submaxillary space matures slowly, the application of a cantharides blister hastens the process.

In chronic diseased conditions of joints, ligaments, and tendons, counter-irritation by means of the thermo-cautery is largely employed. In the case of tendons and ligaments, the beneficial effects of counter-irritation are believed to depend on its action in modifying the nutrition of the part, promoting absorption of exudate, and favouring resolution. The beneficial results in deep pyro-puncture in cases of bone-spavin and ringbone are held to depend on the procedure causing an increase in the inflammatory process, which has the effect of assisting ankylosis (the locking of the affected bones together). Thus motion between the bones involved is prevented and lameness is removed.

In former days firing was practised in an indiscriminate manner, and even at the present time many results attributed to the employment of the actual cautery are really due to the *vis medicatrix naturæ*. We cannot ignore the fact that the long rest which is necessary after firing has been carried out exerts an important influence on the results obtained.

Some practitioners employ counter-irritation (in the form of a cantharides blister) in the treatment of open joint after the acute inflammation has been subdued by suitable means. They claim that the application of a blister to the whole surface of the affected joint limits motion, assists the process of repair, and, by inducing swelling of the parts, brings the surfaces of the wound together and tends to prevent the flow of synovia.

The barbarous practice of firing limbs with a view to the

prevention of diseases is now discontinued. We may remark that in diseased conditions the operation should only be carried out after due consideration with reference to its necessity and the probabilities of favourable results being obtained, and these matters can only be decided by the qualified veterinary surgeon. Unfortunately, farriers and empirics frequently carry out firing in a cruel and barbarous manner, and the owners of horses permit the perpetration of such cruelty. Cases of this kind should be brought under the notice of the Society for the Prevention of Cruelty to Animals.

'Setons' and 'rowels' were formerly employed as substitutes for counter-irritation in the treatment of sinuses and fistulæ, etc.; also in cases of hip and shoulder lameness. Such measures have justly fallen into disrepute, and are not adopted by the modern veterinary surgeon. Sinuses and fistulæ are now treated by means of the knife and curette assisted by vaccine-therapy. The forms of lameness mentioned yield quite as readily to ordinary counter-irritants as to setons, and here we may remark that a large proportion of cases attributed to the shoulder in reality depend on obscure causes in the foot.

For further information on the subject of counter-irritants, see Cantharides and Biniodide of Mercury in Part II.

Cold and Hot Applications.—The application of cold water lessens the supply of blood going to a part by causing contraction of the arterioles (see p. 288). Hot applications dilate the capillaries, increase the superficial circulation, relieve pressure on the nerves, and thus diminish pain in an inflamed part (see p. 190).

Poultices relieve tension, pain, and inflammation, by supplying heat and moisture to the affected part (see p. 189).

Caustics and **Escharotics** destroy living tissue when brought into contact with it. They produce this effect by combining with the water and albumin of the part. Those which produce an extensive slough are termed 'escharotics.' Caustics are employed for the purpose of suppressing exuberant granulations in wounds, and for hastening the

process of healing when this is slow. Nitrate of silver and sulphate of copper are the agents usually selected for this purpose. Caustics are also employed for the destruction of virus in wounds, and for the removal of warts when the latter cannot be excised with safety.

An arsenic paste carefully applied is often found successful in the eradication of warts. In the surgical treatment of sinuses and fistulæ, caustics are still made use of by some practitioners, but operative measures are far preferable and more successful.

Styptics are agents employed for the purpose of arresting hæmorrhage. Some act mechanically, such as the application of tow with pressure. Others are astringents, and act either by coagulating albumin and plugging the bleeding vessels, or by causing contraction of the capillaries. Styptics are represented by compound tincture of benzoin, alum, perchloride of iron. The actual cautery was at one time largely employed as a styptic, but is now superseded by more surgical methods. The destruction of tissue produced by its use renders it anything but a desirable agent for the purpose. A solution of adrenalin injected subcutaneously contracts capillaries and arterioles, and causes anæmia of the part; but it has no effect on larger vessels when severed.

In internal hæmorrhage adrenalin is also employed as a styptic, but its utility in this respect is limited. Ergot is used as a styptic in cases of post-partum hæmorrhage. Atropine has been found useful by American practitioners as an internal styptic.

Astringents, when applied locally to wounds, cause contraction of the capillary vessels of the part, coagulate or precipitate albumin, lessen excessive discharges, and check the formation of exuberant granulations. They are represented by acetate of lead, sulphate of zinc, oxide of zinc, etc.

Emollients soften and relax parts to which they are applied, and also exert a soothing effect. They are represented by fats, oils, lanolin, vaseline, glycerin, etc. Emollients are employed as protectives to the skin; they allay irritation of a part by preventing it from becoming dry. They also

soften the skin and render it more elastic, and some of them are employed as a basis for ointments.

Parasiticides.—This term is sometimes applied to a group of agents which includes germicides (drugs which destroy micro-organisms) and vermicides. Here we apply it to agents which destroy parasites on the skin, and are employed in the treatment of mange, ringworm, lice, ticks, etc. These are represented by sulphur, coal-tar products, stavesacre, etc.

Agents acting on Bacteria and their Products.

Antiseptics.—Strictly speaking, the term 'antiseptic' should be limited to agents which prevent putrefaction by inhibiting the growth of micro-organisms.

Disinfectants or **Germicides**, on the other hand, destroy the germs of disease, and also their spores (in the case of spore-bearing bacteria).

Although in ordinary parlance these terms are often regarded as synonymous, we must point out that many agents are antiseptics — *i.e.*, they inhibit the growth of micro-organisms — while only a few are disinfectant or germicidal in their action.

Again, the strength of the solution employed determines whether it will exert a germicidal (disinfectant) action or an inhibitory (antiseptic) action.

The oldest of the disinfectants is carbolic acid; and although many substitutes for it were brought forward from time to time, it is still regarded by several surgeons as the most reliable germicide and antiseptic.

A large number of coal-tar derivatives in addition to carbolic acid are in common use for surgical work, such as creolin, izal, cresol, lysol, chinosol. Cook's 'Cofectant Fluid,' and also Klondol, have been proved to possess very high germicidal powers, and clinical experience has shown their value in veterinary surgery; moreover, they are non-toxic to animal life.

Perchloride of mercury, and also mercuric iodide, are efficient germicides, but have certain disadvantages, of which their toxic nature is one of the most important.

Deodorants absorb gases and neutralize foul odours.

Examples.—Charcoal, sanitas, solutions of permanganate of potash, etc. Many disinfectants are deodorants, but it does not follow that because an agent removes foul smells it should possess germicidal powers.

For details of the uses of antiseptics and disinfectants in surgery, the reader is referred to the section on 'The Treatment of Wounds' in Part III. of this work.

Germicides are also employed in the disinfection of stables, cowsheds, kennels, clothing, feeding utensils, harness, etc.

Of vast importance is the disinfection of surgical instruments; this can be carried out by boiling them for five minutes, and placing them in a disinfectant solution just before use.

CHAPTER VI

ON PRESCRIBING

THE utilization of medicinal agents in the treatment of a case of disease is termed 'prescribing.' A prescription is a written direction containing the constituents and the preparations of them to be employed; also the quantities and the method of administration.

As veterinary surgeons generally dispense the medicines required for the treatment of their cases, they seldom send prescriptions to the pharmaceutical chemist. Nevertheless, it is always advisable to keep a prescription book, and to enter therein the prescriptions dispensed for each case. By this means it will be possible to refute any accusations of errors or excessive dosage which may be made by litigious clients; also such a book is necessary and useful for reference purposes.

There are many circumstances to be taken into consideration when prescribing for a case of disease. It is not sufficient merely to arrive at a diagnosis. We must determine how and in what manner we can exert a favourable influence on the course of the disease and assist the natural powers of recovery. Of course, in cases where we are enabled to remove or modify the cause of the affection, this should receive first consideration. It also follows that we should possess knowledge as complete as possible of the actions of drugs and the manner in which they exert beneficial effects in conditions of disease.

The subject can be most conveniently discussed under the following headings:

The Selection of the Remedy.—When we arrive at a diagnosis, or, failing this, when we carefully observe the

prominent symptoms present, we select an agent or combination of agents which is likely either to act on the cause and remove it, or to influence the course of the disease in a favourable manner. In both instances a careful clinical examination of the case is essential, so that we may recognize what are known as the indications for treatment. These indications are gleaned from the clinical examination, assisted by a knowledge of pathology. In other words, the problem which constantly requires solution by the therapeutist is, What measures can he employ which are likely to prove beneficial to the case, and to turn the scales in favour of the patient? There are many instances in which we know, as the result of a clinical examination and a diagnosis based thereon, that no agent which we select can prove of any value, and only palliative measures to give temporary relief can be adopted. Again, there are cases presenting obscure symptoms in which a diagnosis is impossible, but by a careful consideration of some of the prominent phenomena we may be able to select treatment which assists the natural powers of recovery. The selection of the remedy in certain diseases is simple once a correct diagnosis is made. For example, in actinomycosis we know from experience that potassium iodide is likely to prove successful, and in milk fever the inflation of the udder with air is followed in the majority of cases by recovery. In other instances, the selection of the remedy is a matter of choice, and largely depends on the individual experience of the practitioner with reference to the value of certain medicinal agents. We cannot be surprised if differences of opinion exist in connection with the utility of certain drugs in certain diseases. Not infrequently we find practitioners altering their views with reference to the value of drugs which they formerly believed to be useful. If the subject be studied with an unbiassed mind, it often happens that results attributed to certain drugs should in reality be ascribed to the *vis medicatrix naturæ*. When this fact is ignored, it follows that many medicinal agents will be credited with a therapeutical value to which they are not entitled. The number of new

remedies which are constantly being placed on the market, and said to possess advantages over known and well-tried agents, do not always fulfil the claims of the introducers. The practitioner should remember that, when a simple agent is likely to succeed, it should be prescribed in preference to one which possesses a multiplicity of actions, some of which may prove undesirable, if not detrimental to the case. When the remedy is selected, it is necessary to decide the most suitable form in which to prescribe it—*i.e.*, whether in powder, bolus, drench, electuary, or as a hypodermic injection. Also the preparation must be chosen—*i.e.*, whether tincture, extract, etc. These selections will depend on various circumstances which can only be learned by experience and by a consideration of the exigencies of the case.

Contra-Indications.

Certain conditions of disease render some medicinal agents or some particular line of treatment improper, undesirable, or even harmful. Thus, active purgatives are contra-indicated in enteritis, in respiratory affections, and in influenza. Stimulants are contra-indicated in acute inflammatory affections of the brain, and diuretics possessing irritating actions in nephritis. Opium or morphine should not be prescribed in cases of colic, gastric tympany, gastric impaction, and intestinal impaction, as it inhibits peristaltic action and tends to increase the morbid condition present. This agent is also contra-indicated in pneumonia accompanied by shallow, embarrassed breathing, in affections of the brain, and in nephritis. Counter-irritants should not be applied to parts during the acute stage of inflammation. All depleting measures are contra-indicated in diseases of a debilitating nature. Drenches should not be given when there is any difficulty in swallowing, such as in laryngitis, pharyngitis, certain affections of the nervous system, tetanus, etc. In the present day, 'drenching' is avoided as much as possible, and other means of administering medicines are substituted for it. Eserine and arecoline are contra-indicated in cases where pulmonary emphysema (broken wind) is present.

This subject will receive attention when the medicinal uses of each drug are being considered. It is a most important one for the therapeutist, as serious consequences are likely to ensue when irrational treatment, owing to neglect or ignorance of these matters, is carried out.

The Combining of Drugs—Chemical and Pharmacological Incompatibles.

While it is sometimes of advantage to combine drugs in a prescription, discretion is necessary so as to avoid the formation of a useless or dangerous compound. When we have a clear conception of the indications for treatment in a case, we are not likely to include a number of medicinal agents in a prescription. If our treatment is to be of real benefit to the patient, we must avoid methods of chance, and remember that, if we are unable to influence the course of the disease in a favourable manner, we should at least be careful not to prescribe combinations which may prove inimical to the patient. What is familiarly known as the 'shot-gun' prescription cannot be too strongly condemned; it is evidence of ignorance on the part of the prescriber, who vainly imagines that he is able to overcome the disease by administering a number of medicinal agents, differing widely in their actions, and producing effects which are either problematical, useless, or harmful.

In combining drugs, it is necessary to be acquainted with the question of incompatibility. Certain agents should not be prescribed together, as, owing to chemical, pharmacological, or physical reasons, the resulting combination is either inert, dangerous, or inelegant.

Chemical Incompatibles.—In order to appreciate these a knowledge of chemistry is essential. Obviously, acids should not be combined with alkalies. There are a large number of agents which are chemically incompatible, but here we can only direct attention to a few examples. In Part II., when dealing with the various drugs, we shall mention the incompatibles of each. Persalts of iron should not be combined with agents rich in tannin, nor chlorates with iodides. As

examples of dangerous combinations we may mention chloride of lime or chlorate of potash with sulphur, and oil of turpentine with sulphuric acid Alkalies should not be prescribed with alkaloids, as, for example, liquor arsenicalis or iodide of potassium with liquor strychninæ, as the strychnine becomes precipitated, and the last dose in the bottle may prove toxic. Potassium iodide is incompatible with sweet spirit of nitre, as free iodine becomes liberated. Occasionally we do combine agents which are chemically incompatible, as, in spite of the reaction that occurs, the combination proves useful. Thus, the familiar white lotion, so often prescribed as an astringent dressing, is a combination of acetate of lead with sulphate of zinc in water. The resulting compound consists of acetate of zinc in solution, with sulphate of lead as a precipitate. Other examples are —acetate of lead and tincture of opium in the form of lotion, preparations of iron with tincture of gentian as a tonic mixture.

Pharmacological Incompatibles.—In this case the drugs possess antagonistic actions, so that, if combined and administered, no therapeutical effects are produced.

Examples.—Nux vomica combined with chloral hydrate or bromides, stimulants combined with sedatives, purgatives with intestinal astringents.

A knowledge of the antagonistic action of drugs enables us to prescribe suitable antidotes in cases of poisoning.

Physical Incompatibles.—These are represented by mixtures containing oil and water, oil of turpentine and water, tinctures with oil, etc. The art of the chemist often succeeds in rendering such combinations homogeneous and elegant.

The Dose.—This is the amount of a drug which it is safe to administer, and which is likely to produce desired results. As already mentioned (p. 126), there are circumstances which lead us to modify the dose. The recognized doses are arranged from the smallest to the largest that can be administered with safety. Of course, the size and vigour of the patient must be taken into account, and there are many occasions on which great discrimination is necessary in order

to compute the dose that will fulfil the conditions of efficiency and safety. In the case of powerful drugs, it is found in some instances that small doses repeated at intervals are safer and more efficient than one full dose.

Rectal doses are usually double those given by the mouth; hypodermic doses of alkaloids should be about one-half the oral dose, and intravenous doses one-half or two-thirds of the hypodermic dose.

The question of dosage for young horses merits attention. As a general rule yearlings take one-third of the dose suitable for an adult, two-year-olds one-half, and three-year-olds two-thirds, of the adult dose.

Dogs vary so much in size that discrimination is necessary in prescribing suitable doses, especially for the smaller breeds. It is always judicious to commence treatment with small doses when powerful drugs, such as nux vomica or arsenic, are prescribed. In computing the dosage, it is convenient to take a dog about the size of a fox-terrier as the standard, and in this book the doses given are arranged according to this method.

Although in many instances the doses suitable for the dog are similar to those laid down for the human being, it is necessary to point out that, in prescribing for small dogs, we cannot compute the safe doses from a comparison with posology in human medicine. Moreover, there are certain drugs—such as nux vomica and strychnine—which, if administered to even large dogs in doses suitable for human beings, would prove toxic. Fatalities from prescribing preparations containing strychnine in this manner are not uncommon. Again, aloes must be given to the dog in relatively larger doses than to man, in order to induce catharsis. On the other hand, calomel must be prescribed in smaller doses for the dog than for man.

If we take as a standard the dose of a drug suitable for the dog, we may, with certain exceptions, compute the doses suitable for other animals as follows:

Cats.—One-half the dose suitable for a dog the size of a fox-terrier.

Pigs.—Twice the dose suitable for a dog the size of a fox-terrier.

Sheep and Goat.—Three times the dose suitable for a dog the size of a fox-terrier.

Horse.—Sixteen times the dose suitable for a dog the size of a fox-terrier.

Cattle.—Twenty-four times the dose suitable for a dog the size of a fox-terrier.

We must point out, however, that the doses of nux vomica and strychnine cannot be computed on the above basis.

As in canine practice the doses of certain drugs are computed according to the weight of the animal, the following table will prove useful:

	Average Weight.
Griffons and Toy-terriers	3 to 5 lb.
Spaniels, Pugs, etc.	10 „ 12 „
Fox-terriers and Irish Terriers, etc.	18 „ 25 „
Bulldogs and Field Spaniels	40 „ 45 „
Retrievers, Collies, Greyhounds	55 „ 65 „
Great Danes, etc.	120 „

Time.—Some medicinal agents are prescribed to be given before feeding, and others either in the food or after feeding. Alkalies administered before feeding correct excessive gastric secretion. Vegetable bitters, such as calumba and gentian, administered on an empty stomach, promote appetite and increase the flow of gastric juice. Acid stomachics are prescribed after feeding in cases where the natural acid of the stomach is deficient. Drugs which tend to cause irritation of the gastric mucosa, such as arsenic, should be given either with the food or immediately after feeding. In herbivora, iodine, when prescribed, should be given at an interval after feeding, as otherwise an insoluble iodide of starch is produced.

The Prescription.

The prescription should indicate in a clear manner the medicinal agents prescribed, the form or preparation of those which are selected, the amount of each, the dose of the resulting combination, and the directions for use.

Prescriptions are usually formed on the following plan:

1. **The Superscription**, ℞, which is an abbreviation of recipe—*i.e.*, take.

2. **The Inscription**, or body of the prescription. This contains the names and quantities of the ingredients.

3. **The Subscription**, or directions to the dispenser.

4. **The Signature**, or directions with reference to the dose

and method of administration, etc. This is preceded by the abbreviation 'sig.,' representing *signa—i.e.*, mark, or label.

The names of the drugs and the preparations of same are written in Latin in the genitive case, and the quantities are expressed by certain symbols and numbers. The directions for use are generally written in English, although it is permissible to use certain Latin abbreviations for this purpose; but as these have to be translated by the dispenser, the former method is advisable in order to avoid a possible source of error.

The typical prescription contains the following headings:

1. **The Basis**, or active drug which has been selected.
2. **The Adjuvant**. This is intended to assist or hasten the action of the basis.
3. **The Corrective** limits or modifies the action of the basis.
4. **The Vehicle or Excipient** is an agent added to render the combination in a convenient form for administration.

A familiar example of the above may be found in the preparation of the ordinary physic ball for the horse. In this the *basis* is Barbadoes aloes; the *adjuvant* is the extract of belladonna, which assists the action of the aloes; the *corrective* is ginger or oil of peppermint, which is added to prevent griping; and the *vehicle* or *excipient* may be soap or treacle, which renders the bolus of a proper consistency.

Of course, it is not necessary that all prescriptions should contain these component parts, as in many all that is required is the basis and the vehicle or excipient.

Abbreviations used in Prescriptions.

āā (*ἀνὰ*), ana—of each. When two or more consecutive ingredients are ordered in equal quantities, the abbreviation āā is placed after the last.

Ad. Up to (the full phrase being 'quantum sufficit ad'). This is used to signify that the vehicle is to be added until a certain quantity is reached.

Bol. Bolus—a ball.

Bis ind. Bis indies—twice daily.

$\bar{c}$. Cum—with.
Div. Divide.
Elect. Electuarinum—an electuary.
Ft. Fiat—let it be made, make.
F.m. Fiat mistura—make a mixture.
Gr. Granum—a grain.
Haust. Haustus—a draught.
Lin. Linimentum—a liniment.
Lb. Libra—a pound.
Lotio. A lotion.
M. Misce—mix.
Mistura. Mixture.
Mitte. Send.
Minimum. A minim, the $\frac{1}{60}$ part of a drachm.
O. Octarius—a pint.
Pil. Pilula—a pill.
Pulv. Pulvis—a powder; pulverizatus—powdered.
Q.s. Quantum sufficit—a sufficiency.
Rep. Repetatur—let it be repeated.
Spts. Spiritus—spirits.
Ss. Semis—a half.
Sig. Signa—mark, or label; *Signetur*—let it be labelled.
Tr. Tinctura—a tincture.
Ungt. Unguentum—an ointment.

Weights and Measures, and Symbols of Same

WEIGHTS.

Libra: 1 pound = 7,000 grains; symbol, lb. i.
Uncia: 1 ounce = 437·5 grains; symbol, $\bar{z}$i.
Drachma: 1 drachm = 60 grains; symbol, ʒi.
Granum: 1 grain; symbol, gr. i.

The *Scruple* (= 20 grains; symbol, ℈i.) is still occasionally employed.

It will be observed that, according to the above table, 8 drachms will represent 480 grains, and hence are equivalent to more than 1 ounce. In the abolished Apothecaries' Weight, the ounce was equivalent to 8 drachms, or 480 grains.

MEASURES.

Congius: 1 gallon = 8 pints = 10 lb.; symbol, C.i.
Octarius: 1 pint = 20 fluid ounces = $1\frac{1}{4}$ lb.; symbol, O.i.
Uncia: 1 fluid ounce = 8 fluid drachms = 437·5 grains; symbol, f.℥i.
Drachma: 1 fluid drachm = 60 minims = 54·68 grains; symbol, f.ʒi.
Minimum: 1 minim = $\frac{9}{10}$ grain; symbol, ♏ i.

Medicines are sometimes measured by the drop, but this is not always safe or accurate. A drop of a mobile liquid is much smaller than a drop of water. The amount will also vary according to the size and form of the neck of the bottle from which it is measured.

Measuring by Domestic Utensils.

This method, in consequence of the variation in size of domestic utensils, cannot be accurate, but is often found convenient.

Common tumblers	= 8 to 10 fluid ounces.
Teacups	= 5 to 7 fluid ounces.
Breakfast-cups	= 8 to 10 fluid ounces.
Wineglasses	= 2 to $2\frac{1}{2}$ fluid ounces.
Tablespoons	= $\frac{1}{2}$ fluid ounce.
Dessertspoons	= 2 fluid drachms.
Teaspoons	= 1 fluid drachm.
A pint wine-bottle	= about 13 fluid ounces.
A quart wine-bottle	= about 27 fluid ounces.
A Scotch pint	= 60 fluid ounces.

The Metric System of Weights and Measures.

This is now adopted by the British Pharmacopœia, but is not yet employed in prescriptions by practitioners in the United Kingdom.

The *Gramme*, which is taken as the unit of weight, is the weight of a cubic centimetre of water at 4° C. or 39·2° F.

The following are the approximate equivalents of the Metric to the ordinary system. They are not strictly accurate, but sufficiently so for practical purposes.

Weights.

1 gramme = about 15½ grains; symbol, Gm.
1 decigramme = 0·1 gramme = about 1½ grains.
1 centigramme = 0·01 gramme = about ⅙ grain; symbol, cgm.
10 centigrammes = about 1½ grains.
0·065 gramme = 1 grain.
4 grammes = about 1 drachm.
30 grammes = about 1 ounce.
1 kilogramme = 1,000 grammes = 2 pounds 3¼ ounces.

Measures of Capacity.

1 cubic centimetre = 1 gramme of water = about 17 minims.
1 litre = 1,000 grammes of water = about 1 pint 15 ounces.
3½ cubic centimetres = 1 drachm of water.
30 cubic centimetres = 1 ounce of water.
1 decilitre = 100 grammes of water = about 3½ ounces.
1 centilitre = 10 grammes of water = about 170 minims.
1 millilitre = 1 gramme of water = about 17 minims.

In using the Metric System it is important to distinguish carefully between the symbols for gramme and grain, as errors have occurred in this direction.

The symbol for gramme is Gm., with a capital initial letter, to distinguish it from gr., the usual contraction for grain. The symbol for cubic centimetre is c.c.

In order to avoid possible errors on the part of the dispenser, the names of drugs should be written in full when the abbreviated designations might appear doubtful. Thus, the term *ac. hydroc. dil.* is erroneous and dangerous, as it might signify dilute hydrochloric acid or dilute hydrocyanic acid. Again, the term *hyd. chlor.* might be taken for calomel or corrosive sublimate, and should not be used.

The doses of mixtures are usually computed according to domestic measures—for the horse in wineglassfuls, and for the dog in tablespoonfuls, teaspoonfuls, etc. For the horse, mixtures are usually ordered in quantities of a pint; and for the dog, from 2 to 8 ounces.

In computing the requisite amount of each drug for a certain quantity of mixture, so that each dose ordered of the latter will contain a medicinal dose of the constituents, the

following rule will assist: First ascertain the number of doses the proposed quantity of mixture will contain, next decide the medicinal dose of each agent selected, then by multiplying the former by the latter the proper amount will be obtained.

Example.

℞ Sodii Bicarb. ...	...	gr. xl.	= 40 grains.
Tr. Nucis Vom. ...	...	♏xxiv.	= 24 minims.
Tr. Gentianæ Co.	...	ʒii.	= 2 drachms.
Syr. Aurantii ...	...	ʒii.	= 2 drachms.
Aquæ	.	ad ℥ii.	= to 2 ounces.

F.m. Sig.: Give 2 teaspoonfuls twice daily.

The above, which is a prescription for an alkaline stomachic mixture for a dog the size of a fox-terrier, contains eight doses, each dose being equivalent to two teaspoonfuls. The amount of bicarbonate of soda in each dose is 5 grains; of tincture of nux vomica, 3 minims; of compound tincture of gentian, 15 minims; and syrup of orange-peel, 15 minims.

Again, an 8-ounce bottle of mixture will contain about 16 tablespoonfuls, or 32 dessertspoonfuls, or 64 teaspoonfuls. A 4-ounce bottle will contain about 8 tablespoonfuls, or 16 dessertspoonfuls, or 32 teaspoonfuls.

In prescribing antiseptic or other solutions the following table will prove useful. The amounts are not strictly accurate, as they are calculated so as to avoid fractions; but for practical purposes they will be sufficiently exact.

1	part	to	1,000	parts	=	$\frac{1}{10}$%	about	$\frac{1}{2}$ gr. to f℥i.	=	9	gr. to Oi.
1	,,	to	500	,,	=	$\frac{1}{5}$%	,,	1 gr. to f℥i.	=	18	gr. to Oi.
1	,,	to	100	,,	=	1 %	,,	$4\frac{1}{2}$ gr. to f℥i.	=	90	gr. to Oi.
1	,,	to	80	,,	=	$1\frac{1}{4}$%	,,	$5\frac{1}{2}$ gr. to f℥i.	=	2	dr. to Oi.
1	,,	to	50	,,	=	2 %	,,	9 gr. to f℥i.	=	3	dr. to Oi.
1	,,	to	40	,,	=	$2\frac{1}{2}$%	,,	11 gr. to f℥i.	=	$3\frac{1}{2}$	dr. to Oi.
1	,,	to	20	,,	=	5 %	,,	22 gr. to f℥i.	=	7	dr. to Oi.
1	,,	to	10	,,	=	10%	,,	44 gr. to f℥i.	=	$1\frac{3}{4}$	oz. to Oi.
1	,,	to	5	,,	=	20%	,,	$1\frac{1}{2}$ dr. to f℥i.	=	$3\frac{1}{2}$	oz. to Oi.
1	,,	to	$2\frac{1}{2}$	,,	=	40%	,,	3 dr. to f℥i.	=	$7\frac{1}{4}$	oz. to Oi.
1	,,	to	2	,,	=	50%	,,	$3\frac{1}{2}$ dr. to f℥i.	=	9	oz. to Oi.
1	,,	to	$1\frac{1}{4}$	,,	=	80%	,,	6 dr. to f℥i.	=	$14\frac{1}{2}$	oz. to Oi.

CHAPTER VII

ON THE ADMINISTRATION OF MEDICINES

THE administration of medicines to animals is a procedure that requires considerable skill and tact, and is one in which the student should render himself proficient. Not only is it of importance that the remedies prescribed should be administered without waste, but also without danger to the patients. Many attendants of animals are very careless and ignorant in these respects, and we know from experience how difficult a matter it is to insure the safe and effectual administration of medicinal agents, more especially in the case of horses and cattle.

Balls are a very convenient method of administering drugs in the solid form. All waste is avoided, and, when skilfully administered, very little discomfort is caused to the patient. The disadvantages are that many attendants are not adepts in the giving of balls, and that medicines in the solid form require a considerable time to become dissolved and in a fit condition for absorption, especially in disordered states of the alimentary canal. If we can insure skilful administration, this method is far preferable in many instances to the employment of drenches.

Balls are now prepared with a special dura-plastic covering and of a convenient shape, which renders their administration far easier than was the case with the old-fashioned form. In administering a ball, the most important points are not to excite the animal and to secure a proper hold of his tongue with the left hand. In order to prevent the head being raised too high, an assistant should keep his

hand on the animal's nose. The ball is held between three fingers of the right hand, and the latter, being in the form of a cone, is passed rapidly along the palate, and the ball pushed gently into the region of the pharynx; the hand is then quickly withdrawn, and the tongue released. The animal's head should be held up until the ball is seen to descend along the gullet. In some cases it may be necessary to allow the animal to take a few mouthfuls of water, which produces the desired effect.

Some horses resent the administration of medicines in this form, and work the jaws vigorously when the hand enters the mouth. In such instances, in order to avoid injury to the hand from the animal's teeth, it is necessary to employ a balling-iron, or a special instrument termed a 'balling-gun.' The practice of using a sharp-pointed stick for this purpose cannot be too strongly condemned, as such has often caused injury to the pharynx and soft palate. Unskilful administration, by which a ball becomes broken in the horse's mouth, is frequently the cause of the animal resenting the taking of this form of medicine on a future occasion. Some horses persistently cough and reject the bolus no matter how carefully it is administered, and even when it is well lubricated. In such cases medicine must be administered either as a drench or in the food.

American practitioners administer medicines in the form of tablets. By means of a special instrument, shaped like a pair of tongs, the tablet is deposited on the posterior region of the tongue, and is readily swallowed by the patient.

In rare instances 'choking' has resulted during the procedure of administering a physic ball. The bolus may become transfixed in the pharynx or upper portion of the œsophagus, and gives rise to very distressing symptoms. It is more likely to occur when the horse violently resents the administration.

In Cattle, medicines in the solid form are seldom administered, as they enter the rumen, and their effect is slow and uncertain in consequence of the large amount of ingesta therein.

In the Dog, medicines are conveniently administered in the form of pills or tablets. These are now prepared in a manner that renders them easy of administration. A pill or tablet can be given to the dog by placing it with the fingers at the back of the animal's tongue, and holding the jaws together until swallowed. Instruments called 'pill-carriers' are sometimes used for this purpose. A popular method of giving the dog a pill is to enclose it in a piece of meat; this is readily bolted by the animal. If he be suspicious, it is advisable to first offer him meat without the medicine; the medicated portion is then taken without any trouble. Medicines in the solid form can also be administered in gelatine capsules, the flexible variety being the most easily given.

Drenches or **Draughts** are the form in which fluid medicines are administered. Considerable care is necessary in the process, so as to avoid the fluid gaining an entrance to the trachea, and thus setting up broncho-pneumonia. The animal's head should not be held too high, the tongue should be left perfectly free, and if the animal makes an attempt to cough, the head should be immediately released. The drench should be administered slowly, so as to avoid danger and prevent waste. Drenches should be administered out of a properly made tin drenching-bottle.

If in cases of emergency a glass bottle has to be used, care should be taken to select one of stout material and with a strong neck, so as to avoid the risk of the latter getting broken in the animal's mouth. In cases of laryngitis, pharyngitis, and, indeed, in all cases of respiratory affections, drenching should be avoided, as there is great danger of the fluid finding its way into the trachea during a sudden inspiratory effort or a fit of coughing. This is very easily induced in consequence of the irritable condition of the respiratory passages. We are quite convinced that the indiscriminate practice of giving drenches in cases of this kind is productive of many serious, if not fatal, results.

In Cattle, similar precautions are necessary. The animal's head should not be held too high, and the head and neck

should be kept in a straight line as much as possible. Many fatal results occur from the ignorant and careless administration of drenches to cattle. In cases of milk fever, drenching is both dangerous and unnecessary. This disease is now treated successfully by inflating the udder with air.

Various contrivances have been introduced to facilitate the administration of drenches, but in our experience they do not render the procedure any less dangerous, although less of the medicament is wasted.

The practice of administering drenches through the nostril cannot be too strongly condemned.

In the Dog, medicines in the fluid form are usually administered with facility. The best method is to distend the cheek with the finger so as to form a pouch, and to pour the fluid slowly into this from the corner of the mouth. It readily finds its way through the teeth, and is swallowed without trouble. Precautions are also necessary in administering fluid medicines to the dog, so as to avoid the risks of any of the medicament entering the trachea.

Powders are a safe and convenient method of administering medicines to the horse and dog. They should not contain substances having a disagreeable taste or smell, as otherwise they will be refused by the patients. Powders are given to the horse either in the food or drinking-water. If possessing any taste or smell, they should be first mixed in cold bran mash and then incorporated with the food. If mixed with warm food their smell and taste are increased. Salines are readily taken in the drinking-water, and substances such as magnesium sulphate, sodium sulphate, and sodium bicarbonate, can be administered in this manner.

In the dog, medicinal agents are best mixed with sugar, and are then taken in the food without difficulty; or tasteless powders, such as bismuth nitrate or carbonate, can be placed on the back of the tongue. Chloretone is best given in this manner.

Electuaries are prepared in a semifluid condition, the basis being honey or treacle, and are administered by placing the required dose between the molar teeth or on the back of

the tongue. Their employment is indicated when swallowing is difficult, such as in cases of acute laryngitis or in tetanus. In respiratory affections, when we deem it advisable to prescribe antipyretics, an electuary is far safer and preferable to a drench. Again, when horses refuse to take powders in the food, the medicine can be mixed in a small amount of treacle and administered in the form of electuary.

Inhalations.—The inhalation of steam medicated with various agents is of marked therapeutical value in cases of respiratory affections. A perfect method of administration has not yet been discovered for the horse. The usual plan is to fill a stable bucket three-quarters full of boiling water, pour in the medicinal agent selected, which is usually some antiseptic volatile oil, cover the top of the receptacle with hay, stir the contents with a stick, and hold the animal's head over the steam that arises.

The practice of covering the horse's head with a sack containing the bucket cannot be too strongly condemned, as it causes respiratory distress and annoys and weakens the patient. The value of medicated inhalations is doubted by some authors, as experiments have shown that, in the usual method of administration, the vapour does not reach the alveoli of the lungs. However this may be, we are convinced of their value from the clinical point of view.

Suppositories are soft medicated masses of a conical shape, intended for insertion into the rectum to produce local therapeutical effects in diseases of this organ. Glycerin suppositories (containing 70 per cent. by weight of glycerin) are employed in cases of constipation in the dog. Nutrient suppositories containing peptonized beef are employed in canine practice when feeding by the mouth is impossible, also in the case of acute gastritis with persistent vomiting. The nutriment is absorbed from the rectum, and by this means it is possible to sustain life for a time.

When rectal feeding is being carried out, it is necessary to administer an enema every few days to clear out the bowel.

Hypodermic Injections.—Medicinal agents in the form of active principles or alkaloids are administered by this method.

The best hypodermic syringe is the all-metal pattern introduced by Messrs. Parke, Davis and Co. The needle should be of very fine calibre, so as not to cause pain during its insertion under the skin; it should also be short, so as not to be readily broken should the animal make a sudden struggle during administration. Strict aseptic precautions must be observed. The site usually chosen for injection is the lower region of the neck, where the skin is thin and the subcutaneous tissue loose. A fold of skin is taken up between the finger and thumb of the left hand, the needle is then passed underneath the skin in an oblique direction, and the syringe containing the solution is attached to the needle by the plug arrangement. The fluid is now slowly injected. In the case of some agents intramuscular injections are preferable.

The injections of sera, etc., are carried out in a similar manner, but with these a large serum syringe is desirable; the hair should be shaved off the site of injection, and the skin painted with tincture of iodine. After injection the site should again be painted with iodine. Serum syringes and needles should always be sterilized by boiling.

The subcutaneous injection of normal saline solution (see p. 214) is largely employed as a cardiac stimulant. A simple apparatus can be constructed with a glass funnel and a piece of indiarubber tubing to which is attached a hypodermic needle. The latter is inserted under the skin, the fluid is poured into the funnel, which is raised above the patient, and the fluid then enters the subcutaneous tissue.

Local anæsthesia is also carried out by means of either subcutaneous or intramuscular injection, etc.

Intravenous Injection.—The jugular vein is the vessel usually selected. The vein is rendered prominent by means of digital pressure exerted inferiorly to the spot selected. The needle is carefully inserted with the point facing downwards. When blood issues from the needle it indicates that the vein has been entered. The injection should be made very slowly, taking care that no air is permitted to enter. The material for injection should be well diluted and

non-irritant. Intravenous injection is employed by some practitioners for the administration of drugs such as eserine, also for solutions of nuclein and normal saline solution. It is also adopted for the administration of influenza antitoxin. Strict aseptic precautions are essential, and neglect in this direction may produce serious consequences, such as phlebitis (inflammation of the vein). In the dog the saphena vein may be selected as the site of injection.

Generally speaking, subcutaneous injection is more convenient and safer, but occasions may arise when immediate effects are desired and the intravenous method is preferable.

Intratracheal Injection.—This method is employed in the treatment of parasitic bronchitis (hoose), in calves and lambs. A combination of oil of turpentine, carbolic acid, etc., in the form of an emulsion with olive-oil, is slowly injected into the trachea, and thus acts directly on the parasites. A strong needle is required, and this is inserted into one of the spaces between the rings of the trachea; the syringe containing the solution is then attached to the needle by a plug arrangement, and the injection slowly carried out. Care must be taken that the needle enters the trachea, and not the surrounding tissues.

In the treatment of purpura hæmorrhagica, the intratracheal injection of a solution of iodine is found successful by some practitioners.

Intraperitoneal Injections—*i.e.*, the injection of medicinal agents into the peritoneal cavity—are employed on the Continent for the following purposes: (*a*) A solution of chloral hydrate as a general anæsthetic; (*b*) normal saline solution as a general stimulant in cases of collapse or shock. A fine trocar and cannula is inserted into the upper region of the left flank with strict aseptic precautions; the trocar is withdrawn and a syringe attached to the cannula. This method has not found favour in the British Isles.

Intramammary Injections.—These are employed in the treatment of acute mammitis. From 2 to 4 ounces of a warm solution of boric acid (3 per cent.) or of chinosol (1 to 1,200) are injected into the udder by means of a

syringe, and a teat-syphon inserted in the teat. In some forms of the disease the injections should be repeated three or four times daily, but in ordinary cases one injection may be sufficient. The teats should be carefully drawn at intervals of three or four hours after each injection.

In the treatment of milk fever in cows, the insufflation of the udder with air proves most successful. A special foot-pump is best for the purpose, but on occasions of emergency a bicycle-pump fitted with a teat-syphon acts well.

Intra-Uterine Injections are employed in cases of retained placenta, when much fœtor is present, and there is risk of septic absorption. Also in cases of septic metritis, and in instances of difficult parturition, where abrasions or wounds of the uterine mucosa have resulted. A 1 per cent. solution of Cook's Cofectant Fluid forms a reliable germicide for such cases. It is best injected by means of a continuous flow syringe attached to a double tube (such as Knisely's stomach-tube), so that when uterine inertia is present the fluid can be syphoned off, and a thorough irrigation carried out.

Intraspinal Injections for the production of spinal anæsthesia are occasionally employed on the Continent. A sterilized solution of stovaine, novocaine, etc., is injected with strict aseptic precautions into the lumbo-sacral space. When the needle enters the subdural space, cerebro-spinal fluid escapes. Anæsthesia of the posterior portions of the body results. The advantages to be gained are not sufficient to render this method a desirable one in veterinary practice.

Pessaries (sometimes termed 'uterine suppositories') are solid bodies of a conical shape, composed of antiseptic agents, and intended for insertion into the uterine cavity to assist the action of intra-uterine injections. They dissolve slowly, and keep up a continuous antiseptic action. The preferable constituents are iodoform, chinosol, etc.

Enemata are fluids of various compositions which are injected into the rectum for the following therapeutical purposes:

1. To procure evacuation of the bowels. For this purpose the simplest form is warm water with soap dissolved

in it. The effect of an enema is not only to cause expulsion of the fæces contained in the rectum, but, by reflex action, to stimulate peristalsis beyond the surface reached by the injection. For the horse and ox the best form of instrument for the administration of enemata is a continuous flow pump, attached to which is a sufficient length of rubber tubing, and to the latter is fixed a gum-elastic tube about 2 feet long. The rectum is first cleared of its contents as far as possible by the hand; the tube, well lubricated, is carefully introduced and the fluid slowly pumped in. In cases of impaction of the colon, the simple injection of fluids into the rectum is not likely to prove of much service, and the long tube (6 feet in length), first recommended by F. Smith, should be utilized. By the exercise of considerable patience, it is possible to pass this tube to its full length. The tube should be well lubricated with lard, and passed in very slowly, the fluid being pumped in at the same time. As the bowel becomes distended, the instrument passes along with facility into the floating colon. The chief difficulty is that the tube is inclined to bend on itself, but with care and patience this can be overcome. Large quantities of water should be introduced, and in many instances good results will follow. Some practitioners fix the tube to a water-tap, and find that cold water acts as well as hot. For further particulars see 'The Treatment of Intestinal Obstruction,' Part III. of this work.

In the treatment of intestinal obstruction in foals due to the retention of the meconium, chief reliance must be placed on enemata. A long gum-elastic rectum tube, similar to that used for large dogs, must be employed. (See 'Intestinal Obstruction in Foals,' Part III.)

For the dog the ordinary human enema syringe is employed. In obstinate cases of fæcal impaction in this animal, by raising the hind-quarters the enema is more likely to reach the seat of obstruction. Enemata of glycerin are often employed to promote evacuation of fæces; this agent is injected undiluted in amounts of 2 to 4 drachms. (For further details, see 'Fæcal Impaction in the Dog,' Part III.)

2. Enemata consisting of boiled starch, medicated with opium, act as intestinal sedatives and astringents in cases of severe diarrhœa. They should be small in bulk, and injected very slowly, so that they may be retained.

3. In painful inflammatory conditions of the pelvic organs, enemata of warm water exert a soothing effect.

4. Enemata containing common salt or a decoction of quassia are employed to destroy and remove parasites (ascarides) infesting the rectum.

5. Nutrient enemata are usually composed of nutrient substances in a form which is capable of being readily absorbed by the rectum. They are employed in cases where swallowing is difficult or impossible, and in the dog are sometimes substituted for nutrient suppositories.

For the horse, one or two pints of linseed-tea with milk and eggs may be employed, and repeated four or five times in twenty-four hours. If introduced at a temperature of 100° F., they are more likely to be retained. Generally speaking, nutrient enemata prove of little value in equine practice.

For the dog, peptonized beef in solution may be given, but suppositories containing this substance are far preferable (see p. 184).

Poultices possess emollient properties, and are employed for the local application of heat and moisture. They may be composed of linseed-meal, oatmeal, or bran, stirred into boiling water until the proper consistency is obtained, and then cooled to the proper temperature before being applied.

Of late years the time-honoured linseed, oatmeal, or bran poultice, also poultices composed of boiled turnips or carrots, have been superseded by applications composed of kaolin and glycerin with antiseptic agents, and by hot compresses of boric lint. Much benefit has resulted from this change, as the old-fashioned articles produced a softened condition of the part to which they were applied, favoured the formation of unhealthy granulations, delayed the process of healing, and could not be rendered antiseptic. The modern substitutes are convenient and clean to use, retain their heat and

moisture for a long period, and, being of little weight, do not cause discomfort. Discretion is necessary in the employment of these agents; they should be discontinued when acute pain and inflammation have been relieved, and in the case of wounds dry antiseptic dressings should be substituted for them.

The chief uses of medicated poultices are in the treatment of punctured wounds, accompanied by acute pain, and in favouring the maturation of abscesses, as in cases of strangles. They are also of value in acute mammitis.

Fomentations are employed to relax and soothe congested or inflamed parts, also in the treatment of strains, contusions, etc. They lessen tension and abate pain. Fomentations usually consist of hot water, medicated or otherwise. The temperature of the water should not be too high; above 110° F. it produces irritation of the skin. The attendant should judge of the proper temperature by placing his elbow in the water; his hand is not a proper index, as, owing to the hardened condition of the skin, he is not able to appreciate excessive heat or otherwise. Discretion is necessary in prescribing fomentations, as there are conditions, such as erysipelas, in which frequent fomenting with hot water leads to extensive sloughing of the skin. The tendency of grooms is to carry out fomenting either in a slipshod manner, or to continue the process for too long a period. In severe strains of tendons, etc., we find far better results by applying a large hot application of kaolin and glycerin, and enveloping the limb in cotton-wool. In punctured wounds of the foot, after free drainage has been provided, the part should be kept immersed in a clean tub containing a hot antiseptic solution, for several hours daily.

Baths.—In equine practice the employment of baths, either hot or cold, is not general, except in the case of certain diseases of the skin. The large extent of the horse's skin, and the difficulty of overcoming the evil effects of excessive reaction and of drying the animal thoroughly, so as to avoid chill, are important considerations. The Turkish bath, however, is of marked value therapeutically in the

treatment of renal affections, rheumatism, the early stages of respiratory affections, and in diseases of the skin. Great care is essential so as to avoid any danger of chills occurring.

Mr. C. Hartley, F.R.C.V.S., Lincoln, has devised a luminous heat bath for veterinary practice, the heating apparatus consisting of luminous electric heaters fixed on reflecting surfaces of special construction, the latter being arranged so as to diffuse the reflected heat and light rays from the luminous source and project them in any given direction (see *Veterinary Journal*, vol. xlix., 1899, p. 440).

In canine practice hot baths are frequently employed in the treatment of various affections. The temperature may range from 95° to 110° F. The patient should be thoroughly dried afterwards, and kept in surroundings of a proper temperature.

House dogs are washed in summer-time once a week or once a fortnight, so as to render their coats clean and free from fleas, etc. Warm water is first employed, and then lukewarm, so as to avoid any danger of chill. Thorough drying is essential, and in fine weather a brisk run afterwards is desirable. Irritant soaps should be avoided. One of the best soaps for the purpose is Cook's Cofectant Liquid Soap.

The Administration of Medicines to Birds.

In the administration of medicines to birds some skill is required. Small birds should have medicinal agents in the form of glycerole or similar liquid menstruum. This can be administered through the beak by means of a cut quill, a toothpick, or a fountain pen dropper. Castor-oil may be given from the end of a probe. When the bird has a desire for water, medicines can often be given in it. As, however, birds usually drink very little water, it is necessary to dissolve in the fluid relatively large doses of the medicine selected. For example, if we wish to administer potassium iodide to a cage-bird, we allow 1 ounce of water containing 5 grains of the drug. Cage-birds will often eat a piece of sponge-cake moistened with a palatable medicine ; or the latter may be

given in a small quantity of hard-boiled egg. In the case of pigeons and poultry, drugs can be given in the form of pills or in the food or water. In administering medicine to a parrot, the bird should be wrapped in a thick bath-towel, and the head held so that the practitioner cannot get bitten. In holding birds of all kinds, care must be taken not to compress the chest, otherwise suffocation would be induced.

(*For details of the Administration of Medicine to Sheep and Pigs, see Part III.*)

CHAPTER VIII

VETERINARY PHARMACY

PHARMACY is the art of preparing and compounding medicines. In the present work, as our aim is chiefly therapeutical, only a short space can be devoted to this subject. Nevertheless, there are important points in connection with pharmacy to which we must briefly refer. Pharmacy being chiefly an art, a knowledge of it can only be acquired by devoting a proper period of time to actual dispensing. No doubt, for the preparation of elegant and homogeneous compounds, it is essential that the dispenser should possess a knowledge of chemistry. The pharmaceutical chemist dispenses the prescriptions issued by the practitioner. The latter is presumed to have a knowledge of pharmacy, so that, in addition to prescribing the suitable medicinal agents and the doses of same to suit the exigencies of his case, he must select preparations which are likely to prove elegant, miscible, and compatible, when dispensed. The art of compounding, however, lies with the dispenser.

As the large majority of veterinary surgeons compound the medicines required in their practice, it follows that they are in the dual position of prescribers and dispensers. Hence it is essential for the veterinary student to become adept at dispensing as well as prescribing. Familiarity with the former teaches him not only the manual part of the work, but it impresses in his mind the appearance, uses, and doses, of the various drugs, and the methods of combining

them so that elegance, convenience, and suitability, will result when the prescription is dispensed.

Veterinary pharmacy in the present day shows vast alterations as compared with former times. It is no longer necessary to make preparations from crude materials, or to seek for impurities in the drugs we purchase. By dealing with reliable wholesale chemists, we are assured of the purity and strength of medicinal agents, and, besides, are enabled to purchase the various preparations in a form convenient and ready for dispensing. We have already drawn attention to the fact that, by reason of these favourable conditions, it is absurd to demand from veterinary students a knowledge of the impurities of drugs, to burden their minds with descriptions of medicinal plants and crude materials, and details of the preparation of alkaloids or active principles, or any other matters which clearly belong to the province of the manufacturing chemist. The time of the student is too valuable to waste on 'cramming' details of this kind, which are rapidly forgotten when he has passed the examination in Materia Medica, and which he will never require to recall.

While we deprecate too much reliance on ready-made medicines, we must at the same time point out that in a busy practice there are many preparations largely employed daily; and it is necessary to keep these in stock so as to have them ready and convenient for dispensing, and thus save valuable time. Many of these can be compounded as opportunity offers, but there are others which involve much difficulty in order to render them attractive in appearance. Others, again, which contain powerful or toxic agents, such as tablets and pills for dogs, and hypodermic tablets, require very careful preparation, and the skill and assistance of the chemist is necessary. Few practitioners in the present day would expend their time or that of their assistants in making up aloetic physic balls, when these can be purchased for a very moderate price from wholesale chemists (see p. 196).

Many practitioners also keep a stock of powders which are in everyday use, so that quick despatch can be carried out when necessary. It is not wise, however, to put up large

quantities of powders containing vegetable drugs, as such are very liable to deteriorate if kept for any length of time.

The practice of prescribing preparations advertised by chemists, the formulæ of which are trade secrets, cannot be too strongly condemned. When it becomes necessary for the sake of convenience to have stock preparations made up by chemists, we should supply the formulæ and the doses of each agent which we desire to administer; in other words, we do the prescribing, while the chemist compounds the prescription. Of course, practitioners who keep assistants have not the same need for the assistance of the chemist as those who have to carry on their work single-handed. The important matter is to have the dispensing carried out in an accurate and neat manner. It should be noted that the owners of animals do not appreciate careless methods in dispensing, and prefer to have the medicines sent out in an attractive style. Neglect of this matter often leads the public to patronize the patent medicine vendor, who takes good care to cater for their taste in this respect. The dispensing of medicines in the veterinary pharmacy should be carried out on exactly similar lines to those adopted by the pharmaceutical chemist. Nothing can excuse slovenly methods and a lack of order in the pharmacy. Explicit directions should be written on the labels attached to each bottle or package of medicines sent out, and poison labels should be affixed to articles that require this designation.

In the case of powerful drugs sent out in bulk, it is a wise precaution to use a label indicating that the preparation is poisonous in overdose. Distinctive labels should be used for lotions, liniments, etc., so as to avoid any danger of mistakes arising.

All poisonous agents should be kept in a separate part of the pharmacy and distinctly labelled.

Powders should be thoroughly ground and mixed by pestle and mortar. It is usual to supply quantities of six powders to each case. In the case of simple drugs, we first decide the dose of each agent, and by multiplying this by the number of powders to be sent we compute the weight

of each ingredient which is required. After thoroughly mixing by pestle and mortar, we divide the bulk into the requisite number of powders and fold each dose neatly in paper. The six powders are then put together in a wrapper or in a cardboard box and labelled.

When a combination is prescribed containing poisonous agents such as arsenic, the dispenser first divides the simple drugs into the requisite number of powders; he then weighs each dose of arsenic separately, and adds it to each of the powders.

In canine practice, triturations are convenient in the case of drugs such as arsenic. For example, the dose of this agent varies from $\frac{1}{50}$ to $\frac{1}{20}$ of a grain, according to the size of the dog. If we triturate 3 grains of arsenic with 10 drachms of milk-sugar, then 10 grains of the resulting triturate will be equivalent to $\frac{1}{20}$ grain. Generally speaking, it is safer and more accurate to prescribe arsenic in the form of tablets.

In prescribing powders, the question of chemically incompatible agents must be carefully considered, otherwise a damp useless mass will result. If powders are made up in bulk, they should be kept in a dry place, and, as already remarked, it is advisable not to make up a larger stock than is absolutely necessary, especially if they contain vegetable drugs.

Balls or **Boluses** are prepared by finely powdering and mixing the ingredients in a mortar with a pestle, and adding excipients such as soap, syrup, treacle, etc., so as to form a mass of proper consistence. The mass is then divided into the requisite number of doses, and each is moulded into the proper shape, which should be elongated and rounded at each end. The ball is then wrapped in thin paper. (For the special preparation of aloetic physic balls, see p. 460.) As already remarked, few practitioners would expend the trouble and time requisite for preparing aloes in this form, when they can obtain the special 'dura-plastic' physic balls manufactured by Messrs. Wyleys and Co., Coventry. These are covered with an air-tight but soluble material, are con-

venient to administer, their contents remain active for a long period, and they are very moderate in price.

Drugs such as chloral hydrate, salicylic acid, etc., can be administered in the solid form by means of gelatine capsules. These capsules can be obtained in various sizes, and filled as required for use.

Pills are used in canine practice, and are prepared by mixing the ingredients with a basis such as soap, treacle, etc., on a slab, and dividing the mass into the requisite number of pills. The process is a tedious one, and most practitioners obtain medicines in pill form from manufacturing chemists, and thus secure accuracy in dose and elegance in appearance.

Tablets containing the agents usually required in canine medicine can also be obtained. These, as well as pills, are coated with either gelatine or sugar, and are very convenient for dispensing and for administration.

Electuaries are prepared by mixing the agents selected with a basis composed of honey or treacle. The consistence should be such that the preparation can be placed on the tongue with facility. If too fluid, the consistence can be increased by the addition of powdered liquorice. Various medicinal agents can be administered in the form of electuary, and in respiratory affections especially, this method of medication is preferable to drenching. Electuaries are also valuable in cases of pharyngitis and laryngitis, owing to their local action on the pharynx and surrounding structures.

Mixtures and Drenches are prepared in the pharmacy as required for use. Mixtures containing insoluble substances, such as bismuth, require the aid of mucilage (gum acacia) to hold the agents in suspension. In canine practice it is necessary to add to mixtures containing bitter drugs a sweetening agent, such as simple syrup, in order to disguise the taste and thus facilitate administration. Flavouring agents should be avoided, as they are disliked by dogs and cats.

Drenches containing substances likely to cause irritation of the mouth and pharynx, such as oil of turpentine, chloral

hydrate, or preparations of ammonia, should be diluted with raw linseed-oil, milk, mucilage, etc. Instructions should be given that the drench be well shaken prior to administration.

Mixtures for horses and cattle are usually dispensed in quantities of a pint, and given in doses of a wineglassful diluted with a sufficient amount of water. Drenches are generally sent out in pint bottles.

For the dog and cat, mixtures are made up in either 2 or 4 ounce bottles, and the doses vary from a teaspoonful to a tablespoonful according to the size of the animals.

Hypodermic Injections are conveniently prepared from pellets containing the correct dose of the alkaloid or active principle selected. The pellet is dissolved in a small amount of sterilized water, and is then ready for use. Ready-made solutions in hermetically sealed glass tubes or ampoules can also be obtained from chemists.

Pellets should be thoroughly soluble; if otherwise, failure in the action of the drugs is likely to result.

Ointments are usually prepared in bulk. The basis may be of lard, vaseline, or lanolin. We prefer equal parts of vaseline and lanolin for the basis. In preparing ordinary ointments, the ingredients are first finely powdered and incorporated, the basis is melted, and the preparation is completed by thoroughly mixing the above together in a pestle and mortar of large size. In preparing cantharides ointment (fly blister), a special procedure is necessary. But it is preferable to purchase in bulk the special blistering ointment manufactured by Wyleys and Co., which contains the active principle (cantharidin), and is non-irritant, while producing copious vesication. The preparation of such an ointment would entail the expenditure of much time and labour on the part of the practitioner.

The Medicine Chest.—In a country practice a portable medicine chest is essential in order that immediate treatment of urgent cases may be carried out. Cases have often to be attended at long distances from the surgery, and a pharmaceutical chemist's establishment may not be available. The medicine chest should contain a sufficient amount of medi-

cines which may be required in an emergency. Owing to the fact that hypodermic medication is so often practised in the present day, a medicine case of small size can be made to contain all that is requisite for emergency cases.

In concluding the subject of dispensing, we may again point out the desirability of supplying clients, residing at a long distance from the practitioner, with suitable remedies which they can make use of for urgent cases until professional assistance can be procured. We have found that much benefit accrues as the result of this plan. It puts a check on the purchase of patent nostrums, which frequently do more harm than good, and, when the practitioner arrives to attend his case, he is aware of the medicinal agents which have been administered.

PART II

THE MATERIA MEDICA

CHAPTER I

INTRODUCTORY

As no recognized Veterinary Pharmacopœia is in existence, the veterinary surgeon adopts the preparations of drugs laid down by the British Pharmacopœia. Of course, there is no reason why he should not alter the strength of these preparations if he deems it necessary. He can also use any medicinal agents he pleases, whether they are included in the B.P. or otherwise. He must, however, remember, that if he writes prescriptions to be dispensed by chemists, that the latter will employ the preparations of the B.P.

We have already remarked that we do not consider it necessary for the student to commit to memory details of the preparation of the various medicinal agents, as such knowledge belongs to the domain of the pharmaceutical chemist. Hence, in the present work, we only intend to give very brief details of the preparations of drugs, our aim being mainly therapeutical. Similar remarks will apply to pharmacology, and we shall only deal with the actions of drugs in so far as they explain the therapeutical value of the agents. The toxic actions will be briefly considered, and for full and complete information on this subject the student is referred to Lander's 'Veterinary Toxicology.'

The student should be familiar with the meaning of the

following terms. They refer to the preparations and mode of preparation of the various crude drugs employed in medicine.

Aquæ (Waters) are prepared either by distilling the drug with water and preserving the distillate, or by making a simple solution of the agent in distilled water.

Examples.—Aqua Camphoræ; Aqua Chloroformi; Aqua Rosæ.

Decocta (Decoctions) are prepared by boiling the drug in distilled water for a certain time and then straining.

Example.—Decoctum Hæmatoxyli.

Infusa (Infusions) are prepared by treating the prepared drug with boiling water, and then straining.

Example.—Infusum Digitalis.

Tincturæ (Tinctures) are solutions of medicinal agents in alcohol (either rectified spirit, 84 per cent. by weight, or proof spirit, 49 per cent. by weight). The mode of preparation varies; thus, some tinctures are prepared by a simple solution of the drug in spirit, others by a process of maceration, and others, again, by maceration with a portion of the alcohol for forty-eight hours, followed by percolation with the remainder. In some instances a tincture is prepared with the standardized fluid extract of the drug and alcohol.

Example.—Tinctura Nucis Vomicæ.

Other examples of tinctures are: Tinct. Opii; Tinct. Aconiti.

Extracta (Extracts) may be solid, semi-solid, or liquid. Solid extracts are prepared by exhausting the drug by maceration or percolation with a suitable menstruum, and subsequently removing the bulk of the latter by evaporation.

Examples.—Extractum Belladonnæ Siccum (dry extract of belladonna); Extractum Nucis Vomicæ.

Liquid or fluid extracts are prepared in a similar manner to the above, but the evaporation process is not carried so far, and rectified spirit is added for the purpose of preserving the fluid.

Examples.—Extractum Belladonnæ Liquidum; Extractum Nucis Vomicæ Liquidum.

Glycerina are solutions of various drugs in glycerin.

Examples.—Glycerinum Boracis; Glycerinum Acidi Carbolici.

Spiritus (Spirits) are solutions of drugs in rectified spirit.

Example.—Spiritus Camphoræ.

More commonly they are solutions of volatile oils in rectified spirit.

Example.—Spiritus Juniperi.

Vina (Wines) are prepared in a similar manner to tinctures, but sherry or orange wine is substituted for alcohol.

Example.—Vinum Ipecacuanha.

Liquores (Liquors) are solutions of medicinal agents in water, and in many instances the process of preparation is complex.

Examples.—Liquor Ammonii Acetatis; Liquor Arsenicalis.

Syrupi (Syrups) consist of a strong solution of refined sugar in distilled water, to which is added the medicinal agent in a state of solution.

Examples.—Syrupus Aurantii; Syrupus Chloral.

Olea (Oils) include fixed and volatile or essential oils.

Examples.—Oleum Anisi; Oleum Eucalypti; Oleum Menthæ Piperitæ.

Misturæ (Mixtures) are fluid preparations in a suitable form for internal administration.

Example.—Mistura Cretæ (chalk mixture).

Pulveres (Powders) are prepared by reducing drugs by trituration to a state of fine division, and mixing the ingredients thoroughly.

Example. — Pulvis Ipecacuanhæ Compositus (Dover's powder).

Pilulæ (Pills) are prepared by mixing the ingredients in a mortar, and kneading them into a firm mass with a suitable excipient, then by means of a pill machine the pills are made of the size and form desired.

Example.—Pilula Colocynthidis Composita (compound pill of colocynth).

Linimenta (Liniments) are fluid preparations which have an oily, soapy, or alcoholic basis, and are intended for external

use, being either applied with friction or simply painted on a part.

Example.—Linimentum Terebinthinæ (liniment of turpentine).

Lotiones (Lotions) are solutions intended for external use.

Examples.—Lotio Hydrargyri Flava (yellow wash); Lotio Alba (white lotion).

Unguenta (Ointments) are preparations for external applications, having a basis composed of lard, a mixture of hard and soft paraffin, or lanolin.

Examples.— Unguentum Acidi Borici (boric acid ointment); Unguentum Hydrargyri Ammoniati (white precipitate ointment).

Alkaloids are the active principles of vegetable drugs; they are alkaline in reaction, and readily combine with acids forming salts soluble in water. All contain nitrogen; some drugs may contain more than one alkaloid, the latter differing in their actions from each other. Alkaloids have the termination 'ine' or 'ina.'

Examples.—Morphine; Atropine; Physostigmine; Cocaine.

Neutral Organic Principles are another form of active concentrated vegetable drugs, prepared by complex processes.

They are represented by digitalin, aloin, santonin, and are distinguished from alkaloids by having the terminal 'in.'

Standardization of Drugs.—Owing to the fact that crude drugs vary in medicinal activity according to the different conditions of soil, climate, etc., under which they have been cultivated, it follows that all preparations made therefrom will vary in strength, unless standardization be carried out. It has been found that preparations of drugs, such as the ordinary tincture of digitalis, may be inert. Hence it is absolutely necessary for chemists to adjust drugs containing alkaloids or other active principles to a definite degree of medicinal value. In the case of some drugs this is carried out by chemical analysis; in others this method cannot be availed of, and it is necessary to test them physiologically —*i.e.*, by noting their effects on animals. Amongst the drugs in which physiological standardization is necessary are

aconite, cannabis indica, digitalis, strophanthus, ergot, and squill.

Here we may direct attention to the value of the standardized fluid extracts prepared by Messrs. Parke, Davis and Co., which are thoroughly reliable, convenient for use, and have largely taken the place of the old-fashioned tinctures. If desired, tinctures can be prepared from these fluid extracts by diluting the latter with a certain amount of rectified spirit, the amount varying according to the strength of the fluid extracts.

The fluid extracts, being concentrated, can be conveniently administered in the food or in the form of electuary.

The Materia Medica

may be divided into the following groups for convenience of description :

GROUP I.—Alkalies and alkaline earths.
GROUP II.—The metals.
GROUP III.—The non-metallic elements.
GROUP IV.—Acids.
GROUP V.—Water.
GROUP VI.—The carbon compounds.
GROUP VII.—The vegetable kingdom.
GROUP VIII.—The animal kingdom.

In dealing with the preparation of tinctures, etc., the quantities will be given according to the Metric System. The doses will be arranged according to the Imperial System, as up to the present time the Metric System of Dosage is not employed in the British Isles.

CHAPTER II

GROUP I.—ALKALIES AND ALKALINE EARTHS

Of these the most important are—(1) Potassium, (2) Sodium, (3) Ammonium, (4) Calcium, (5) Magnesium, (6) Barium.

(1) POTASSIUM AND ITS MEDICINAL SALTS.

General Actions.—Potassium salts are rapidly absorbed and quickly excreted; they increase the alkalinity of the blood in a transient manner. In large doses they depress the heart, lower blood-pressure, and, finally, paralyze the nerve centres. Potassium salts vary in their actions according to their composition. Thus, caustic potash is *irritant* and *caustic;* the nitrate and acetate of potassium are *diuretics;* while the iodide and bromide of potassium possess the specific actions of iodine and bromine respectively.

Potassa Caustica—Hydrate of Potash; Caustic Potash.

Liquor Potassæ—Solution of Caustic Potash.

Preparation.—**Liquor potassæ** is prepared by boiling slaked lime in a solution of carbonate of potassium, and then decanting. **Caustic potash** is prepared from liquor potassæ by boiling it down quickly, and pouring the residue into pencil-shaped moulds.

Actions.—Caustic potash in full doses is an irritant corrosive poison.

Externally it is a penetrating caustic, and its action in this respect is difficult to control.

Uses.—Neither of these preparations of potash is prescribed internally.

Externally, caustic potash is often employed as an applica-

tion to prevent the growth of horns in young cattle. It is seldom used as a caustic. Liquor potassæ is recommended in combination with creosote and olive-oil as an efficient dressing in the treatment of follicular mange in the dog (see p. 337). It is sometimes added to dressings for mange in horses, to increase their penetrating power.

Potassii Carbonas—Carbonate of Potassium; Carbonate of Potash.

Potassii Bicarbonas—Bicarbonate of Potassium; Bicarbonate of Potash.

PREPARATION.—The carbonate is prepared from pearl ash. The bicarbonate is prepared by saturating a strong aqueous solution of the carbonate with carbonic acid, and recrystallizing.

DOSES OF THE BICARBONATE.—Horses, ℥ss. to ℥i.; cattle, ℥i. to ℥i.ss.; sheep and pigs, ʒss. to ʒi.; dogs, grs. x. to grs. xl. Administered twice daily, either mixed in the food or dissolved in the drinking-water.

ACTIONS.—The carbonate in toxic doses and in concentrated form is an irritant corrosive poison. The bicarbonate does not possess this irritating effect, and is the salt prescribed for internal use. It is an *antacid*, it increases the alkalinity of the blood and urine, and acts as a *mild diuretic*.

Like other soluble alkalies, bicarbonate of potassium exerts an inhibitory action on the gastric glands if given before or during feeding (see p. 130).

Externally, both salts act as stimulants and cleansers of the skin.

MEDICINAL USES.—In cases of dyspepsia, it is believed that in the early stages there is a hypersecretion of gastric juice, and later on the secretion becomes continuous and is of a slimy character. In such a condition bicarbonate of potassium checks this abnormal secretion and lessens the irritability of the gastric nerves. The bicarbonate of soda is, however, preferred for this purpose.

In *rheumatism*, the bicarbonate is prescribed as an antacid and alterative; it neutralizes excess of acid in the system, increases the flow of urine, and renders it alkaline.

In *cystitis* and in irritable conditions of the bladder, the

bicarbonate is prescribed in combination with hyoscyamus; it renders the urine alkaline, and reduces vesical irritability.

Externally, carbonate of potassium is added to applications for the treatment of parasitic skin diseases. It softens the cuticle, and enables the active agent to reach the parasites.

An emulsion of carbonate of potassium, olive-oil, and water, forms a useful dressing for blistered surfaces.

Potassii Nitras—Nitrate of Potassium; Nitrate of Potash; Nitre; Saltpetre.

PREPARATION. — Prepared from solutions of the native salt by crystallization.

DOSES.—Horses, ʒii. to ℥ss.; cattle, ℥i.; sheep and pigs, ʒss. to ʒi.; dogs, grs. x. to grs. xx. Repeated twice daily.

INCOMPATIBLES.—Sulphuric acid and some sulphates.

ACTIONS.—Nitrate of potassium is an *alterative, febrifuge,* and *diuretic.* It is excreted chiefly by the kidneys, also by the bronchial mucous membrane and the skin, increasing the secretions from these organs. It is believed to act as a diuretic in the following manner, and this also applies to other saline diuretics: On reaching the blood the agent increases the liquor sanguinis. Dilatation of the renal vessels, and a rise of capillary and venous pressure, with increased rate of blood-flow, result, and diuresis is produced.

In toxic doses it produces fatal gastro-enteritis, irritates the kidneys, and paralyzes the heart and nervous centres. Fatal cases of poisoning have occurred in cattle as the result of this agent being sold and administered in mistake for Epsom salt.

ANTIDOTES.—Mucilaginous substances should be freely administered, such as linseed-tea, white of egg, olive-oil, etc. If collapse supervenes, stimulants are indicated. Opiates should be given to allay pain.

Externally it acts as a *refrigerant.*

MEDICINAL USES.—As an *alterative* and *febrifuge,* nitrate of potassium is very frequently prescribed in febrile conditions and catarrhal affections. It produces beneficial results by promoting the bronchial, cutaneous, and urinary secretions, and assisting in the elimination of effete products.

For these purposes it is combined with febrifuge doses of Epsom salt, and is readily taken when dissolved in the patient's drinking-water.

As a diuretic, it is largely employed in cases of œdematous conditions of the limbs, lymphangitis, etc. In cases of renal disease it should be used with caution, in consequence of its action on the bloodvessels of the kidneys. It is *contra-indicated* in acute inflammation of these organs.

Externally, potassium nitrate is employed in combination with sal ammoniac and water as a refrigerating lotion.

Potassii Chloras—Chlorate of Potassium; Chlorate of Potash.

PREPARED by passing chlorine gas into water holding lime or magnesia in suspension, treating the clarified liquid with potassium chloride, and subsequently crystallizing out the potassium chlorate.

DOSES.—Horses, ʒii.; cattle, ʒss.; sheep and pigs, grs. xx. to grs. xl.; dogs, grs. v. to grs. xv. Repeated twice daily, and administered in the form of powder, mixture, or electuary.

INCOMPATIBLES.—Sulphur and tannic acid, which form explosive mixtures with it; also charcoal, ferrous salts, and hydrochloric acid.

ACTIONS.—It increases the secretion of the salivary and buccal glands, and also stimulates bronchial secretion, thus acting as a *saline expectorant*. Formerly it was supposed to become reduced in the body and to give up oxygen to the tissues, but, as 90 to 95 per cent. of the drug can be recovered in the urine, this reduction cannot occur to any extent. According to some authors, when the drug comes in contact with septic tissues it undergoes slow reduction with elimination of oxygen, and its beneficial effects in septic conditions of the mouth and pharynx, and in cystitis with decomposition of the urine, are thus explained. If the drug be added to blood drawn from the body, the mixture becomes chocolate-coloured, the red corpuscles are partly disintegrated, and methæmoglobin is set free in the serum. Microscopical examination shows the red corpuscles altered in shape and colourless. It is excreted chiefly by the urine, also by the

salivary glands and the bronchial and nasal mucosa, in an unchanged condition.

Toxic doses cause gastro-intestinal irritation. Owing to the alterations in the blood, oxygenation is interfered with, and when a large amount of methæmoglobin is formed death occurs from asphyxia. The urine is of a dark brown colour, and contains albumin, hæmoglobin, and not infrequently blood-casts. Anuria and uræmia may occur, also jaundice. On post-mortem, gastro-enteritis, cystitis, and nephritis, may be found.

Externally, chlorate of potassium is a *local stimulant*, and also possesses feeble antiseptic actions.

MEDICINAL USES.—Chlorate of potassium is employed in cases of laryngitis, pharyngitis, and bronchitis. It may be administered in the drinking-water, or in the form of an electuary in combination with extract of belladonna, glycerin, or honey.

In prescribing the drug large doses should be avoided, as they are likely to produce gastro-intestinal irritation.

In cases of purpura hæmorrhagica it is sometimes employed, but its value is doubtful in such instances.

In catarrh of the bladder associated with decomposition of the urine it occasionally proves useful.

Externally, chlorate of potassium in solution forms a useful mouth-wash in cases of stomatitis and ulcerations in the region of the mouth, and in inflammation of the tongue and buccal membrane. For these purposes it is combined with borax, honey, and water.

Potassii Acetas—Acetate of Potassium ; Acetate of Potash.

PREPARED by saturating acetic acid with carbonate of potassium, then evaporating and solidifying.

DOSES.—Similar to those of the nitrate.

ACTIONS AND USES.—It is an efficient diuretic, acting in a similar manner to the nitrate, but is said to be less liable to cause irritation of the kidneys, and hence should be regarded as a safer agent in cases of renal diseases. It is employed as a diuretic in cases of ascites and in renal affections.

Potassii Permanganas — Permanganate of Potassium; Permanganate of Potash.

PREPARED by evaporating a mixture of black oxide of manganese, chlorate of potassium, and solution of caustic potash.

PREPARATIONS.—LIQUOR POTASSII PERMANGANATIS (1 in 100 of distilled water). Condy's red disinfecting fluid contains permanganate of potassium and sodium.

ACTIONS AND USES.—It is a *disinfectant*, a *deodorant*, and also an *antiseptic*. It acts by parting with its oxygen to albumin or other organic matter, and in doing so loses its colour. According to the results of experiments, a 5 per cent. solution is necessary in order to destroy bacteria. A 1 per cent. solution is employed as a uterine injection in canine practice.

In the treatment of snake-bite, Sir T. Lauder Brunton recommends the application of permanganate of potassium to the wound, either in the form of crystals or a saturated solution of the agent.

It is an antidote to opium and morphine, also to phosphorus, strychnine, colchicum, and oxalic acid.

Potassii Iodidum—Iodide of Potassium (see Iodine, p. 266).

Potassii Bromidum—Bromide of Potassium (see Bromine, p. 272).

Potassii Citras—Citrate of Potassium—is an antacid and a diuretic, occasionally employed in canine practice.

Potassii Tartras Acidus—Bitartrate of Potassium; Cream of Tartar—is a mild cathartic and a diuretic; it is seldom used in veterinary practice.

(2) SODIUM AND ITS MEDICINAL SALTS.

General Actions of Sodium Salts.

Sodium salts are much less depressing to muscles, nerve centres, and nerves, than the corresponding salts of potassium. They are less diffusible, more slowly absorbed and excreted, and, as they are normal constituents of the body, they are less useful as alteratives than the corresponding salts of potassium. Some are *irritant* and *caustic*, such as the

hydrate and carbonate. Others, such as the sulphate and chloride, are *diuretic* and *alterative* in small doses, but act as *cathartics* in large amounts. Again, there are others, such as the bromide and the iodide, whose actions resemble those of bromine and iodine respectively.

Sodii Bicarbonas—Bicarbonate of Sodium; Bicarbonate of Soda.

PREPARED by exposing crystals of carbonate of sodium to carbon dioxide.

DOSES.—Horses, ℥ii. to ʒss.; cattle, ʒss. to ʒi.; sheep and pigs, grs. xx. to grs. xxx.; dogs, grs. x. to grs. xx. It can be administered either in the form of powder or electuary, and is readily taken in the drinking-water.

ACTIONS.—The carbonate and bicarbonate only differ as regards the degree of their action; and in consequence of the tendency of the carbonate to irritate, the bicarbonate is almost invariably prescribed. The action of the drug on the secretion of gastric juice is similar to that of the corresponding potassium salt. It also possesses a slight *diuretic* action, and is a *gastric sedative*.

MEDICINAL USES.—In cases of gastric indigestion it is largely employed, either alone or in combination with nux vomica and carminatives. It corrects acidity, and neutralizes the organic acids which arise from fermentation of the gastric ingesta.

As a gastric sedative it is prescribed in combination with bismuth in cases of gastric catarrh.

As an *antacid*, it is a very useful agent in the treatment of excessive acidity of the stomach, which is evidenced by the animal licking the walls, eating clay, etc.

Large doses of bicarbonate of soda have been found useful by some practitioners in the treatment of azoturia.

In cases of what are known as 'stomach coughs' in horses and dogs, the administration of full doses of bicarbonate of soda in the drinking-water often gives good results. These coughs are believed to depend on gastric irritation, which produces reflex irritation of the larynx or pharynx

Sodii Chloridum—Chloride of Sodium; Common Salt.

SOURCE.—Native.

DOSES.—As a *purgative:* cattle, lb. ss., with an equal amount of Epsom salt dissolved in 3 pints of water and 1 lb. of treacle; sheep, ℥ss. to ℥i.ss., with a similar amount of Epsom salt. As a *stomachic and alterative,* 2 or 3 ounces may be given to horses or cattle twice daily mixed in the food.

ACTIONS.—Chloride of sodium promotes digestion and assimilation, and a proper allowance of this agent is as necessary for animals as for human beings. In full doses it acts as a *saline cathartic* in ruminants, but its action in this respect in horses is violent and uncertain. Toxic doses are *irritant,* and produce *gastro-enteritis.*

MEDICINAL USES.—In the form of rock-salt, this agent should be allowed to horses and cattle both in the mangers and on the pasture. As a top dressing for pastures, it is highly recommended by men of experience, and is stated to prevent the occurrence of red-water and certain parasitic diseases.

As a cathartic for cattle, chloride of sodium is often combined with Epsom salt, and is believed to increase the action of the latter. In the early stages of *red-water* in cattle, ½ pound of chloride of sodium liberally diluted with fluid is recommended by some practitioners. In gastric derangements of cattle, small doses of sodium chloride administered in the form of electuary prove useful, and also by inducing thirst lead the patient to drink fluids freely. Sodium chloride is used as a popular emetic for the dog, 1 or 2 teaspoonfuls, with half a teaspoonful of mustard flour dissolved in 4 ounces of warm water, being given for this purpose.

In the treatment of surgical shock occurring during or after operations, and in cases of hæmorrhage, collapse, etc., also in exhaustion appearing during the course of debilitating diseases, intravenous or subcutaneous injections of solutions of sodium chloride prove very useful. They raise the blood-pressure, and in cases of severe hæmorrhage supply fresh fluid to the circulation; and it is believed that physiological saline solution can take up oxygen and give it off to the tissues. They also exert a diuretic effect, and thus assist in the removal of effete products from the system.

The usual solution employed contains 1 drachm of sodium chloride to 1 pint of boiled (sterilized) water. Convenient tablets are prepared by chemists for making these solutions, each containing 30 grains of sodium chloride; and two of these dissolved in 1 pint of sterilized water form a solution of the required strength, termed 'normal saline solution.' Some surgeons prefer what is termed 'physiological saline solution,' which can be prepared with tablets, each containing the following agents:

℞	Sodii Chlor.	grs. xxv.
	Sodii Sulph.	grs. 1¼
	Sodii Carb.	grs. 1¼
	Sodii Phosph.	gr. i.
	Potass. Chlorid.	grs. i.ss.

Two of these dissolved in a pint of sterilized water form the required solution.

The solution, at a temperature of 100° F., is injected into any convenient vein at the rate of about a pint per ten minutes. For the horse the jugular is selected. A special aspirating needle is carefully inserted, and to this a piece of tubing is attached; the fluid can be allowed to flow into the latter by means of a funnel, or a large syringe can be employed for the purpose. Care must be taken that no air is permitted to enter the vein, and that the inner coat of the latter is not injured; also the strictest aseptic precautions must be adopted.

In the dog any superficial vein can be selected. This is exposed, a double ligature passed underneath it; the distal end is tied; an incision is made in the other end, and a metal nozzle with a bulbous end inserted, and secured with a single twist of the ligature. A piece of tubing is attached to a small glass funnel, the tubing is clamped, and the funnel filled with the solution. The free end of the tubing is attached to the nozzle. Now compress the vein before relieving the clamp; shake the apparatus, holding the funnel vertically. If any air has entered the nozzle it will ascend and escape. Next release the pressure on the vein, and

allow the solution to enter it. If a syringe be used, the piston should be withdrawn slightly before the fluid is injected; this will withdraw any air that may have gained entrance. In case that a further injection of the fluid may be necessary, the ligature may be left long, so that the vein can readily be got at. If not necessary, the ligature can be cut short, and an antiseptic dressing applied to the part.

Most practitioners prefer the subcutaneous method of administering saline solutions. It is safer and more easily adopted, but probably not so effectual in cases of surgical shock as the intravenous method.

The ordinary hypodermic needle may be employed, and to this is attached a piece of tubing. The needle is inserted into the loose subcutaneous tissue in the pectoral region, or at the lower part of the neck, or behind the elbow. A funnel may be attached to the tubing and the fluid poured in, or a douche-can containing the latter held above the part, or a large syringe may be employed to inject the solution. In the case of horses, from 1 to 3 pints may be thus administered; the part may be then gently massaged in order to diffuse the fluid in the subcutaneous tissue. For the dog, from 2 to 6 ounces may be injected, according to the size of the animal. A fresh spot should be selected for each injection, and aseptic precautions should be observed. For the horse, some practitioners employ a rubber syringe to inject the fluid.

Saline solution can also be administered by rectal injections, but, of course, cannot prove so effectual as when given by the above methods.

Externally, sodium chloride combined with nitre and chloride of ammonium forms a refrigerating lotion.

Sodii Sulphas.—Sulphate of Soda; Glauber's Salt.

PREPARED by heating chloride of sodium with sulphuric acid. Hydrochloric acid is evolved, and sulphate of soda occurs as a residue.

DOSES.—As a purgative for cattle, lb.i. to lb.i.ss.; sheep, ℥ii. to ℥iv.; well diluted with water, and given with treacle. As an *alterative* and *laxative* for horses, ℥ii. twice daily, dissolved in the drinking-water; for dogs, grs. x. to ℥i.

ACTIONS.—Sulphate of soda administered in full doses to ruminants is a *saline purgative*, resembling Epsom salt, but slower in its action. Its purgative action on the horse is uncertain. Formerly it was believed to stimulate directly the secretion of bile, but this view is not supported by experimental evidence.

Small doses are excreted by the kidneys for the most part unchanged, and produce a slight diuretic effect. If injected into the circulation, it does not produce toxic effects, such as those induced by the similar injection of Epsom salt.

MEDICINAL USES.—As a *saline purgative*, it is administered to cattle instead of Epsom salt, in accordance with the view that it possesses a cholagogue action. As a routine practice, it is prescribed in cases of congestion of the liver in the horse, as a laxative and direct cholagogue; but, as already remarked, the latter action is doubtful. It may, however, assist in the removal of bile from the intestine, and thus act as an indirect cholagogue. For this purpose it may be combined with sodium bicarbonate and sodium chloride, forming artificial Carlsbad salt. In canine practice sulphate of soda is not a suitable agent, as it tends to produce gastric irritation and vomition.

Sulphate of soda is recommended by Sir T. Lauder Brunton as the best *antidote to carbolic acid poisoning*. In urgent cases he recommends that a solution of this agent should be injected directly under the skin, or even into the peritoneal cavity. The phenol unites with the sulphate, forming a non-poisonous compound, which is excreted in the urine.

Sodii Nitris.—Sodium Nitrite.

PREPARED by fusing sodium nitrate with metallic lead.

DOSES.—Horses, grs. xx. to ℥ss.; dogs, gr. i. to grs. ii. Repeated every four hours.

It is a vaso-dilator and antispasmodic, resembling amyl nitrite in its actions. It is sometimes used in cases of cardiac palpitation; also in asthma in the dog to ward off attacks of this affection.

Sodii Hyposulphis.—Hyposulphite of Soda.

PREPARED by passing sulphurous acid gas into a solution of carbonate of soda with sulphur.

DOSES.—Horses and cattle, ℥ss. to ℥i.; dogs, grs. v. to grs. x. Administered twice daily, either in the form of powder or mixture.

ACTIONS.—Some authorities believe that hyposulphite of soda gives off sulphurous acid when administered internally, and is thus an internal antiseptic.

MEDICINAL USES.—The results of the use of hyposulphite of soda as an internal antiseptic have not been satisfactory. In human practice a solution of the drug in water (1 in 10) is sometimes employed as a dressing for ringworm.

Liquor Sodii Ethylatis is prepared by dissolving metallic sodium in absolute alcohol.

ACTIONS.—It is an effective caustic in human surgery, but is seldom employed in veterinary practice.

Liquor Sodæ Chlorinatæ.—Solution of Chlorinated Soda; also known as Labarraque's Disinfecting Fluid.

This agent is sometimes employed as a disinfectant and deodorant, but the derivatives of coal-tar are more serviceable and convenient for these purposes.

Sodii Biboras.—Borax (see Boric Acid, p. 282).

Sodii Bromidum (see Bromine, p. 272).

Sodii Iodidum (see Iodine, p. 267).

Sodii Phosphas (see p. 263).

Sodii Sulphocarbolas (see p. 336).

Sodii Salicylas (see Salicylic Acid, p. 490).

Sodii Hypophosphis (see Phosphorus, p 261).

(3) AMMONIUM AND ITS MEDICINAL COMPOUNDS.

SOURCES.—The chloride of ammonium supplies directly or indirectly all the medicinal preparations and compounds of ammonium.

Liquor Ammoniæ Fortis—Strong Solution of Ammonia; Spirits of Hartshorn. This is water containing 32·5 per cent. by weight of gaseous ammonia.

Liquor Ammoniæ—Solution of Ammonia. This contains only 10 per cent. by weight of gaseous ammonia, and is selected for internal use.

DOSES.—Horses, ℥ii. to ℥ss.; cattle, ℥ss. to ℥i.; sheep and pigs, ℥i.; dogs, ♏v. to ♏x. Repeated at intervals according to circumstances, and administered *well diluted* with mucilaginous fluids or oil, so as to avoid its irritating effect on the mouth and pharynx.

GENERAL ACTIONS.—Liquor ammoniæ fortis possesses the typical actions of ammonia. If applied to the skin it is a *stimulant;* and if prolonged, and evaporation prevented, it produces *vesication.* Unless well diluted, it causes violent irritation of the mouth, tongue, pharynx, and stomach. Inhaled by the nostrils, it produces reflex stimulation of the vasomotor system, contraction of the bloodvessels, and a rise of blood-pressure, thus being a general stimulant. If administered internally, it is a powerful general stimulant, acting on the heart, the cerebrum, the nerve centres, and the spinal cord; but its action in this respect is transient.

It is quickly absorbed and rapidly excreted.

In *toxic* doses it is an *irritant* to the stomach, and, after primary stimulation of the nervous system, it causes paralysis of the nerve centres and spinal cord.

Mistakes have occurred by administering the strong solution of ammonia instead of the milder preparations.

Suitable Antidotes are dilute acetic acid, vinegar, oil, and a free allowance of demulcents and diluents.

The irritating effects of this agent on the tongue and buccal membrane are best treated by keeping the animal on fluid diet, and applying mouth-washes containing dilute acetic acid, borax, and honey.

MEDICINAL USES.—The strong solution of ammonia is not used internally. The weaker solution is sometimes employed as a general stimulant in cases of narcotic poisoning. In *tympanites* of the rumen in cattle it neutralizes the gases present, acts as an *antacid*, and stimulates the stomach and intestines to healthy action. In ordinary cases of *spasmodic*

colic some practitioners prescribe the solution of ammonia well diluted, and claim beneficial results.

In canine practice the fumes of the strong solution of ammonia are sometimes employed as an inhalation in cases of shock, or in narcotic poisoning, but its value is doubtful.

Externally, the strong solution of ammonia is largely used as a component of stimulating liniments and as a mild counter-irritant. For these purposes, 1 part each of strong solution of ammonia, oil of turpentine, and water, are mixed with 10 parts of linseed-oil. Another useful liniment is prepared by mixing 1 ounce of camphor, 4 ounces of rectified spirit, 2 ounces of solution of ammonia, and 1 pint of olive-oil. Strong applications of ammonia should not be applied as counter-irritants, in consequence of their tendency to blemish the skin.

A weak solution of ammonia relieves the irritation produced by the bites and stings of insects.

Ammonii Carbonas—Carbonate of Ammonia. This is a mixture of ammonium hydrogen carbonate with ammonium carbamate..

PREPARED by heating ammonium sulphate or chloride with calcium carbonate.

DOSES.—Horses, ℥ii. to ℥ss.; cattle, ℥ss. to ℥i.ss.; sheep and pigs, grs. xv. to grs. xxx.; dogs, grs. iii. to grs. viii. Administered in the form of bolus or pill, or dissolved in mucilaginous solution, and repeated at intervals according to circumstances.

ACTIONS.—Carbonate of ammonia, although not so active as the solution of ammonia, is more permanent in its effects. It is a powerful *general stimulant* in full doses, acting on the cardiac and respiratory systems, and also on the glands of the body, increasing the secretions from the latter. It stimulates the entire nervous system and promotes intestinal secretion, also bronchial secretion. Besides these actions, it is *antacid*, *antitympanitic*, and *carminative*.

MEDICINAL USES.—As a *stimulant*, carbonate of ammonia is a very useful agent in the treatment of respiratory affections when stimulants are indicated. It can be administered

in the form of bolus, repeated at intervals, and is far preferable to alcohol for this purpose.

In the treatment of obstructive colic, depending on impaction of the large intestine, full doses of carbonate of ammonia, combined with nux vomica, are recommended by Caulton Reeks. Instead of prescribing sedatives for the relief of pain in this condition, he advises the administration of 2 ounces of carbonate of ammonia and 1 ounce of powdered nux vomica, divided into four balls, and given at one dose. These doses are intended for a full-sized horse, and can be lessened in the case of an animal of smaller size. The carbonate of ammonia, without the nux vomica, is repeated at intervals according to the progress of the case. By means of this treatment nerve power is restored to the intestinal walls and normal peristaltic action is promoted. At the same time, the agents administered act as general stimulants, also as antispasmodics.

In the gastric affections of cattle depending on atony of the muscular coat of the various compartments of the stomach, carbonate of ammonia is largely used, in combination with nux vomica. It relieves tympany, restores nerve power to the gastric walls, and acts as a general stimulant.

In canine practice carbonate of ammonia is sometimes prescribed as a stimulating emetic, combined with ipecacuanha wine, in cases of bronchitis, where it is desirable to remove viscid mucus from the bronchial tubes, the expiratory efforts induced by the act of vomition causing expulsion of the material which is obstructing the respiratory passages. But apomorphine is preferable for this purpose.

As a *stimulating expectorant*, promoting bronchial secretion and expectoration, it is prescribed in the secondary stages of bronchitis.

Spiritus Ammoniæ Aromaticus — Aromatic Spirit of Ammonia ; Spirit of Sal Volatile.

PREPARED by combining carbonate of ammonia, 100 grammes ; strong solution of ammonia, 200 millilitres ; oil of nutmeg, 15 millilitres ; oil of lemon, 20 millilitres ; alcohol (90 per cent.), 3,000 millilitres ; distilled water, 1,500 millilitres.

DOSES.—Horses and cattle, ℥ii. to ℥iv.; dogs, ℥ss. to ℥i.

ACTIONS AND USES.—As this preparation contains about ½ ounce of carbonate of ammonia and 1 ounce of strong solution of ammonia to the pint, it is not of sufficient strength for horses and cattle unless given in large doses. To prevent irritation of the mouth, these doses must be well diluted, and, as the preparation is expensive as compared with the carbonate of ammonia, the latter is usually preferred for the larger animals.

In canine practice aromatic spirits of ammonia is employed as a general stimulant, also as a carminative and antacid. In combination with vegetable bitters, such as calumba or gentian, it forms a useful alkaline stomachic mixture in cases of dyspepsia.

Liquor Ammonii Acetatis—Solution of Ammonium Acetate; Mindererus Spirit.

PREPARED by combining acetic acid, 162·5 millilitres; ammonium carbonate, 50 grammes; distilled water, sufficient to produce 1,000 millilitres.

DOSES.—Horses, ℥iv. to ℥vi.; dogs, ℥ii. to ℥ss. Repeated at intervals.

ACTIONS AND USES.—Acetate of ammonium is a *diaphoretic*, a *febrifuge*, and a *mild diuretic*. Its diaphoretic action is not well marked in animals, and in consequence of the small amount of ammonia it contains its action as a stimulant is very slight. In combination with sweet spirit of nitre, it constitutes an old form of febrifuge mixture.

Ammonii Chloridum — Chloride of Ammonium; Sal Ammoniac.

PREPARED by neutralizing crude solution of ammonia with hydrochloric acid and purifying the product.

DOSES.—Horses, ℥ii.; cattle, ℥ss.; sheep and pigs, grs. xx. to ℥ss.; dogs, grs. iii. to grs. x.

ACTIONS AND USES.—Chloride of ammonium is an *expectorant*. In toxic doses it is a gastro-intestinal irritant. It is occasionally prescribed as an expectorant in the secondary stages of bronchitis, also in cases of chronic bronchitis.

Externally, in combination with nitrate of potassium, sodium chloride, and water, it forms a refrigerating lotion.

(4) CALCIUM AND ITS MEDICINAL SALTS.

Calcium Oxide—Lime; Quicklime; Calx.

PREPARED from limestone or other forms of calcium carbonate.

Calcii Hydras—Slaked Lime—is prepared by slaking lime with water.

Liquor Calcis—Lime-water.

PREPARED by adding 50 grammes of slaked lime (washed free from chlorides with distilled water) to 5,000 millilitres of distilled water, and drawing off the clear solution with a syphon; 100 millilitres should contain rather more than 0·1 gramme of calcium oxide in 100 millilitres (110 minims contain the equivalent of $\frac{1}{10}$ grain of lime).

ACTIONS AND USES.—*Externally*, lime is a *caustic* and *irritant*. It is largely employed in the form of solution as a cleansing and deodorizing agent to the walls of buildings, etc.

Lime-water possesses *sedative*, *antacid*, and *astringent* actions. It is frequently added to milk, in order to prevent the formation of masses of casein in the stomachs of animals fed exclusively on this diet, such as calves and young dogs. The addition of about one-fourth of lime-water proves very beneficial in such cases.

In irritable conditions of the stomach, met with in dogs and characterized by excessive acidity and frequent vomition, lime-water added to the milk diet gives good results.

The saccharated solution of lime is preferable in some cases, as it is fourteen times stronger than ordinary lime-water; and, less being required, the milk need not be diluted to the same extent. It is prepared by mixing 50 grammes of slaked lime, 100 grammes of refined sugar, in 1,000 millilitres of distilled water (1 ounce of slaked lime, 2 ounces of sugar, and 1 pint of water), and decanting the clear solution. The addition of the sugar to water greatly increases its solvent power for lime, so that each fluid ounce contains about 8 grains of lime.

The dose for calves is about 2 ounces, and for dogs about 20 to 60 minims.

Linimentum Calcis is prepared by mixing equal parts of lime-water and olive-oil.

CARRON-OIL is prepared by mixing equal parts of lime-water and raw linseed-oil.

They are employed as local astringents and desiccants in cases of scalds and burns.

Creta Præparata—Prepared Chalk—is prepared from the native carbonate of calcium.

DOSES.—Horses, ʒi. to ʒii.; cattle, ʒii. to ʒiv.; sheep and pigs, ʒii. to ʒiv.; dogs, grs. viii. to ʒss.

ACTIONS AND USES.—Chalk is *antacid* and *astringent*. Being more slowly absorbed than lime-water, it is capable of exerting its actions on the intestinal canal. It is prescribed in cases of diarrhœa, and is believed to produce therapeutical effects by lessening the irritability of the intestinal mucous membrane, and leaving a film of carbonate of calcium thereon.

In severe cases of diarrhœa it is combined with astringents and carminatives or with chlorodyne, and may be administered in solutions of starch. Astringents in such cases should be used with discretion. See 'The Treatment of Diarrhœa,' Part III.

Chalk is an antidote to oxalic acid and the mineral acids.

Calcii Chloridum—Chloride of Calcium.

PREPARED by adding hydrochloric acid to calcium carbonate.

ACTIONS AND USES.—The chloride of calcium increases the coagulability of the blood, and has been found useful in human surgery as a hæmostatic agent in cases of hæmophilia. It is given for this purpose, both internally and by enema, for several days prior to an operation, in doses of 30 grains.

As a local hæmostatic, a solution of 30 grains to the ounce of water is recommended in cases of bleeding after tooth-extraction, such as may occur in patients with hæmophilia. It has also been found useful in cases of intestinal hæmorrhage.

Calcium lactate has been used for similar purposes.

Calx Chlorinata—Chlorinated Lime; Bleaching-powder.

PREPARED by exposing slaked lime to the action of chlorine gas.

ACTIONS AND USES.—It is a disinfectant and deodorizer, and may be employed for disinfecting stables, cowsheds, etc.; but other agents are preferred for these purposes.

Calcii Sulphas—Sulphate of Lime; Calcined Gypsum; Plaster of Paris.

This agent is employed in making plaster of Paris bandages for use in the treatment of fractures.

Calcii Phosphas—Phosphate of Lime—is prepared from bone-ash by the action of hydrochloric acid. It is occasionally prescribed in the treatment of anæmia and rickets in young animals.

Calcii Hypophosphis (see Phosphorus, p. 261).

Calx Sulphurata (see Sulphur, p. 273).

(5) MAGNESIUM AND ITS MEDICINAL SALTS

Magnesii Carbonas Ponderosus—Heavy Carbonate of Magnesium.

Magnesii Carbonas Levis—Light Carbonate of Magnesium.

These are prepared by mixing solutions of sulphate of magnesia and carbonate of soda.

The heavy carbonate is formed by boiling the solution, and only differs from the light carbonate in its physical properties. Fluid magnesia contains 10 grains of carbonate of magnesia to the fluid ounce.

Magnesia Ponderosa—Heavy Magnesium Oxide; Heavy Calcined Magnesia—is prepared by exposing heavy magnesium carbonate to a dull red heat.

Magnesia Levis—Light Magnesium oxide; Light Calcined Magnesia—is prepared by exposing light magnesium carbonate to a dull red heat.

The carbonates and the oxides of magnesia have similar actions—viz., *antacid* and *laxative*.

DOSES.—Foals and calves, aged from three to four months, ℥ss. to ℥ii.; dogs, grs. v. to ℥ss.

ACTIONS AND USES.—Magnesia is chiefly prescribed as an *antacid* and *laxative* for young foals, calves, and for dogs, in cases of dyspepsia.

A mixture of the carbonate with the sulphate of magnesium is useful in canine practice, forming what is known as *Mistura Alba*. This is prepared by combining 10 grains of magnesium carbonate and 1 drachm of magnesium sulphate in 1 ounce of peppermint-water.

Magnesii Sulphas—Sulphate of Magnesium; Epsom Salt.

PREPARED from the native sulphate or from carbonate of magnesium by solution in dilute sulphuric acid, and then purifying.

DOSES.—As a *purgative:* for adult cattle, lb. i.; calves, two or three months, ℥iii. to ℥iv.; sheep and pigs, ℥iv.; dogs, ʒii. to ʒiv. As an *alterative* and *febrifuge:* horses, ℥ii. to ℥iii., repeated twice daily, and administered either in the food or in the drinking-water; dogs, grs. x. to grs. xx.

ACTIONS.—In ruminants a full dose acts as a *hydragogue cathartic*, causing in from twelve to fifteen hours free fluid evacuations. The mode in which it produces purgation is described on p. 133. Only a small portion of the drug is absorbed, and this is excreted by the kidneys. A certain amount of fluid and saline matters is removed from the blood, the result being that a compensating amount is withdrawn from the tissues, and thirst is induced. Solutions containing less than 5 per cent. of the drug may fail to induce purgation. Sulphate of magnesium has no direct cholagogue action, but it clears away the bile present in the intestine. The purgative action of sulphate of magnesium on the horse is uncertain. Large amounts of this agent may produce no cathartic effect in some instances, while in others purgation may ensue. Small doses frequently repeated produce a gentle aperient effect. On the dog a full dose is more likely to induce vomiting than purgation, but small doses act as laxatives.

If sulphate of magnesium be injected into the circulation it is an active poison, causing paralysis of the vital nerve centres. In this respect it differs from sodium sulphate (see p. 215).

MEDICINAL USES.—As a *purgative* the sulphate of magnesium is largely employed for ruminants, and if used with

discretion is a very valuable agent for this purpose. It should be administered in a liberal supply of warm water and treacle, the addition of a carminative such as powdered ginger being of advantage to prevent griping.

The formula we find most effectual for cattle is as follows: 1 pound of sulphate of magnesium and 1 ounce of powdered ginger, dissolved in 3 pints of warm water and 2 pounds of treacle.

A very erroneous practice prevails among the owners of cattle—viz., that of administering large and repeated doses of sulphate of magnesium in cases of obstinate constipation. In such instances a paralyzed condition of the gastric and intestinal walls is present, depending usually on some affection of the stomach. The large doses of this agent administered, instead of producing catharsis, cause marked depression of the system, a tympanitic condition of the rumen, and induce gastritis; while, if this latter condition be already present, it becomes aggravated.

The rational treatment of affections in which a paralyzed condition of the stomach and intestines is present is to prescribe nerve tonics and general stimulants, together with full doses of oleaginous aperients—*e.g.*, carbonate of ammonia, nux vomica, and raw linseed-oil.

Sodium chloride is sometimes prescribed along with sulphate of magnesium in the proportion of ½ pound of each agent, and the combination is said to produce more active cathartic effects than the magnesium salt administered alone.

For the horse, sulphate of magnesium, although not prescribed as an active cathartic, is very useful as a mild purgative and as a laxative. It is readily taken in the food or in the drinking-water, and to some horses 2-ounce doses can be administered in this manner, and repeated until mild purgation results. In others, however, large amounts may be taken, and only a laxative effect is produced.

In all febrile conditions sulphate of magnesium is largely prescribed. It lowers abnormal temperature, stimulates the functions of the bowels and kidneys, and assists in the removal of waste products from the system. For these purposes it is

combined with nitrate of potassium, and can be dissolved in the patient's drinking-water twice daily.

As an *alterative* it is prescribed in unhealthy conditions of the skin and in cutaneous affections.

In the treatment of tetanus, subcutaneous injections of solutions of sulphate of magnesia have been found useful (see 'Treatment of Tetanus,' Part III.).

In canine practice it is not employed as a purgative, as its nauseous taste is liable to induce vomiting. Small doses, however, are prescribed as alteratives and laxatives.

Sulphate of magnesium is an efficient *antidote* in poisoning by salts of lead. It converts the latter into insoluble sulphates, and assists in their removal from the system.

Externally, a saturated solution of the drug proves useful as an application to strains, inflamed joints, articular rheumatism, and orchitis.

(6) BARIUM.

Barii Chloridum—Chloride of Barium. Prepared by dissolving the native carbonate in hydrochloric acid.

DOSE.—As an intravenous injection for the horse, grs. viii. to grs. xx., dissolved in 2½ to 6 drachms of water. As a drench, ʒi.ss. to ʒiii. in 2 pints of water; smaller doses—viz., ʒi. to ʒii.—are safer.

ANTIDOTES — Sulphate of magnesium or sulphate of sodium.

ACTIONS.—According to Dixon, barium has a special affinity for all forms of muscle. When it comes into contact with muscle fibre, either by direct application or through the medium of the circulation, it throws the muscle into tonic contraction. If administered by intravenous injection, chloride of barium acts with great rapidity, within one to two minutes causing energetic contraction of the muscular coat of the intestine throughout its entire length, the result being copious evacuations of the intestinal contents. This action may continue for five or six hours. At the same time, stimulation of the muscular tissue of the bladder and blood-vessels occurs.

The heart is at first stimulated and blood-pressure raised; but the secondary effect is to depress the former and lower the latter.

Toxic doses produce salivation, muscular tremors, sweating, violent straining, and finally spasm of the heart and general paralysis of the nervous system.

MEDICINAL USES.—Chloride of barium has been employed by Continental practitioners in the treatment of colic depending on impaction of the intestine. Although favourable reports have been given with reference to the use of this drug, the violence of its action, the difficulty in controlling it, the risks of rupture of the intestine, or of fatal cardiac depression, should induce us to prefer agents which experience has proved to be safer, while quite as effectual. It is described by Fröhner as 'a heroic and very toxic remedy for colic.'

Dieckerhoff recommends that the dose be divided as follows: Half the amount at the first injection, and two quarter-doses at intervals of eight to ten minutes. If administered in the form of a drench, the chloride of barium is not so certain in its effects.

Chloride of barium has also been recommended in the treatment of impaction of the rumen and acute tympanites in cattle. The doses advised are 15 grammes (℥iv.) for cows and 16 to 18 grammes (℥v) for oxen and bulls. These doses are divided into two parts, and may be given in draught, electuary, or bolus, in combination with sodium chloride, an interval of three or four hours being allowed between each dose.

CHAPTER III

GROUP II.—THE METALS

ALUMINIUM.

THE most important salt of this metal is **Alumen** or **Alum**

Potassium Alum—Potash Alum.

PREPARED by combining aluminium sulphate with potassium sulphate.

Ammonium Alum—Ammonia Alum.

PREPARED by combining aluminium sulphate with ammonium sulphate.

ACTIONS AND USES.—*Internally*, alum is an *astringent*, and in carnivora is an emetic. In toxic doses it is an *irritant* to the gastro-intestinal canal.

Externally it possesses *astringent* and *styptic* actions.

Alum is employed in combination with glycerin as a mouth-wash in cases of ulcerative stomatitis. In the treatment of laminitis, Douglas of New Orleans recommends the administration of alum as follows: In hospital cases, 3 to 6 drachms of the drug are given in the form of bolus every four to six hours until the condition is relieved, and drinking-water is allowed only in limited quantities. In cases treated on the owner's premises, the drug is prescribed in the form of a drench, 6 to 12 ounces of a solution of 1 part of alum to 16 parts of water being given every four to six hours. This treatment may be combined with the subcutaneous injection of adrenalin solution (1 to 10,000) on both sides of the fetlock, at the site usually selected for plantar neurectomy.

Campbell advises the administration of 2 ounces of alum in 2 pints of water repeated every two hours until 1 pound has been given. This treatment is preceded by the ad-

ministration of 1½ grains of arecoline. One-sixth grain of aconitine is given hypodermically every half-hour until the temperature becomes normal (*American Journal of Veterinary Medicine*, vol. ix., October, 1914).

Mayall (*Veterinary Journal*, February, 1915) recorded a case of chronic laminitis treated by alum. One ounce of the drug with ½ ounce of potassium nitrate and 15 minims of tincture of aconite (B.P.) was prescribed in a pint of water every three hours until four doses had been taken, and on the following day all symptoms had disappeared.

The mode of action of the drug in this affection has not up to the present been explained.

Alum is often administered to cows by farmers in order to arrest the secretion of milk when it is desired to stall-feed the animals, the dose being from 2 to 4 drachms twice daily.

Externally, a saturated solution of alum proves useful as a *styptic* in cases of emergency. It is also a popular application to the shoulders of horses that tend to get galled by the collar.

A solution containing 1 drachm of alum to the pint of water has been found useful as an injection in cases of leucorrhœa.

Alum is an *antidote* to lead-poisoning, as it precipitates the lead salts in the intestine.

PLUMBUM (LEAD) AND ITS MEDICINAL SALTS.

General Actions of Lead Salts.—*Externally* the salts of lead are *astringent*, *sedative*, and *desiccant*. They precipitate albumin, cause contraction of capillaries, and depress the peripheral terminations of sensory nerves. In the latter action they differ from most of the other metals.

Internally they act as astringents, diminishing secretion, contracting bloodvessels, and retarding normal peristaltic movements of the intestines. They are absorbed as albuminates, and are readily taken up by the tissues. They are slowly excreted by the bowels, kidneys, liver, and skin.

Toxic Effects.—The tendency of lead to accumulate in the tissues gives rise to a condition known as *plumbism*. This occurs in cases where the agent has been taken for some time.

The effects produced are due to the irritant action of the lead salt on the voluntary and involuntary muscles and on the nervous system.

The symptoms vary in different animals: in some there are evidences of gastro-intestinal disturbance; in others the nervous system is involved, resulting in a cramped condition of the muscles of the limbs, and finally paralysis.

In cattle, brain symptoms, evidenced by a staggering gait and impaired vision, may occur.

In horses, convulsions, partial paralysis, and marked respiratory distress, have been observed.

Colic and constipation, which are frequent symptoms of lead-poisoning in human beings, are seldom met with in animals in connection with this agent.

The diagnosis of lead-poisoning is difficult, as the symptoms may be ascribed to other causes. A blue line may be observed around the gums at the base of the incisor teeth. This is due to a deposition of the sulphide of lead beneath the mucous membrane, which, shining through the latter, appears of a blue colour.

Lead-poisoning may occur from contamination of the food or water with this agent. Cases are recorded in which toxic symptoms have been produced by animals licking fresh paint containing lead.

H. Begg has met with cases of plumbism in a large stud of horses. The source of the poison was contamination of the drinking-water from lead pipes. All the horses showed thirst, polyuria, and a tendency to constipation. Seven horses died after showing evidences of paralysis. Analysis of the drinking-water, and of the urine, tissues, liver, spleen, glands, etc., of the dead horses revealed the presence of lead.

Other sources of lead-poisoning which have been reported are the contamination of pastures by bullet-spray from rifle butts and smelting furnaces. The latter cause a deposit of soluble lead salts on the pastures.

Soft waters and those rich in nitrites, nitrates, chlorides, and nitrogenous matters, may acquire toxic properties by passing through lead pipes, especially if the latter be new.

Hard waters—*i.e.*, those containing carbonates, sulphates, or phosphates—are less liable to contamination, as insoluble precipitates are formed in the interior of the pipes, and the water cannot come into contact with the metallic lead.

ANTIDOTES TO LEAD SALTS.—The administration of the iodide of potassium three times daily, each dose being followed in about two hours by sulphate of magnesia and dilute sulphuric acid, gives the best results.

The iodide of potassium eliminates the lead from the tissues into the blood; it is then removed by the intestinal canal. Here the sulphate of magnesia renders the lead insoluble, and by its aperient action hastens the removal of the latter from the body.

In the case of plumbism resulting from water passing through lead pipes, the taps should be allowed to flow for a time before the animals are watered.

Plumbi Oxidum—Oxide of Lead; Litharge.

PREPARED by roasting lead in a current of air.

ACTIONS AND USES.—It is not prescribed internally.

Externally it is *desiccant* and *astringent*, and its chief use is in the preparation of lead plaster or diachylon plaster. This is sometimes employed for bringing the edges of small wounds together.

Plumbi Carbonas—Carbonate of Lead; White Lead.

PREPARED by exposing lead to the vapour of acetic acid and simultaneously to air charged with carbonic acid.

ACTIONS AND USES.—It is not used internally.

Externally it is astringent and sedative. It is employed in the treatment of cracked heels, mud fever, etc., in the form of ointment, for which the following is a useful and most effectual formula:

Plumbi carb., ℥i.; plumbi acet., ℥i.; pulv. camphoræ, ℥ss.; ol. eucalypti, ℥ss.; lanolin, ℥vi. Mix.

Plumbi Acetas—Acetate of Lead; Sugar of Lead.

PREPARED by dissolving oxide of lead or carbonate of lead in acetic acid.

DOSES.—Horses and cattle, ℥ss. to ℥i.; dogs, gr. i. to grs. iv.

INCOMPATIBLES.—All vegetable astringents, alkalies, preparations of opium, iodide of potassium.

ACTIONS AND USES.—*Internally*, acetate of lead is an *astringent* and *styptic*.

Externally it is an *astringent* and *local sedative*.

As an astringent it is prescribed in obstinate cases of diarrhœa and dysentery, usually in combination with opium. As a styptic or hæmostatic, it is sometimes prescribed in cases of hæmorrhage from the stomach or intestines, or from any of the internal organs.

Externally, lotions containing acetate of lead are useful as cooling and sedative applications to strained tendons, bruises, and superficial inflammatory conditions. The familiar *white lotion* so largely employed as an astringent in veterinary practice is composed of 1 part acetate of lead and ¾ part sulphate of zinc, dissolved in 20 to 30 parts of water. Although chemically incompatible, the combination proves a very useful one.

Liquor Plumbi Subacetatis Fortis—Strong Solution of Lead Subacetate; Goulard's Extract.

PREPARED by the admixture of acetate of lead, oxide of lead, and distilled water.

Liquor Plumbi Subacetatis Dilutus—Diluted Solution of Lead Subacetate; Goulard Water; Goulard's Lotion.

PREPARED by mixing Goulard's extract, 12·5 millilitres, and distilled water, 1,000 millilitres.

ACTIONS AND USES.—Both the above preparations are astringents and local sedatives resembling the acetate of lead in these respects. For external application they are preferred to the latter, being more soluble and not liable to crystallize. Goulard's extract diluted with 6 parts of olive-oil or glycerin forms a useful liniment in cases of grease and mud fever in horses. It is also employed as a local application in cases of irritable conditions of the skin.

In canine practice, liniments containing lead must be used with caution, as the animals may lick the parts, and toxic symptoms may result.

Dilute solutions of Goulard's lotion are sometimes employed as collyria in cases of catarrhal inflammations of the eye, but are contra-indicated if any abrasion of the cornea be present, as an opacity due to the formation of albuminate of lead may result. Diluted with an equal part of methylated spirit and with 8 to 10 parts of water, Goulard's extract forms a useful lotion in cases of strained tendons, etc.

The Glycerinum Plumbi Subacetatis, which is prepared in a similar manner to Goulard's extract, but contains glycerin as a solvent instead of water, is a useful application for eczema in the horse.

Plumbi Iodidum—Iodide of lead.

PREPARED by mixing solutions of nitrate of lead and iodide of potassium, and drying the precipitate

It is occasionally employed in the form of an ointment (1 to 7) as an absorbent application to enlarged joints, glandular swellings, etc.

ZINCUM (ZINC) AND ITS MEDICINAL SALTS.

INCOMPATIBLES OF ZINC SALTS.—Alkalies and their carbonates, lime-water, acetate of lead, nitrate of silver, astringent vegetable preparations.

GENERAL ACTIONS OF ZINC SALTS.—The salts of zinc resemble those of lead, silver, and copper, in their actions. In large doses they produce *irritant* effects and depress the nerve centres. In medicinal doses they act as astringents and nerve tonics.

Zinci Oxidum—Oxide of Zinc.

PREPARED from metallic zinc by combustion in air.

ACTIONS AND USES.—*Internally* it is an astringent and a nerve tonic, but is seldom employed for this purpose.

Externally it is an astringent and desiccant, and is largely employed as a dressing in cases of eczema, either as a dusting powder or as an ointment. Combined with iodoform it gives excellent results as a dressing in cases of fissured heels arising from grease and mud fever in horses. It also forms a useful application in cases of canker of the ear in dogs.

One part of zinc oxide with 6 or 8 parts of lanolin forms a

mild astringent ointment, which is largely employed in canine practice in the treatment of eczematous affections of the skin.

Zinci Carbonas—Carbonate of Zinc—is prepared by the interaction of zinc sulphate and sodium carbonate.

It has similar actions and uses to the oxide of zinc.

Calamina Preparata—Prepared Calamine, obtained by calcining native calamine (zinc carbonate) and reducing it to an impalpable powder, is generally used in preference to carbonate of zinc.

Zinci Sulphas—Sulphate of Zinc; White Vitriol.

PREPARED by the action of dilute sulphuric acid on granulated zinc.

DOSES.—As an *astringent* and *tonic:* Horses, ʒss. to ʒi.; dogs, gr. i. to grs. iii. As an *emetic* for dogs, grs. x. to grs. xxx., dissolved in 2 ounces of warm water.

ACTIONS AND USES.—Given internally, sulphate of zinc is an *astringent* and *nerve tonic*. It forms a safe and effectual *emetic* in those animals capable of the act of vomiting.

Externally it is a stimulant and astringent.

As a nerve tonic and astringent it is seldom prescribed, other agents proving more satisfactory.

As an *emetic*, from 10 to 30 grains dissolved in 2 ounces of warm water act promptly in the dog, producing little prostration or nausea, as it belongs to the class of direct emetics (see p. 131).

Externally, as an astringent injection, it is employed to check discharges from the genito-urinary passages, such as leucorrhœa. A saturated solution is sometimes used in the treatment of sinuses and fistulæ.

In catarrhal conditions of the conjunctiva, after the acute stage has passed, a solution containing 2 grains of sulphate of zinc to the ounce of distilled water, applied with an eye-dropper twice daily, gives good results.

A combination of sulphate of zinc with acetate of lead and water, as already stated, forms the familiar *white lotion*. As these substances are chemically incompatible, the result is that the acetate of zinc is formed in solution and is the active constituent in this lotion; the sulphate of lead, being insoluble, is thrown down as a white precipitate.

Zinci Chloridum—Chloride of Zinc.

PREPARED by the action of hydrochloric acid on granulated zinc.

ACTIONS AND USES.—It is a powerful *caustic*, producing this effect by coagulating albumin and abstracting water from the tissues. Judiciously employed, it proves useful in the treatment of unhealthy ulcers, and also in cases of foot-rot in sheep. It was a favourite application in the treatment of sinuses and fistulæ, but these are now treated far more satisfactorily by surgical methods.

Chloride of zinc is not used internally, and in a toxic dose it is an *irritant* and *corrosive* poison. A 10 per cent. solution of the drug acts as an efficient germicide, but it is not employed for this purpose. Strong solutions are sometimes applied to prevent the extension of malignant growths.

Burnett's Disinfecting Fluid contains 25 grains of chloride of zinc to each fluid drachm.

CUPRUM (COPPER) AND ITS MEDICINAL SALTS.

The general actions of the soluble salts of copper resemble those of zinc and silver. *Toxic* doses are *irritants*, producing colicky pains and diarrhœa, while in cases of chronic poisoning nervous symptoms appear, with muscular weakness and trembling.

Cases of copper poisoning may result from contaminated pastures in the neighbourhood of copper-smelting works, but the most common source is the use of copper vessels in cooking food for cattle, pigs, and dogs. This is more likely to occur if the food be allowed to remain in the copper vessel, exposed to air and moisture, and especially if acid and fatty matters be present.

Suitable *antidotes* are—Demulcents, white of egg, barley-water, gruel, etc.; and if pain be a prominent symptom, the hypodermic injection of morphine will be indicated.

The only important salt of copper in veterinary practice is the sulphate.

Cupri Sulphas—Sulphate of Copper; Cupric Sulphate; Blue-stone; Blue Vitriol.

PREPARED by the interaction of sulphuric acid, copper or copper oxide, and water.

INCOMPATIBLES.—Alkalies and their carbonates, lime-water, iodides, and most vegetable astringents.

ACTIONS AND USES.—*Internally* it is *astringent* and *tonic*, and a prompt *emetic* in those animals capable of vomiting.

Externally it is *stimulant*, *astringent*, and *escharotic*.

As a nerve tonic and astringent, it is occasionally prescribed for the horse, in doses of a drachm, administered in the form of bolus; but other agents are preferable.

As a direct emetic, it is sometimes employed in canine practice in cases of narcotic poisoning, from 6 to 10 grains being dissolved in water for this purpose.

Sulphate of copper is an antidote to phosphorus-poisoning, and for this purpose is administered in small doses frequently repeated. The copper, becoming deposited on the phosphorus, renders the latter inert.

Externally, sulphate of copper is extensively employed as a stimulant, astringent, and caustic, in suppressing exuberant granulations and in the treatment of ulcers, etc. It may be applied in the form of a solution or in powder. Combined with the sulphates of iron and zinc, it forms a useful dressing in cases of canker of the horse's foot.

In cases of foot-rot in sheep, sulphate of copper, in combination with lard and tar, is a serviceable application.

As an astringent lotion in the treatment of granular conjunctivitis in the dog, 1 or 2 grains to the ounce of distilled water is recommended.

Combined with acetate of lead, sulphate of zinc, and camphor-water, it forms a useful astringent lotion in cases of fœtid grease and cracked heels in horses.

ARGENTUM (SILVER).

The salt of silver used in veterinary practice is the nitrate.

Argenti Nitras—Nitrate of Silver; Lunar Caustic.

PREPARED by dissolving silver in dilute nitric acid.

Argenti Nitras Induratus—Toughened Caustic.

Silver nitrate, 95 grammes ; potassium nitrate, 5 grammes. Mix by fusion.

ACTIONS AND USES.—*Internally*, in medicinal doses it is a *nerve tonic* and *astringent*, but is seldom employed for these purposes in veterinary practice. In *toxic* doses it is an *irritant* poison, and the suitable antidote is common salt, which converts it into the insoluble chloride. Demulcents should also be given freely.

Externally, nitrate of silver is caustic and astringent. As its action is confined to the part to which it is applied, it is largely employed for the purpose of controlling exuberant granulations in wounds. In such cases it coagulates albumin and forms a protective covering under which healing proceeds ; this covering tends to contract, and thus a slight pressure is exerted on the part. It constringes dilated vessels and lessens secretion from mucous membranes. When applied to a raw surface a white film is produced, due to the formation of chloride of silver ; this soon becomes of a dark colour.

In cases of pharyngeal or laryngeal ulceration in dogs, a solution of nitrate of silver, containing from 8 to 10 grains to the ounce, is applied by means of a camel-hair brush.

In cases of ophthalmia, a lotion containing from ½ grain to 2 grains to the ounce is useful, when the acute inflammation has subsided.

In opacity of the cornea, a solution containing 4 grains to the ounce is applied with a camel-hair brush, and often succeeds in removing this blemish.

In cases of canker of the ear in dogs, when ulceration of the lining membrane is present, a solution of nitrate of silver sometimes proves useful, but must be used with discretion.

If the solid nitrate of silver be employed in the treatment of ulcers of the pharynx, etc., care should be taken that the agent is not swallowed by the patient. Should this accident occur, the antidotes mentioned above should be administered.

Argentum Colloidale—Colloid Silver ; Collargol.

This is a soluble metallic silver preparation possessing antiseptic actions. It has been used in the treatment of

purpura hæmorrhagica, in doses of 7½ grains, administered by intravenous injection.

Protargol—Silver Protein—possesses deep penetrating powers, and is said not to precipitate albumin. It has been advised in conjunctival affections in the form of a 5 to 10 per cent. solution.

Argyrol contains 30 per cent. of silver combined with a protein. Solutions of 5 to 50 per cent. are used in ophthalmic practice, and are said to be painless when instilled into the eyes.

FERRUM (IRON) AND ITS MEDICINAL SALTS.

General Actions.—Some salts of iron, such as the perchloride, are strongly *astringent*, and in toxic doses are irritant and corrosive. Others are mild astringents and are prescribed as hæmatinics; these are represented by the oxides and the carbonate.

All preparations of iron possess *hæmatinic* and *tonic* actions. The precise action of iron on the blood is not yet determined. According to Dixon, in whatever form iron reaches the stomach, probably a portion of it is converted by the hydrochloric acid into ferrous chloride, in which form it combines with albumin, and on reaching the duodenum is decomposed by the alkaline medium into the carbonate of iron. Absorption of iron granules takes place through the epithelial cells. These granules are taken up by the leucocytes of the mucosa, and ultimately reach the portal vein. The excess is stored up in the liver, and to some extent in the spleen and bone marrow. Iron, like most metals, is excreted more slowly than it is absorbed, and excretion takes place by the rectum, only a small amount entering the system. The liver is believed to prepare the iron for hæmoglobin formation. The unabsorbed portions give a characteristic black appearance to the fæces. This is due to the formation of the sulphide and tannate of iron, which results from the action of the ingesta and the sulphuretted hydrogen which is present.

The beneficial effects of iron in anæmia are well known, but a satisfactory explanation of its action in this connection is not yet arrived at. Anæmia may follow various diseases,

and probably depends on a deficiency of hæmoglobin in the blood, without alteration in the number of red corpuscles. Insufficient absorption of iron from the alimentary canal may be one of the etiological factors. At any rate, iron improves the quality of the blood and favours recovery. In the affection known as 'pernicious anæmia,' in which there is destruction of red blood-corpuscles, but a relatively insignificant deficiency of hæmoglobin in the corpuscles, iron is rarely of service.

INCOMPATIBLES OF PREPARATIONS OF IRON.—Alkalies and their carbonates, lime-water, and all preparations containing tannin.

Ferri Carbonas Saccharatus—Saccharated Carbonate of Iron.

PREPARED by mixing ferrous sulphate, glucose, sodium carbonate, and distilled water, decanting the supernatant liquid, washing the precipitate with distilled water, drying, and powdering the product.

DOSE.—Horses, ʒii. to ʒiv., sheep and pigs, gr. xx. to ʒi., given in the food twice daily; dogs, grs. v. to grs. xv. in the form of pills twice a day.

ACTIONS AND USES.—This is a mild preparation of iron, not tending to cause gastric irritation or to derange digestion. Hence it is prescribed in cases of anæmia, debility, and as a general tonic in convalescence from debilitating affections.

Pilula Ferri—Blaud's Pill; Iron Pill.

PREPARED with exsiccated ferrous sulphate and exsiccated sodium carbonate; contains about 22·5 per cent. of ferrous carbonate.

DOSE for dogs, grs. v. to grs. x.

MEDICINAL USES.—This forms a useful tonic and hæmatinic pill for dogs in cases of debility, anæmia, etc. In combination with quinine, nux vomica, and aloin, it forms a tonic laxative, which is prescribed in cases of constipation depending on loss of intestinal nerve-power, the following formula proving a useful one: Blaud's pill, 3 grs.; quinine sulphate, ½ gr.; extract of nux vomica, $\frac{1}{20}$ gr.; and aloin, ⅛ gr.

Liquor Ferri Dialysatus (B.P., 1885)—Solution of Dialyzed Iron. Contains about 5 per cent. ferric oxide.

DOSES.—Horses, ʒss. to ʒi.; dogs, ♏ x. to ♏ xx.

MEDICINAL USES.—This preparation is useful as a tonic and hæmatinic in cases where the stronger preparations of iron would be inadmissible, such as in irritable conditions of the stomach. A drawback to its employment is that it is compatible with few drugs, and does not bear dilution with ordinary water without depositing the oxide. Hence it should be mixed with two parts of glycerin when dispensing. It is stated by some authorities to be superior to the moist peroxide of iron as an antidote to arsenic.

Ferri Peroxidum Humidum—Ferri Peroxidum Hydratum; Sesquioxide of Iron; Moist Ferric Oxide, with about 86 per cent. of uncombined water.

PREPARED by mixing 3 parts of liquor ferri perchloridi and 1 part of sodium carbonate, and diluting with water.

MEDICINAL USES.—This is the most effectual antidote for arsenical poisoning. It converts the arsenious acid into an insoluble compound, and should be given freshly prepared, in hot water and in large amounts at frequent intervals.

In cases of emergency the tincture of perchloride of iron may be precipitated with carbonate of sodium, and filtered through a handkerchief; or a solution of ammonia may be employed instead of carbonate of sodium.

Ferri Sulphas—Ferrous Sulphate; Sulphate of Iron; Green Vitriol; Copperas.

PREPARED by the interaction of dilute sulphuric acid and iron.

DOSES.—Horses, ʒss. to ʒii.; cattle, ʒii. to ʒiv.; sheep, grs. x. to grs. xxx.; pigs, grs. x. to grs. xx; dogs, gr. i. to grs. v. Given twice daily. Horses and cattle take it readily in the food, in the form of powders.

Ferri Sulphas Exsiccatus—Exsiccated or Dried Sulphate of Iron—is prepared by heating the ordinary sulphate of iron to 212° F. Two and a half parts of the former are equal to 4 parts of the latter, hence the doses are computed accordingly. The dried sulphate is a convenient form of the drug for dispensing.

MEDICINAL USES.—Sulphate of iron is extensively prescribed in equine practice as a *hæmatinic* and *general tonic*.

It is contra-indicated in cases where an irritable condition of the stomach is present. In consequence of its astringent action, it tends to produce constipation, and hence should be combined with saline laxatives, such as sulphate of magnesia or sulphate of soda.

As a general tonic, it is usually prescribed with nux vomica, quinine, or a vegetable bitter, such as gentian. Although technically incompatible with all vegetable drugs which contain tannin, the combination is often useful. In solution with vegetable astringents, it forms a black-coloured mixture, due to the production of tannate of iron.

We often find that the milder preparations of iron give better results in cases of debility, such as occur after attacks of influenza and respiratory affections. Sulphate of iron is prescribed in cases of diabetes insipidus, along with iodide of potassium. These agents are incompatible, but the iodide of iron which is formed nevertheless proves useful. In combination with other drugs, sulphate of iron is employed as a vermicide.

MacFadyean reported a case of Johne's disease in cattle successfully treated by means of ferrous sulphate and dilute sulphuric acid. Two drachms of each were administered daily in a pint of water. Improvement was observed after two months' treatment, and recovery resulted three months later (*Journ. of Comp. Path. and Therap.*, vol. xxvii., p. 76).

The milder forms of iron give better results in canine practice than the sulphate.

Externally it is disinfectant and antiseptic, but is seldom employed for these purposes.

Liquor Ferri Perchloridi Fortis—Strong Solution of Perchloride of Iron; Strong Solution of Ferric Chloride.

PREPARED by boiling iron in hydrochloric acid and water, and adding a little nitric acid to produce the higher chloride.

From the above are prepared—

Liquor Ferri Perchloridi—Medicinal Solution of Perchloride of Iron. This is formed by adding 250 millilitres of the strong solution to 1,000 millilitres of distilled water.

DOSES. — Horses and cattle, ℥ss. to ℥i.; dogs, ♏v. to ♏xv. Given properly diluted with water.

Tinctura Ferri Perchloridi—Tincture of Perchloride of Iron ; Tincture of Ferric Chloride ; Tincture of Steel. This is formed by mixing 250 millilitres of the strong solution with an equal amount of alcohol (90 per cent.) and distilled water sufficient to produce 1,000 millilitres.

DOSES.—Same as those of the medicinal solution of the perchloride.

MEDICINAL USES.—The strong solution is not used internally.

Externally it is a powerful *styptic*, but possesses a very corrosive action on the tissues, hence other styptics are preferred. The medicinal solution and the tincture are hæmatinics and general tonics, but, owing to their nauseous taste and tendency to cause gastric irritation, milder preparations of iron are preferable. Moreover, they cannot be given in the food, and drenching has to be adopted, this being very undesirable.

In cases of purpura hæmorrhagica, the tincture of iron is sometimes prescribed, but its value is doubtful.

In canine practice, the milder preparations of iron give better results.

Ferri Iodidum—Iodide of Iron—is a combination of iron and iodine, which is useful in cases of diabetes insipidus, nasal gleet, and in affections where a *tonic* and *alterative* are indicated.

It is best prescribed in the form of syrup of ferrous iodide, the dose of which for the horse is ʒi., and for the dog ʒss. to ʒi.

Ferri Arsenas—Arsenate of Iron—is a combination of iron and arsenic, which is occasionally prescribed in the treatment of chronic skin affections as a tonic and alterative.

DOSES.—Horses, grs. v. to grs. x. ; dogs, gr. $\frac{1}{16}$ to gr. $\frac{1}{4}$.

Ferri Phosphas—Phosphate of Iron—is a combination of ferrous phosphate and ferric phosphate. It combines the actions of iron and phosphorus, and is prescribed chiefly in canine practice as a tonic in cases characterized by debility, and in convalescence from distemper. It is also useful in cases of rickets.

In combination with quinine and strychnine, it is sometimes prescribed as a tonic for dogs in the form of *Syrupus Ferri Phosphatis cum Quinina et Strychnina*, which is a modified form of *Easton's Syrup*. This contains in each fluid drachm 1 grain of ferrous phosphate, $\frac{1}{5}$ grain of quinine sulphate, and $\frac{1}{32}$ grain of strychnine; and the dose for dogs is from ♏x. to ♏xx. Care must be taken, however, in prescribing this preparation for small dogs, owing to the strychnine it contains. Cases of poisoning resulting from the administration of this preparation are not uncommon.

The *Syrupus Ferri Phosphatis Compositus* is a modified form of Parrish's Syrup, and contains $\frac{1}{2}$ grain of phosphate of iron, $\frac{1}{5}$ grain of phosphate of calcium, with small quantities of phosphates of potassium and sodium in each fluid drachm. It is prescribed for dogs suffering from debility of any origin, and during convalescence from acute diseases, the dose varying from ℥ss. to ℥ii.

Ferri et Ammonii Citras—Iron and Ammonium Citrate.

This preparation is a useful hæmatinic in canine practice, being almost devoid of astringency, and not tending to cause gastric irritation or constipation. It can be prescribed in cases where other preparations of iron would not be tolerated.

The dose for dogs is from grs. v. to grs. x., given in solution with syrup of orange to disguise the taste.

Ferri et Quininæ Citras—Iron and Quinine Citrate—a preparation of citrate of iron and quinine, is employed as a tonic in canine practice, when it is desirable to combine these agents.

Dose.—For dogs, grs. v. to grs. x., in solution with syrup of orange.

Liquor Ferri Acetatis—Solution of Ferric Acetate.

This preparation is a diuretic as well as a hæmatinic, and may be administered in cases of chronic renal disease in doses of 5 to 15 minims for the dog. It is compatible with potassium acetate and potassium iodide.

HYDRARGYRUM (MERCURY).

All salts and preparations of mercury are derived either directly or indirectly from the metal itself.

GENERAL ACTIONS.—Mercurous salts, such as calomel, are slowly absorbed, and only possess a slight local action. According to Dixon, 'they do not come into contact with the living tissues very readily, hence a soluble albuminate is formed only very slowly. On this account these salts have little or no corrosive action.' Mercuric salts, such as corrosive sublimate, are soluble; they are quickly absorbed, and their corrosive action is 'largely due to the fact that the mercury albuminate does not form a protective sheath on the mucous membrane, on account of its solubility in saline solution or albumin, and so it leaves the acids free to exert their full corrosive action' (Dixon).

The solution of mercuric nitrate is an active caustic, the biniodide is a counter-irritant, and the perchloride is an antiseptic, and in toxic doses an irritant corrosive poison. The subchloride or calomel is a cathartic. If applied to the skin in the form of ointments or dressings for any length of time, mercurials become absorbed and produce definite effects, known as *mercurialism* or *hydrargyrism*. This also occurs from the prolonged administration of the drug. It is characterized by salivation, tenderness of the mouth and gums, impaired appetite, dyspepsia, diarrhœa, muscular tremors, emaciation, and in some cases the appearance of eczematous eruptions on the skin. Osseous affections may also be produced.

The suitable antidotes are the administration of potassium iodide, which withdraws the mercury in a soluble form from the tissues into the blood, from whence it is excreted by various channels, but chiefly by the kidneys. Mouth-washes containing chlorate of potash are also indicated.

Dogs are more susceptible to the action of mercurials than horses or cattle, hence great care is essential in prescribing these agents internally, or in applying dressings containing them.

Experiments have demonstrated that mercury exerts a paralyzing effect on the movements of the white blood-corpuscles. The drug acts as a sialagogue, when given in continued doses, by exerting a special action on the salivary glands after its absorption into the substance of the cells, and this effect is produced by all preparations of the drug and by all methods of administration. Calomel and blue pill, owing to their insolubility, are only absorbed into the system in very small amounts when given in medicinal doses. They exert a purgative effect by causing slight irritation of the intestines, and are excreted practically unchanged in the fæces. Formerly mercury was regarded as a cholagogue, but experiments have shown that it does not increase the flow of bile from the liver. It does, however, clear out bile from the intestines, hence after a purgative dose of calomel bile appears in the fæces. The drug is slowly eliminated from the system, and when administered in continued doses it quickly enters the tissues from the blood, being found in the largest amount in the liver, spleen, and kidneys. It is excreted chiefly by the large intestine as the sulphide, also in the urine and saliva. During its excretion by the kidneys, it exerts a moderate diuretic effect, probably by causing slight irritation of these organs. Large doses may induce acute nephritis.

Pilula Hydrargyri—Blue Pill.

Mercury, 40 grammes; confection of roses, 60 grammes; and powdered liquorice root, 20 grammes.

This is prescribed in canine practice as a cathartic, in combination with the compound pill of colocynth and hyoscyamus, the dose being from grs. ii. to grs. iv.

Hydrargyrum cum Creta—Mercury with Chalk; Grey Powder.

PREPARED by triturating together 20 grammes of mercury with 40 grammes of prepared chalk.

MEDICINAL USES.—As a *laxative*, *antacid*, and *alterative*, it is prescribed in cases of bilious indigestion and diarrhœa occurring in young foals and calves, and for this purpose is given in doses of grs. v. to grs. xv., repeated twice daily.

It is a useful preparation of mercury in canine practice, being mild and non-irritating in its action.

It is specially indicated in dyspepsia depending on hepatic irregularities, which occurs in young dogs, and in small doses frequently repeated it sometimes gives good results in cases of jaundice.

The dose varies from gr. ss. to grs. iv., according to the size of the patients, and it is best administered in the form of pills or tablets.

Unguentum Hydrargyri — Blue Ointment; Mercurial Ointment.

PREPARED by triturating 30 grammes of mercury with 65 grammes of benzoated lard and 5 grammes of prepared suet.

USES.—Blue ointment forms an efficient parasiticide dressing for ringworm. If applied to the skin in sufficient amount and with friction, the mercury gains entrance to the system, and produces its specific effects thereon. This is neither desirable nor necessary in veterinary practice.

Linimentum Hydrargyri—Mercurial Liniment.

Oleatum Hydrargyri—Oleate of Mercury.

These preparations are diffusible, penetrating, absorbent agents, occasionally employed in the treatment of ringworm, and in cases of enlarged and indurated glands.

Hydrargyri Suboxidum—Black Oxide of Mercury.

This is the active constituent in the following lotion—viz.:

Lotio Hydrargyri Nigra—Black Mercurial Lotion; Black Wash.

PREPARED by mixing calomel, 6·85 grammes; glycerin, 50 millilitres; and solution of lime, sufficient to produce 1,000 millilitres.

This lotion is occasionally prescribed as a stimulant and astringent to ulcers and unhealthy surfaces.

Hydrargyri Oxidum Rubrum—Red Mercuric Oxide; Red Precipitate.

This preparation of mercury is sometimes used as a stimulant and astringent application in cases of chronic grease, cracked heels, etc., and for such purposes is employed in the form of an ointment—viz.: the *unguentum hydrargyri oxidi rubri*, known as red precipitate ointment. This is prepared

with 10 grammes of red precipitate and 90 grammes of yellow paraffin ointment (1 in 10).

Hydrargyri Oxidum Flavum—Yellow Mercuric Oxide.

This is the active constituent in the following lotion:

Lotio Hydrargyri Flava — Yellow Mercurial Lotion; Yellow Wash.

PREPARED by mixing 4·6 grammes of corrosive sublimate with 1,000 millilitres of solution of lime. This lotion is more active than that already mentioned as black wash, and its uses are similar.

Unguentum Hydrargyri Oxidi Flavi—Yellow Mercuric Oxide Ointment.

PREPARED with 2 grammes of yellow mercuric oxide and 98 grammes of yellow soft paraffin (1 in 50).

The chief use of this ointment is in the treatment of certain affections of the eye and eyelids.

Diluted with an equal amount of white vaseline, it is applied in cases of eczematous affections of the eyelids, corneal ulcerations, and chronic conjunctivitis. A small quantity placed between the eyelids is useful in cases of ophthalmia, as it prevents the tendency of the eyelashes to become glued to each other by the drying of the discharge.

Hydrargyri Subchloridum — Subchloride of Mercury; Calomel; Mercurous Chloride.

PREPARED by heating a mixture of mercurous sulphate and sodium chloride. The calomel rises in vapour, and is then condensed and washed.

DOSES.—As a *cathartic*: Horses, ʒi. to ʒii.; cattle, ʒi. to ʒii.; sheep and pigs, grs. xv. to grs. xxx.; dogs, grs. ii. to grs. v. —usually combined with other purgatives.

INCOMPATIBLES.—Bromides and iodides, nitro-hydrochloric acid, hydrocyanic acid, chlorides of the alkalies, solution of lime, iodoform.

ACTIONS AND USES.—Calomel, in consequence of its insoluble character, is mild in its action as compared with other preparations of mercury. Given in a sufficient dose, it acts as a *purgative* in all animals, and is believed to produce this effect by irritating the intestinal mucous membrane. As already remarked, calomel is not a cholagogue, but it clears

away bile from the intestine, and thus prevents reabsorption of the former.

Calomel possesses a diuretic action, which is more marked when it is combined with salines or resinous agents. If administered in repeated doses it produces the physiological effects of mercury which have already been described.

In the horse an excessive dose may produce colicky pains and superpurgation. Some authorities state that this animal is not so susceptible to the toxic effects of the drug as cattle.

Dogs are very susceptible to the action of calomel, and great discretion is necessary in computing suitable doses, especially for the smaller breeds.

Calomel possesses a disinfectant action on the intestinal canal, and limits putrefaction within the bowels.

Externally it is *desiccant*, *stimulant*, and *astringent*.

As a *cathartic* calomel is prescribed for the horse in cases where full purgative effects are desired, such as acute indigestion, lymphangitis, brain affections, azoturia, etc. For these purposes it is usually combined with aloes, and administered in the form of bolus. A combination of calomel and aloin (2 drachms of each) forms a very efficient purgative, and is readily taken by some horses when mixed in the food.

In the treatment of the various forms of indigestion in dogs, calomel is a useful cathartic agent, as it is not likely to be rejected by the stomach. It can be administered in the form of pill or tablet, and may be combined with the compound pill of colocynth and hyoscyamus.

In the treatment of jaundice, whether depending on disorders of the liver or on obscure causes, small repeated doses of calomel often give good results. It should be administered in doses of $\frac{1}{10}$ grain every four hours, until the bowels are acted on, and some improvement in the symptoms is observed. In the case of young dogs and in the small breeds grey powder is preferred for this purpose.

Externally, calomel in the form of ointment (1 to 8) is sometimes employed to allay the severe itching of certain skin affections in the horse, such as eczema. Combined with iodoform, oxide of zinc, and boric acid, it forms an excellent

application for the treatment of that affection known as 'thrush' in the horse's foot. The incompatibility of calomel and iodoform does not affect the value of the combination.

Hydrargyri Perchloridum — Mercuric Chloride; Perchloride of Mercury; Bichloride of Mercury; Corrosive Sublimate.

PREPARED by heating a mixture of mercuric sulphate, sodium chloride, and black oxide of manganese.

INCOMPATIBLES.—Alkalies and their carbonates, iodide of potassium, acetate of lead, albumin.

ACTIONS.—Perchloride of mercury, being very soluble and containing twice as much chlorine as calomel, possesses marked toxic properties. It is an *irritant corrosive* poison, causing gastro-enteritis and general collapse. Administered in smaller doses, it produces mercurialism.

The suitable *antidotes* are—Albumin, in the form of eggs, which forms an insoluble albuminate; milk and flour may also be administered for a similar purpose.

Externally corrosive sublimate precipitates albumin, and is an active caustic and escharotic. In the proportion of 1 part to 1,000 parts of water it forms an efficient germicide capable of destroying bacilli and their spores.

MEDICINAL USES.—It is seldom prescribed for internal use. Experiments show that the drug does not possess a cholagogue action. Nevertheless, it has been found useful in some cases of jaundice in the dog. For this purpose the **Liquor Hydrargyri Perchloridi**, which contains 1 grain in 2 ounces of distilled water, is the most convenient form for prescribing this agent, the dose for the dog being ½ to 1 fluid drachm.

The chief use of corrosive sublimate is as an efficient *antiseptic* in the treatment of wounds and for general surgical work. For these purposes it is employed in the form of lotions, the strength being 1 part to 1,000 parts of water.

For convenience, accuracy, and portability, tablets containing 8·75 grains are prepared by chemists. One of these, dissolved in 20 ounces of water, forms a solution of the strength indicated.

Perchloride of mercury possesses certain drawbacks as an

antiseptic agent. First, in the case of extensive wounds, it may exert toxic effects owing to its absorption. Again, the perchloride has a corrosive action on steel and plated instruments. In the presence of albumin it forms an inert and insoluble compound, but this can be obviated by adding 5 parts of tartaric acid to each part of the perchloride, and so preventing the formation of an albuminate. In our experience other disinfectants and antiseptics are far preferable to this agent.

Perchloride of mercury forms one of the constituents of Dean's injection for the treatment of bog-spavin (see p. 270).

In former times corrosive sublimate, in the form of powder and strong solutions, was employed in the treatment of quittor and allied affections, but modern surgical methods have superseded the use of such agents, and give more satisfactory results.

In the treatment of open joint the following lotion is recommended by some authorities: Perchloride of mercury, ½ drachm; tincture of myrrh, 4 ounces; water, ½ ounce.

Various forms of surgical dressings contain corrosive sublimate as an antiseptic agent, such as sublimate gauze (1 to 1,000) and sublimate wool (1 to 400).

Sal Alembroth—Mercuric Ammonium Chloride—is a mixture of 1 part of perchloride of mercury with 2 parts of ammonium chloride.

It is a powerful antiseptic. It does not combine with albumin so quickly as corrosive sublimate, and hence is less irritating. It is chiefly used in the preparation of surgical dressings. Alembroth gauze contains 1 per cent.; alembroth wool contains 2 per cent. But owing to the fact that sal alembroth is very soluble, it is quickly washed out of dressings by any discharge from a wound, and acts as an irritant; hence many surgeons have ceased to employ it.

Mercuro-Zinc Cyanide is a combination of perchloride of mercury with zinc and potassium cyanide. It is a reliable non-irritating antiseptic, and its chief use is in the preparation of a special gauze (3 per cent.), which is employed as a surgical dressing.

Hydrargyrum Ammoniatum — Ammoniated Mercury; Ammonio-chloride of Mercury; White Precipitate.

PREPARED by precipitating a solution of perchloride of mercury with a diluted solution of ammonia. It is not used internally.

Unguentum Hydrargyri Ammoniati—Ammoniated Mercury Ointment; White Precipitate Ointment.

Ammoniated mercury, 5 grammes; benzoated lard, 95 grammes (1 in 20).

USES.—In the horse white precipitate ointment gives good results in the treatment of grease and cracked heels, and also in cases of those affections of the skin known as *mallenders* and *sallenders*. It is also a useful parasiticide in cases of ringworm. Owing to the danger of absorption, and of the animal licking the part to which the dressing is applied, this agent is not a safe one in canine practice.

Hydrargyri Iodidum Rubrum—Biniodide of Mercury; Red Mercuric Iodide; Red Iodide of Mercury.

PREPARED by mixing solutions of perchloride of mercury and potassium iodide.

ACTIONS AND USES.—Red iodide of mercury in medicinal doses is an *alterative* and *antiseptic*; in toxic doses it is an irritant poison. It is prescribed in cases of lymphangitis in the horse, after the acute stage has passed, in doses of 5 grains three times daily, and is said to be as effectual as potassium iodide, while it is far cheaper. Also in cases of scirrhous cord, and in tumours of the shoulder depending on botriomycosis.

A convenient solution is prepared by dissolving 1 drachm of the biniodide in 12 ounces of water by means of the addition of an equal amount of potassium iodide. Of this mixture 1 ounce may be given three times daily in the food.

This preparation has been found very useful in the treatment of the above affections and allied conditions by Mr. F. G. Edwards, F.R.C.V.S., Chester, and he states that it can be given for a long period of time without any risk of the toxic effects of mercury occurring. In the treatment of cellulitis and septic arthritis in foals, he advises the ad-

ministration of 1 grain of biniodide of mercury three times daily. For actinomycosis in cattle, 10 grains of the biniodide with an equal amount of potassium iodide, given three times daily, proves as effectual as the latter agent, while it is far cheaper. The combination is termed mercuric potassium iodide. In a solution of 1 to 1,000 of water it forms an efficient antiseptic for surgical purposes.

Externally, the red iodide of mercury is an active *counter-irritant* and *absorbent*, which is extensively employed in the form of ointment in the treatment of diseased joints and the various forms of exostoses. If applied of sufficient strength, it penetrates deeply and acts as a *suppurant*. A safe blistering ointment is prepared with 1 part of red iodide of mercury and 4 parts each of lanolin and vaseline. When severe counter-irritation is indicated, it is usual to combine equal parts of the red iodide and cantharides.

In the treatment of capped hock, a useful absorbent lotion is prepared by dissolving 1 drachm of the red iodide with a sufficiency of the iodide of potassium to render the former soluble in 12 ounces of water. This is applied daily until the part gets tender and scaly, then discontinued for a time and reapplied. The red iodide is also an efficient antiseptic, and for this purpose it enters into the composition of antiseptic soaps, and tablets for preparing solutions.

In cases of ulcerated heels in the horse, when the ulcers are deep as the result of large portions of skin sloughing out, the biniodide of mercury ointment acts as an excellent stimulant and promoter of cicatrization. Mr. H. Gray, Kensington, finds that the application relieves all pain in a few hours, and he also advises its use in the treatment of ulcers on the shoulders or withers.

The **Green Iodide of Mercury** (mercurous iodide), in the form of ointment (1 to 8) freshly prepared, has been found useful in the treatment of mallenders and sallenders.

Liquor Arsenii et Hydrargyri Iodidi—Donovan's Solution. This combines the alterative actions of arsenic and mercury, and contains 1 per cent. of iodide of arsenic and red iodide of mercury. It is recommended in the treatment of

chronic scaly affections of the skin, the dose for horses being ʒi. to ʒii., and for dogs ♏v. to ♏xx.

Unguentum Hydrargyri Nitratis—Citrine Ointment.

This is prepared by mixing together mercury, nitric acid, lard, and olive-oil. When mixed with 4 parts of soft paraffin, it forms the Dilute Citrine Ointment, which is the preparation usually employed.

USES.—In the treatment of cutaneous diseases, citrine ointment is not a safe agent in canine practice, owing to the danger of absorption, and of the dog licking the parts to which it is applied. In irritable discharging conditions of the eyelids, with chronic inflammation and ulceration of the hair follicles, a very dilute citrine ointment, carefully applied, is productive of good results. In these cases it should be diluted 1 to 7.

The **Liquor Hydrargyri Nitratis Acidus**—Acid Solution of Nitrate of Mercury—is a strong caustic seldom employed in veterinary practice.

ANTIMONIUM (ANTIMONY).

The only preparation of antimony which is of any interest in veterinary practice is the antimonium tartaratum, or tartar emetic. The Liquor Antimonii Chloridi, or Butter of Antimony, is a powerful escharotic which is now seldom employed, but was formerly used as a caustic application in cases of canker of the foot in the horse and foot-rot in sheep.

Antimonium Tartaratum—Tartarated Antimony; Potassio-tartrate of Antimony; Tartar Emetic.

PREPARED by mixing oxide of antimony and acid tartrate of potassium with water, then purifying by crystallization from water.

ACTIONS.—Tartar emetic, in the form of powder, administered to horses and cattle, produces no appreciable effects. Experimental evidence shows that even large amounts do not exert any physiological action beyond causing a slight degree of nausea and a lowering of the blood-pressure. If administered in the form of solution, however, doses of from ½ ounce to 2 ounces produce muscular spasms, colicky pains, and death, in a variable period of time. One drachm given by

intravenous injection produced sweating, purging, salivation, attempts at vomiting, and 2 drachms caused death in from one and a half to three hours, preceded by vertigo and paralysis.

In the dog it is a powerful emetic, 1 to 3 grains causing vomiting in from ten to fifteen minutes; this action is prolonged, much nausea and depression resulting. At the same time it acts as an expectorant, but, according to Dixon, there is no evidence to show that it has any specific action on the bronchial mucous glands, or that it is excreted by the bronchioles. The expectorant action probably results from the irritating effect of the drug on the stomach, which produces a reflex increase of bronchial mucus. The same authority states that the emesis is due to a direct irritant action on the stomach, and there is no reason to suppose that the drug has a direct action on the vomiting centre. In toxic doses it is an irritant poison, causing gastro-enteritis, purging, cardiac weakness, and paralysis.

The suitable *antidotes* are tannic acid and substances containing tannin; these form an insoluble compound with the toxic agent. Demulcents are also indicated, and stimulants if there are symptoms of collapse.

Externally, tartar emetic is a powerful irritant when applied to the skin; it irritates the orifices of the sweat glands and sebaceous follicles, and causes the formation of pustules together with deep-seated painful inflammation of the part.

MEDICINAL USES.—Tartar emetic is believed by some practitioners to exert an alterative action on the skin, and is sometimes prescribed, along with other agents, to improve the condition of horses, the usual doses being 1 to 2 drachms. It is also employed as a vermicide for the horse, in combination with sulphate of iron and gentian, and proves useful for the eradication of round worms. The violence of its action externally precludes its use as a counter-irritant.

In canine practice the drug is not used in this form.

Vinum Antimoniale—Antimonial Wine—is prepared by dissolving 4 grammes of tartar emetic in 40 millilitres of distilled water (boiling), and adding sufficient sherry to produce 1,000 millilitres.

It is sometimes prescribed in canine practice, in the early stages of bronchitis, as an expectorant, in doses of from 10 to 20 minims.

ARSENIUM (ARSENIC).

Acidum Arseniosum—Arsenious Acid; White Arsenic.

SOURCE.—Obtained by roasting certain arsenical ores.

DOSES.—Horses and cattle, grs. v. to grs. viii.; sheep and pigs, gr. ss. to grs. ii.; dogs, gr. $\frac{1}{60}$ to $\frac{1}{20}$—repeated twice daily and combined with other agents in the form of powders administered in the food.

Liquor Arsenicalis—Liquor Potassæ Arsenitis; Fowler's Solution.

INCOMPATIBLES.—Liquor strychninæ.

DOSES.—Horses and cattle, ʒss. to ʒi.; dogs, ♏ii. to ♏viii. This is a mixture of arsenious acid and carbonate of potash in water, coloured with compound tincture of lavender. It contains about $4\frac{1}{2}$ grains of arsenic to each fluid ounce; or 110 minims contain 1 grain of arsenic.

Liquor Arsenici Hydrochloricus—Hydrochloric Solution of Arsenic—contains hydrochloric acid, and is employed when it is desired to combine liquor strychninæ with arsenic (see p. 259). It is of similar strength to Fowler's solution, and is prescribed in similar doses.

Atoxyl is one of the organic compounds of arsenic, and is said to have only one-fortieth the toxicity of arsenious acid.

DOSES.—For horse, by subcutaneous injection, grs. vii. to grs. x.; for foals, grs. iii. to grs. v.—gradually increasing the doses.

ACTIONS.—In medicinal doses arsenic is a *tonic* and *alterative*. It stimulates the gastric nerves, improves digestion, and increases the appetite. It diminishes oxidation, increases the formation of fat, and is eliminated from the system chiefly by the kidneys, also by the liver and the skin. It exerts a specific action on the skin, and is believed to favour desquamation of the superficial layer of this structure by a process of stimulation.

Administered in gradually increasing doses, a tolerance of

the drug is acquired, and a knowledge of this fact is of importance from a therapeutical point of view.

Externally, arsenic in the form of arsenious acid is a powerful *caustic* and *escharotic*. In dilute solutions it is a parasiticide.

Toxic Actions.—Arsenic is an *irritant* poison, producing in all animals gastro-enteritis. The rapidity of its action depends on the solubility of the agent, the presence of food in the stomach, and on the susceptibility of the animal to the effects of the drug.

The action of the drug is not strictly local, as subcutaneous injections produce similar lesions in the alimentary canal. Arsenic differs from corrosive poisons, as its compounds form no combination with proteids analogous to the albuminates of the heavy metals. Moreover, it requires a definite latent period before its action becomes apparent, while corrosive poisons produce their effect immediately (Dixon).

In the horse the symptoms observed are violent purging, severe colicky pains, tenesmus, staggering gait, cold extremities, a weak, irregular, thready pulse, death occurring in a variable period, with symptoms of coma or with tetanic spasms. The toxic dose for the horse is liable to great variation. In some instances 1-drachm doses have produced no effects, while in others smaller amounts have caused nausea, colic, and purging. One case is recorded in which 30 grains given in a solution of carbonate of potash caused death in four days. If the stomach be empty, the toxic actions may be manifested with great rapidity, and death may occur within an hour.

Formerly it was held that arsenic had a special action on the central nervous system, but modern investigators have shown that such a view was erroneous. According to Dixon, the drug may give rise to a peripheral neuritis by a special action on the interstitial tissue of the nerves, leading to pressure on the nerve fibres and degeneration of the latter.

But in some recorded cases of arsenical poisoning the usual symptoms of gastro-enteritis were absent, a state of profound coma resulting instead.

Cases of chronic arsenical poisoning are on record which have occurred from contamination of the pastures in the neighbourhood of copper-smelting works. The symptoms observed were swollen joints, emaciation, indigestion, thirst, and distressed breathing on moderate exercise.

Cattle are less susceptible to the toxic actions of arsenic than horses. They take larger amounts, and in consequence of the physiological peculiarities of their digestive system absorption is slow. From 4 to 8 drachms are stated to produce poisonous effects.

In *sheep* many cases of arsenical poisoning are recorded from the careless use of sheep-dips containing this agent. Experiments have demonstrated that arsenic in dilute solutions is not absorbed through the healthy skin, and that the source of the poisoning was contamination of the pastures by allowing the sheep to wander thereon after being dipped, the drippings from the fleece falling on the grass, and thus the drug gained entrance to the system. The symptoms observed were—Dulness, nausea, frothing at the mouth, colicky pains, accelerated respirations, and in some instances death occurred rather suddenly. The precautions to be taken in using arsenical sheep-dips are to avoid too large a proportion of arsenic in the preparation of the dip, to keep the animals in an empty yard for a proper interval after dipping, and not to return them to the pastures until their fleeces are dry.

The dog is very susceptible to the actions of arsenic, the toxic dose being from 2 to 5 grains. The symptoms produced are—Nausea, vomiting, abdominal pain, purging with dark-coloured evacuations, quick, wiry pulse, soon becoming thready, and death preceded by convulsions. Moderate doses frequently repeated for a long period are said to prove more toxic sometimes than larger doses given at longer intervals.

If the drug be given in medicinal doses for a long period of time, redness and swelling of the conjunctiva, an œdematous condition of the eyelids, catarrh of the nasal and pharyngeal mucosæ, and, in the dog, vomiting and diarrhœa, may be observed.

The post-mortem appearances of arsenical poisoning vary

according to the severity of the case. In the horse the villous portion of the stomach is intensely inflamed, and may be eroded if the poison be taken in the form of powder. The small and large intestines are acutely inflamed in patches In cases where the drug has been continued for some time, fatty degeneration of the liver and other organs is observed, and the carcase usually resists decomposition to a large extent.

A source of arsenical poisoning in horses is the continued administration of the drug by attendants with the idea of improving the condition of the animals. In the dog, cases occur from the careless use of rat-poisons and vermin-killers containing arsenic.

The *suitable antidotes* to arsenical poisoning are, in the dog, if treatment can be adopted immediately, the use of emetics, such as mustard or zinc sulphate, with full amounts of fluids, in order to get rid of the poison from the stomach. The best *chemical antidote* for arsenic is the moist ferric hydroxide. This can be prepared in various ways. In cases of emergency a solution of ammonia may be added to the tincture of perchloride of iron or to the solution of ferric chloride; or carbonate of soda may be added to the above preparations of iron, and the resulting precipitate filtered through a handkerchief. The antidote thus prepared should be given in large amounts in hot water and at intervals of ten minutes.

Another preparation recommended is 3 parts of solution of perchloride of iron in 17 parts of water, and adding to this, when the antidote is required, 1 part of calcined magnesia in 17 parts of water. For the dog ½ ounce should be administered every five or ten minutes; for the horse, 8 or 10 ounces.

These antidotes should be given freshly prepared, and in amounts equivalent to at least twelve times the probable quantity of the poison that has been taken. They convert the arsenic into an inert insoluble substance.

Dialyzed iron is also an efficient antidote, while, in the absence of iron preparations, hydrated magnesia, obtained by precipitating a solution of sulphate of magnesia with caustic potash, may be employed.

As mechanical antidotes, oils, demulcents, milk, white of egg, lime-water, etc., should be administered in large amounts.

Hypodermic injections of morphine are indicated to retard absorption and relieve pain.

In chronic arsenical poisoning, oleaginous laxatives, tonics, and occasional diuretics, should be prescribed.

MEDICINAL USES.—In cases where diarrhœa occurs shortly after food has been taken, this depending on imperfect digestion in the stomach, small doses of liquor arsenicalis, administered *before* feeding, give good results. This beneficial effect is due to the action of arsenic as a gastric tonic.

In nervous affections, such as chorea and epilepsy in dogs, arsenic is prescribed in combination with other nerve tonics.

In spasmodic asthma in dogs, and in cases of that affection known as 'broken wind' in horses, arsenic is a valuable palliative remedy, attention being directed at the same time to dietetic treatment. It is also useful in cases of chronic cough, and its effects in connection with such affections may be ascribed to its actions as a general nerve tonic, acting on the nerves of the respiratory system as well as on the gastric nerves.

In cases of *anæmia* and *general debility*, it is prescribed in combination with preparations of iron.

As an *alterative*, with a special action on the skin, it is employed in various affections of this structure, such as chronic eczema, etc. It should not be prescribed in the acute stage of eczema, and is contra-indicated in cases accompanied by gastric irritability. The best form for administration is the liquor arsenicalis. This should be given either along with the food or immediately after feeding, so as to avoid any tendency to irritation of the gastric mucosa. The exception to this has already been mentioned.

As the liquor arsenicalis is incompatible with acid mixtures—*e.g.*, with liquor strychninæ—the liquor arsenici hydrochloricus should be substituted when such a combination is desirable. When arsenic is continued in medicinal doses for a long period, certain symptoms may appear which are important to recognize, as their advent is an indication to

diminish the amount prescribed, but not to suspend the drug suddenly. These, as already mentioned, consist of a slight œdematous condition of the eyelids, a slight degree of conjunctivitis, and gastric irritation, the latter being evidenced by indigestion, diarrhœa, and thirst.

In prescribing arsenic, it is always advisable to commence with small doses, and to gradually increase these as the system becomes accustomed to the effects of the drug. This precaution is necessary in consequence of individual idiosyncrasies, and also because it is necessary in many instances to push the administration of the agent in order to secure its beneficial effects.

Externally, the chief use of arsenic is in the preparation of sheep-dips for the treatment of scabies in sheep. The following is a safe dip: Take 2 pounds of arsenious acid, 2 pounds of carbonate of potash, 2 pounds of sublimed sulphur, and 4 pounds of soft soap; dissolve in 10 gallons of boiling water, and add cold water to make 100 gallons. This will be sufficient to dip about 100 sheep, and the following precautions should be attended to—viz.: The sheep should be kept in the dip about a minute, with the head carefully kept away from the fluid. The animal is then placed on a sparred apparatus over another receptacle, and the wool squeezed as dry as possible with a scraper, especial care being taken not to allow the animal on pasture immediately afterwards.

In former times arsenic was employed as a caustic and escharotic in cases of quittor, but modern surgical methods of treatment have superseded such antiquated and barbarous measures. Arsenic in the form of paste carefully applied is found useful in the treatment of inoperable tumours in the horse, and in the removal of warts having a sessile base. For this purpose a paste composed of arsenic. alb. ʒi., tinct. cantharidis ʒi., and 6 drachms each of Venice turpentine, olive-oil, and yellow wax, has been advised.

In the treatment of surra, Holmes has obtained excellent results by the administration of atoxyl subcutaneously, followed by gradually increasing doses of arsenious acid (*vide* our 'System of Veterinary Medicine,' vol. i., p. 1110).

Atoxyl has also proved useful as a vermicide in cases of infestation by *Sclerostomum tetracanthum* in foals.

In the treatment of infective sarcomata or contagious venereal tumours in the vagina of the bitch (especially frequent in the bull bitch), Mr. H. Gray, Kensington, recommends the following treatment: First apply a solution of cocaine by means of swabs soaked therein, so as to anæsthetize the part; then curette, and rub the raw surface with a crystal of cupri sulph. a few times to remove diseased tissue. Dress with liq. arsenicalis, and administer gr. $\frac{1}{20}$ of arsenic twice daily until the parts have healed. Examine at periods of two weeks. This method does not cause constriction of the vagina, such as may occur after excision of the growths.

PHOSPHORUS.

Although phosphorus is a non-metallic element, we insert it in this chapter in consequence of a similarity in its actions to those of arsenic. It is derived from bones by the action of sulphuric acid thereon, calcium phosphate being formed, from which phosphorus is obtained by evaporation, then mixing with charcoal and distilling. Phosphorus itself is not prescribed in veterinary practice, but the HYPOPHOSPHITES of SODIUM and CALCIUM are important *alteratives* and *tonics*.

ACTIONS.—Phosphorus possesses alterative actions similar to those of arsenic. It diminishes combustion of fats increases tissue change in the body, and augments the transformation of proteids into fats. It has special actions as a nerve tonic, and is a stimulant to the central nervous system. It has also a special effect in promoting the development of bone.

TOXIC ACTIONS.—Phosphorus is an *irritant corrosive poison*, causing in the dog gastro-enteritis, vomiting, intense thirst, and purging. The vomited substance may be of a dark green colour, with the odour of garlic, and sometimes appears luminous in the dark. In some cases there may be vomiting of blood, a weak pulse, and convulsions, followed by coma. It is usually a comparatively slow poison, death not occurring before two or three days, but occasionally cardiac paralysis

results and death occurs quickly. Partial recovery may ensue; this is followed by symptoms of hepatic disease, such as jaundice, with tenderness over the region of the liver and enlargement of that organ. Smaller doses, repeated for a few days, cause fatty degeneration of various organs and tissues.

Phosphorus is more toxic if taken in a finely divided condition, and the chief source of poisoning by it in the dog is from the accidental ingestion of rat-pastes or vermin-killers, which frequently contain this agent.

ANTIDOTES.—Sulphate of copper should be administered in a dose of 3 grains dissolved in water every five minutes until vomiting is produced. By this means a portion of the poison is got rid off, and copper is deposited on what remains, rendering it inert. This agent should be continued in 1-grain doses every quarter of an hour, and combined with morphine if rejected by the stomach. Oil of turpentine is another antidote; this combines with the phosphorus, and, although rendering it soluble, a non-poisonous substance is formed. Some authorities state that only the French oil of turpentine is effectual for this purpose. This is obtained from the *Pinus maritima*. Thirty minims should be administered every half hour. A purgative consisting of Epsom salt is also advised. *All fats, oils, milk, eggs*, etc., should be avoided, as they render the agent soluble, but mucilaginous drinks may be freely given.

USES.—The hypophosphites of calcium and sodium, which possess the medicinal actions of phosphorus without the irritating effects of the latter, are prescribed as alteratives and nerve tonics. They are specially indicated in cases of debility and anæmia in young animals, and in convalescence from acute diseases. They are also useful in cases of rickets in young dogs.

In the resolution stage of catarrhal pneumonia in the dog, the hypophosphites tend to cause absorption of the exudate, by assisting the process of fatty degeneration therein. For this purpose they are preferably administered in the form of an *emulsion with cod-liver oil*.

The doses of calcium hypophosphite and sodium hypo-

phosphite for the horse are from ʒi. to ʒii.; for the dog, grs. iii. to grs. x.

Sodium Phosphate acts as a moderate cholagogue, and in full doses as a mild saline purgative. It is seldom used in veterinary practice.

BISMUTHUM (BISMUTH).

The chief salts of bismuth employed in veterinary practice are the subnitrate and the carbonate.

Bismuthi Subnitras—Subnitrate of Bismuth.

Bismuthi Carbonas—Bismuth Oxycarbonate; Carbonate of Bismuth.

Doses of both the above: Horses, ℈ss. to ʒi.; dogs, grs. x. to grs. xxx.

Liquor Bismuthi et Ammonii Citratis is composed of subnitrate of bismuth, citric acid, solution of ammonia, and distilled water.

Dose for the dog, ♏ xv. to ℈ss.

Actions and Uses.—According to some authors, bismuth is a *gastric* and *intestinal sedative* and also an *astringent*, lessening the irritability of the gastric nerves, and also acting in a mechanical manner by shielding the mucous membrane with a protective covering. But other writers state that the drug acts in a physical manner only, forming an adhesive coating on the gastric mucosa, and thus protecting it from the irritation of the food and secretions. In the small intestine it also acts as a protective covering to the mucosa; thus it diminishes the stimulation of the bowel by ingesta and secretions, and lessens peristalsis (Dixon). Large doses, if given in a soluble form, are said by some writers to produce gastric irritation. Full doses cause the fæces to assume a leaden-grey colour, due to the partial conversion of the drug into the sulphide.

Externally, bismuth exerts *sedative*, *desiccant*, and *astringent* actions.

It is seldom prescribed internally for horses, but is a valuable *gastric sedative* in canine practice. Its use is indicated

in gastric catarrh and in cases of dyspepsia accompanied by troublesome vomiting and gastric irritation.

The liquor bismuthi is frequently combined with pepsin, while dilute hydrocyanic acid and spirit of chloroform may be added if considered necessary. In consequence of the acid reaction of bismuth subnitrate, it is incompatible with sodium bicarbonate, and if these are dispensed together the evolution of carbonic acid gas will probably burst the bottle, unless the latter be left uncorked for some time. Hence it is preferable to prescribe the carbonate instead of the subnitrate in such cases. As bismuth preparations are very insoluble, it is necessary to suspend them in mixture by the addition of compound tragacanth powder or mucilage of tragacanth.

A combination of bismuth carbonate, magnesium carbonate, and sodium bicarbonate, is found useful in cases of gastric catarrh.

Bismuth subnitrate, in the form of a paste prepared with white wax and hard paraffin, is sometimes employed in the treatment of sinuses and fistulæ. The preparation is first melted and sterilized. It is then drawn up into a glass syringe and injected into the sinus or fistula in a semi-fluid state, with light pressure.

The salicylate of bismuth and bismuth benzoate are preparations of the drug which are occasionally prescribed as intestinal disinfectants in cases of diarrhœa and intestinal irritation in calves and foals, the dose being from 15 to 40 grains.

Thioform is a basic dithio-salicylate of bismuth, which is recommended as a desiccant antiseptic for the dry dressing of wounds. It is non-irritant, non-toxic, and inodorous.

Bismuthi Subgallas—Dermatol—is recommended as a substitute for iodoform. It promotes cicatrization in wounds, and, lessening the secretion from weeping surfaces, it is used as a dusting-powder in cases of moist eczema. It is sometimes prescribed internally as an astringent in cases of diarrhœa.

Bismuthi Oxy-Iodogallas—Airol, Airoform—has similar properties to the above.

CHAPTER IV

GROUP III.—THE NON-METALLIC ELEMENTS

CHLORUM (CHLORINE GAS).

PREPARED by heating common salt and black oxide of manganese with sulphuric acid.

Liquor Chlori—Water charged with 2 volumes of chlorine gas. It can be prepared by the action of hydrochloric acid on potassium chlorate, and subsequent dilution with water.

ACTIONS AND USES.—Chlorine gas is a *deodorant* and *disinfectant*, and acts by virtue of its affinity for water, hydrochloric acid being formed and nascent oxygen liberated. If inhaled, it irritates the respiratory passages. It is seldom employed in veterinary practice, other agents being more convenient and effectual as disinfectants.

The liquor chlori is an internal antiseptic which has proved useful in human medicine in the treatment of enteric fever.

The combination of calcium with chlorine has already received notice (see p. 222).

IODUM (IODINE).

Prepared from kelp, the ashes of seaweed.

INCOMPATIBLES.—Alkalies, metallic salts, alkaloids, starch.

DOSES.—Horses, grs. xv. to ʒss.; cattle, ʒss. to ʒi.; dogs, gr. $\frac{1}{16}$ to gr. $\frac{1}{4}$. Administered in bolus or pill.

PREPARATIONS.

Tinctura Iodi Fortis—Strong Tincture of Iodine. Iodine, 100 grammes; potassium iodide, 60 grammes; distilled

water, 100 millilitres; alcohol (90 per cent.), q.s. to produce 1,000 millilitres (1 in 10). This contains approximately the same proportion of iodine as the liquor iodi fortis of the B.P. 1898. It was formerly known as Linimentum Iodi.

Tinctura Iodi Mitis—Weak Tincture of Iodine. Iodine, 25 grammes; potassium iodide, 25 grammes; distilled water, 25 millilitres; alcohol (90 per cent.), q.s. to produce 1,000 millilitres (1 in 40). This contains the same proportion of iodine as the tinctura iodi of the B.P. 1898.

Glycerinum Iodi—Iodine, 1; glycerin, 50. Heat carefully till dissolved.

Unguentum Iodi—Iodine Ointment. Iodine, 1 part; potassium iodide, 1 part; glycerin, 3 parts; lard, 20 parts (1 in 25).

For use in horses, we prefer an ointment prepared with 1 part each of iodine and potassium iodide in 8 parts of lanolin, the latter being rendered sufficiently soft by admixture with vaseline.

Unguentum Iodi Intinctum—Stainless Iodine Ointment—is prepared with iodine, oleic acid, soft and hard paraffin.

Lugol's Solution of Iodine—Iodine, 1 part; potassium iodide, 3 parts; water, 40 parts.

DOSE.—By hypodermic injection, for the horse, ʒi. to ʒi.ss., suitably diluted.

Intratracheal Injection of Iodine—Iodine, 1 part; potassium iodide, 5 parts; water, 100 parts.

DOSE for the horse, 4 to 5 drachms, slowly injected into the trachea.

Tinctura Iodi Decolorata—Decolorized Tincture of Iodine. Iodine, 2·85; alcohol (90 per cent.), 27·5; strong solution of ammonia, 6·25; and alcohol (90 per cent.), q.s. to 100. The solution contains ammonium iodide and iodate; it is colourless, and does not stain the skin.

Pigmentum Iodi et Olei Picis—Coster's Paste. Iodine, 1; light oil of wood tar, 4. Dissolve cautiously, applying heat if necessary. This is an efficient application for ringworm.

Potassii Iodidum—Iodide of Potassium.

PREPARED by dissolving iodine in hot liquor potassæ, evaporating, mixing the residue with wood charcoal and fusing, and purifying by crystallization.

DOSES.—Horses, ʒi. to ʒii.; cattle, ʒii. to ʒiv.; sheep and pigs, grs. xx. to grs. xl.; dogs, grs. iii. to grs. x. Administered in solution twice daily, or in the food.

INCOMPATIBLES.—Sweet spirit of nitre; salts of iron (except ferri et ammonii citras and liq. ferri acetatis); salts of bismuth and liquor strychninæ.

Sodii Iodidum—Iodide of Sodium.

PREPARED by the same process as iodide of potassium, solution of soda being used instead of potash. The doses are similar to those of the potassium salt.

Linimentum Potassii Iodidi cum Sapone—Liniment of Potassium Iodide with Soap.

This is composed of curd soap, iodide of potassium, glycerin, oil of lemon, and water. This liniment does not stain or irritate the skin. It is useful in canine practice, in the treatment of enlarged or indurated glands.

Iodalbin (P., D. and Co.).—A tasteless iodo-protein compound containing 21·5 per cent. of iodine chemically combined.

GENERAL ACTIONS OF IODINE AND ITS PREPARATIONS.

Externally, iodine acts as a stimulant to the skin, and if applied of sufficient strength it is an *irritant* and *vesicant*. In light-coloured animals it stains the skin a yellowish-brown.

It is *antiseptic*, *disinfectant*, *resolvent*, and a *parasiticide*.

Internally, iodine has special actions on mucous membranes and lymphatic glands. It stimulates the activity of glands, accelerates tissue changes, increases bronchial secretion, renders the latter more fluid, and thus facilitates expectoration. It is excreted by the respiratory mucous membrane, the skin, the kidneys, and the salivary glands. During its excretion it stimulates the epidermis, and also acts as a sialagogue.

In *toxic* doses iodine is an irritant, causing diarrhœa, emaciation, loss of appetite, and the total refusal of water.

In some instances large doses of the drug produce no toxic symptoms in horses and cattle. This may be accounted for by the large amount of starch in the food of herbivora, the insoluble iodide of starch being formed.

In the dog large doses of iodine cause gastro-enteritis, hæmaturia, and the formation of small ulcers in the stomach.

If the drug be given in full doses for a length of time, a condition termed 'iodism' may result. This is evidenced by loss of appetite, dyspepsia, an irritable catarrhal condition of the mucous membrane of the nasal passages, pharynx, eyes and stomach, abstinence from water, emaciation, a dry, scurfy condition of the skin, and loss of hair.

ANTIDOTES.—The administration of starch, to convert the iodine into the insoluble iodide of starch; mineral tonics and vegetable bitters; and the prompt withdrawal of the drug.

Potassium iodide possesses similar actions to iodine, but it is *more soluble* and *less irritant*, and about half the strength of the latter. It is also more convenient for administration, and may be given either in powder or in bolus. If pure, it is far less irritating to the stomach than iodine itself. If impure, it contains the iodate. This is decomposed by the gastric juice, and free iodine is liberated. If pure, only hydriodic acid is formed in the stomach. Iodides are very rapidly absorbed from the stomach and intestines, and during their excretion some free iodine is liberated. The effects on the mucous membranes and on the skin, mentioned above, depend on the action of the drug during its excretion from the system.

Sodium iodide is less irritating and less depressing in its action than the potassium salt, and is preferred in cases characterized by debility or gastric irritability.

MEDICINAL USES.—As a *promoter of absorption*, potassium iodide is prescribed in cases of hydrothorax and ascites. In the secondary stages of pneumonia it produces beneficial effects by promoting absorption of the exudate, and for this purpose may be combined with preparations of iron.

In canine practice it proves useful in cases of chronic bronchitis, by rendering the secretion less viscid and facilitating expectoration.

In purpura hæmorrhagica it is occasionally prescribed in the form of intratracheal injections, about 5 drachms of a solution containing 1 part of iodine, 5 parts of potassium iodide, and 100 parts of water, being injected slowly into the trachea twice daily. Potassium iodide may also be prescribed in the form of bolus in this affection.

In actinomycosis in cattle, potassium iodide in full doses gives excellent results, 2 drachms dissolved in a pint of linseed-tea being given twice daily for eight to ten days. The disease then usually shows signs of improvement, but in some cases a long course of the drug may be necessary.

In that troublesome sequel to castration termed 'scirrhous cord,' and in cases of chronic abscess of the shoulder and other parts of the body which depend on botriomycosis, a long course of potassium iodide sometimes causes the abnormal growths to disappear without an operation being necessary.

In diabetes insipidus, either iodine or potassium iodide allays the excessive thirst and reduces the abnormal quantity of urine excreted. Some practitioners prefer the pure iodine administered in doses of ½ drachm, with sulphate of iron 2 drachms, and gentian 4 drachms, in the form of bolus once daily. In severe cases it may be repeated twice a day. The *modus operandi* of the drug in this affection is not understood.

In lymphangitis the administration of potassium iodide sometimes assists in removing the abnormal thickening which occurs as a sequel to the disease.

In cases of milk-fever in cows, Schmidt's original treatment consisted of the injection into the udder of about 2½ drachms of potassium iodide in a quart of sterilized water. One-fourth of this amount was injected into each teat. But simple inflation of the udder by means of an air-pump gives far more satisfactory results.

In canine practice a long course of potassium iodide sometimes gives beneficial results in cases of paraplegia resulting from an attack of pachymeningitis.

Potassium iodide is an antidote in chronic cases of lead and mercury poisoning. It disengages these agents from

the tissues, and renders them capable of being excreted from the system.

Pure iodine is not prescribed in canine practice, and in many instances the iodide of sodium is better borne than the iodide of potassium. But the best form of iodine for long-continued administration in the dog is iodoalbin, as it does not cause gastric irritation.

In tetanus, the hypodermic injections of iodine solutions have been tried, with a varying degree of success.

In the treatment of bog-spavin, Mr. Deans, M.R.C.V.S., advises the injection into the affected joint of the following solution, after the withdrawal of the fluid by a special aspirator: ʒi. of decolorized tincture of iodine, combined with ʒi. of a solution containing 20 grains of hydrarg. perchlorid. in 1 ounce of methylated spirit.

Externally, for the reduction of bursal enlargements, etc., a combination of iodine (12½ per cent.), Stockholm tar, soft soap, and lanolin, proves very useful and is largely employed.

In the treatment of goitre, the application of an ointment composed of potassium iodide 1 part, lanolin 8 parts, often gives good results. As a parasiticide, iodine is employed in the treatment of ringworm, either in the form of unguentum iodi or as Coster's paste.

One of the most important uses of iodine in the present day is in connection with the sterilization of the skin prior to the performance of surgical operations, and also as an antiseptic dressing for wounds. For these purposes the weak tincture of iodine is usually employed. The use of this agent has rendered complicated and troublesome methods of disinfection of the skin unnecessary. The skin is painted twice with the tincture, at an interval of fifteen minutes. It is said that a tincture made with 70 per cent. spirit is preferable to the ordinary tincture. A solution of iodine in petrol (of the strength of Tr. iodi mitis, B.P.) has been found quite as effectual and is far cheaper. Iodine was used as an antiseptic agent at Guy's Hospital in 1876. In the present day it is largely employed for the disinfection of wounds, although there are some surgeons who express

doubt as to its value in this direction. The manner in which tincture of iodine acts in skin sterilization is not definitely determined. Some authorities believe that the hyperæmia of the skin and subcutaneous tissue produced by the agent is the real factor in inducing asepsis. W. Scott, F.R.C.V.S. (*Lancet*, March 13, 1915), found that a combination of tincture of iodine and petrol proved a most effectual and economical antiseptic dressing for wounds, and also for sterilization of the skin prior to operations.

For skin sterilization the tincture prepared with methylated spirit is far cheaper than the B.P. preparation, but for dressing wounds the former is too irritating.

In the treatment of periodic ophthalmia in the horse, Continental authorities advise the use of potassium iodide, both internally and locally. Professor Brusasco, Turin, prescribes ʒiv. of the drug with sodium bicarbonate, twice daily in the drinking-water, or as a drench. A few drops of the following lotion should be instilled into the eyes twice daily:

℞ Potass. Iod.	2·5	parts
Cocainæ Hydrochloridi	1	part
Glycerini	8	parts
Aq. Destil....	50	parts

Dissolve the iodide in a portion of the water, add the glycerin, dissolve the cocaine in the remainder of the water, and mix the two solutions.

A 3 per cent. solution of potassium iodide in sterilized water should be applied to the eyes by means of a saturated compress constantly applied. When intolerance to light and hyperæsthesia disappear, omit the cocaine, but continue the iodide. If the eyes have been affected for some time, and synechiæ have formed, instil a few drops every three or four hours of a 1 per cent. solution of atropine, until symptoms of the above disappear. This treatment requires to be continued for four or five weeks, and it is said that the disease may be arrested or even recovery may occur.

Sulphuris Iodidum—Iodide of sulphur.

PREPARED by heating iodine and sulphur together.

Unguentum Sulphuris Iodidi—Iodide of Sulphur Ointment (1 in 25 of benzoated lard).

This ointment is occasionally employed in the treatment of ringworm and other parasitic skin diseases.

BROMUM (BROMINE).

This is a liquid element obtained from sea-water and from some saline springs. The medicinal preparations are potassium bromide, sodium bromide, and ammonium bromide.

Potassii Bromidum—Bromide of Potassium.

DOSES.—Horses, ʒss. to ʒi.; dogs, grs. x. to grs. xx. Administered in solution.

INCOMPATIBLES.—All oxidizing agents which tend to set free bromine, also sweet spirit of nitre.

Sodii Bromidum—Bromide of Sodium.

DOSES.—Similar to potassium bromide.

Ammonii Bromidum—Bromide of Ammonium.

DOSES.—Similar to the above.

ACTIONS AND USES.—All bromides lessen the activity of the nervous system, and act as sedatives to the brain and spinal cord. They are also sporifics or hypnotics. By some obscure chemical action they depress the processes by which functional activity of the brain is kept up, and also depress reflex excitability of the spinal cord.

Toxic doses are cardiac depressants, and also produce muscular weakness, an unsteady gait, impaired reflex movements, and a listless condition. Full doses continued for some time may induce a condition known as 'bromism,' which is evidenced by cerebral depression, feebleness, anæmia, and in some instances the appearance of an eruption resembling acne. These symptoms, however, are very rare in veterinary practice.

MEDICINAL USES.—Potassium bromide is the salt of bromine usually employed in equine practice. Sodium bromide is less depressant and better tolerated by the stomach, hence it is preferred in canine practice in cases where debility and gastric irritation are present.

Ammonium bromide is slightly stimulating in its action,

and its use is indicated when cardiac weakness is present as a complication. In some cases the three salts of bromine are combined. In cases of epileptic convulsions in dogs the bromides lessen excitability, and are given in full doses. In chorea they act as palliative remedies when the symptoms are acute. They are of little or no value in the convulsions occurring in connection with distemper.

They are also useful in the treatment of puerperal eclampsia occurring in the bitch, and may be combined with chloral hydrate in such cases. Although antagonistic to the actions of strychnine, bromide of potassium is not a reliable antidote in cases of poisoning by that agent.

In the earlier stages of pericarditis, and in all cases where cardiac palpitation is a prominent symptom, the bromides prove useful.

SULPHUR.

SOURCE.—Occurs native as a product of volcanic action in soils in Sicily and Italy.

Sulphur Sublimatum—Sublimed Sulphur; Flowers of Sulphur.

PREPARED from crude sulphur by subliming.

DOSES.—As a laxative: horses, ʒi. to ʒii.; cattle, ʒiii. to ʒiv.; sheep and pigs, ʒss. to ʒi.; dogs, grs. xv. to ʒii. As an alterative, one-fourth of these doses is prescribed.

Sulphur Præcipitatum—Precipitated Sulphur; Milk of Sulphur.

PREPARED by boiling sublimed sulphur with slaked lime in water, and precipitating the filtrate with dilute hydrochloric acid.

DOSES.—Similar to those of sublimed sulphur.

Lotio Sulphuris—Precipitated sulphur, ½ ounce; glycerin, 2 drachms; alcohol, 1 ounce; lime-water, 3 ounces; rose-water, 3 ounces. This is sometimes used in skin affections in canine practice.

Unguentum Sulphuris—Sulphur Ointment.—Sublimed sulphur, 1 part; benzoated lard, 9 parts (1 in 10).

Lotio Calcii Sulphurati—Sublimed sulphur, 8 ounces; quicklime, 1 pound; water, 4 pints. Simmer until the

mixture becomes of a golden-yellow colour, and filter after three days.

GENERAL ACTIONS OF SULPHUR.—The precipitated form is stated to be more active than the sublimed, in consequence of its finely divided condition and freedom from grittiness. It is preferred for the preparation of ointments and liniments in canine practice. When sulphur is applied to the skin in the form of ointment, a small proportion of the agent is converted by the cutaneous secretions into sulphides. This process is slow and continuous, and a mild degree of stimulation of the skin is produced. If applied too frequently irritation of the skin results.

Internally, sulphur passes through the stomach unaltered. In the small bowel a small percentage is converted into alkaline sulphide, which acts as a stimulant to the intestines, renders their contents in a soft condition, and thus has a laxative effect. The major part of the drug is excreted in the fæces unchanged. A small amount is absorbed as alkaline sulphide, is oxidized in the body, and excreted chiefly in the form of sulphate in the urine. Small amounts are also excreted from the lungs, and traces of sulphur compounds by the skin. In very large doses sulphur produces irritant effects, evidenced by colicky pains and purging; in some instances recorded, gastro-enteritis was observed, as well as paralysis of the vital nerve-centres.

MEDICINAL USES.—As an *alterative*, it is prescribed in affections of the skin, and it forms a favourite constituent of condition and alterative powders. It may be combined with other alterative agents, and is readily taken in the food. In canine practice it is a useful laxative agent, and is largely employed for this purpose.

Externally, sulphur is used as a parasiticide in the treatment of mange in all species of animals. Various formulæ are recommended for such cases, the most efficacious containing potassium carbonate, which is believed to increase the formation of sulphuretted hydrogen and sulphides, thus helping to destroy the parasites on which this affection depends. The alkali also enables the sulphur to penetrate

the affected parts by softening and removing the crusts and scales that are formed on the skin.

For the horse, 2 parts of sublimed sulphur, 1 part of potassium carbonate, 1 part oil of tar, and 8 parts train-oil, form a serviceable dressing. This is applied as follows: Wash the affected parts thoroughly with soft-soap and warm water; when the skin is dry apply the dressing, and let it remain on for two days; then wash it off and reapply. Some practitioners prefer a liniment composed of sulphur vivum (black sulphur), 4 ounces; liquor potassæ, 1 ounce; oil of tar, 2 ounces; and train-oil, 1 pint.

The unguentum sulphuris is a suitable application for mange in the dog; while for the small breeds of house dogs the lotio sulphuris is convenient, as is also a liniment composed of precipitated sulphur, 1 part; zinc oxide, 1 part; liquid paraffin (white vaseline oil), 8 parts.

The lotio calcii sulphurati is recommended as a mange dressing for the horse, also as a sheep-dip. This preparation is sometimes employed in the treatment of mange in the dog.

Sulphurous acid gas, prepared by burning sulphur mixed with $\frac{1}{10}$ part of charcoal, is sometimes employed as a disinfectant for stables and farm buildings, but unless large quantities are used, and precautions taken to close all doors, windows, etc., this method will not prove effectual. At one time it was used as an inhalation in the treatment of parasitic bronchitis in calves and lambs, but it proved neither safe nor effectual for this purpose.

CARBO (CARBON, CHARCOAL).

Two forms of carbon are recognized—viz.: (1) Carbo Animalis; (2) Carbo Ligni.

(1) **Carbo Animalis**—Animal Charcoal (omitted from the B.P.).

PREPARED by exposing bones to a red heat, excluding air, and powdering the residue.

(2) **Carbo Ligni**—Wood Charcoal.

PREPARED from wood charred by exposure to a red heat, and excluding air.

General Actions.—*Externally*, charcoal acts as a *deodorant*. It possesses the property of absorbing and condensing many gaseous bodies and vapours. It absorbs but little hydrogen, although it will take up a considerable amount of oxygen and large quantities of sulphuretted hydrogen and ammonia. The oxygen which it retains is believed to have the power of oxidizing and deodorizing noxious gases. Some authorities state that it has the power of absorbing and condensing the noxious gases in its pores.

Internally, charcoal given in sufficient amount is said to have the power of absorbing gases formed in the stomach; but as the agent loses this power when moist, this view is not correct. It possesses the power of attracting alkaloids from their solutions in the stomach and rendering them inert; hence animal charcoal has been recommended by Dr. Garrod as an antidote in cases of poisoning by morphine, aconite, strychnine, etc.

Charcoal is removed from the system entirely by the intestines, and, not being absorbed, it does not exert any specific action on the body.

Medicinal Uses.—Charcoal is sometimes prescribed in cases of dyspepsia accompanied by flatulence, in doses of ℥ss. to ℥ii. for horses and cattle, and grs. xx. to ℥i. for dogs, but its value is doubtful.

Externally, it is occasionally employed as a *deodorant* to unhealthy ulcers or foul wounds, being applied directly in the dry form; but, as it does not possess antiseptic actions, other agents are preferred.

CHAPTER V

GROUP IV.—ACIDS

General Actions of Acids.

For convenience of description, the acids employed in veterinary practice may be arranged under the headings of inorganic and organic.

Some of the organic acids (such as salicylic and prussic acids) have actions and uses which are but slightly connected with their properties as acids, hence they will not receive notice in this chapter, but will be considered under separate headings.

The mineral acids—viz., sulphuric, nitric, and hydrochloric—when undiluted are *caustics* and *escharotics;* internally they are violent *corrosive* and *irritant* poisons.

Administered in the dilute form and in medicinal doses, acids act as *sialagogues*, and increase the flow of saliva in a reflex manner. They do not affect the secretion of gastric juice, but prove useful in cases of dyspepsia when the natural acid is deficient in amount. They increase the pancreatic secretion. Acids are quickly absorbed and converted into salts. They render the blood less alkaline, an effect which is more marked in herbivora. The urine is rendered more acid by the formation of acid salts, and diuresis is also induced.

All acids should be given properly diluted with water, and not continued for too long a period.

INORGANIC ACIDS.

Acidum Sulphuricum—Sulphuric Acid; Oil of Vitriol.

PREPARED by the combustion of sulphur, the resulting sulphurous acid being subjected to oxidation and hydration by means of nitrous and aqueous vapours.

Acidum Sulphuricum Dilutum—Dilute Sulphuric Acid.—Sulphuric acid, 112·5 grammes; distilled water, 940 millilitres. Contains 10 per cent. by weight of sulphuric acid.

INCOMPATIBLES.—Alkalies and their carbonates, salts of calcium and lead.

DOSES.—Of the dilute acid: horses, ʒi. to ʒii.; cattle, ʒii. to ʒiv.; dogs, ♏ v. to ♏ xv. Administered freely diluted, in combination with vegetable bitters.

Acidum Sulphuricum Aromaticum—Aromatic Sulphuric Acid.—Sulphuric acid, 70 millilitres; tincture of ginger, 250 millilitres; spirit of cinnamon, 15 millilitres; alcohol (90 per cent.), sufficient to produce 1,000 millilitres.

DOSES.—Similar to those of the dilute sulphuric acid.

ACTIONS AND USES.—Strong sulphuric acid is a powerful *caustic* and *escharotic*. It destroys the tissues to a considerable extent, producing a brown or black eschar or slough.

Internally it is a corrosive irritant poison, causing erosions of a brown or black colour in the mucous membrane of the mouth, pharynx, œsophagus, and stomach, death resulting from collapse. In some cases the acute inflammation of the throat produces extensive swelling, with asphyxia as a result.

In the dog, violent emesis occurs, the vomited matters being dark-coloured, blood-stained, and containing shreds of mucous membrane.

The ANTIDOTES are—Alkaline carbonates, especially magnesia; also chalk, white of egg, carron-oil, milk, lime-water, emollient and demulcent drinks, opiates to relieve pain, and stimulants to prevent collapse. The strong sulphuric acid is not employed as a medicinal agent for internal use.

The dilute acid and the aromatic preparation are tonics and intestinal astringents. They increase appetite, promote digestion, and are believed to exert an astringent action on the intestinal bloodvessels. In chronic diarrhœa and dysen-

tery they give excellent results, and may be prescribed in combination with opiates, astringents, and carminatives. According to Dixon, sulphuric acid has no action on the large intestine, as it is quickly neutralized and absorbed, and does not possess any astringency after absorption.

Dilute sulphuric acid, combined with sulphate of iron, has proved useful in the treatment of Johne's disease in cattle (see p. 241). It is an efficient antidote in cases of chronic lead-poisoning. In pharmacy it is employed as a solvent for quinine.

Externally, sulphuric acid, carefully applied by means of a glass rod, is occasionally employed in the treatment of umbilical hernia. The skin is lightly touched with the acid at various points, and the beneficial effects are probably produced by the marked swelling and subsequent contraction of the skin which result.

Acidum Nitricum—Nitric Acid; Aqua Fortis.

PREPARED by distilling a mixture of sodium nitrate and sulphuric acid.

Acidum Nitricum Dilutum—Nitric acid, 151 grammes; distilled water, sufficient to produce 1,000 millilitres (contains 10 per cent. by weight of nitric acid).

DOSES.—Of the dilute acid: horses and cattle, ʒi. to ʒii.; dogs, ♏ v. to ♏ x. Administered properly diluted, and combined with aromatic bitters.

INCOMPATIBLES.—Alcohol, alkalies, carbonates, sulphides, ferrous sulphate, lead acetate.

ACTIONS AND USES.—*Externally*, strong nitric acid is a *caustic* and *escharotic;* it is slower in its action than sulphuric acid, but penetrates the tissues deeply, producing an extensive slough. It stains the skin a *yellow* or brownish colour, due to the formation of picric acid.

Internally, in toxic amounts it is a corrosive irritant poison, causing in the dog violent vomiting, the vomited matter containing altered blood of a brown colour, and shreds of membrane stained yellow. The mouth, throat, and stomach, are acutely inflamed.

The ANTIDOTES are similar to those recommended for sulphuric acid.

The strong acid is not used internally. The dilute acid was formerly believed to act as a cholagogue, but there is no evidence to support this view.

Occasionally the agent is prescribed in cases of dyspepsia characterized by a deficiency of acid in the gastric secretion.

Externally, the strong acid is occasionally employed as a caustic for the removal of warts, fungus growths, etc.; but great care is necessary in the application, and serious injuries have resulted when it has been carelessly applied to warty growths, especially if close to a joint or on the horse's heel or coronet.

In cases of chronic papular eruptions of the skin, which are sometimes met with in aged dogs suffering from renal affections, Mr. H. Gray, M.R.C.V.S., has found that the application of very weak solutions of dilute nitric acid to the skin causes the eruptions to disappear.

Acidum Hydrochloricum—Hydrochloric Acid; Muriatic Acid; Spirits of Salt.

PREPARED by the action of sulphuric acid upon chloride of sodium, and solution of the fumes in water.

Acidum Hydrochloricum Dilutum—Dilute Hydrochloric Acid.—Hydrochloric acid, 330 grammes; distilled water, sufficient to produce 1,000 millilitres (contains 10 per cent. by weight of hydrochloric acid).

DOSES.—Of the dilute acid, similar to those of dilute nitric acid.

INCOMPATIBLES.—Salts of silver and lead, alkalies and their carbonates.

ACTIONS AND USES.—The strong hydrochloric acid applied externally is an *active caustic*, causing the formation of a white film on the tissues with which it comes in contact.

Internally, in toxic amounts it is an irritant corrosive poison, resembling in its actions the other mineral acids just described.

The antidotes are also similar to the above.

Dilute hydrochloric acid is prescribed in cases of dyspepsia in which there is a deficiency in the secretion of the natural acid in the stomach. It is usually combined with vegetable tonics and bitters, and administered after feeding.

In some cases of dyspepsia associated with excessive fermentation of the gastric contents, and leading to the formation of various organic acids (so-called 'acid dyspepsia'), dilute hydrochloric acid given before feeding may prove beneficial.

In the treatment of canine typhus, H. Gray points out that the gastric secretion is alkaline, and the usual gastric sedatives are of no value. He has found that dilute hydrochloric acid gives favourable results if treatment be adopted before structural changes have occurred in the alimentary canal. (See 'The Treatment of Canine Typhus,' Part III.) The same authority has observed that in cases of fœtid breath, accompanied by an accumulation of tartar on the teeth and bleeding of the gums, the following solution, if applied with a brush to the tongue, gums, and teeth, once daily, gives good results: Dilute hydrochloric acid, ℥ii.; water, O.i.

Externally, hydrochloric acid is employed as a caustic in the removal of warty growths, etc. In cases of superficial necrosis of bone, if applied properly diluted, it assists removal of the diseased portion, and thus hastens healing.

Acidum Nitro-Hydrochloricum Dilutum—Dilute Nitro-hydrochloric Acid; Dilute Nitro-muriatic Acid; Aqua Regia.

PREPARED by mixing nitric acid, 60 millilitres; hydrochloric acid, 80 millilitres; and distilled water, 500 millilitres. It should be recently prepared.

DOSES.—Similar to those of dilute nitric acid.

INCOMPATIBLES.—Alkalies, carbonates, sulphides, salts of silver and lead.

ACTIONS AND USES.—Dilute nitro-hydrochloric acid is still employed as a cholagogue, but experimental evidence shows that it does not possess this action. It is also prescribed in cases of dyspepsia in which an acid treatment is indicated.

Acidum Chromicum (Chromic Acid).

PREPARED by the interaction of sulphuric acid and potassium bichromate.

Liquor Acidi Chromici—Contains 25 per cent. of chromic acid in water.

ACTIONS AND USES.—Chromic acid is a *penetrating caustic*, and, in concentrated form, an *escharotic*. It is a powerful oxidizing agent, and, if applied in a warm concentrated solution, it rapidly dissolves all animal tissues. It is occasionally employed in the treatment of that affection of the horse's foot known as canker, also in the treatment of malignant growths. It should be carefully applied with a glass rod, and if proper precautions be adopted, and if the agent be free from sulphuric acid, its action does not tend to spread beyond the area to which it is applied. Chromic acid is not prescribed for internal use.

Potassii Bichromas—Potassium Bichromate—is sometimes employed as an application to promote reduction of umbilical hernia, and is said to give good results.

Acidum Boricum (Boric Acid, Boracic Acid).

PREPARED by the purification of native boric acid or by the interaction of sulphuric acid and borax.

DOSES.—Horses and cattle, ʒii. to ʒiv.; dogs, grs. v. to grs. xv.

PREPARATIONS.—**Glycerinum Acidi Borici**—Boric acid, 300 grammes; glycerin, sufficient to produce 1,000 grammes.

Unguentum Acidi Borici—Boric Ointment.—Boric acid, 10 grammes; white paraffin ointment, 90 grammes (1 in 10).

Boric Lint—Lint containing 50 per cent of boric acid. It should not be scaly.

Boric Gauze—Gauze containing 20 per cent. of boric acid.

Boric Wool—Wool containing from 20 to 50 per cent. of boric acid.

Borax Purificatus—Purified Borax; Biborate of Sodium.

PREPARED by boiling together native calcium borate and solution of carbonate of soda. It may also be obtained from native borax.

INCOMPATIBLES.—Mineral acids and most of their metallic salts; also alkaloidal salts.

Glycerinum Boracis—20 grammes of borax with 20 millilitres of glycerin (1 in 6).

DOSES.—Horses, ʒi.; dogs, ʒss. to ʒi.

Mel Boracis—Borax, 10 grammes; glycerin, 5 grammes; purified honey, 85 grammes (1 in 10).

DOSES.—Similar to those of glycerinum boracis.

ACTIONS AND USES.—Boric acid and borax are similar in their actions, but the latter possesses in addition slightly *astringent* properties. Boric acid possesses feeble *antiseptic* actions; it is non-irritant and practically non-poisonous. It checks fermentation in the alimentary canal, is excreted by the kidneys, and to a less extent in the milk and saliva, and exerts antiseptic effects on the bladder and urino-genital mucous membrane. A 3 per cent. solution lessens irritability of the skin, while a 5 per cent. solution exerts slight antiseptic effects in wounds. It is used as an antiseptic dressing for simple wounds in the horse, and is especially useful for this purpose in canine practice.

Boric lint forms an excellent dressing for punctured wounds, two or three folds of this material being soaked in a hot solution of boric acid and applied to the part, which is then covered with oiled silk, wool, and a bandage. This forms an antiseptic poultice, and is also applicable to other conditions in which moist dressings are indicated. The lint can be kept moist by pouring in a further supply of a hot boric solution between the dressing and the part at intervals. In the dry dressing of wounds boric acid is largely employed. For this purpose it may be combined with oxide of zinc and starch.

In unhealthy wounds, ulcerated surfaces, and in cases of fissured heels, boric acid in combination with iodoform and oxide of zinc forms a useful application used in the following proportions: Iodoform, 1 part; boric acid, 2 parts; and zinc oxide, 2 parts. This also forms an excellent dressing for canker of the ear in the dog.

In catarrhal and purulent conjunctivitis, a lotion consisting

of boric acid (4 grains), laurel-water (½ ounce), and rose-water (½ ounce), lessens irritability and reduces the discharge.

In the treatment of vesical catarrh, boric acid in combination with other remedies is sometimes prescribed. It is said to prevent decomposition in the urine, and to exert antiseptic effects in the urinary passages. It is occasionally prescribed in the treatment of fermentative diarrhœa in foals and calves. Boric ointment, either alone or combined with other agents, is useful in cases of erythema and eczematous conditions of the skin in dogs.

Toxic symptoms resulting from the absorption of boric dressings, such as occasionally occur in human practice, are not observed in animals.

Borax, in the form of glycerinum boracis, or mel boracis, is employed as a mouth-wash in aphthous conditions, ulcerations of the mouth, tongue, and fauces, and in glossitis. For these purposes it is combined with potassium chlorate and tincture of myrrh. Similar preparations are also useful in the treatment of pharyngitis in the dog. Solutions of borax are recommended as injections for the udder in the treatment of mammitis, also as injections in cases of leucorrhœa.

ORGANIC ACIDS.

Acidum Aceticum—Acetic Acid.

PREPARED from wood by destructive distillation, also from the oxidation of ethylic alcohol.

Acidum Aceticum Dilutum—Dilute Acetic Acid. Acetic acid, 152·6 grammes; distilled water, sufficient to produce 1,000 millilitres (contains 5 per cent. by weight of acetic acid).

Acidum Aceticum Glaciale—Glacial Acetic Acid.

PREPARED from acetate of sodium and sulphuric acid.

Acetum—Vinegar—contains 5·41 per cent. of acetic acid.

PREPARED by the acetous fermentation of a mixture of malt and unmalted grain.

ACTIONS AND USES.—*Externally*, strong acetic acid is *corrosive* and *irritant;* the dilute acid, when applied in sufficient amount, is a *stimulant* and *vesicant.*

Internally, the strong acid is a corrosive irritant poison, the dog being more susceptible to its actions than horses or cattle; 4 or 5 ounces of vinegar are stated to have produced fatal effects in the dog.

The ANTIDOTES are magnesia, lime-water, chalk and water.

Acetic acid is not prescribed for internal use.

Externally, the strong acid is frequently employed as a caustic in the treatment of warts.

A 3 per cent. solution of glacial acetic acid was found useful in a case of follicular mange in the dog. A 5 per cent. solution of hyposulphite of soda was first applied, followed by the solution of acetic acid (see *Veterinary News*, January 30, 1915).

The dilute acid, also vinegar, are antidotes in cases of poisoning by alkalies. They are also employed in pharmacy as solvents for certain drugs, such preparations being termed 'aceta.'

Acidum Tartaricum—Tartaric Acid.

Acidum Citricum—Citric Acid.

These acids are devoid of irritant or toxic properties. Tartaric acid is not employed in veterinary practice.

Citric acid is not prescribed as such, but citrate of potassium is sometimes employed as a diuretic, and to render the blood and urine more alkaline. If injected into an animal, potassium citrate as well as other citrates retard the clotting power of the blood, this action depending on the formation of calcium citrate.

In the treatment of infected wounds, Sir A. E. Wright recommends irrigation with a 5 per cent. solution of sodium chloride mixed with ½ per cent. of citrate of soda. The object is to increase the outflow of lymph from the wound, and thus to wash the infecting microbes out of the walls of the wound and also assist phagocytosis. The solution of common salt 'brings into play osmotic forces, and "draws" the lymph out of the walls of the wound by a *vis a fronte*. The citrate of soda is added with a view to decalcify and render incoagulable the outflowing lymph' (*Lancet*, April 24, 1915).

Glycerophosphoric Acid.—This agent and its salts are formed during the hydrolysis of lecithin. Glycerophosphates are often prescribed in canine practice as nerve tonics, but, according to some writers, there is no evidence to show that the agents exert an action different from the ordinary inorganic phosphates.

CHAPTER VI

GROUP V.—WATER

AQUA (WATER).

ACTIONS AND USES.—*Externally*, water is employed as a means of applying either cold or heat to various parts of the body. Cold water is *refrigerant*, and exerts tonic and constringing effects on the parts to which it is applied. It causes contraction of the bloodvessels, and lessens the supply of blood going to the part. It is extensively employed to reduce inflammatory action in cases of open joints, opened bursæ, inflammation of the sheaths of tendons, strains of tendons and ligaments, etc. In such instances the parts are irrigated by means of a continuous flow of water from a hose-pipe.

Hot water applied in the form of fomentation is emollient and anodyne. It dilates capillaries, relaxes the tissues, and reduces tension on the nerves of the part, acts as a sedative to the latter, and thus relieves pain.

The choice of cold or hot applications requires discrimination on the part of the practitioner. As a rule, when pain and tension are prominent symptoms, the use of hot applications is indicated; these must, however, be used with discretion, whether in the form of fomentations or poultices. They should not be employed too hot, and the suitable temperature should be ascertained by testing them with the point of the elbow, and not with the hand, as the skin of the latter is not sufficiently sensitive for the purpose. Hot applications should not be continued for too long a period, as they tend to produce a softened, unhealthy condition of

the part. In certain cases, such as in erysipelas, they are contra-indicated, as they increase the tendency to sloughing of the skin and subcutaneous tissues.

Cold water dashed over the head and neck acts as a stimulant, and causes increased respiratory movements. It is sometimes employed in cases of narcotic poisoning, but is of little use in overcoming the toxic effects of chloroform.

Ice, as a local application to the head, is employed in cases of meningitis, phrenitis, etc. It is also used in cases of acute gastritis in the dog to overcome vomiting, small pieces being placed in the mouth at intervals.

In equine practice the use of hot fomentations to the thoracic walls in respiratory affections, and to the abdominal region in cases of intestinal diseases, would be more serviceable if it were possible to apply them in a satisfactory manner. The large area over the affected parts, and the difficulty of keeping the hot applications (which are usually rugs wrung out of hot water) in close contact with the skin, render it very difficult to prevent the evil effects of reaction, or to keep up a continuous supply of heat.

In canine practice, however, the application of heat by means of flannel wrung out of hot water can be carried out with greater facility and better results.

The inhalation of steam, medicated with oil of eucalyptus or terebene, proves very useful in the treatment of laryngitis, pharyngitis, bronchitis, and pneumonia, in all animals.

Cold water should be freely allowed in the treatment of febrile affections; it allays thirst, promotes the action of the bowels and kidneys, and lowers temperature.

Cold water is contra-indicated directly after feeding, or when the horse is in a heated condition after exertion, also after the administration of a cathartic dose of aloes. In the latter instances warm drinks should be allowed.

Water at a temperature of 120° F. is a hæmostatic, and may be employed for this purpose when other means are not at hand. Water is also employed in the form of enemata (see p. 187) and of baths (see p. 190).

Aqua Destillata—Distilled Water—is used for pharmaceutical purposes and in dispensing.

OXYGEN.

For convenience of description this agent is considered here.

In the treatment of pneumonia in human practice, the inhalation of oxygen proves of value in cases where one lung is beginning to clear up, but consolidation is commencing in the other lung. If the latter proceeds more rapidly than the former, there is grave danger to life, and the use of oxygen may enable respiration to be carried on until the first lung affected is able to resume its function. The practical value of this treatment has not yet been demonstrated in veterinary practice.

The injection of oxygen into the udder by means of a special apparatus is recommended in the treatment of milk fever; but the employment of ordinary air for this purpose appears to give equally satisfactory results, and is far more economical and convenient. In very severe cases, however, and in those that have been neglected or badly treated, oxygen often gives good results, and its employment is indicated.

HYDROGEN PEROXIDE.

Liquor Hydrogenii Peroxidi—Solution of Hydrogen Peroxide.

PREPARED by the interaction of water, barium peroxide, and a dilute mineral acid. Contains 10 volumes of available oxygen in 1 volume of the solution.

ACTIONS AND USES.—Peroxide of hydrogen is an antiseptic, and acts in this manner by liberating free oxygen. It is non-poisonous, and, although causing a smarting sensation when applied to a wound, it is scarcely irritant, and does not precipitate albumin.

The solution of hydrogen peroxide may be diluted with 3 volumes of boiled water for ordinary surgical purposes. It forms a very efficient antiseptic, and is now largely employed in veterinary practice. When brought into contact with pus

or blood, a profuse foamy effervescent mixture results. Gauze soaked in hydrogen peroxide is an excellent dressing for wounds. The agent prevents adhesion of the dressing to the wound. In the case of punctured wounds, after providing free drainage, the part should be thoroughly irrigated with the solution, and plugged with a tampon of gauze soaked in the agent.

In canker of the ear in the dog, when associated with profuse suppuration, the solution should be poured into the meatus and the head held for ten minutes; the part is then cleansed and dried with gauze.

In purulent conjunctivitis, etc., a dilute solution of hydrogen peroxide gives excellent results. The agent forms a most efficient mouth-wash in canine practice, and is also useful as a uterine injection in cases of metritis.

In cases of mammitis the solution has given good results when injected into the udder.

CHAPTER VII

GROUP VI.—THE CARBON COMPOUNDS

ALCOHOL.

Alcohol Absolutum—Absolute Alcohol.

This is ethyl hydroxide, containing not more than 1 per cent. by weight of water. It is not used for medicinal purposes.

The following forms of alcohol are employed for therapeutical purposes:

Spiritus Rectificatus—Rectified Spirit—contains 90 per cent. by volume of ethyl hydroxide. It is obtained by the distillation of fermented saccharine liquids.

Diluted Alcohols are obtained by diluting alcohol (90 per cent.) with distilled water. The four official liquids contain, respectively, 70 per cent., 60 per cent., 45 per cent., and 20 per cent., of ethyl hydroxide by volume, and are employed for pharmaceutical purposes.

Spiritus Tenuior—Proof Spirit (B.P., 1885)—contained 57 per cent. by volume of alcohol, and was prepared by mixing 5 volumes of rectified spirit with 3 volumes of distilled water.

Spiritus Methylatus—Methylated Spirit—a mixture of rectified spirit with 10 per cent. by volume of wood naphtha. For retail use it contains, in addition, $\frac{3}{8}$ per cent. of mineral naphtha, and is known as 'denaturalized methylated spirit,' and forms a turbid mixture with water. It is not employed for internal use.

Industrial Methylated Spirit is a mixture of rectified

spirit with 5 per cent. by volume of wood naphtha. It is considerably purer, and of greater utility for manufacturing purposes, and also less irritating than ordinary methylated spirit. It can only be used by a manufacturer on giving a bond—*i.e.*, more than 50 gallons per annum must be used.

Spiritus Frumenti—Whisky—contains 37 to 47 per cent. by weight of alcohol.

Spiritus Vini Gallici—Brandy—contains 40 to 60 per cent. of alcohol.

Vinum Xericum—Sherry—contains from 16 to 22 per cent. of alcohol.

Port contains from 20 to 30 per cent. of alcohol.

Gin, Hollands, and **Geneva**, contain 51 per cent. of alcohol.

Ale, Porter, and **Stout,** contain from 2 to 9 per cent. of alcohol.

ACTIONS.—Of late years the views held with reference to certain actions of alcohol have been considerably modified. Although experimental evidence has supplied several definite facts on the subject, there are other points on which marked differences of opinion exist. We are only concerned with these matters from the clinical point of view, hence the remarks made will be brief.

External Actions.—If applied to the skin a cooling action results, owing to the volatibility of the drug. It also hardens the cuticle, owing to its power of absorbing water and precipitating proteins.

If evaporation be prevented, or if the agent be applied with friction, a local vaso-dilatation is produced, hence it may be termed a rubefacient. Alcohol also exerts an antiseptic action on the skin.

Internally.—On the mouth, alcohol acts as a slight sialagogue in a reflex manner, owing to the direct contact of the drug with the buccal mucosa.

On the Stomach.—The secretion of gastric juice is increased, chiefly by the local action on the gastric mucosa. The drug does not cause the secretion of an active ferment, but the secretion of acid is augmented. In moderate doses it is very rapidly absorbed from the stomach. The digestion of pro-

teids is slightly accelerated, and the pancreatic secretion is somewhat increased.

Central Nervous System.—The pyschical phenomena that occur in man as the result of taking alcohol are not observed in animals after this agent has been administered. The precise action of alcohol on the central nervous system has not been determined. According to Binz, the nerve cells are first stimulated, and later are depressed. On the other hand, Schmiedeberg claims that the drug exerts a depressing effect on the central nervous system from the commencement. The higher centres are first depressed, and as the result of toxic doses paralysis of the medulla finally occurs The primary stimulating psychical effects observed in man after moderate doses are said to result from depression of the inhibitory centres.

Circulatory System.—Small doses cause a slight acceleration of the *pulse.* Large amounts render the pulse-rate slower, this effect being due to the action of the drug on the medulla. Moderate doses exert a slight but definite stimulant action on the *heart.*

The superficial *bloodvessels* are considerably dilated, while the systemic vessels at first tend to become constricted. The latter action is partly due to stimulation of the medulla, but also depends on peripheral stimulation. Large doses cause dilatation of all the vessels throughout the body.

The *blood-pressure* is generally raised, this effect being due to the vaso-constriction that is present, and also to the cardiac stimulation.

Temperature.—Moderate doses cause a lowering of the temperature, this effect depending on the dilatation of the cutaneous vessels, permitting a great loss of heat. Small doses have an effect on the formation of heat.

Respiration.—Some authorities believe that alcohol exerts a direct stimulating action on the respiratory centre, which action, although slight, is decided. Others hold that the stimulant action on respiration is due to an indirect effect. According to Dixon, the most probable explanation of the stimulant action of alcohol on respiration is that the drug

causes an increased loss of heat from the surface of the body, and in consequence heat production is augmented to make good the loss; hence there is a compensatory increase in the oxygen intake, and increased combustion. The agent is therefore an indirect stimulant to respiration.

Metabolism.—Experiments show that alcohol in moderate doses is almost entirely oxidized in the body, and yields energy. It spares the oxidation of fat and increases the metabolism of protein. If continued for a long period so that the tissues become tolerant to its toxic action, the drug acts as a proteid sparer, and the body is increased in weight. Experiments have also shown that, in moderate doses continued for some time, alcohol acts as a food, so long as the amount of the drug in the body can be oxidized and destroyed by the tissues. When an excessive amount is present in the system, so that it cannot be oxidized, it exerts a toxic action on the tissues. If the drug be present to the extent of 0·5 per cent. in the blood, profound intoxication results. Only 1 or 2 per cent. of alcohol is excreted in the urine. The process of oxidation is slow, as it has been shown that after the administration of a small dose the amount circulating in the blood remains constant for about two hours.

Toxic Effects.—In excessive doses alcohol acts as a *narcotic* poison, and proves fatal by producing paralysis of the vital nerve-centres.

After a stage of excitement the functions of the brain become disturbed, then loss of consciousness occurs, and, if very large amounts have been given, a condition of paralysis of the vital nerve-centres ensues. The more concentrated forms of alcohol prove far more toxic than diluted solutions. Usually the respiratory centre is the first to become paralyzed, but in some instances respiration and circulation fail simultaneously.

In the horse preliminary excitement is well marked and accompanied by an unsteady gait, with spasmodic movements of the limbs; the pupils are at first contracted, then dilated, and in the final stages either convulsions or coma occur.

In the dog there is very little preliminary excitement, and after a toxic dose has been administered the animal becomes rapidly comatose.

Cattle and sheep are less susceptible to the action of alcohol, and are only affected by very large amounts of this agent.

Cases are recorded of chronic alcoholic poisoning in cattle supplied with the dregs or wash from distilleries; but with this exception cases of poisoning by alcohol are very rare in veterinary practice. The suitable *antidotes* are the application of cold water to the head and neck and the hypodermic injection of strychnine.

MEDICINAL USES.—In former times whisky was largely employed as a stimulant in cases of influenza and pneumonia in horses. Careful clinical observation, however, has shown the practitioner of the present day that, when stimulants are indicated, far better results are achieved by the administration of agents such as strychnine, strophanthus, and subcutaneous injections of normal saline solution, than by forcing alcoholic stimulants in the form of drenches on the patients. We have already drawn attention to the dangers associated with the administration of drenches in the diseases mentioned, and also pointed out that attention to dietetics, hygiene, and good nursing, constitute very important details in the treatment of such conditions. In fact, it can truly be said that drenching with alcohol is neither necessary, safe, nor desirable, and since this practice has been discontinued far more successful results have been obtained. It occasionally happens that horses will voluntarily take whisky in the drinking-water, and in such instances, when stimulants are indicated, they can be administered in this manner.

In cases of emergency, when other drugs are not available, and stimulants are required, a full dose of whisky may be prescribed, as, for example, when, in the early stages of influenza, rigors are present, or at the commencement of an attack of acute pulmonary congestion. In such instances from 6 to 10 ounces of whisky, suitably diluted, often proves

beneficial, but it is rarely necessary to repeat the dose. In cases of severe diarrhœa in foals, port wine, combined with other suitable remedies, gives good results. In cattle practice, alcoholic stimulants are useful adjuncts to other treatment in cases of atony of the stomach. Strong ale, in doses of from 1 to 2 pints, three times daily, proves beneficial in cases of indigestion and debility. Agents such as nux vomica and gentian can be administered in ale.

In canine practice alcoholic stimulants are often prescribed, but they should be used with discretion. Overdosing leads to derangement of the stomach and vomiting (see p. 112).

CONTRA-INDICATIONS.—Alcohol is contra-indicated in all conditions of cerebral excitement, congestion of the brain, meningitis, etc.; in cases of shock depending on concussion or injury to the brain; and in cases of nephritis, hepatitis, and gastritis.

EXTERNAL USES.—Alcohol enters into the composition of various liniments. In the form of rectified spirit and proof spirit, it is largely employed in the preparation of tinctures and extracts.

CHAPTER VIII

THE CARBON COMPOUNDS (*Continued*)

REMARKS ON THE ACTION OF ANÆSTHETICS

GENERAL anæsthetics produce loss of consciousness, and abolish sensation and voluntary muscular action. The vapour of certain volatile drugs, when inhaled, has the power of producing these effects, and in veterinary practice the agents employed as general anæsthetics are chloroform and ether. It must be remembered that hypnotics—*i.e.*, agents used to produce sleep (imperfect consciousness)—if administered in large doses, bring about complete anæsthesia ; but their action is associated with grave risks to the patient. Hypnotics are slowly absorbed and excreted ; a certain amount remains in the blood for some hours, hence the depressant action is prolonged. On the other hand, chloroform and ether are rapidly absorbed and excreted, and the effects last only so long as the administration is continued.

The exact manner in which certain narcotics and anæsthetics produce their effects is not definitely known, but theories have been advanced in connection with the subject. Some narcotics, such as morphine and the bromides, are believed to act by their direct chemical affinity for nerve cells, and are termed 'specific.' Others such as chloroform, chloral hydrate, etc., are believed to act physically, and are termed 'indifferent.' With reference to the latter, Meyer has put forward the following theory: These agents are readily soluble in fats and oils, and only slightly soluble, or even insoluble, in water. Lecithin and cholesterin are fat like

bodies largely present in nervous tissue. When the narcotic agents circulate in the blood, they tend to leave the latter, and pass into and alter the above-mentioned fatty substances of the nervous structures, interfere with the normal activity of the neuron, and thus exert anæsthetic or narcotic effects. This theory, however, cannot be fully accepted, as several examples could be quoted to show that substances more readily soluble in water than in oil (*e.g.*, chloral hydrate) may be efficient hypnotics.

CHLOROFORMUM (CHLOROFORM).

PREPARED from ethylic alcohol, industrial methylated spirit, or acetone, by heating with chlorinated lime, slaked lime, and distilled water, and subsequent purification.

For use in veterinary practice chloroform made with industrial methylated spirit (methylated chloroform) is both safe and economical.

DOSES.—Administered by the *mouth* as an antispasmodic and analgesic: Horses, ʒi. to ʒii.; cattle, ʒii. to ʒiv.; sheep and pigs, ♏xx. to ♏xl.; dogs, ♏v. to ♏x. Given with syrup, mucilage, or in diluted spirit.

As an anæsthetic, by inhalation: Horses, ʒii. to ʒvi.; sheep, and pigs, ʒiv. to ʒi.; dogs, ʒi. to ʒss.

Spiritus Chloroformi — Spirit of Chloroform; Chloric Ether; Spirit of Chloric Ether.

PREPARED by dissolving chloroform, 50 millilitres, in alcohol (90 per cent.) sufficient to produce 1,000 millilitres (1 in 20).

DOSES.—Horses, ʒi.; cattle, ʒii.; sheep and pigs, ʒii. to ʒiv.; dogs, ♏xxx. to ♏xl.

Aqua Chloroformi—Chloroform-water.

PREPARED by dissolving chloroform, 2·5 millilitres, in distilled water sufficient to produce 1,000 millilitres.

This is used for preserving medicinal solutions, and also as a flavouring agent for unpalatable drugs in canine practice.

A.C.E. Mixture. — Contains absolute alcohol, 1 part; chloroform, 2 parts; and purified ether, 3 parts.

Tinctura Chloroformi et Morphinæ Compositæ—Chlorodyne (see p. 364).

General Actions of Chloroform.

Externally, chloroform acts as a refrigerant, and also depresses the termination of sensory nerves. If the vapour be confined, or if the drug be applied to the skin with friction, it acts as an irritant.

Internally, if administered in small doses by the mouth, it is carminative, antispasmodic, and anodyne. Unless properly diluted with mucilage or oil, it causes severe irritation of the tongue and buccal mucosa.

If administered by *inhalation*, chloroform acts as an anæsthetic.

Three stages of chloroform anæsthesia are usually described, but in practice we find that there are marked variations in the duration and intensity of these stages, especially with regard to horses.

The *preliminary* stage is characterized by excitement, struggling, and accelerated respirations. The excitement is believed by some authorities to depend on stimulation of the central nervous system, but others hold the view that, as in the case of alcohol (see p. 293), the primary stimulating effects are due to depression of the inhibitory centres.

Certain reflex effects occur as the result of the local irritating effects of the vapour of the drug on the respiratory passages, such as salivation, and hypersecretion from the bronchial mucosa, and occasionally coughing. Two reflex effects also occur from the action of the chloroform vapour on the nasal mucosa. One is a temporary 'holding of the breath,' which depends on irritation of the nerve-endings of the fifth cranial nerves. This is frequently observed in the horse, and lasts only for a short time. The other is a slowing of the heart's action, and it depends on a similar cause. Dilatation of the pupils and frequent lateral movements of the jaws may also be present.

The *second* stage, termed the *narcotic* stage, is characterized by more marked excitement and struggling, sometimes neighing, irregular respirations, and accelerated pulse.

In veterinary practice it is seldom possible to differentiate

these two stages, and it may be said that the duration of the period of excitement varies according to the temperament of the animal and the mode of administration of the drug. In some horses, which may be described as 'bad subjects for chloroform,' the period of excitement is greatly prolonged, and large amounts of chloroform are required before the anæsthetic stage is reached. If the drug be administered in concentrated form—*i.e.*, very little air being allowed—and if a sufficient amount be allowed at the commencement, the stage of excitement is usually brief, and anæsthesia is induced in a comparatively rapid manner. On the other hand, if a special form of inhaler be employed, so that the chloroform vapour is well diluted with air, the stage of excitement is prolonged and anæsthesia is delayed.

The *third*, or *anæsthetic* stage, is the one selected for the performance of surgical operations. Consciousness and sensibility are removed, voluntary muscular action is lost, the muscles are relaxed, and in deep anæsthesia the reflexes disappear. As we shall point out later, the anæsthetic stage may be reached in the horse, and yet the corneal reflex may not have disappeared. In this stage the respirations are regular and somewhat slower than normal, and the pupils are slightly contracted.

If the administration of the drug be pushed still further, a *paralytic* stage is reached, the vital nerve-centres in the medulla become paralyzed, and there is complete loss of all reflex excitability. The respiratory centre is usually the first to fail; the respirations become shallow, irregular, and finally cease, and the pupils are widely dilated. It is of importance to note that in the horse death is often preceded by convulsive movements of the fore and hind limbs.

The stages of chloroform anæsthesia are well shown when the drug is administered to the horse in the standing position. After the preliminary period of excitement, the animal is unable to maintain the standing posture, and when he lies down it is often an indication that the stage of anæsthesia has been reached.

We shall now consider the actions of chloroform *seriatim*,

as the safe administration of the drug is based on a knowledge of such actions.

Action on Respiration.—In the first stage in man the respiratory movements are rendered slower owing to irritation of the nerve-endings of the fifth nerves in the nasal mucosa. In animals, owing to the excitement and struggling produced by restraint, in addition to the irritating effects of the drug on the respiratory mucosa, the respirations are accelerated and irregular. During the anæsthetic period the respirations become slower than normal, and also more shallow. If chloroform inhalation be pushed beyond the anæsthetic stage the respiratory centre fails, and this effect is generally believed to depend on the marked fall of blood-pressure which is produced by the drug. In the majority of cases death results from respiratory failure, but, as we shall point out later on, instances occur in which the patient succumbs so rapidly that it would seem as if the heart and respiration failed simultaneously. Usually, when an excess of chloroform has been administered to the horse, the respiratory movements become quick and shallow; later on a long inspiration is observed, followed by a temporary cessation of respiratory movements, then a series of quick, shallow respirations occur, and respiration finally ceases. The heart beats in a feeble and irregular manner for a short time after respiration ceases. Oral breathing, accompanied by marked stertor, may also be observed. Cases, however, are met with in which respiration ceases without any preliminary warning; these are more common in dogs than in horses.

Action on Circulation.—In the horse it is uncommon to meet with cases of death during the first stage of chloroform anæsthesia. But the fact that such instances have occurred should lead us to study the matter. In the dog they are not uncommon. Experiments indicate that the fatal termination in such cases results from the rapid absorption of concentrated chloroform vapour, more especially when an animal is breathing irregularly, and thus takes in a large quantity of the vapour of the drug at one inspiration.

Death results from sudden inhibition of the heart due to stimulation of the vagal centre in the medulla.

The vasomotor centre in the medulla is stimulated during the early stages of chloroform inhalation, but this action is transient, and is soon followed by depression of this centre.

Chloroform exerts an important action on the heart. The cardiac muscle, in common with all forms of muscular tissue, is directly depressed, its force of contraction is diminished, and blood-pressure falls. As the result of excessive dosage the contractile power of the heart muscle becomes still more diminished, cardiac dilatation results, and the heart becomes over-distended with blood.

During the stage of excitement chloroform stimulates the vasomotor centre, and thus causes constriction of internal vessels, dilatation of the cutaneous vessels, and a raising of blood-pressure. These effects are transient, as the centre soon becomes depressed, and ultimately paralyzed; the blood-pressure falls owing to vaso-dilatation and the diminished output from the heart. Chloroform has but a slight effect on the movements of the bladder, intestines, or uterus, and if administered during parturition the uterine contractions are only influenced to a very small extent. Observations have shown that during anæsthesia the temperature of the animal falls in a steady manner.

Uses.—Chloroform given in medicinal doses *per os* is sometimes employed as a carminative, antispasmodic, and anodyne, and is prescribed in the form of spirit of chloroform. But the most important use of the drug is as a general anæsthetic, and this aspect of the question merits special consideration, as follows:

The Uses of Chloroform as a General Anæsthetic, with Remarks on its Administration.

In the present day the necessity for anæsthetics in veterinary surgery is gradually becoming recognized. Prejudice, combined with ignorance of the technique of chloroform administration, has been responsible for the neglect of this very important attribute to successful surgery in the

past, and a number of trivial objections are still put forward by some practitioners, who try to lead the public to believe that the employment of anæsthetics is unnecessary, and is surrounded by grave difficulties and risks. The subject may be regarded from two points of view. In the first place, it is apparent that the struggling which occurs during the performance of painful operations interferes materially with the delicate manipulations associated with surgery. It seems hardly necessary to point out that with the patient in a quiescent condition the work of the surgeon is greatly facilitated. In the next place, it is our duty to avoid the infliction of pain during surgical operations. Nothing is more repulsive to individuals endowed with feelings of humanity than the spectacle of an animal cast and securely bound, and subjected to a painful operation, vainly struggling as sensitive structures are being manipulated or severed. There is no defence for the veterinary surgeon in the present day who ignores the necessity for anæsthetics, and evidence is not wanting to show that the owners of animals will in the near future insist that all painful operations must be performed under anæsthesia.

It would not be correct to state that chloroform anæsthesia is unattended with any risks. For the protection of the practitioner it is very essential that he should be thoroughly acquainted with these risks, and with the best means of preventing the occurrence of fatalities during anæsthesia. Judging by our own experience in the employment of chloroform as an anæsthetic in equine surgery, and also from observations made in destroying horses by means of this drug, we are forced to the conclusion that of all animals the horse is most resistant to the toxic action of chloroform, provided ordinary care be exercised. Again, the very large number of horses that have been subjected to the modern operation for roaring, without any fatalities resulting from chloroform anæsthesia, is ample evidence of the comparative safety of the drug.

We cannot, of course, deny the fact that experience in the administration of chloroform is very essential, in order

that danger-signals may be recognized and immediate steps taken to prevent the occurrence of fatalities. From our knowledge of the actions of chloroform, we are aware that, owing to its depressant effects on the vital nerve-centres, and the fall in blood-pressure which occurs, the safety in administration depends on the withdrawal of the drug when a sufficient degree of anæsthesia is produced, and before paralysis of the respiratory centre is brought about. Although it has been clearly demonstrated that chloroform is a comparatively safe anæsthetic for the horse, and in our present state of knowledge we must admit that the drug is preferable to all others for this purpose, yet there are many instances in which marked difficulty is experienced in obtaining a proper degree of anæsthesia. As we shall point out later on, the method of administration often exerts a very important influence on the production of anæsthesia, and there is much to be said in favour of administering the drug with the animal in the standing posture. The usual method adopted is to cast the horse first, and then administer the anæsthetic. Now, the procedure of casting and securing the animal causes a marked degree of excitement and struggling, accentuated in the case of highly bred nervous horses. Cases are not uncommon in which extreme and long-continued excitement are prominent features during the administration of the drug, and large quantities are required before a proper degree of anæsthesia is induced. The excitement caused by the chloroform is superadded to that arising from the animal being cast and secured, and the irregularity of the respirations leads to a large amount of the drug being taken into the system at one time. On the other hand, we frequently meet with cases in which very little excitement or struggling is present, and anæsthesia is produced in a comparatively short space of time. These two extremes constitute a source of danger, but in addition we have another factor to consider—viz., the occurrence of 'surgical shock' during the course of an operation.

Unlike the human being and the dog, it is very rare to find dangerous symptoms or sudden death occurring during

the early stages of chloroform administration in the horse. We have met with such cases, but the autopsy showed that unsuspected cardiac disease was present. Without any warning, failure of the heart's action and of respiration occur simultaneously during a fit of struggling. In other instances, the period of excitement is greatly prolonged, and there is a tendency for the practitioner to push the administration of the drug. Evidences of respiratory failure may occur rather suddenly, and unless these are promptly recognized a fatal termination will result.

But it often happens that dangerous symptoms do not appear until the later stages of a prolonged operation, and here the element of surgical shock must be considered. The patient may have taken the anæsthetic in an ordinary manner, and during the operation it may have been necessary to repeat the administration, and no cause for anxiety has presented itself. Then suddenly the respirations become short, shallow, and irregular, the animal sinks into a deeper stage of anæsthesia, the visible mucous membranes become anæmic, and death from respiratory failure soon closes the scene. Here we may remark that it is not uncommon for a horse under chloroform to struggle in a purposeless manner with fore and hind limbs, and yet be in a dangerous condition. Observations conducted while destroying healthy horses with chloroform show that this involuntary struggling often precedes death. Hence the practitioner should take warning that this type of struggling occurring during prolonged anæsthesia is by no means an indication that the patient is recovering from the effects of the drug, and that, if the operation be not completed, it is not wise to continue the administration without a careful scrutiny of the respirations and pulse. Another point of importance is the fact that a horse apparently recovering from the effects of chloroform may suddenly sink into a very deep stage of anæsthesia after the completion of the operation, and give rise to much anxiety on the part of the practitioner.

Experience in destroying horses by means of chloroform would lead us to the belief that the equine is very resistant

to the toxic effects of the drug. Very frequently, even when air is excluded, the procedure is a tedious and lengthy one, and in every instance death results from paralysis of the respiratory centre. But experience in the administration of the drug for the production of anæsthesia for surgical purposes also teaches us that an element of danger is present which does not obtain in the case of experimental observations. Of late years much has been learned in this direction, and we are forced to the conclusion that the condition known as *surgical shock* exerts an important influence on the occurrence of fatalities during anæsthesia.

At one time it was held that, if a proper degree of anæsthesia was induced and maintained, shock resulting from the manipulation or section of parts highly endowed with nerves could not occur. Numerous experiments have demonstrated that such a view was erroneous, and modern authorities are clearly of opinion that even deep anæsthesia does not prevent afferent impulses reaching the central nervous system and bringing about the condition known as 'surgical shock.' The effects of this condition are well recognized, but its real nature and the means of preventing its occurrence are questions which are still *sub judice*. Some authorities regard surgical shock as a condition produced by exhaustion of the vasomotor centre, resulting in a marked fall in blood-pressure and an accumulation of blood in the splanchnic vessels; other observers hold that, although no pain is felt during operations under chloroform anæsthesia, the nerve impulses set up by the surgical manipulations, etc., reach the brain, and bring about certain changes in the organ, more especially in the cells of the cortex and of the cerebellum, which induce a condition of physical exhaustion. This is known as the 'kinetic theory of shock.'

It is rational to conclude that some at least of the fatalities which occur in horses and dogs during chloroform anæsthesia depend on surgical shock; hence we should be acquainted with the measures suggested to combat the condition (see p. 310).

Having now pointed out the risks attending chloroform

anæsthesia, it is necessary to consider the methods of administration, and also the means to be adopted when dangerous symptoms are manifested. We do not desire to exaggerate the risks, but it is essential to remember that, although the horse is as a rule very resistant to the toxic effects of chloroform, exceptions occur, and it is the duty of the practitioner to point out this fact to the owners of animals. Such risks, however, should not deter us from administering the drug in the case of painful operations. In human surgery the risks from anæsthesia are far greater, yet the fatalities that occur do not prevent chloroform from being extensively employed; hence the occasional occurrence of a death during anæsthesia in horses and dogs is no reason why we should abandon the employment of so necessary an attribute to surgical work.

For practical purposes, three methods of chloroform administration in the case of horses may be considered:

1. By means of an apparatus arranged so that very little air is admitted, and the vapour of the drug is inhaled in a concentrated form. This method has the advantage of shortening the stage of excitement and inducing anæsthesia very rapidly. Two ounces of chloroform are poured on the sponge contained in the apparatus, and this amount usually suffices to bring about the desired degree of anæsthesia. This method is largely practised, and with very successful results. The remarkably few fatalities recorded seem to indicate that the horse can inhale concentrated chloroform vapour with comparative impunity; but there seems little doubt that during a long operation, when it becomes necessary to administer a further amount of the drug in order to maintain anæsthesia, there is grave risk in supplying the vapour in a concentrated form, and under such conditions a proper amount of air should be allowed. We may also remark that during the first stage there is an element of risk in administering concentrated chloroform vapour, for the reasons mentioned on p. 301. In the case of aged horses in high condition, we have on several occasions observed serious symptoms resulting from this method of administration, and

hence advocate a certain allowance of air, even though it prolongs the administration.

2. In this method the chloroform vapour is diluted with air prior to inhalation. This is accomplished by means of a special apparatus arranged on the principle of Junker's inhaler. It consists of a foot-bellows and rubber tubing, by which air is driven through a graduated bottle containing chloroform; another rubber tube connects this bottle to a capacious nosebag, fitted with a ventilator, so that the supply of air can be controlled. This method of administration is slow, and in certain horses there is difficulty in producing a proper degree of anæsthesia. Having had a long experience in the administration of chloroform by means of this apparatus, we can testify to its safety, and also to its value in the case of long operations in which it is necessary to continue the administration of the drug. For prolonged anæsthesia it is of importance to control the amount of chloroform, and also to insure that it is administered in a diluted form, and with this apparatus such precautions can be carried out.

3. Many practitioners administer chloroform to the horse in the standing position. The advantages are that by this method there is no obstruction to respiration, such as occurs when the animal is cast and secured. The stage of excitement is shortened, and the animal assumes the recumbent position in a short time, without the necessity for casting. When he goes down it is often an indication that a proper degree of anæsthesia has been reached. Various forms of inhalers are used for this method, but all of them are arranged so that the supply of air is limited. In order to control the horse during the stage of excitement it is necessary to have two reliable assistants, and also plenty of space; but some practitioners fix the inhaler, containing the requisite amount of the drug, to the animal's head while in the stall, and then bring him into the open space.

We must emphasize the fact that, in order to carry out this method safely and successfully, experience is necessary, and also reliable assistants are required. Defects in the

technique may prove serious, as is exemplified in recorded cases where horses have broken loose and seriously damaged themselves.

We shall now consider the *danger-signals* which should be looked for during the induction of chloroform anæsthesia, and the measures to be adopted when such arise. Obviously it is of great importance to recognize when the proper degree of anæsthesia is reached, so that we may cease the administration of the drug before dangerous depression of the vital nervous centres occurs. We have already mentioned that the condition of the corneal reflex in the horse is of no value as a guide to the proper degree of anæsthesia. In very many instances it persists, even when a stage of anæsthesia is reached sufficient for any operation. A relaxed condition of the limbs, and the absence of struggling when the horse is sharply struck on the quarters, are far more reliable guides. Care should be taken not to commence an operation until a proper degree of anæsthesia has been induced. Neglect of this point may prove serious, as the administration has to be continued during the operation, and the struggling often leads to the inhalation of an excessive amount of the drug. Moreover, the element of surgical shock has to be taken into consideration. In the case of a short operation, such as castration, there is no necessity to induce a deep degree of anæsthesia. Castration performed by the emasculator is so rapid an operation that only a moderate degree of anæsthesia is required. The occurrence of slight involuntary or purposeless movements of the limbs, which are so often observed when sensitive structures are manipulated or severed, is not an indication for a further administration of chloroform. These movements are feeble and of short duration, and are easily distinguished from the struggling which is indicative of pain.

In the large majority of instances, the state of the respirations is the only reliable guide as to the safety of the animal during anæsthesia. Should the respirations become laboured, shallow, or irregular, the apparatus should be immediately removed, the animal's tongue drawn forward, and artificial

respiration carried out. Early attention to this matter has prevented many a fatality. (See 'Artificial Respiration,' Part III.)

In those unfortunate cases where circulation and respiration seem to cease simultaneously, nothing can be done, as death takes place in a sudden manner.

We sometimes observe a danger-signal which merits attention—viz., the occurrence of well-marked 'straining' of the muscles all over the body; this is more likely to occur during the stage of excitement, and we mention it because in two of the fatal cases which came under our notice it was present. When observed, the administration of the drug should be stopped immediately. We may remark that this phenomenon may occasionally be observed during operations performed under local anæsthesia, more especially when the animal is secured on an operating-table.

Not infrequently it happens that, after an operation is completed, the horse seems to sink into a secondary stage of anæsthesia, and this may continue for a lengthened period. This need not cause alarm so long as the respirations are regular, but the patient should be kept under observation, so that artificial respiration may be carried out should dangerous symptoms manifest themselves.

Believing as we do that surgical shock is responsible for some at least of the fatalities occurring during chloroform anæsthesia, we adopt the preventive measure advised by several human surgeons—viz., in the case of serious operations we apply local anæsthesia in addition to chloroform. This procedure effectually prevents the afferent impulses from reaching the central nervous system, and, besides, far less chloroform is required.

There are many other details with reference to the prevention of fatalities during anæsthesia which merit attention, but owing to lack of space we can only make a brief reference to them.

The patient should be prepared for operation by withholding bulky food for a reasonable time beforehand. Repletion of the digestive organs is well known to favour respiratory

difficulties, and we know from experience that when the stomach is comparatively empty the horse is far more readily brought under the influence of the anæsthetic.

It is always advisable to examine the animal's heart prior to administering chloroform; not that we can always detect the presence of cardiac lesions, but we can at least protect ourselves from a charge of negligence, should a fatality occur and the post-mortem reveal the existence of disease of this organ. Care should be taken that there is no impediment to free respiration, such as might ensue from an abnormal position of the animal's head, an ill-fitting halter, or from the manipulations of the attendants while endeavouring to hold the head during a fit of struggling.

While the horse is recovering from the effects of chloroform it is necessary to adopt precautions in order to prevent injuries occurring as the result of the nervous excitement and struggling to rise which are not uncommon at this stage. It is always prudent not to release the animal from the hobbles until consciousness has fully returned, and he should not be forced to rise until a reasonable time has elapsed. Solid food should not be allowed until a few hours after he is returned to his stall, as cases are recorded in which 'choking' has occurred as a sequel to chloroform anæsthesia.

In the dog, great care is essential in the administration of chloroform, and it is absolutely essential to insure that a proper amount of air is allowed. Various forms of inhalers are employed, the chief feature in which is an arrangement for the proper dilution of the chloroform vapour with air, and the administration of the drug in a regular manner. But H. Gray has pointed out that chloroform can be safely administered to the dog by means of a wide-mouthed jar or tin in which a sponge is placed; a small amount of the drug is poured on the sponge and repeated when required. It has been shown that in dogs chloroform anæsthesia can be safely maintained for long periods, provided plenty of air be allowed. Another important matter is that during the stage of excitement the attendant should be cautioned not to hold the animal in such a manner that any interference with respiration is likely

to result. An operating-table provided with suitable hobbles for securing the limbs of the dog proves of marked value in preventing fatalities from the above cause.

In the majority of instances when death occurs during chloroform anæsthesia in the dog, it results from respiratory failure. But occasionally the animal dies during the stage of excitement, and the action of the heart ceases simultaneously with the respirations. The measures to be adopted on the occurrence of dangerous symptoms are similar to those advised in the case of the horse. Our chief reliance must be on artificial respiration, and this should be continued for a reasonable time, even in cases that seem to be hopeless. When circulation and respiration cease spontaneously, treatment of any kind is of no avail. The inhalation of the vapour of ammonia and the hypodermic injection of strychnine are generally advised as antidotes to the toxic effects of chloroform, but in our experience they are useless.

Measures for the prevention of surgical shock should be employed in the dog as in the horse (see p. 310).

Some practitioners advise a hypodermic injection of morphine as a useful preliminary to the administration of chloroform. This is found to diminish the period of excitement, and far less chloroform is required to produce anæsthesia. American veterinary surgeons employ with success a combination of morphine, hyoscine, and cactoid, for this purpose.

The A.C.E. mixture is sometimes employed in the dog instead of chloroform, and is said to be safer than the latter agent.

In difficult cases of parturition chloroform anæsthesia proves of assistance during manipulations in effecting delivery.

In cases of persistent abdominal pain depending on intestinal affections, in which chloral hydrate fails to give relief, we advise the use of chloroform administered by inhalation, so as to bring about a condition of light anæsthesia. This can be continued for long periods if necessary, and in cases that ultimately prove to be curable we have never found any interference with the peristaltic action of the intestines as the result of the chloroform anæsthesia.

ÆTHER (ETHER; SULPHURIC ETHER).

PREPARED by distilling 1 part of sulphuric acid with 5 parts of rectified spirit.

Æther Purificatus—Purified Ether.

This is almost free from alcohol and water, and is used for producing general anæsthesia.

Rectified Ether—This is prepared from industrial methylated spirit.

It is washed to free it from methylic ether, then purified and redistilled. It is also used for producing general anæsthesia.

DOSES.—Horses, ʒi. to ʒii.; cattle, ʒii. to ʒiii.; dogs, ♏xx. to ʒi. Administered, well diluted, with mucilaginous fluids, and repeated as required.

In cases of collapse, where immediate results are desired, the drug is administered hypodermically in one-quarter to one-half the above doses, or may be injected into the muscles.

Spiritus Ætheris—Spirit of Ether: Ether, 1; Alcohol (90 per cent.), 2.

DOSES.—Similar to those of ether.

Absolute Ether (Methylated) is employed for producing local anæsthesia by spraying, as it is very volatile and is free from water.

ACTIONS.—*Externally* ether is a *refrigerant* and a *local anæsthetic*. It evaporates rapidly, abstracts heat, and depresses the sensory nerves of the part to which it is applied. If used in the form of a spray, it freezes the skin, and thus removes sensation. If applied with friction, it produces *rubefacient* or *vesicant* effects.

Internally its action resembles in many respects that of alcohol, but it is absorbed and excreted more rapidly. It increases gastric secretion and the movements of the stomach, and thus is a carminative. According to Dixon, ether in medicinal doses has little direct action on the heart, but it accelerates the pulse reflexly, from its irritant effect on the mouth and stomach. If inhaled, ether is an anæsthetic, and in some respects resembles chloroform.

The important distinctions are as follows:

(*a*) Ether has a less depressing effect upon the heart, bloodvessels, and respiratory centre, than chloroform.

(*b*) With ether the exciting stage is prolonged, the struggling more marked, the stage of anæsthesia is shorter and less profound, and consciousness is more quickly regained.

(*c*) Ether must be administered in a concentrated form in order to induce anæsthesia, about 70 per cent. of vapour being necessary in the air inhaled.

Ether increases secretion from the respiratory mucous membrane, and causes a flow of ropy mucus from the mouth. It produces marked acceleration of the respiratory movements, and does not cause paralysis of the vital nerve-centres until large amounts have been inhaled. It raises blood-pressure during the whole period of anæsthesia, thus differing in a marked degree from chloroform.

USES.—As a general anæsthetic ether is of no value in the horse. The violent struggling and excitement which it causes in this animal, and the difficulty of inducing anæsthesia, even when a large amount of the drug has been inhaled, have led to its use being abandoned.

In the dog, however, it proves a safe anæsthetic, and for this reason is preferred by some practitioners to chloroform; but it is very troublesome to administer, and often large quantities are required to induce anæsthesia. In administering ether, its highly inflammable nature must be remembered, so as to avoid the occurrence of accidents.

The use of ether as an anæsthetic is contra-indicated in cases of chronic bronchitis, also in operations in the region of the mouth and throat.

As a *local anæsthetic*, the ether spray has not proved useful in veterinary practice.

As a *stimulant*, ether may be administered by hypodermic injection in cases of collapse depending on hæmorrhage or exhausting disease. As its action is evanescent, it requires to be repeated at intervals. The tendency for abscess formation to follow the subcutaneous administration of the drug is a great drawback to its employment in this manner.

As an *antispasmodic* and *carminative*, ether is useful in cases of gastric tympany in the horse, and is usually combined with other agents in the treatment of this affection. It is necessary to administer the drug in oil or mucilage so as to prevent its irritating effect in the mouth.

Rectified ether is employed for heating Dechery's autocautery.

Nitrous Oxide.

This is a gas prepared by heating ammonium nitrate. We consider it here for convenience, in consequence of its anæsthetic action. It is used in human surgery to produce temporary anæsthesia during short operations, especially in dentistry, and is also employed as a preliminary to the administration of chloroform or ether. We are not aware of its successful employment in veterinary practice. According to Dixon, nitrous oxide causes depression of the central nervous system and a certain degree of asphyxia. It is the safest anæsthetic, but, owing to the difficulty of prolonging the anæsthesia, it is only suitable for dental operations.

Collodium (Collodion).

This is prepared by dissolving 21 grammes of pyroxylin or gun-cotton in 750 millilitres of ether and 250 millilitres of alcohol (90 per cent.).

Flexible collodion is prepared from collodion, Canada turpentine, and castor-oil.

A large number of substances can be dissolved in collodion to form medicated collodions, and the most important of these consist of antiseptics, such as iodoform. These form a protective covering for slight wounds, the usual strength being 1 in 10. They are applied with a fine brush at short intervals, and are especially recommended for laparotomy wounds in the dog, and as a protective covering for wounds of the eyelid in the horse, or in the case of any wound which should heal by first intention.

Colic Draught.

Aloes ℥ v
Chloral Hydrate ℥ i
Oil of Turpentine ℥ ii

Dissolve in water, add linseed oil ℥i.

CHAPTER IX

THE CARBON COMPOUNDS (*Continued*)

CHLORAL HYDRAS (CHLORAL HYDRATE).

PREPARED by the addition of water to the liquid chloral produced by the action of dry chlorine on ethylic alcohol.

DOSES.—Horses and cattle, ℥i. to ℥ii.; sheep and pigs, ℥ss. to ℥ii.; dogs, grs. v. to grs. xx. The drug can be administered in the form of bolus, drench, or enema. When prescribed as a drench it should be combined with mucilage, so as to prevent its irritating effect on the buccal mucosa, or it may be dissolved in water and shaken up with raw linseed-oil.

INCOMPATIBLES.—Quinine and alkalies.

ACTIONS. — *Externally* it possesses *antiseptic* and *disinfectant* properties. In concentrated solution it acts as a *topical irritant*.

Internally, unless well diluted, it causes severe irritation of the mouth and tongue. Chloral is quickly absorbed, and, contrary to what was at one time believed, its composition does not undergo alteration in the blood.

Its specific action is exerted on the central nervous system, and in all animals it acts as a powerful *hypnotic* when full doses are administered.

In some horses even a moderate dose (℥i.) will produce a sleepy condition and a staggering gait, while in others but little effect is observed. Reflex action is weakened, and sensibility to pain is diminished. These effects are due to depression of the central nervous system. Chloral also causes depression of the vasomotor centre, a fall of blood-pressure,

and dilatation of the bloodvessels throughout the system. It has a direct action on the heart-muscle, resembling that of chloroform.

In *toxic* doses, chloral causes in the horse relaxation of the muscles, staggering, dilatation of the pupils, a lowering of the temperature, and finally a condition of deep stupor. Some observers record a brief period of preliminary excitement after a large dose has been administered. In the dog, a toxic dose usually causes a short stage of excitement before producing the condition of stupor. Death occurs from respiratory failure, but in some instances well-marked cardiac depression contributes to the fatal result. The lethal dose for the horse is said to be 4 to 6 ounces administered *per os*.

ANTIDOTES.—Strong coffee, hypodermic injection of strychnine, artificial respiration, warmth to surface of body.

MEDICINAL USES.—In equine practice chloral is largely prescribed as an *anodyne*, and it may be described as the most useful agent we possess for the relief of pain from whatever cause arising. It exerts anodyne effects by preventing the brain from receiving painful impressions, and is said to have no action on the seat of the pain—*i.e.*, on peripheral nerves. But of chief importance is the fact that the drug, even in repeated doses, does not interfere with the peristaltic action of the intestines, neither does it cause nausea nor nervous excitement, all of which actions render opium and morphine so undesirable as anodynes in equine practice. Another point in favour of chloral is that it exerts an antiseptic action on the gastro-intestinal canal, and thus tends to overcome and prevent tympanites. We are convinced, as the result of long experience in the employment of chloral, that it can be prescribed in all cases of abdominal pain, without interfering with intestinal peristalsis. For such cases it can be administered in the form of bolus, or preferably in solution as a drench. The solution may be shaken up with a pint of raw linseed-oil, and combined with oil of turpentine in cases where intestinal tympany is present. If thought desirable, aloes (℥v.) in solution may be combined with chloral hydrate (℥i.) and oil of turpentine (℥ii.), and these

form with raw linseed-oil a very useful drench for colic with impaction. Some practitioners combine camphor with chloral, and state that the anodyne effect of the latter is increased thereby.

Chloral may be repeated at intervals until relief from pain is obtained, and it in no way affects the ultimate issue of the case. Although the drug is regarded as being antagonistic to eserine, we have not observed that the action of the latter is in any way affected by the administration of chloral.

In all diseases characterized by cerebral excitement and convulsions, such as meningitis, azoturia, etc., chloral is indicated.

In the management of horses which are vicious to shoe or to clip, chloral in a dose of 2 ounces dissolved in a pint of water, with mucilage, and administered as an enema, often has a magical effect. Chloral administered in the same manner is very useful in the case of nervous, excitable, or vicious horses, when it is necessary to place them on an operating-table, or to cast them in the usual manner for surgical operation.

The enema should be given about thirty minutes prior to operation. The effects in many instances are very satisfactory, as the preliminary struggling is to a great extent abolished In some instances a hypodermic injection of 2 to 4 grains of morphine given at the same time increases the sedative effect. With the assistance of chloral and of local anæsthesia many operations can be carried out without the necessity of administering chloroform.

As an *anæsthetic*, chloral is employed by many Continental veterinarians. Various methods of administration are adopted. Cagny administers 2 to 3 grains of morphine with ½ to 1 grain of atropine by hypodermic injection, and soon afterwards gives 1 ounce of chloral by enema. In about an hour anæsthesia is induced, and is maintained by chloroform inhalation Hendrickx states that, without producing general anæsthesia, chloral lessens sensibility, and causes sufficient muscular relaxation to prevent the patient from struggling. He advises as the best method 30 to 100 grammes (1 ounce to 3½ ounces) of the drug dissolved in a litre (1 pint, 15 ounces)

of water heated to 38° or 40° C., and administered as an enema. The desired effect is produced in from ten to fifteen minutes.

The intravenous or intraperitoneal injection of chloral is advised by some authorities, but, as the administration is troublesome and the risks out of proportion to the advantages to be gained, we do not consider this method serviceable in ordinary practice.

Few horses will take the drug when mixed with their food or drinking-water. According to Vennerholm, if administration can be effected in the drinking-water, the hypnotic action of chloral will be observed in from five to ten minutes, whereas if the agent be introduced *per rectum* the effects are not produced for a period of twenty to thirty minutes.

Major Ryan, A.V.C., employs chloral prior to the administration of chloroform to horses in the standing position, and finds that it greatly facilitates the procedure.

In canine practice, chloral combined with bromides proves useful in cases of puerperal eclampsia in the bitch. It also gives good results in some cases of bronchial asthma, and in such instances is best prescribed in the form of syrupus chloral (syrup of chloral), one fluid drachm of which contains 10·9 grains of chloral.

In cattle practice, chloral was at one time employed in the treatment of milk-fever, and proved successful in some instances. The marked success which has attended the simple measure of inflating the udder with air in this disease has now led to the universal adoption of this method of treatment. Nevertheless, some practitioners still prescribe chloral in addition to the air treatment when marked excitement is present, and hold that it assists recovery. (See 'The Treatment of Milk-Fever,' Part III.)

Chloralose is a compound of chloral and glucose. It is absorbed more slowly than chloral, but exerts more powerful hypnotic effects. According to Dixon it heightens reflexes, and in large doses may even give rise to strychnine-like convulsions.

H. Gray (*Veterinary Record*, vol. xx., pp. 614, 629) advises

chloralose as an anæsthetic for the dog, and states that in medicinal doses the drug does not affect respiration, circulation, or the vital reflex centres. It may be administered either intravenously or *per os*. When given by the latter method, full anæsthesia is induced within half or three-quarters of an hour, and anæsthesia may continue for some hours. The doses advised are as follows: *Dose per pound of the body-weight*—by intravenous injection as a *hypnotic*, $\frac{1}{6}$ to $\frac{1}{3}$ grain; as an anæsthetic for surgical purposes, $\frac{1}{3}$ to 1 grain. When given mixed with the food or as a draught, 1 to 2 grains. Cats are more susceptible to the action of the drug than dogs, and the maximum dose for these animals should never exceed $\frac{1}{2}$ grain to the pound of body-weight. Toxic doses cause death by paralysis of respiration, and this may not occur for twenty-four hours.

According to Gray, chloralose is also useful in the treatment of many of the nervous complications of distemper, and may be combined with potassium iodide for this purpose.

Chloralamide.—This is prepared by the action of formamide on chloral hydrate. It is said to be less toxic to the cardiac muscle than chloral, but is inferior to the latter as a hypnotic. Fröhner advises its employment in the nervous sequelæ of canine distemper, in doses of 10 to 40 grains.

Butyl-Chloral Hydrate is not employed in veterinary practice, but in human medicine is prescribed in cases of neuralgia. It was believed to exert a special action on the fifth cranial nerve, but according to Dixon there is no evidence to support this view.

Chloretone.

PREPARED by the interaction of chloroform, acetone, and an alkali.

DOSES.—Horses, ʒii. to ʒiv.; dogs, grs. v. to grs. x.; cats, grs. ii. to grs. iv.

ACTIONS AND USES.—Chloretone possesses sedative, hypnotic, local anæsthetic, and antiseptic properties. In consequence of its comparatively high price, it is seldom prescribed for horses. In canine practice it is largely employed in the treatment of gastritis and obstinate vomit-

ing. The beneficial effects of the drug in such cases depend on its action as a gastric sedative and internal antiseptic. It also proves of value in some cases of canine typhus. Chloretone is best administered in the form of powder, placed on the back part of the tongue. It may be repeated at intervals of half an hour until vomiting ceases.

As a hypnotic, chloretone is useful in canine surgery in association with local anæsthesia. It is said to act specially on the central nervous system without exerting any influence on the heart. It is employed by some practitioners as a preliminary step in the induction of general anæsthesia, and, if administered about an hour beforehand, lessens the period of excitement, and a much smaller amount of chloroform is required. Chloretone has been employed in the treatment of tetanus in the horse, with a varying degree of success.

In the cat, special caution is necessary in prescribing the drug, as this animal seems very susceptible to its action. Hence it is advisable to employ only minimum doses.

Externally, chloretone in combination with boric acid ('boro-chloretone') proves useful as an antiseptic dressing for wounds, and for canker of the ear in dogs.

Sulphonal may be obtained by oxidizing mercaptol. It is described as a pure hypnotic, which is absorbed and also excreted very slowly, and is said to have no depressant effect on cardiac muscle. Hendrickx states that 60 to 80 grammes of the drug given in tepid bran-water twelve hours previous to operation produce a hypnotic effect sufficient to dull sensibility and to bring about muscular relaxation. He also points out that the action of sulphonal on the horse may be erratic, as in some instances no effect is produced, while in others the animal is unable to maintain the standing posture. Again, cases are observed in which the hypnotic action is maintained for forty-eight hours.

As a hypnotic for neuroses associated with hyperexcitability in the dog, sulphonal may be prescribed in doses of 10 to 40 grains, to be given in warm milk.

Paraldehyde is a polymeric modification of aldehyde. It is a hypnotic, but is less effectual than chloral hydrate, and

is erratic in its action in animals; hence it is seldom prescribed in veterinary practice.

Urethane (ethyl carbamate), **Hypnone**, and **Amylene Hydrate**, are agents sometimes used in human medicine as hypnotics, but are seldom employed in veterinary practice, as they are not as effectual as chloral or chloralose.

Amyl Nitris (Amyl Nitrite).

PREPARED by the interaction of amylic alcohol and nitrous acid.

DOSES.—Horses and cattle, ℥x. to ℥lx.; dogs, ℥i. to ℥v. Administered either as an inhalation, or dissolved in rectified spirit as a draught.

ACTIONS.—Amyl nitrite, if administered by inhalation, enters the system rapidly. It has a special action on the circulatory system; it *dilates* the peripheral bloodvessels by causing relaxation of their muscular walls, the result being that the blood-pressure is lowered to a marked degree. The action of the heart is accelerated, but its force is only slightly increased, and there is a fall in the temperature, due to diminished oxidation.

Toxic doses produce muscular weakness, laboured respirations, loss of reflex excitability, a staggering gait, and finally death from asphyxia, which may be preceded by convulsions.

Amyl nitrite depresses the motor tracts of the spinal cord, thus reducing reflex excitability. It is believed to have a special action on the blood, by which it converts a portion of the hæmoglobin into methæmoglobin, and as the latter does not readily part with oxygen, oxidation is interfered with.

USES.—Amyl nitrite is seldom employed in veterinary practice. As an antidote to the toxic effects of chloroform it is of no value. In spasmodic asthma in the dog it is recommended by some practitioners, and experimentally it has proved an antidote to strychnine-poisoning. It has been tried in the treatment of tetanus, but not with encouraging results. In human medicine it gives marked relief in cases of angina pectoris. This disease is rarely met with in veterinary practice.

Sodii Nitris (sodium nitrite) has similar actions to amyl

nitrite; its effects are less rapidly produced, but persist for a longer period.

Trinitroglycerin, Nitroglycerin, or Glonoin, resembles amyl and sodium nitrites in its actions, but is more powerful and persistent. In the form of LIQUOR TRINITRINI it is sometimes prescribed for cases of spasmodic asthma in the dog, the dose being ½ to 2 minims well diluted with water.

Spiritus Ætheris Nitrosi (Spirit of Nitrous Ether; Sweet Spirit of Nitre).

This is an alcoholic solution containing not less than 1·52, nor more than 2·66 per cent. by weight of ethyl nitrite, together with aldehyde and other allied substances.

PREPARED by distilling a mixture of rectified spirit, nitric acid, sulphuric acid, and copper, and dissolving the distillate in spirit (90 per cent.).

DOSES.—Horses, ʒi. to ʒiii.; cattle, ʒii. to ʒiv.; sheep and pigs, ʒii. to ʒiv.; dogs, ℥xx. to ʒi.

The smaller doses are those intended to be repeated at intervals. The drug should be properly diluted in order to avoid irritation of the mouth.

INCOMPATIBLES.—Potassium iodide, ferrous sulphate, gallic and tannic acids, antipyrine, and salicylates. When it is desirable to combine potassium iodide with spirit of nitrous ether, some potassium bicarbonate or sodium bicarbonate should be added to the latter in order to neutralize the free acid; this will prevent the separation of iodine, which would otherwise occur. When spirit of nitrous ether is combined with acetate of ammonium in a mixture, the bottle should not be corked for a short time; otherwise the gas formed may cause the bottle to burst.

ACTIONS.—Spirit of nitrous ether is a *stimulant*, an *antispasmodic*, a *diuretic*, a *febrifuge*, and a *carminative*. It accelerates cardiac action, produces dilatation of superficial bloodvessels, lowers arterial pressure, and causes relaxation of involuntary muscles. It acts as a diuretic by dilating the renal bloodvessels, and, by a similar action on the cutaneous vessels, as well as by stimulating perspiration, it produces

diaphoretic effects, but the latter action is seldom observed in animals.

USES.—As a diffusible stimulant, it is extensively employed in veterinary practice. In combination with solution of acetate of ammonium, it is useful in the early stages of influenza when rigors are present. Marked diaphoretic effects are seldom observed in animals, except the action of the drug be assisted by the application of warm clothing to the body.

As an antispasmodic and carminative, it is often prescribed in cases of spasmodic colic.

As a *diuretic*, it is useful in cases of chronic renal affections with increased arterial tension. It causes a free flushing out of the renal tubules and relaxes spasm of the renal vessels. It is contra-indicated in cases of acute nephritis in consequence of its effects on the renal vessels.

In the primary stages of azoturia spirit of nitrous ether is useful, in addition to other details of treatment. Owing to the fact that the administration of drenches in respiratory affections is practically abandoned, spirit of nitrous ether is not employed to the same extent as in former years. At one time the routine treatment for such cases, and also for influenza, was the continued administration of 'fever drenches,' composed chiefly of sweet spirit of nitre and solution of acetate of ammonia.

Formaldehyde.

This is a gaseous body obtained by the limited oxidation of methyl alcohol.

Liquor Formaldehydi, Solution of Formaldehyde; Formalin.—This is an aqueous solution containing 35 to 40 per cent. of formaldehyde.

ACTIONS.—Formalin is an antiseptic, a disinfectant, and a deodorant. If undiluted it is a powerful caustic and an irritant. Its vapour is very irritating to the eyes and respiratory passages, and it has a corrosive action on surgical instruments. In $\frac{1}{2}$ per cent. solution it kills most micro-organisms. Strong solutions applied to the skin may produce toxic effects. In excessive doses it is an irritant poison,

causing gastritis and subsequent collapse, and in carnivora vomiting occurs, followed by coma.

USES.—A solution of 1 part of formalin in 500 parts of water is sometimes employed as an antiseptic for surgical purposes, but other agents are far preferable; moreover, the solution is very irritating to the hands of the surgeon. In the treatment of canker of the horse's foot, a 2 to 5 per cent solution of the drug often gives good results; a similar solution is sometimes employed as an injection in the treatment of sinuses and fistulæ. But stronger solutions than the above should not be employed, as they are likely to cause extensive destruction of the tissues. In the treatment of ringworm a 2 per cent. solution has been found useful.

In cases of recurring tympanites in cattle not depending on the presence of a foreign body in the reticulum or on organic disease of the stomach, the internal administration of formalin gives excellent results. Similar remarks apply to those obscure cases of gastric derangement which occur in from one to five weeks after parturition (the so-called 'parturient indigestion'). In such instances, 2 drachms of formalin with 1 drachm of liquid extract of nux vomica mixed in 2 pints of ale, and administered two or three times daily, often gives excellent results. Formalin diluted with 10 to 50 parts of water is used in the preservation of pathological specimens. It is also employed in the sterilization of catgut ligatures.

Lysoform is a liquid formaldehyde potash soap. It contains 18 to 20 per cent. of formalin, and has a high bactericidal action even in a 2 to 5 per cent. solution. It is an efficient antiseptic for surgical work and for the disinfection of instruments, and for these purposes solutions of 3 per cent. may be employed.

Urotropine—also known as Aminoform, Formin, or Cystamin—is a condensation product of ammonia and formaldehyde. When administered *per os*, it is rapidly excreted by the kidneys, and when the urine is acid a certain amount of the drug is split up, yielding free formaldehyde. It is thus a valuable urinary disinfectant, but is

said to be inefficient when the urine is alkaline. Hence in such a condition acid sodium phosphate should first be given, so as to render the urine acid.

Urotropine is advised in the treatment of cystitis in the horse by Hutyra and Marek, in doses of 1 to 2 drachms, well diluted, two or three times daily. For the dog the dose is 3 to 15 grains. The drug may also be employed in canine practice as a solvent of uric acid and urates.

Helmitol is sometimes termed 'New Urotropine,' and is advised for similar purposes to the above.

Glutol is a combination of gelatine and formaldehyde.

Amyloform is a compound of formaldehyde with starch.

Glutol and amyloform are sometimes employed as dry antiseptic dressings for wounds, but in our experience they do not possess any special advantages, and are too expensive for veterinary use.

Tannoform is a condensation product of tannic acid and formaldehyde.

Internally it acts as an intestinal astringent and antiseptic, and is said to pass through the stomach unaltered. It proves useful in obstinate diarrhœa and intestinal catarrh in foals and calves, the doses being from 30 to 60 grains three times daily, given in linseed gruel or in milk. For the dog 10 to 20 grains may be prescribed.

Externally, tannoform is astringent, desiccant, and antiseptic, and is employed as a dry dressing for wounds, cracked heels, etc. In canine practice it gives good results in cases of moist eczema and in the treatment of canker of the ear.

BENZOL OR BENZENE SERIES OF CARBON COMPOUNDS.

The agents in this series are also known as *coal-tar derivatives*. They are of complex composition and include a number of antiseptic and antipyretic agents, while some possess analgesic actions.

Benzol or **Benzene** is a liquid obtained from light coal-tar oil. It must be carefully distinguished from petroleum benzine or benzoline, which is obtained from American petroleum and is used for heating thermo-cauteries (see

p. 345). Benzene acts as an irritant when applied to mucous membranes or to skin-abraded surfaces, or if rubbed into the skin it also possesses antiseptic and parasiticide actions. If administered *per os*, in toxic doses, it produces muscular tremors, loss of sensibility, and convulsions. It is occasionally employed in the treatment of parasitic affections of the skin, and also for the destruction of lice. In equine practice it can be applied undiluted, but for the dog it is combined with three parts of oil or vaseline.

Acidum Benzoicum—Benzoic Acid. (See Benzoin.)

Phenazonum—Phenazone; also known as **Antipyrine**—is obtained by the interaction of phenylhydrazine with aceto-acetic ether.

DOSES.—Horses, ʒii. to ʒiv.; cattle, ʒiii. to ʒvi.; sheep and pigs, grs. xxx. to ʒi.; dogs, grs. v. to grs. x. Administered three times daily.

ACTIONS AND USES.—Antipyrine possesses antiseptic, anti-pyretic, analgesic, and hæmostatic actions, and is also said to be a uterine sedative. Its antipyretic effect is ascribed to its action on the heat-regulating nervous mechanism. The analgesic action depends on some influence exerted on the central nervous system. The drug passes through the body unchanged, and is thus less toxic than antifebrin. Toxic doses cause convulsions resembling those produced by strychnine, followed by serious depression of the central nervous system and collapse.

Antipyrine is sometimes prescribed in cases of influenza associated with high fever or rheumatic complications. It is said to prove of value in the treatment of acute laminitis.

Acetanilidum—Acetanilide; also known as **Antifebrin.** This is obtained by the interaction of glacial acetic acid and aniline.

DOSES.—Horses and cattle, ʒii. to ʒiv.; sheep and pigs, grs. xxx. to ʒi.; dogs, grs. ii. to grs. x. Administered three times daily, or more frequently if required.

ACTIONS AND USES.—Antifebrin possesses marked anti-pyretic actions; it is also a sedative and diuretic and a feeble antiseptic. Some authors state that even in excessive doses

it rarely causes toxic symptoms in animals; but, according to experiments carried out by others, it produces in the dog vomiting, purging, a weak, thready pulse, laboured respirations, convulsive movements, and collapse. Unlike antipyrine, it is readily oxidized in the body, and hence is more toxic than the former agent. It induces the formation of methæmoglobin in the substance of the red blood-corpuscles. If large doses be given, the methæmoglobin is set free, and the red corpuscles become shrunken and colourless.

Antifebrin is sometimes prescribed in cases of influenza accompanied by a high temperature, and may be given in the form of powder in the food, or as an electuary.

Phenacetinum (Phenacetin) is obtained by the interaction of glacial acetic acid and paraphenetidin.

DOSES.—Similar to those of antipyrine. (See p. 327.)

ACTIONS AND USES.—Phenacetin is an antipyretic and analgesic. It is said to be the safest of all the antipyretics, as its toxic properties are feeble. It is occasionally employed as an antipyretic in equine practice.

Resorcinum (Resorcin) is obtained by the interaction of fused sodium hydroxide and sodium metabenzene-disulphonate.

ACTIONS AND USES.—Resorcin in a 1 per cent. solution is an antiseptic. Concentrated solutions act as irritants to the skin and mucous membranes. It is seldom employed in veterinary practice. Continental authors recommend the drug as an intestinal antiseptic in cases of diarrhœa in foals or calves, the dose being from 30 to 60 grains.

Salol—also known as Phenyl Salicylate—is obtained by the interaction of salicylic acid and phenol. It is an antipyretic, an antiseptic, and an intestinal disinfectant. It is occasionally prescribed in cases of diarrhœa depending on excessive fermentation in the intestines, the dose for the horse being ʒii. to ʒiv., and for the dog grs. iii. to grs. x., administered in the form of an emulsion. Externally salol has been used as a substitute for iodoform.

Pyoktanin occurs in two forms—viz, Pyoktanin Cœruleum, or Methyl Violet, and Pyoktanin Aureum, or Auramin. Methyl

violet is the form generally employed. It is said to possess marked germicidal actions, to be non-toxic and non-irritating. A solution of 1 in 1,000 of water is advised by Continental authors in the treatment of conjunctivitis and ulceration of the cornea.

Methylene Blue possesses antiseptic and local analgesic actions, and has proved useful as an application to ulcerative stomatitis, 10 parts of methylene blue being dissolved in 50 parts each of alcohol and glycerin.

Trypanblue or **Trypanblau** is a complex substance derived from toluidine and sodium amido-naphthol sulphonate. It has been successfully employed by Nuttall and others in the treatment of canine and bovine piroplasmosis. In canine piroplasmosis (malignant jaundice) Nuttall employed a 1 to 5 per cent. solution of trypanblue in cold sterilized water, the dose being for small dogs 2 c.c. (34 minims), and for large dogs 15 c.c. (4¼ drachms), administered by intravenous or subcutaneous injection. Subcutaneous injection is likely to be followed by abscess formation and sloughing of the skin. As a result of the administration, all the tissues are stained a blue colour. In the treatment of malignant jaundice as met with in this country, we have not observed any beneficial results from this treatment. For cattle the dose of the above solution is 150 c.c. (5 ounces) to 200 c.c. (6½ ounces).

Naphthalinum (Naphthalene) occurs in the form of crystals, is prepared from tar and tar oils, and is formed in the manufacture of coal gas. It is an antiseptic and parasiticide. In cases of diarrhœa and dysentery it may be prescribed as an intestinal antiseptic, and is also recommended as a vermicide.

Doses.—Horses and cattle, ʒi. to ʒiii.; calves, ʒss. to ʒi.; sheep and pigs, grs. x. to grs. xx.; dogs, grs. ii. to grs. x. Administered in mucilage or castor-oil.

Externally, naphthalene may be employed as a dressing for the destruction of skin parasites, in the form of a 10 per cent. solution in olive-oil or glycerin.

Naphthol occurs in white shining crystals, and is obtained by a complex process from naphthalene. Two forms of this

agent are recognized—viz., alpha-naphthol, or *α*-naphthol; beta-naphthol, or *β*-naphthol. Both forms are antiseptics and parasiticides. Alpha-naphthol is said to possess greater antiseptic powers than the other form, and also to be less toxic; but the latter is usually prescribed.

It is occasionally used as a vermifuge and as an intestinal antiseptic, the dose for the horse being from ʒi.ss. to ʒii., and for the dog from grs. iii. to grs. x. Administered in the form of emulsion.

Externally, it is sometimes employed in the treatment of scabies, eczema, and psoriasis, in the form of ointment—*e.g.*, 1 to 8 of prepared lard or lanolin.

Scarlet Red—Toluol-azo-toluol-azo-*β*-naphthol.—In the form of a 4 per cent. ointment this agent has been found useful in human surgery as a dressing for ulcers and ulcerated surfaces, also to promote the growth of new skin. The ointment is spread on gauze and applied to the part by means of a bandage. It should not be left on longer than forty-eight hours, or marked irritation may occur. It has also been employed in the treatment of corneal ulcers, and is worthy of a trial in veterinary practice.

Acetozone, or Benzoyl-Acetyl-Peroxide, occurs as a white crystalline powder. It possesses marked germicidal actions, and is non-toxic and non-irritant. A solution of 20 grains to 2 pints of water is the strength usually employed. This may be prescribed as an internal antiseptic in cases of toxæmic gastritis and canine typhus, in doses of from 2 to 5 ounces every four hours. A solution containing 5 grains to a pint of water is useful as a lotion in the treatment of purulent conjunctivitis, ulcer of the cornea, etc., also as a mammary injection in cases of mastitis. Malloch has found the drug useful in the treatment of joint-ill in foals, ½ ounce of a 1 in 500 solution being injected into and around the affected joints, and a similar amount administered *per os* every five hours. B. P. Mahony has observed good results from the administration of a solution of acetozone in the treatment of white scour in calves (*Veterinary Record*, February 22, 1913).

Externally, acetozone, diluted with 50 parts of zinc oxide

or boric acid, forms a useful antiseptic dry dressing for wounds.

In prescribing the drug, solutions should be freshly prepared.

Chinosol is a mixture of potassium sulphate and oxychinoline sulphate. A solution of 15 grains in a pint of water is said to be equal in germicidal powers to a 1 in 40 solution of carbolic acid. As an antiseptic dressing for wounds, a solution of 1 in 50 to 1 in 60 may be employed. Hobday (*Journal of Comparative Pathology and Therapeutics*, March, 1898) arrived at the following conclusions with reference to the toxic actions of chinosol in the cat and dog: The cat was susceptible to its actions, both from application of solutions to the skin as well as from administration by the mouth. It was not rapidly absorbed from the unbroken skin of the dog. The toxic symptoms observed were 'sneezing, coughing, a flow of ropy saliva from the mouth, a subnormal temperature, staggering gait, loss of motor power, commencing in the hind extremities, prostration, and death from cardiac failure.'

Chinosol in the form of powder has proved useful in the treatment of open joint and open tendon sheaths. A solution of 8 to 15 grains to a pint of water is employed by some practitioners as a mammary injection in the treatment of milk-fever in cows, but the simple inflation of the udder with air gives better results.

For convenience in dispensing, chinosol can be obtained in tablets containing 5, 8, and 15 grains.

Amongst other agents of the benzene series of carbon compounds which have been introduced from time to time, we may mention the following: ORTHOFORM, EXALGIN, CHINASEPTOL, QUINOLINE, THALLINE, and TRAUMATOL. All possess antiseptic actions, but their superiority over the agents we have described has not been demonstrated.

ORTHOFORM, in addition to its antiseptic action, is a local anæsthetic, and is recommended in canine practice as a dressing for wounds, as it allays irritation and pain, and thus lessens the tendency of the animal to bite or scratch the affected part. Large doses given by the mouth cause nausea, vomiting, and depression of the central nervous system.

CHAPTER X

CARBOLIC ACID AND ALLIED AGENTS

ACIDUM CARBOLICUM (CARBOLIC ACID; PHENOL).

THIS occurs in the form of crystals, and is obtained from coal-tar oil.

Acidum Carbolicum Liquefactum (Liquefied Phenol, Liquefied Carbolic Acid) is prepared by mixing 100 grammes of phenol with distilled water sufficient to produce 115 grammes. (Phenol liquefied with 15 per cent. by weight of water; it contains about 87 per cent. of phenol.)

DOSES.—Horses, ℥xv. to ℥xl.; cattle, ʒss. to ʒi.; sheep and pigs, ℥v. to ℥x.; dogs, ℥i. to ℥ii. It should be properly diluted with water, and if mixed with a little glycerin it is less liable to cause irritation.

For disinfecting purposes varieties of carbolic acid are employed. No. 4 Carbolic Acid contains 10 per cent. of phenol and nearly 90 per cent. of cresols. 1 in 40 of hot water forms a suitable disinfectant fluid. No. 5 Carbolic Acid is dark-coloured, and consists chiefly of cresylic acid. It is used for disinfecting buildings, drains, etc.

The liquefied acid (B.P.) should be used for medical and surgical purposes.

Glycerinum Acidi Carbolici — Glycerin of Phenol: Phenol, 1; glycerin sufficient to produce 5 (1 in 5).

Unguentum Acidi Carbolici—Ointment of Carbolic Acid: Phenol, 3; white paraffin ointment, 97 (1 in $33\frac{1}{3}$).

Carbolic Soaps contain from 10 to 20 per cent. of phenol.

Carbolic Antiseptic Dressings—Carbolic absorbent wool and lint contain from 5 to 10 per cent. of phenol. Carbolic gauze contains 5 per cent. Carbolic tow contains from 5 to 10 per cent.

Carbolic Disinfecting Powders contain from 20 to 30 per cent. of carbolic acid.

Sodii Sulphocarbolas—obtained by dissolving phenol in excess of sulphuric acid, and converting the acid so formed into a sodium salt.

DOSES.—Horses, grs. xl. to ʒii. ; dogs, grs. iii. to grs. xv.

Zinci Sulphocarbolas—prepared from carbolic acid, sulphuric acid, and oxide of zinc.

ACTIONS.—*Externally*, if applied to the skin in a concentrated form, carbolic acid acts as a *caustic*, producing a *white* eschar, which afterwards becomes of a brown colour. It also produces local anæsthesia of the part to which it is applied. Carbolic acid possesses marked *antiseptic*, *disinfectant*, and *deodorant* actions, a 4 per cent. solution destroying putrefactive and pus-forming organisms, while a 5 per cent. solution is capable of destroying the bacilli of various diseases. It is stated, however, that, in order to destroy anthrax spores, exposure to a 5 per cent. solution for two days was necessary.

Internally, carbolic acid also exerts antiseptic effects, and is frequently prescribed in cases of septic diseases. If used in the form of a medicated inhalation, it acts as a disinfectant to the nasal passages and to the respiratory mucous membrane. In medicinal doses it acts as a gastric and intestinal disinfectant, and arrests excessive fermentation of the ingesta. It can be absorbed from the unbroken skin, also from wounds, mucous surfaces, and subcutaneous tissues.

TOXIC EFFECTS.—In large doses carbolic acid is an irritant and also a narcotic poison, and has special actions on the nervous system. The undiluted acid produces a white, hardened condition of the mucosa of the mouth.

The symptoms observed in the horse are: salivation, muscular tremors, a staggering gait, accelerated respirations, coldness of the surface of the body and extremities, and convulsions, succeeded by paralysis and coma

In the dog, vomiting and symptoms of intoxication may first appear, succeeded by a state of collapse, death occurring either from respiratory or cardiac paralysis.

On the nervous system carbolic acid has a primary stimu-

lating action. This is succeeded by paralysis of the medulla and spinal cord. On the circulation, after primary stimulation, it acts as a cardiac depressant, and produces a fall in the blood-pressure. The urine assumes a characteristic olive-green or brown colour, and may contain blood.

Cases of carbolic acid poisoning in animals may occur from the use of too strong solutions of the agent as a surgical dressing for wounds or as an application in the treatment of skin diseases.

The dog is specially susceptible to its toxic effects from absorption. Instances of poisoning have also occurred from this agent being administered by mistake, and fatal cases have occurred in cats when strong carbolic disinfecting powder has been liberally applied to the floors of buildings to which these animals had access, the poison probably entering the system by the animals licking their paws.

The post-mortem appearances of carbolic acid poisoning are patches of inflammation in the stomach and intestines, and if death has occurred within twenty-four hours the characteristic odour of the drug can be detected throughout the body. The kidneys may show inflammatory changes.

One ounce of carbolic acid has proved fatal to the horse, and from 15 minims to 2 drachms to the dog.

ANTIDOTES.—In the dog emetics should be given, preferably the hypodermic injection of apomorphine. Failing this, sulphate of zinc may be employed. In all animals sulphate of magnesium or sulphate of sodium are suitable antidotes, as they convert the poison into sulphocarbolates, which are inert and are excreted by the kidneys. Sulphate of sodium injected hypodermically is recommended. It must be remembered, however, that sulphate of magnesium should not be used by subcutaneous injection for this purpose, as it acts as a poison. Olive-oil and lime-water should be given freely, also stimulants, to ward off collapse. The hypodermic injection of atropine is also recommended. Other antidotes are saccharate of lime, vinegar, camphorated oil, while oil of turpentine has given good results in some cases.

The irritation of the mouth and pharynx should be treated

with demulcent drinks and medicated inhalations. The escharotic effects of the drug are said to be best treated by the application of pure alcohol, as solutions of carbolic acid in strong alcohol or concentrated glycerin are not caustic, but assume the latter action when diluted with water.

USES.—*Internally*, carbolic acid is prescribed in cases of pyæmia, septicæmia, septic pneumonia, etc., as an internal antiseptic. It is also employed in combination with other agents in the treatment of dysentery. In flatulent colic in the horse and in tympanites of the rumen in cattle, it is a useful agent for preventing the further formation of gases arising from fermentation of the ingesta.

The inhalation of steam medicated with carbolic acid gives good results in cases of respiratory affections that tend to assume a septic character, and these inhalations should be employed in conjunction with the internal administration of the drug.

Hypodermic injections of a 3 per cent. solution of phenol in distilled water have been tried in the treatment of tetanus, but the results are not encouraging.

In the treatment of parasitic bronchitis in calves, carbolic acid in doses of 10 minims is prescribed in the form of intra-tracheal injections; for this purpose it is usually combined with 2-drachm doses of the oil of turpentine, 20 grains of carbonate of potash, and 1 drachm each of olive-oil and water.

In consequence of the susceptibility of the dog to the action of carbolic acid, both internally and externally, extreme caution is necessary in its employment.

Externally, as an antiseptic agent for general surgical work, carbolic acid is still extensively used. The drug coagulates albumin, and, according to some observers, combines with it.

Many practitioners, however, prefer antiseptic agents which are less toxic and less irritating to the operator's hands. The usual strength of carbolic solutions for surgical purposes is from $2\frac{1}{2}$ to 5 per cent.

Carbolic oil is prepared by combining phenol with olive-oil in varying proportions. Some authors state that this

preparation is only feebly antiseptic, and not reliable as a germicide. But according to Watson Cheyne carbolic acid dissolves readily and in large amount in oil, still retaining its antiseptic property, though not so strong as in watery solution; a 1 in 10 oily solution is about equal antiseptically to a 1 in 20 watery solution (*Lancet*, November 21, 1914).

In the treatment of follicular mange in the dog, Professor Slavu advises an ointment composed of pure phenol, 1 part; camphor, 2 parts; and white vaseline, 8 parts. The hair is first removed by clipping, and a fourth part of the body is dressed daily until the entire surface is treated. Then the animal receives a bath composed of a 2 per cent. solution of sulphurated potash. Mild cases usually require three courses of treatment, and for severe cases four courses generally suffice.

Carbolic acid is largely employed in the treatment of sheep-scab, in the form of dips containing this agent.

Crude carbolic acid is used for the disinfection of buildings, etc., but in consequence of its poisonous nature other agents are preferred.

Sodium Sulphocarbolate is said by some authors not to produce any evidence of the actions of phenol. According to Dixon it acts like carbolic acid, but is far less poisonous, and can be employed as a gastric and intestinal disinfectant. It forms one of the constituents of the 'colic' remedies prepared by chemists, which usually consist of sulphocarbolate of soda, chloral hydrate, and aloes.

Zinc Sulphocarbolate possesses astringent as well as antiseptic actions, and is advised as an injection in the treatment of leucorrhœa (℥i. to O.i. of water).

Creosotum (Creosote).

This is a mixture of phenols which may be obtained by the distillation of beech tar, and consists chiefly of guaiacol and cresol (B.P.)

Doses.—Horses, ♏ xx. to ℥i.; cattle, ℥i. to ℥ii.; sheep, ♏ xv. to ♏ xxx.; pigs, ♏ v. to ♏ xv.; dogs, ♏ i. to ♏ v.

The drug should be administered in the form of emulsion, and mixed with milk or oil.

ACTIONS AND USES.—*Externally*, in undiluted form, creosote is an *irritant* and *caustic;* it stains the skin white and coagulates albumin. It resembles carbolic acid in its actions, but is stated to be less poisonous, and a more active germicide. It possesses marked germicidal and deodorant properties, and checks fermentation.

Toxic doses produce in the dog salivation, vomiting, muscular tremors, laboured respirations, feeble pulse, and in some cases convulsions and coma.

The *antidotes* are similar to those mentioned for carbolic acid (see p. 334).

Creosote is prescribed in obstinate cases of *diarrhœa* and *dysentery*, in combination with other agents. It acts as a *gastro-intestinal disinfectant* and checks fermentation. In some cases of obstinate vomiting in dogs it gives relief, but other agents are preferable. It may be used as an inhalation in cases of septic pneumonia. Administered by intratracheal injection, it is employed in the treatment of parasitic bronchitis in calves, in the form of an emulsion, the dose being from 5 to 10 minims.

Externally it has proved useful in the treatment of follicular mange in the dog. Hunting advised a liniment composed of 4 drachms of creosote, 1 ounce of liq. potassæ, and 7 ounces of olive-oil, applied twice a week, and when the parts become tender, longer intervals should be allowed. Before commencing treatment the affected parts should be shaved, as this enables the drug to reach the parasites more readily.

As an antiseptic agent for the treatment of wounds creosote in the form of a liniment proves very useful. A serviceable formula is—Creosote, ʒii.; terebene, ʒviii.; olive-oil, O.i.

Guaiacol.—A liquid obtained from wood creosote. It can also be obtained from guaiacum resin. It resembles creosote in its actions, and in addition is a local anæsthetic and an antipyretic. It is not used in veterinary practice.

Cyllin (Creolin), Jeyes' Fluid, etc.

Cyllin was formerly known as 'creolin.' This is a dark liquid prepared from coal-tar, and contains 50 per cent. of

a new series of oxidized hydrocarbons, free from phenol, and emulsified with neutral tar-oil. It forms a white emulsion with water.

Jeyes' Fluid is a preparation of coal-tar containing 20 per cent. of tricresol saponified with resin and an alkali.

Jeyes' Soluble Fluid forms a clear solution with water, and is stated to be more concentrated than the above preparations.

Doses of Cyllin.—Horses and cattle, ʒii. to ʒvi.; dogs, ♏i. to ♏x. It should be administered properly diluted, so as to avoid irritation of the mouth and tongue.

Actions.—Both cyllin and Jeyes' Fluid are germicides, antiseptics, deodorants, and parasiticides. Cyllin, being more refined, is preferred for internal use and for canine surgery. Jeyes' Fluid is extensively employed as an antiseptic agent for surgical purposes in horses and cattle, and also as a general disinfectant and deodorant.

Both these agents are said to possess higher germicidal powers than carbolic acid; they are not caustic in their action, and, being far less toxic, they are preferred to carbolic preparations as general antiseptics and disinfectants.

Strong solutions applied to the skin of dogs or cats produce toxic effects.

Hobday, who has investigated the actions of creolin, has arrived at the following conclusions (*Veterinary Record*, October 21, 1905):

'1. Creolin is a narcotic and irritant poison to the dog and cat, and its use in these animals must be watched with the greatest care.

'2. It is especially toxic when spread in emulsions of a certain strength over a large area of the body.

'3. This effect is more rapidly seen and more violent when mixed with water than when applied pure or when mixed in the form of ointment.

'4. When mixed with water in certain proportions and applied externally, it will act as a violent irritant.

'5. The less refined preparation of creolin is not so toxic in action as pure creolin.'

The solutions employed were strong: in some instances, equal parts of the agent with water; in others, 2 ounces with 4 ounces of water; but in one instance 1 drachm in 2 ounces of water caused toxic symptoms when applied all over the skin of a collie puppy six weeks old. These, no doubt, are more concentrated than would be used in ordinary practice, but at the same time the experiments teach that only dilute solutions can be used with safety, certainly not stronger than 2 per cent. In small dogs and puppies it is safer to avoid this agent altogether.

The toxic symptoms observed were 'an unsteady gait (the hind-limbs being particularly affected) and a subnormal temperature. These were followed by complete paralysis, prostration, and clonic spasms of all voluntary muscles, especially those of the limbs, jaws, and eyelids. There was a state of semi-coma, followed by complete coma and death from collapse.'

The following antidotes are advised when the toxic effects are due to the application of an external dressing: 'Wash the skin thoroughly with hot water containing sulphate of magnesium or sulphate of zinc, whilst diffusible stimulants should be administered internally at frequent intervals, the patient being well wrapped up and put into a warm room. . . .

'Prognosis must be very guarded, as even when an animal has apparently recovered it is by no means certain that a relapse may not occur.'

Hobday has also found that strong solutions of creolin in the horse as well as in the dog have caused violent irritation of the skin, and dulness, with a subnormal temperature and loss of appetite for several days.*

USES.—Cyllin is prescribed in cases of gastric tympany both in horses and cattle, and is usually combined with other agents. It checks fermentation, and assists in dispelling accumulated gases in the stomach and intestines.

As an internal antiseptic, it is safe and effectual in medicinal doses, and can be administered in all cases of septic diseases.

* A fatal case of poisoning in the horse by creolin is recorded in the *Veterinary Journal*, February, 1906: 8 ounces of the drug were given by mistake, and death occurred after three days.

Externally, as surgical antiseptics, cyllin and Jeyes' Fluid are used, of the strength of from 1 to 2 per cent. solutions in water. In the case of extensive septic wounds this strength may be increased. They are also employed to sterilize instruments, etc.

The soluble fluid is stronger than either of those mentioned, and may be diluted in the proportion of 1 to 200 of water. Forming a clear solution with water, it is preferred as an antiseptic agent for surgical instruments, as it does not obscure them from view in the tray.

In the treatment of parasitic affections of the skin, cyllin is largely used, and may be combined with other agents. Care should be taken that it is properly diluted.

As a general disinfectant and deodorant for stables, cowsheds, kennels, and drains, Jeyes' Fluid is effectual, economical, and safe. Jeyes' Fluid is employed in the treatment of mange or scab in sheep, and dips containing this agent give good results.

The usual strength of solutions for affections of the skin is from 1 to 2 per cent., and glycerin or soft soap may be added with advantage.

Jeyes' Fluid forms an effectual parasiticide for the eradication of lice, ticks, etc., in all classes of animals, but requires to be well diluted with water and used with care in the case of dogs and cats.

Lysol is a clear brown syrupy liquid, first manufactured in Germany, and stated to be a solution of tar-oils in neutral soap, and to contain about 50 per cent. of cresols.

ACTIONS AND USES.—Lysol is *antiseptic*, *disinfectant*, and *deodorant*. It is stated to be five times stronger than carbolic acid as a germicide, and far less toxic. It is an agent of marked value as a *general antiseptic*, and may be used in solution of from 1 to 2 per cent.

Klondol has been introduced as a substitute for lysol, by Messrs. E. Cook and Son, Bow, London, E. Investigation has shown that it possesses higher germicidal powers than those of any of the other disinfectant agents. It is non-toxic, and, when properly diluted, non-irritant. From

experience of its use, we are enabled to state that it is preferable to all other antiseptics and disinfectants on the market. Solutions of 1 or 2 per cent. are suitable for the dressing of wounds and for the disinfection of surgical instruments. Klondol forms a clear solution with boiled water, it does not injure steel or plated instruments, and does not cause irritation of the hands. Combined with vaseline it forms an excellent antiseptic ointment. It is also of marked value as a uterine injection (1 to 2 per cent. solutions) in cases of putrid retained placenta and septic metritis.

Cofectant Fluid—also manufactured by Messrs. Cook—is a reliable agent as a general disinfectant.

Izal is a product distilled from coke, and is supplied in different forms—viz., medical izal, which is an emulsion containing 40 per cent. of izal-oil; izal fluid, which contains 40 per cent. of unrefined oil and is used for disinfecting purposes. Izal is employed as a disinfectant and antiseptic, and is said to be an intestinal disinfectant. Although stated to be non-toxic, Hobday has proved that in concentrated solutions it is an irritant narcotic poison, resembling creolin, but not quite so rapid or violent. The antidotes are similar to those mentioned for the latter.

Liquor Picis Carbonis.—Solution of coal-tar.

Liquor Carbonis Detergens.—This is an alcoholic solution of coal-tar. It is said to owe its properties in part to phenol.

These agents, diluted with 20 parts of water, are occasionally used as local applications in the treatment of skin affections in horses and cattle.

IODOFORMUM (IODOFORM).

PREPARED by the action of iodine on ethylic alcohol in the presence of solution of potassium carbonate (B.P.).

Iodoformi Pulvis.—This is in the form of very minute crystals, which do not tend to agglomerate.

Iodoformum Præcipitatum (Precipitated Iodoform) is in the form of an impalpable powder. It has a slight tendency to agglomerate, which interferes with its use as a dry dressing for wounds.

INCOMPATIBLES.—Calomel; nitrates and nitrites.

Collodium cum Iodoformo—Iodoform Collodion: Iodoform, 1; flexible collodion, 12. Used as a protective covering for wounds.

Unguentum Iodoformi—Iodoform, 1; yellow paraffin ointment, 9.

Iodoform Gauze contains 10 to 20 per cent. of iodoform. Iodoform Wool contains 10 per cent. of iodoform.

ACTIONS AND USES.—Iodoform is an *antiseptic*, a *deodorant*, and a *local anæsthetic*. According to some authorities, it is a feeble germicide and not fatal to bacteria, but it acts on their products, rendering the latter harmless. When in contact with wounds liberation of free iodine occurs, and on this its antiseptic action is believed to depend.

Although containing 96 per cent. of iodine, iodoform does not act as an irritant, either given internally or applied topically.

When applied to wounds, abrasions of the skin, and ulcers, it exerts slight local anæsthetic actions. Constitutional symptoms are seldom observed in animals as the result of absorption of iodoform from surgical dressings.

In the dog, however, care is necessary in order to prevent the animal from licking parts which have been dressed with this agent. The toxic symptoms which have been observed in the dog as the result of the ingestion of iodoform are vomiting, drowsiness, muscular tremors, cardiac depression, and if continued for some time, emaciation occurs.

Iodoform is not used internally in veterinary practice. Its chief use is in the treatment of wounds that have assumed an unhealthy character. It may be applied in the form of a dusting-powder, either undiluted or combined with boric acid. Iodoform also forms a useful constituent of uterine pessaries. In consequence of its tendency to promote excessive granulations in wounds, other agents are preferred to iodoform for general surgical purposes.

In the treatment of nasal gleet, after surgical measures have been adopted, the application of iodoform to the interior of the affected air sinuses gives good results.

A combination of iodoform, zinc oxide, and boric acid, forms an excellent application for the treatment of moist *canker of the ear* in the dog. A similar combination is of value as a dry dressing for *fissured* or *cracked heels* in the horse.

In *thrush* of the horse's foot equal parts of iodoform and calomel form an efficient dressing; and although the combination is incompatible, it proves useful. In spite of the large number of substitutes for iodoform that have been introduced from time to time, we have not found any that can replace it in the treatment of unhealthy wounds, ulcers, etc.

A useful antiseptic ointment is prepared with—Iodoform, 1 part; boric acid, 1 part; oil of eucalyptus, 1 part; vaseline and lanolin, of each 4 parts.

Iodoform collodion is employed as a protective covering to small wounds and to operation wounds, as it assists healing by first intention.

In the treatment of septic metritis, some practitioners, after thoroughly flushing out the uterus, advise the application of a 1 in 4 iodoform ointment to the interior of the organ.

Aristol—prepared by mixing a solution of iodine in potassium iodide with an alkaline thymol solution. It contains 46·2 per cent. of iodine, and is said to be non-toxic. It is recommended for the treatment of burns and scalds, also as a dusting-powder, combined with starch, etc., for wounds.

Several substances have been suggested as substitutes for iodoform, such as Iodol, Europhen, Loretin, Losophan, Iodoformal, Iodoformin, etc. They all contain iodine in varying amount, but do not possess sufficient advantages over iodoform to merit special attention.

Ichthyol—Ammonium Sulpho-Ichthyolate—is a viscid brown liquid obtained by heating the products of distillation of a bituminous quartz found in the Tyrol with sulphuric acid, and neutralizing with ammonia. The deposit from which this substance is obtained is believed to be the fossil remains of fish and other animals.

Ichthyol is a *local vascular sedative*, a *parasiticide*, and an *antiseptic*. If applied to a raw surface or to an inflamed skin,

it causes at first a sensation of smarting; this is succeeded by a feeble local anæsthetic and astringent action.

Ichthyol is recommended by Continental authorities as an efficient application in the treatment of chronic affections of the skin, such as eczema and psoriasis. It is advised in the treatment of parasitic skin affections, also as a local application in erysipelas and in rheumatism affecting joints. For these purposes it is employed in the form of ointment, the strength of which may vary from 10 to 50 per cent., the basis being lanolin. In combination with glycerin it is also useful as a local application in the treatment of erysipelas.

Thiol, a substance prepared by heating gas-oil with sulphur, resembles ichthyol in its composition and properties, and is recommended for similar purposes.

PARAFFINA (PARAFFINS).

These are arranged according to their consistency, as follows:

Paraffinum Durum—Hard Paraffin; Paraffin Wax.

This is usually obtained by distillation from shale. When sterilized, and having a melting-point between 110° and 115° F., it is employed in human surgery in plastic operations, being injected subcutaneously. A special rubber-covered syringe is used for this purpose to prevent the material cooling during injection. It is also used in the form of a submucous perirectal injection in the treatment of prolapsus ani. About 17 minims are injected into the part every ten seconds until desired results are obtained. Hobday has found it useful in cases of the latter affection occurring in canine practice.

Paraffinum Molle—Soft Paraffin.

This consists of some of the softer or more fluid members of the paraffin series of hydrocarbons, obtained by purifying the less volatile portions of petroleum. It is also known as vaselinum or vaseline. When soft paraffin is repeatedly filtered through animal charcoal, it becomes white in appearance; hence there occur two forms of soft paraffin—viz.,

the *yellow* and the *white*. Similar forms of vaseline are manufactured.

A variety of compounds resembling vaseline are manufactured, such as adepsine, chrisma, cosmoline, cremontine, petroleum jelly, etc.

Vaseline, or soft paraffin, is non-irritating to the skin and mucous membranes. It does not oxidize or become rancid, and thus is preferred to lard as a basis for ointments. It is not readily absorbed, and hence is employed as a basis for agents intended to have a surface action on the skin. Vaseline, medicated with antiseptic agents, is employed as a lubricant for surgical instruments.

Unguentum Paraffini—Paraffin Ointment.

PREPARED with hard paraffin, 27 grammes; soft paraffin (either yellow or white), 70 grammes; white beeswax, 3 grammes.

When used as a basis for white ointments, the white variety of soft paraffin is employed. Paraffin ointment, being firmer in consistence than soft paraffin, is used in the preparation of many ointments.

Paraffinum Liquidum, also known as Liquid Paraffin or White Vaseline-Oil, is a semi-liquid mixture of paraffins of low melting-point. It is the most useful agent we possess for the treatment of intestinal obstruction, or habitual constipation, in the dog, and is administered in doses of ʒii. to ʒiv. (See 'The Treatment of Intestinal Obstruction in the Dog,' Part III.)

Liquid paraffin is also employed as a basis for applications to the skin and for antiseptic liniments, and as a lubricant for surgical instruments.

Petroleum Benzine must be carefully distinguished from benzene, which is a product of coal-tar (see p. 326). It is an irritant to the skin if applied undiluted, and is also a germicide.

Paraffin-Oil, or lamp paraffin, if applied with friction, acts as a counter-irritant. Diluted with olive-oil, it is sometimes used as a dressing for follicular mange in the dog, and is said to prove effectual. For this purpose the refined paraffin-oil should be employed.

An instance of slow poisoning from paraffin-oil is recorded by Williams ('Principles and Practice of Veterinary Medicine'). This occurred in several cattle, the source of the poisoning being the refuse of paraffin works, which gained access to the stream supplying the animals with water. The symptoms observed were gradual loss of flesh and persistent diarrhœa. The post-mortem appearances were anæmia, wasting of the muscles, a greyish-black appearance of the intestines, and the presence of dull dark-grey or blackish spots therein. The mesenteric glands were enlarged, and both these as well as the lacteals were found to contain paraffin. The chief action of the agent seemed to be exerted on these glands, as the power of absorption was lost, the chyle vessels being rendered impermeable by the paraffin.

A point worthy of note is that some of the affected animals had ceased to have access to this stream for some months, and still the characteristic smell of paraffin was present in the organs of the body on post-mortem examination.

The antidote advised for paraffin-oil poisoning is the free use of stimulants, and in the dog emetics should be given in the early stages.

Paraffin-oil, in combination with other oils or with a solution of soap, forms an efficient dressing for cases of parasitic mange in the horse. It is also employed in the treatment of ringworm.

PHENOLPHTHALEIN.

Phenolphthaleinum (Phenolphthalein) may be obtained by heating phenol with phthalic anhydride and sulphuric acid and purifying the product. It is also known as Purgen. Phenolphthalein is a purgative, which is sometimes employed in canine practice, the dose being from 2 to 5 grs. In smaller doses it is a laxative, and has been found useful in hepatic affections and in chronic constipation in the dog and cat.

CHAPTER XI

PRUSSIC ACID

Acidum Hydrocyanicum Dilutum (Diluted Hydrocyanic Acid; Dilute Prussic Acid).

THIS is an aqueous solution containing 2 per cent. by weight of hydrogen cyanide.

PREPARED by the interaction of diluted sulphuric acid and potassium ferrocyanide, and subsequent distillation.

Acidum Hydrocyanicum (Scheele's) contains 4 per cent. of hydrogen cyanide.

DOSES.—Of the dilute acid: Horses and cattle, ♏ xx. to ʒi.; sheep, ♏ x. to ♏ xv.; pigs, ♏ iv. to ♏ vi.; dogs, ♏ ii. to ♏ v. The doses of Scheele's acid are one-half of the above.

INCOMPATIBLES.—Silver, copper, and iron salts.

ACTIONS.—*Externally* it acts as a local anæsthetic by depressing or paralyzing the superficial sensory nerves. If applied over a large area of skin, it can be absorbed and produces toxic effects.

Internally, in medicinal doses, it acts as a sedative to the gastric nerves. It enters the blood rapidly, and, according to Dixon, while it is in the circulation it profoundly affects metabolism, so that the tissues gradually lose their power of absorbing oxygen from the blood. As the result of a fatal dose, the blood becomes of a bright red colour; this is due to the tissues being unable to reduce the oxyhæmoglobin.

TOXIC ACTIONS.—Hydrocyanic acid is one of the quickest and most fatal poisons.

In the dog, a dose of from 40 to 60 minims may cause

death almost instantaneously by paralysis of the cardiac and respiratory centres. Usually, however, death occurs from asphyxia.

The drug, being very diffusible and volatile, is quickly absorbed. Immediately after administration the animal makes a few quick inspirations, utters a suppressed cry, falls in convulsions, and death occurs in from two to three minutes from respiratory arrest; the heart continues to beat for several minutes after respiration has ceased. In other instances death does not occur so rapidly, and the symptoms observed are dilatation of the pupils, impaired voluntary movement, weakness of the pulse, and tetanic convulsions.

Horses are not so susceptible to the medicinal acid, and in some experiments 3-drachm doses were taken without causing death.

The anhydrous acid, administered hypodermically in doses of 10 to 20 minims, has caused death in from one to two minutes. Doses of from 4 to 5 drachms of the diluted acid given by the mouth have caused death in about an hour in the horse.

The specific action of hydrocyanic acid is exerted on the central nervous system. The vasomotor, vagal, and respiratory centres are briefly excited and then paralyzed, causing convulsions and asphyxia. The blood-pressure is increased for a brief period, and then falls owing to vaso-dilatation; the nervo-muscular structures of the heart itself are depressed, and the cardiac action is slowed. The cerebrum and spinal cord are also depressed, and finally paralyzed, the results being tonic and clonic convulsions, succeeded by coma and paralysis of the voluntary muscles. Owing to the primary stimulation of the medulla, the respirations are first rendered quicker and deeper, but the breathing soon becomes slower and shallower.

The *post-mortem* appearances are not constant. In cases where death has been instantaneous the blood throughout the body is found of an arterial hue, and remains fluid for some hours. When death has occurred from paralysis of the respiratory centre, the usual appearance of asphyxia will

be present. If the autopsy be held within a short time after death, the characteristic odour of the drug will be evolved from the body.

ANTIDOTES.—Artificial respiration constitutes the most important means of treatment, but to be successful it must be carried out immediately after the poison has been taken. The subcutaneous injection of ether is also indicated. The other antidotes suggested are the hypodermic injection of atropine, in order to stimulate the cardiac and respiratory centres, the inhalation of the vapour of ammonia, the inhalation of oxygen, and the use of the hot and cold douche alternately over the head and neck.

The chemical antidote recommended is the administration of a ferric and ferrous salt, combined with magnesia or potassium carbonate. Oxide of iron freshly precipitated with magnesia is also advised; but obviously, with such a rapidly acting poison, chemical antidotes prove of little or no avail.

USES.—As a *gastric sedative*, hydrocyanic acid is prescribed in cases of gastritis in the dog. It lessens the irritability of the gastric nerves, arrests vomiting, and relieves pain. In such cases it may be prescribed with bismuth in an alkaline mixture. In obstinate vomiting, depending on any cause, hydrocyanic acid often proves useful, but in our experience chloretone is far more effectual. It is occasionally prescribed to allay the dry, irritable cough of asthma, but other drugs are safer and quite as effectual. It should be administered in minimum doses at first, and repeated at intervals, the effects being closely watched.

Hobday has found that a full medicinal dose of hydrocyanic acid, placed on the tongue, acts as an antidote to the toxic effects of chloroform in the dog. The beneficial result is believed to depend on the primary stimulation of the respiratory centre which occurs, and also on the deep inspirations produced. Artificial respiration should be carried out at the same time.

Hydrocyanic acid is occasionally prescribed along with other agents in the treatment of parasitic bronchitis in calves,

and may be added to the solution for intratracheal injection in doses of 5 minims. It assists in destroying the parasites, and relieves the cough by allaying bronchial irritation.

Hydrocyanic acid has been recommended in the treatment of tetanus, but the results obtained are not more encouraging than those from other agents. It also forms one of the constituents of chlorodyne (see p. 364).

Externally, hydrocyanic acid is employed in the form of a lotion to allay excessive itching of the skin in horses. One drachm of the dilute acid may be combined with 1½ ounces of glycerin and a pint of water. This must be applied with caution.

CHAPTER XII

THE VEGETABLE KINGDOM

Aconite.

Aconiti Radix—Aconite Root.

The dried root of *Aconitum Napellus* (Monk's-hood).

Tinctura Aconiti (B.P.)—Tincture of Aconite.

Powdered Aconite root 150 grammes in Alcohol 70 per cent., to produce by the percolation process a tincture containing 0·04 gramme of ether-soluble alkaloids in 100 millilitres of the tincture. This is twice as strong as the corresponding preparation of the B.P. of 1898.

DOSES.—Horses, ℥x. to ℥ss.; cattle, ℥i.; sheep and pigs, ℥v. to ℥x.; dogs, ℥i. to ℥v.

Fleming's Tincture of Aconite is about six times as strong as the above, and the doses are computed accordingly.

Extractum Aconiti Liquidum—Fluid Extract of Aconite. Standardized physiologically. Contains not less than 0·4 per cent. of aconitine, and is twenty times the strength of the B.P. tincture.

A powdered *dry extract* of aconite is prepared by Parke, Davis and Co., of which 1 grain represents 4 grains of powdered aconite root. Dose for horses, grs. ii. to grs. v.

Linimentum Aconiti—Liniment of Aconite.

PREPARED with Aconite root, Camphor, and Alcohol (90 per cent.), so that 100 millilitres contain 0·2 gramme of the ether-soluble alkaloids of aconite root, and 3 grammes of camphor.

Linimentum Aconiti Compositum—A.B.C. Liniment. Aconite Liniment, Belladonna Liniment, Chloroform Liniment, equal parts.

Aconitina—Aconitine. An alkaloid obtained from Aconite root.

DOSE.—For the horse, gr. $\frac{1}{60}$ to gr. $\frac{1}{20}$ by hypodermic injection.

Unguentum Aconitinæ—Aconitine Ointment.

Aconitine, 2 grammes; Oleic acid, 16 grammes; Prepared Lard, 82 grammes. This contains 2 per cent. of aconitine.

ACTIONS OF ACONITE.—*Externally*, aconite if applied to the skin or mucous membranes depresses and subsequently paralyzes the peripheral endings of sensory nerves, and thus removes sensation from the part. It is not absorbed from the unbroken skin unless it is rubbed in with chloroform, alcohol, or some fatty substance, but is readily taken into the system if applied to mucous surfaces. If injected hypodermically it causes a primary excitation of sensory nerve-endings, and thus induces pain.

Internally, aconite is rapidly absorbed from the stomach, enters the tissues quickly from the blood, and causes a primary excitation of the nerve-endings in various parts of the body, especially in those parts which are most sensitive. It possesses anodyne, sedative, antipyretic, mild diaphoretic, and diuretic actions. Small doses repeated at intervals lessen the frequency, force, and tension, of the pulse, lower blood-pressure, and reduce temperature. The fall in temperature probably depends on some central effect.

The exact mode by which aconite influences cardiac action is not understood. Some authorities believe that the slowness of pulse induced is due to excitation of the roots of the vagus. The secretions of the skin and salivary glands are increased, and the flow of urine is augmented both in solids and fluids.

TOXIC ACTIONS.—Aconite exerts its actions most markedly on the peripheral ends of sensory nerves, on the heart, respiration, medulla, and spinal cord. The drug causes irritation of the stomach, evidenced in the dog by violent vomiting and continuous retching. The primary effect on the circulation is slowing of the pulse, but the latter soon becomes frequent, irregular, and feeble, as the motor

ganglia in the heart and the roots of the vagus become paralyzed.

On respiration, the effect is that of depression; the respirations are at first slow and deep, but soon become shallow and laboured. The respiratory centre becomes paralyzed, and death usually occurs from asphyxia; but a very large dose may kill by syncope, depending on sudden paralysis of the cardiac muscle. Convulsions may precede death, and probably depend on indirect effects through the circulation.

On the nervous system, the chief action of aconite is on the medulla, which is first excited, then depressed, and finally paralyzed. The medullary effects are believed to be reflex and not central.

According to Dixon, it is doubtful if aconite has any action on the higher parts of the brain, and the convulsive movements sometimes observed depend on asphyxia.

In the horse the toxic dose of tincture of aconite is variable. In one instance, recorded by F. Smith, 4 ounces given to a pony, although causing alarming symptoms, did not prove fatal; but it is well known that preparations of aconite, unless physiologically standardized, are notoriously unreliable. The usual symptoms observed are salivation, champing of the jaws, frequent attempts at swallowing, a weak and very compressible pulse, regurgitation of air and fluid from the nostrils, sweating, pallid mucous membranes, muscular twitching, shallow, irregular breathing, and frequent attempts at vomition. In some instances evidences of irritation of the stomach and intestines are present, consisting of nausea, colicky pains, and diarrhœa, and in the later stages paralysis of the limbs occurs.

Cattle are less susceptible to the action of the drug, and take far larger doses without exhibiting toxic symptoms.

Dogs are very susceptible, and in some instances recorded 1 drachm of Fleming's tincture caused death in thirty minutes. The symptoms observed are violent vomiting, retching, salivation, muscular weakness, and paralysis of the posterior extremities. The toxic dose is variable.

The *post-mortem* appearances recorded are the presence

of frothy mucus in the trachea and bronchi, the lungs collapsed and anæmic, the right side of the heart distended with blood, and the left side empty.

Aconitine is a very active poison, a dose of $\frac{1}{20}$ grain inducing toxic symptoms in the horse in a few minutes. The prominent symptoms observed in fatal cases are salivation, grinding of the teeth, abdominal pain, and tetanic convulsions.

ANTIDOTES.—In the dog, if seen immediately after the drug has been taken, emetics should be administered without delay. The most effectual is apomorphine, given hypodermically, the dose being $\frac{1}{15}$ to $\frac{1}{10}$ grain.

Stimulants, such as alcohol and ammonia, are indicated; but, as there is usually difficulty in swallowing, the hypodermic injection of ether is best.

Atropine is recommended in the form of hypodermic injection—for the dog $\frac{1}{50}$ grain, and for the horse $\frac{1}{2}$ grain; the dose is to be repeated in fifteen minutes if the pulse does not improve.

Other antidotes suggested are digitalin and inhalations of amyl nitrite. The body and extremities should be kept warm, and artificial respiration adopted.

MEDICINAL USES.—Aconite is not so frequently employed in the present day as in former times. Being a powerful depressing agent, its use is contra-indicated in most cases of respiratory affections, and other drugs are found safer and more effectual as febrifuges. Its chief use in veterinary practice is in the treatment of laminitis, in which disease it relieves pain and reduces the force and frequency of the pulse. It should be administered at first in a full dose, and afterwards repeated every two hours in half-doses, being combined with acetate of ammonium and salines. It is readily taken in the drinking-water.

In the early stages of erysipelas in the horse aconite is also useful. In chronic cough in the horse, powdered extract of aconite, in combination with other respiratory sedatives, is employed with temporary benefit, and it enters into the composition of a well-known patent preparation for this purpose.

Aconite is sometimes prescribed in the early stages of pericarditis. It is recommended by some practitioners in the treatment of enteritis, but we fail to see any beneficial effect which it can produce in this condition.

Externally, aconite in the form of liniment is applied as a local anodyne to the swollen painful joints in rheumatic cases. Aconitine ointment is occasionally employed for a similar purpose.

The danger of absorption should be remembered, and aconite in any form should not be used as an external application for the dog.

Veratrine.

Veratrina—Veratrine—an alkaloid or mixture of alkaloids obtained from Cevadilla or Sabadilla, the dried ripe seeds of *Schœnocaulon officinale*—a Mexican plant. It is said to consist of cevadine and cervine, as well as veratrine.

DOSES.—Horses, grs. i. to gr. iii. given *per os*, gr. ss. to gr. i. by hypodermic injection; cattle, grs. ii. to grs. v. *per os*, gr. i. to grs. iii. by hypodermic injection.

ACTIONS.—Veratrine in some respects has similar actions to aconite.

Externally, it is an irritant to the skin and mucous surfaces; its secondary action is to depress the terminations of sensory nerves, and cause loss of sensibility in the parts to which it is applied.

Internally, veratrine exerts marked effects on the nerves, circulation, respiration, and muscles. It is stated to have no marked action on the brain or spinal cord, but it increases the excitability of motor nerves, and ultimately causes paralysis of their peripheral ends. It stimulates the peripheral ends of sensory nerves and then paralyzes them. It has a special action on the muscles, increasing their contractile power, and producing a well-marked lengthening of their contraction. It also stimulates contraction of the muscular coats of the stomach and intestines, and thus increases peristaltic action. The effect on the heart is to lengthen its contractions and to reduce the frequency of the

pulse; large doses lower blood-pressure, and cause a slow, feeble, and irregular pulse. Respiration is at first accelerated, but the effect of toxic doses is to lessen its rapidity and finally to paralyze the respiratory centre, death occurring from asphyxia.

Toxic doses in the horse cause salivation, purging, attempts at vomition, shallow respiration, muscular twitching, and violent contraction of the abdominal muscles.

In the dog, emesis occurs, also paralysis of the extremities, preceded by convulsions.

MEDICINAL USES.—Veratrine is seldom prescribed by British practitioners. Continental authorities recommend it in the treatment of gastric impaction in cattle, a dose of from 2 to 3 grains being injected hypodermically.

Some authors advise $\frac{5}{8}$ grain administered by subcutaneous injection for this condition, and repeated every two hours until the desired effect is produced. The drug may be combined with strychnine and eserine.

Veratrine is also employed in the treatment of chronic cough and broken wind, in combination with strychnine and ergotin. It forms one of the constituents of several patent preparations which are largely advertised for the cure of the conditions mentioned.

In cases of chronic rheumatism affecting the shoulder in horses, Friedberger advises a dose of $\frac{1}{2}$ grain to $1\frac{1}{2}$ grains of veratrine dissolved in alcohol to be injected deeply into the muscles. The smaller dose is first injected daily, and the amount is gradually increased; the treatment is omitted every fourth or fifth day, and the horse is forced to walk after each injection until the excitement produced by the treatment subsides. Veratrine, in combination with eserine and pilocarpine, is suggested in the treatment of impaction of the colon in the horse, but in consequence of its violent action, when injected hypodermically, we cannot regard it as a safe agent for the condition mentioned. The drug should not be prescribed in canine practice.

Stavesacre.

Staphisagriæ Semina—Stavesacre Seeds.

The dried ripe seeds of *Delphinium Staphisagria*, a species of Larkspur. They contain the alkaloids Delphinine and Staphisagrine, and also an oil, the Oleum Staphisagriæ.

Delphinine resembles aconitine in its actions in many respects. Staphisagrine paralyzes motor nerves and arrests respiration, thus resembling curare in its actions.

ACTIONS AND USES.—Strong solutions of stavesacre, if applied too freely to the denuded skin of the dog, or if licked by the animal, become absorbed and may produce toxic symptoms, evidenced by nausea, cardiac weakness, and prostration.

The chief use of this agent in veterinary practice is as a parasiticide. A decoction prepared by boiling 1 part of the bruised seeds in 20 to 30 parts of water for two hours is employed for the destruction of lice, and should be rubbed into the skin; it destroys both the pediculi and their eggs. An ointment is also employed, and is prepared with 20 grammes of stavesacre seeds crushed, and 85 grammes of benzoated lard; this is heated on a water-bath for two hours, then strained, 10 grammes of yellow beeswax are added, and the entire components dissolved by heat. This ointment may be used in the treatment of mange in the horse.

One part of oil of stavesacre in 6 to 12 parts of olive or almond oil also forms an effectual parasiticide for pediculi.

These preparations should be used with caution in canine practice.

In the treatment of eczema and mange in small pet dogs, oil of stavesacre may be combined with zinc oxide, sulphur, balsam of Peru, and lanolin. (See Appendix.)

Colchicum.

Colchici Cormus—Colchicum Corm. The fresh corm of *Colchicum autumnale*, the Autumn Crocus or Meadow Saffron, dried and powdered.

DOSES.—Horses, ʒss. to ʒi.; cattle, ʒi. to ʒii.; sheep, grs. x. to grs. xxv.; dogs, grs. ii. to grs. viii.

Colchici Semina—Colchicum Seeds. The dried ripe seeds of *Colchicum autumnale*. These are said to be one-third stronger in amount of alkaloid than the corms.

Tinctura Colchici—Tincture of Colchicum: Colchicum seeds, 100 grammes; Alcohol (70 per cent.) sufficient to produce 1,000 millilitres.

DOSES.—Horses, ʒii. to ℥ss.; cattle, ℥ss. to ʒi.; dogs, ♏ v. to ♏ x.

Colchicina—Colchicine—is an alkaloid found in colchicum. It is seldom used in veterinary practice.

DOSES.—By hypodermic injection: horses, gr. $\frac{1}{3}$ to grs. ii.; dogs, gr. $\frac{1}{120}$ to gr. $\frac{1}{60}$.

ACTIONS OF COLCHICUM.—In *medicinal* doses it is a *diuretic*, but its action in this respect is at times uncertain. Authorities differ with reference to the precise action of this drug on the secretion of urine. Some state that it increases the amount of solid constituents excreted, others that it augments the fluid portion. Experiments show that it does not increase the excretion of either uric acid or the fluid part of the urine. Full doses exert a *purgative* action.

TOXIC ACTIONS.—Colchicum in toxic doses, or in full doses repeated, produces gastro-intestinal irritation, purging, cardiac depression, abdominal pain, rapid thready pulse, and death from collapse. The sensory nerves become paralyzed, also the spinal cord, but the motor nerves and muscles are unaffected, and the agent is said to exert no well-marked action on the brain. Cases are on record of colchicum-poisoning in the horse resulting from the stalks, leaves, and seeds, of this plant being mixed with hay. The symptoms observed were colic, tympanites, purging, and great depression, death occurring in twenty-four hours. The autopsy showed acute gastritis, with patches of erosion on the gastric mucous membrane.

It is a 'slow poison,' and its effects on the central nervous system may not be apparent until three to six hours after ingestion.

In cattle the toxic symptoms observed were abdominal

pain, violent purging (the excreta containing blood), an imperceptible pulse, and coma. The post-mortem appearances were those of acute gastritis, with patches of erosion.

The dog is more susceptible to the toxic effects of the drug than herbivora, the prominent symptoms observed being vomiting, purging, blood-stained evacuations, and death from collapse.

According to some authors, colchicine has a marked action on leucocytosis. It first expels the leucocytes from the circulation, and next causes an increase in their number in the peripheral circulation.

The suitable *antidotes* are demulcents, such as white of egg, arrowroot, barley-water, linseed-tea, etc. Tannic or gallic acid in large doses act as chemical antidotes, and should be frequently repeated. If there be signs of collapse, stimulants such as alcohol and ammonia are indicated. If pain be a prominent symptom, a hypodermic injection of morphine should be given. In the dog, the early treatment should consist of an emetic, if vomiting be not induced by the drug itself.

MEDICINAL USES.—In cases of chronic rheumatism, colchicum combined with sulphate of magnesia sometimes gives favourable results. By its diuretic action it is believed to assist in removing the products of the disease, but its specific action is doubtful, and other agents have taken its place, not only in the treatment of rheumatism, but in other affections. In combination with potassium iodide, it has been recommended in the treatment of rheumatic pericarditis in the horse.

A proprietary preparation known as 'Colchi-Sal' contains colchicine, and is useful in the treatment of muscular rheumatism in the dog. It is conveniently dispensed in the form of capsules.

CHAPTER XIII

THE VEGETABLE KINGDOM (*Continued*)

Opium.

THE milky exudation obtained by incision from the unripe capsules of *Papaver somniferum*—the White Poppy. This exudation is inspissated by spontaneous evaporation. The Turkey opium is preferred for pharmacy.

Opium, when dried and powdered, should contain between 9·5 and 10·5 per cent. of anhydrous morphine.

DOSES OF POWDERED OPIUM.—Horses, ʒi. to ʒii.; cattle, ʒii. to ʒiii.; sheep, grs. x. to grs. xxx.; dogs, gr. ss. to grs. ii. These doses must be modified according to the size of the animals and to circumstances.

INCOMPATIBLES OF OPIUM.—Alkaline carbonates, lime-water, salts of lead, iron, copper, mercury, and zinc, liquor arsenicalis, and vegetable astringents.

PREPARATIONS OF OPIUM EMPLOYED IN VETERINARY PRACTICE.

Tinctura Opii—Tincture of Opium; Laudanum. This consists of Opium treated with Distilled Water and Alcohol, and standardized to contain 1 gramme of anhydrous morphine in 100 millilitres. It contains 1 grain of Morphine in 110 minims, and about 44 grains of Opium in each fluid ounce, and is about one-third stronger than the corresponding preparation of the B.P. of 1898.

DOSES.—Horses and cattle, ʒi. to ʒiii.; sheep and pigs, ʒii. to ʒiv.; dogs, ♏v. to ♏xx. These doses should be modified according to requirements.

Extractum Opii Liquidum—Liquid Extract of Opium.

This contains 0·75 gramme of anhydrous Morphine in 100 millilitres; 110 minims contain ¾ grain of Morphine.

Extractum Opii Siccum—Dry Extract of Opium. This contains 20 grammes of anhydrous Morphine in 100 grammes (20 per cent. of morphine).

Fluid Extract of Opium (Parke, Davis and Co.). In this preparation 1 fluid ounce approximately represents ½ ounce of opium, and 20 minims represents 10 grains of opium.

Tinctura Camphoræ Composita—Compound Tincture of Camphor; Paregoric. This contains Tincture of Opium, Camphor, Benzoic Acid, Oil of Anise, and Alcohol. One drachm contains about ¼ grain of opium.

The suitable doses of this preparation are double those stated for tincture of opium (see p. 360).

Pulvis Ipecacuanhæ Compositus (Dover's Powder) is prepared with 1 part each of Opium and Ipecacuanha, and 8 parts of Potassium Sulphate. This powder contains 10 per cent. of opium.

Unguentum Gallæ cum Opio. This ointment contains 7·5 per cent. of Opium, with Galls, 1 part, and Benzoated Lard, 4 parts.

It is employed as a local application in the treatment of hæmorrhoids in the dog.

Liquor Opii Sedativus (Battley). This is a proprietary preparation of opium. It resembles the liquid extract, but is stronger, and is said to be superior to the tincture as an anodyne and sedative.

Its high price prohibits its employment for the horse, but in canine practice it is prescribed in doses of from 5 to 10 minims.

Opium contains a number of constituents, among which are many alkaloids. Of the latter the most important are Morphine, Heroin, Codeine, and Thebaine. Codeine may be obtained from opium or prepared from morphine; heroin is a morphine derivative.

Morphina—Morphine.

This alkaloid is the most important, as the anodyne and sedative actions of opium are principally due to its presence.

It is obtained from opium by complex chemical processes. In consequence of its slight solubility in water, it is not used in its alkaloidal form, but by combining it with an acid it forms a salt which is soluble.

The salts of morphine are the Hydrochloride, the Acetate, the Sulphate, and the Tartrate.

Morphinæ Hydrochloridum — Morphine Hydrochloride. This was formerly known as the Hydrochlorate of Morphine. It is the salt of morphine most commonly employed.

Doses.—By hypodermic injection: Horses, grs. ii. to grs. iv.; cattle, grs. iv.; sheep and pigs, gr. ss. to gr. i.; dogs, gr. $\frac{1}{8}$ to gr. $\frac{1}{4}$. If given by the mouth, double these doses will be necessary.

Liquor Morphinæ Hydrochloridi (B.P.). — Morphine Hydrochloride, 1 gramme; Diluted Hydrochloric Acid, 2 millilitres; Alcohol (90 per cent.), 25 millilitres; Distilled Water, sufficient to produce 100 millilitres. This preparation contains 1 gramme of Morphine Hydrochloride in 100 millilitres; 110 minims contain 1 grain, and 11 minims contain $\frac{1}{10}$ grain.

The hypodermic dose for the dog is from 10 to 20 minims.

For the horse, a more convenient solution for hypodermic use is prepared, which contains 2 grains of morphine hydrochloride in each 25 minims.

Tabloids and pellets containing accurate doses of this salt are now prepared by chemists. They are readily soluble in water, and are both convenient and reliable for forming hypodermic injections.

The other salts of morphine—viz., Morphinæ Acetas, Morphinæ Sulphas, and Morphinæ Tartras—may be prescribed in similar doses to the hydrochloride.

Injectio Morphinæ Hypodermica—the official hypodermic injection of morphine of the British Pharmacopœia—contains 2·5 grammes of Morphine Tartrate in 110 millilitres; 110 minims contain 2·5 grains. This injection is about one-half the strength of the corresponding preparation of the B.P. of 1898.

The dose for the horse is about 80 to 120 minims, and for the dog 5 to 10 minims.

INCOMPATIBLES of morphine salts are similar to those mentioned under opium.

Apomorphinæ Hydrochloridum—Apomorphine Hydrochloride. This is a derivative of morphine.

Its chief use is as an *emetic* for the dog in cases of poisoning. It exerts its emetic effect by acting on the vomiting centre in the medulla, and, administered by hypodermic injection, it usually acts in from two to three minutes, producing little nausea or depression.

In cases of narcotic poisoning, however, apomorphine may fail to act owing to a depressed condition of the vomiting centre. It is especially useful when there is inability to swallow.

DOSE.—By hypodermic injection: For the dog, $\frac{1}{25}$ to $\frac{1}{10}$ grain; or by the mouth, $\frac{1}{10}$ to $\frac{1}{5}$ grain. Gray advises that large doses of the drug should be avoided, and considers that better results as an emetic are obtained by doses such as $\frac{1}{50}$ to $\frac{1}{10}$ grain administered hypodermically. Tabloids or pellets containing the requisite doses are supplied by chemists. It also possesses expectorant actions, and is prescribed in doses of $\frac{1}{50}$ to $\frac{1}{40}$ grain in cases of acute and chronic bronchitis.

Injectio Apomorphinæ Hypodermica (B.P.)—Hypodermic Injection of Apomorphine. This preparation contains 1 grain of Apomorphine Hydrochloride in 110 minims. It should be recently prepared. Dose for the dog, ℥v. to ℥x.

Codeina—Codeine—an alkaloid obtained from opium or from morphine. It is a methylic ether of morphine.

Codeine is sometimes employed in the treatment of diabetes mellitus in the dog, and occasionally proves useful.

The dose is from $\frac{1}{4}$ to $\frac{1}{2}$ grain three times a day at first, and then increased gradually until the sugar disappears from the urine or increasing drowsiness occurs. The drug is also prescribed in cases of chronic bronchitis and bronchial asthma in the dog.

Thebaine is present to the extent of 0·3 per cent. in opium. It resembles in its actions strychnine more than morphine, as it stimulates the motor tract of the spinal cord and produces convulsions. It is of no therapeutical interest.

Tinctura Chloroformi et Morphinæ Composita—Chlorodyne.

The chlorodyne of the British Pharmacopœia is composed of Morphine Hydrochloride, Dilute Hydrocyanic Acid, Chloroform, Tincture of Indian Hemp, Tincture of Capsicum, Oil of Peppermint, Glycerin, and Alcohol. Each 10 minims of this preparation contains morphine hydrochloride $\frac{1}{11}$ grain; chloroform $\frac{3}{4}$ minim; dilute hydrocyanic acid $\frac{1}{2}$ minim; tincture of Indian hemp 1 minim; and tincture of capsicum $\frac{1}{4}$ minim.

The dose for horses and cattle is from ℥ii. to ℥ss., and for dogs from ♏v. to ♏xv.

Various formulæ are employed in the preparation of chlorodyne for veterinary purposes. The amount of morphine present is usually 4 grains to the fluid ounce.

Actions of Opium.

In consequence of the number of alkaloids present in opium, its actions are complex.

Externally.—It was formerly believed that opium or morphine applied locally lessened the sensibility of sensory nerves. According to modern observers this is erroneous, as the drug has no action on either motor or sensory nerve-endings. If local pain be relieved by the application of the agent, the result is probably due to absorption of the drug.

Internally, medicinal doses diminish the secretion of saliva and cause dryness of the mouth. Large doses, however, may cause an increased flow of saliva.

On the Alimentary Canal.—Experimentally it has been shown that, if a comparatively large dose of opium be injected subcutaneously or intravenously in the dog or cat, purgation with vomiting is produced. This initial effect of the drug is said to be due to paralysis of the splanchnic nerve. This is the inhibitory nerve to the intestine, and by diminishing inhibitory influences peristaltic movements are augmented. But if a medicinal dose of the agent be given, there is no initial increase of peristaltic movements, and the opposite effect is produced—viz., diminished peristalsis,

This is believed to depend on depression of some part of the peripheral nervous mechanism. Morphine, even when injected subcutaneously, is excreted by the alimentary canal, and it is believed that its effects on peristaltic movements are produced during its excretion. Large doses produce a paralyzed condition of the intestines.

In the horse we find that opium or morphine, given either in small or large doses, does not produce increased peristalsis, but has the opposite effect. In this animal the actions of opium are comparatively slowly developed when the drug is administered by the mouth, as absorption is slow.

On the Nervous System.—The actions of opium and morphine differ considerably in man and in the horse.

In man the higher centres of the cerebrum are developed to a far greater degree than in animals, hence the chief effect of the drug is to induce sleep; this may be preceded by a brief period of excitement. The soporific effect is believed to depend on depression of the sensory nerve cells in the brain. The motor cells are only very slightly affected.

In the horse these higher brain-centres are less developed, but there is relatively more development of the locomotor centres and of the reflex centres of the spinal cord. Hence the sedative and hypnotic effects of opium are by no means so well marked as in man, and, if full or repeated doses be given, the drug produces symptoms of excitement, evidenced by restlessness, pawing, and walking in a circular direction. This is followed after an indefinite period by drowsiness, a staggering gait, and extreme nausea. These effects depend on stimulation of the locomotor centres and of the reflex centres in the spinal cord.

In some cases moderate doses may produce a sedative effect, and relieve the pain of ordinary spasmodic colic. But in cases of prolonged pain, such as that depending on impaction of the intestine, and in the violent pain of enteritis, volvulus, etc., moderate doses produce no analgesic action, and if full doses be given the characteristic symptoms of excitement are induced.

In ruminants full doses also produce excitement, and it is

only after large amounts have been administered that the hypnotic effects of the drug become manifest. In the dog moderate doses exert a primary exciting effect; this is followed by sleep. Full doses cause preliminary excitement, but the hypnotic action of the drug is not so well marked as in man, and the sleep induced is accompanied by muscular twitchings and is not profound. In the cat, full doses of morphine induce marked restlessness and excitement.

The Sensory Nerves are first depressed and then paralyzed. According to some authors, the drug acts first on the sensory centres, and next on the peripheral terminations and on the nerve-trunks. The result of this action is that the sensibility of all organs of the body is diminished, and pain cannot be originated therein. In toxic doses opium paralyzes the vital centres in the medulla, and death is caused by asphyxia, depending on paralysis of the respiratory centre.

On the Heart and Circulation.—According to Dixon, morphine has little effect on the heart or vessels. Owing to a slight depressing action on the medulla, it causes dilatation of the cutaneous bloodvessels, but has little effect on other vessels, and hence has hardly any influence on blood-pressure.

On Respiration opium acts as a *depressant*, not only exerting this action on the respiratory centre, but also on the pulmonary branches of the vagus. The result of this depression is that reflex respiratory acts, such as coughing, etc., are less liable to occur. Toxic doses arrest respiration by paralysis of the respiratory centre. The bronchial secretions are diminished, this being probably due to the action of the drug on the bronchial glands.

On the Skin.—Moderate doses in the horse do not produce any appreciable effect on the cutaneous secretion, but large or repeated amounts may cause sweating. Toxic doses may produce profuse sweating towards the later stages, probably depending on stimulation of the sweat centres in the spinal cord induced by the venous condition of the blood.

In the dog a dry, congested condition of the skin is observed.

On the Kidneys.—Morphine has no influence on the secre-

tion of urine. It may, however, remove the desire for micturition, so that a distended bladder may be present, and no attempts at urination may be made by the animal.

On the Eye.—In the horse the pupil is generally dilated by opium, this depending on some special action of the drug on the central nervous system. Topical application produces no effect on this organ.

In the dog the pupil is contracted while the animal is under the narcotic influence of the drug.

Opium is excreted by the alimentary canal, and only a trace can be detected in the urine. Excretion commences rapidly, but after full doses have been administered it may not be completed for several days. Morphine can be detected in the stomach even when it has been administered by hypodermic injection. On this probably depend the nauseating effects of full doses of opium which occur in all animals.

Toxic Actions.—Experiments have demonstrated that large doses of opium or morphine can be tolerated by the horse without producing fatal effects. In cases of acute abdominal pain still larger amounts can be given, as the drug under these conditions appears to lose its full effects.

The toxic dose of morphine sufficient to cause death in the horse is said to be from 45 to 75 grains, administered hypodermically, and of opium from 2 to 2½ ounces, given by the mouth. Of course, individual susceptibility has an important influence on the toxic actions of this drug, and in some instances delirium is more easily induced than in others.

In some nervous, excitable horses 4 or 5 grains may produce the characteristic symptoms already mentioned. Excessive doses induce violent delirium in some horses: the animals become partially blind, and rush against surrounding objects; the gait is staggering, sweating is profuse, and respiration is laboured. When the violent symptoms subside marked depression results; the animal stands immovable, and appears to suffer extreme nausea. Constipation is also present. In those cases where toxic doses have caused death, convulsions preceded the fatal termination.

In the dog, toxic doses of opium or morphine cause vomiting, delirium, clonic spasms, and stertorous breathing. The toxic dose of morphine is from 2 to 3 grains.

The *post-mortem* appearances are those of death from asphyxia. The ventricles of the brain contain a quantity of serous fluid, the cerebral and spinal veins are distended, and slight extravasation of blood into the tissues may be observed.

ANTIDOTES.—Cases of poisoning by opium are very rare in animals. The exciting effects of the drug that occur in the horse after full and repeated doses have been given for the relief of pain usually pass off without any treatment being necessary.

The following antidotes are recommended: potassium permanganate, 6 grains of which are said to neutralize 1 ounce of laudanum. The addition to this of acetic acid or vinegar renders it a more effectual antidote.

In the dog emetics should first be given. If the ordinary ones do not succeed, the hypodermic injection of apomorphine may be tried, but it may fail to act. Measures should be adopted to rouse the animal, and the alternate use of hot and cold water as a douche to the head and neck is useful. Artificial respiration should be resorted to, and the surface of the body must be kept warm.

The hypodermic injection of atropine is also advised as a stimulant to the respiratory centre. This requires great discrimination. The hypodermic injection of strychnine has given good results. Strong coffee is also recommended in the form of enemata.

ACTIONS OF THE PRINCIPAL ALKALOIDS OF OPIUM.

Morphine.—The actions of opium depend chiefly on morphine. Morphine is more readily absorbed than opium, and acts more quickly. It is also said to be less constipating and less nauseating. Morphine is of definite composition, while opium is often variable. It exerts more pronounced sedative effects, in consequence of the absence of constituents possessing convulsant actions that are present in opium.

Another advantage of morphine is that it can be administered by hypodermic injection. Opium exerts a marked local action on the intestines, and hence is preferred to morphine in the treatment of diarrhœa and dysentery.

Codeine possesses slight hypnotic actions. Large doses cause muscular twitching, irregular movements of the limbs, and symptoms of general excitement. Toxic doses produce convulsions. It also lessens the irritability of the respiratory nerves, and thus acts as a respiratory sedative. The explanation of its therapeutic action in cases of diabetes mellitus is not definitely determined. Owing to its depressant action on sympathetic nerve cells, it causes vaso-dilatation and a fall in blood-pressure. It is less depressant to the respiratory centre than morphine.

Apomorphine, as already mentioned, acts as a prompt emetic in carnivora. Toxic doses in the dog stimulate the motor centres of the central nervous system, causing in some instances 'circus movements,' the animal running unceasingly in a circle, the respirations are accelerated, tetanic convulsions occur, and death results from asphyxia.

In the horse doses of 2 grains cause delirium, sweating, and marked respiratory distress.

Circumstances modifying the Action of Opium and Morphine.

(*a*) *Susceptibility.*—In young animals opium is more quickly absorbed than in adults, and the effects on the nervous system are more marked. Hence discrimination is necessary in prescribing it for the former, and the doses must be carefully regulated. An idiosyncrasy to the action of the drug is met with in some horses, even moderate doses exerting exciting effects.

(*b*) *Disease.*—In cases characterized by the presence of severe pain, large doses of opium are tolerated without producing toxic effects. In gastric and intestinal affections, where absorption is retarded, full doses of opium administered by the mouth may produce little or no effect.

(*c*) *Combinations with Other Drugs.*—Morphine is often prescribed in combination with atropine. The latter drug

is said to prevent or relieve certain undesirable effects of the former, such as nausea, depression, and constipation. We have never found any advantage from this combination, and in the horse the atropine appears to intensify the exciting effects of the morphine.

In some respects the actions of atropine are antagonistic to those of morphine. Thus atropine stimulates the respiratory centre, and morphine depresses it. Atropine acts as an anhydrotic by influencing the terminal nerves in the sweat-glands. Morphine produces diaphoretic effects by causing cutaneous vaso-dilatation. Atropine depresses the inhibitory branches of the splanchnic nerves, and thus tends to increase peristaltic action of the intestines. Morphine lessens peristaltic action, and induces constipation. Chloral, combined with morphine, lessens the tendency of the latter to produce exciting effects.

Medicinal Uses of Opium and Morphine.

As an anodyne, opium in various forms has from the earliest times been prescribed in cases of abdominal pain in the horse. In recent years, however, practitioners have observed that many cases of simple colic recover spontaneously or with the assistance of a diffusible stimulant, and the tendency to commence treatment by the administration of an opiate is altered in accordance with modern views.

If the pain depends on the presence of irritating ingesta in the intestines, or on impaction of the double colon, it is apparent that opiates are contra-indicated, as they interfere with peristaltic action and increase the tendency to paralysis of the intestines which is already present. In such cases chloral hydrate combined with a purgative is the rational treatment to adopt.

In cases such as acute enteritis, volvulus, etc., which prove fatal in spite of every form of treatment, all that the practitioner can do is to administer anodynes to relieve pain. Full doses of opium or morphine produce excitement and delirium, while ordinary doses have no effect. Hence chloral hydrate is far preferable as an anodyne in such instances.

In the treatment of diarrhœa and dysentery, opium is a valuable agent, and may be combined with astringents such as chalk, catechu, etc. In such cases chlorodyne often proves more effectual than other preparations of opium.

In cases of eversion of the uterus, bladder, rectum, or vagina, the use of opium is indicated. It prevents the patient from straining, and thus ensures that the everted organ will remain *in sitû* when replaced.

Morphine is sometimes given prior to the administration of chloroform, and in some instances it shortens the period of excitement. In others it has the opposite effect.

A combination of morphine with hyoscine hydrobromide is largely used by American practitioners for the above purpose, and also as a sedative for rendering vicious horses docile while being shod or clipped. Discrimination as regards dosage is, however, necessary, as otherwise excitement is produced instead of a sedative effect. We have seen a very serious attack of intestinal tympany occur in a hunter that was a 'wind-sucker,' some hours after the administration of a full dose of the above combination.

In canine practice opium proves an efficient anodyne; but the doses must be carefully regulated, otherwise vomiting and extreme nausea result.

In cases of abdominal pain in the dog, discrimination is necessary in prescribing opiates, as they mask the symptoms, and thus may lead the practitioner to overlook the necessity for performing laparotomy. This operation, if it is to be of any value, must be carried out before the vital powers of the animal become exhausted, and, if the symptoms which indicate its employment be disguised by opiates, an erroneous diagnosis and a fatal result will ensue. We must also take into consideration the depressing effects of opium in such cases, which must tell against the success of the operation.

Morphine administered by hypodermic injection is sometimes employed to produce a condition of narcosis in the dog, during which even major operations may be performed.

From gr. $\frac{1}{10}$ to gr. i., according to the size of the patient, is administered by hypodermic injection for this purpose. It

is also advised in doses of gr. $\frac{1}{30}$ to gr. $\frac{1}{10}$, as a preliminary procedure to the administration of chloroform. For such a purpose it is given about twenty or thirty minutes prior to the anæsthetic. American practitioners employ a combination of morphine hydrobromide gr. $\frac{1}{4}$, hyoscine hydrobromide gr. $\frac{1}{100}$, and cactoid gr. $\frac{1}{64}$, as an anæsthetic for dogs. The combination, under the name of H.M.C., is prepared in the form of tablets each containing the above doses. One to three tablets (according to the size of the animal) are administered subcutaneously, and repeated in forty-five minutes. In fifteen minutes after the second injection a few whiffs of chloroform are given, and the patient is then fit for operation.

Morphine is an antidote to strychnine-poisoning in the dog, and F. Smith recorded a case in which the hypodermic injection of 5 grains of morphine brought about a successful result in an apparently hopeless case of strychnine-poisoning in this animal.

Externally, opium is employed in the form of liniment as a local anodyne to bruises, contusions, and superficial inflammations, but its effect in this direction is doubtful (see p. 364).

Contra-Indications of Opium and Morphine.

(*a*) In affections of the brain, such as congestion or inflammation of this organ, opiates should be avoided, as they increase the tendency to coma. In meningitis they have no effect in medicinal doses, and in full amounts they increase the excitement and struggling movements of the patient.

(*b*) In diseases of the respiratory organs, with shallow, distressed breathing, opiates, by their depressing effect on the respiratory centre, increase the tendency to asphyxia. They should also be avoided in cases of bronchitis.

(*c*) In affections of the kidneys it was formerly held that opiates should not be given. But as these agents have no effect on the secretion of urine, and are not excreted by the kidneys, this objection cannot be maintained. If there be any real objection to the employment of opium or morphine in renal affections it is on account of the constipation

which these agents produce. In uræmia opiates prove of no value.

(*d*) In cases of abdominal pain in the horse, opiates should be avoided (see p. 370).

Heroin, also known as **Heroine.**—This is a derivative of morphine, and is technically known as Diacetyl-Morphine.

From the above is prepared—

Heroin Hydrochloride — Diacetyl - Morphine Hydrochloride.

This salt is the form in which the drug is prescribed.

Doses.—Horses, gr. ss. to gr. i. *per os*, repeated every four hours; dogs, gr. $\frac{1}{40}$ to gr. $\frac{1}{6}$, every three hours.

Incompatibles.—Alkalies, such as sodium bicarbonate and ammonium carbonate.

Actions.—Heroin differs in its actions from morphine in some important respects. It is far less narcotic than morphine, it does not depress the respiratory centre in medicinal doses, it is far less toxic, and it does not produce constipation or other undesirable after-effects.

The researches of Guinard (*Journal de Physiol. et de Path. Gén.*, 1899) show that the effects of heroin varied in different animals. Toxic doses, given by intravenous and hypodermic injection, produce a narcotic action on the dog and an exciting effect on the horse and cat. The donkey is said to be specially susceptible, as 0·00035 gramme per kilogramme of body-weight, given hypodermically, proved fatal.

In the dog heroin rendered the pulse slower, but increased its force, while the blood-pressure was somewhat lowered. In the horse it caused an increase in the heart-beats, and raised the blood-pressure.

On respiration, marked and important effects were produced. The respirations were rendered slower, but increased in depth, by moderate doses. Large doses tend to depress the respiratory centre, and in the dog the respirations were increased in frequency.

The exact action of heroin on respiration is not yet definitely known. The drug is said to cause increased depth

of inspirations, and to render them slower, the result being a more perfect aëration of the blood.

MEDICINAL USES.—Heroin is a valuable agent in the treatment of bronchitis and in cases of irritable coughs. In our experience it exerts favourable effects in the secondary stages of bronchitis, in chronic bronchitis, and in asthmatic affections in the dog.

In the treatment of coughs depending on bronchial catarrh in the horse, heroin sometimes proves useful.

The most convenient form to administer the agent is in combination with glycerin. Chemists supply various combinations of heroin and glycerin, and there is also a proprietary preparation known as Glyco-heroin. They usually contain $\frac{1}{16}$ grain of heroin hydrochloride in each fluid drachm, combined with ammonium hypophosphite and hyoscyamus.

The dose for the dog is from 10 minims to $\frac{1}{2}$ drachm, according to the size of the animal and the severity of the case.

For the horse the average dose is 1 ounce, repeated three or four times daily; but doses of 2 ounces can be administered with safety.

The drug may also be combined with terpene hydrate.

Omnopon—also known as **Pantopon**—is stated to be a mixture of the soluble hydrochlorides of opium alkaloids (twenty in number). One gramme of omnopon is equivalent to 5 grammes of 10 per cent. opium, and contains approximately 50 per cent. of morphine. It has been advised by American practitioners in the treatment of azoturia; a dose of 10 c.c. of a 4 per cent. solution of the drug is administered hypodermically, and is followed shortly afterwards by a dose of Digalen (see 'Treatment of Azoturia,' Part III.). In human medicine, omnopon has been employed as a preliminary procedure to the administration of chloroform or ether.

Dionin—also known as Ethyl-Morphine Hydrochloride—is prescribed in human medicine as local anodyne in the treatment of iritis, corneal ulcers, and interstitial keratitis. The solutions employed are from 1 to 5 per cent.

Indian Hemp.

Cannabis Indica—Indian Hemp.

The dried flowering or fruiting tops of the female plants of *Cannabis sativa*, from which the resin has not been removed. It is grown in India. The active principle is stated to be cannabinol, a reddish-coloured oil which is obtained from the resin by distillation. The therapeutic value of the drug is contained in the resin. Cannabis indica contains other constituents—viz., a glucoside, cannabin, and a volatile alkaloid, cannabinine.

PREPARATIONS.

Extractum Cannabis Indicæ—an alcoholic extract.

DOSES.—Horses, ʒss. to ʒi.; dogs, gr. ¼ to gr. i.

Tinctura Cannabis Indicæ—1 part of Extract in 20 parts of Alcohol (90 per cent.); 22 minims contain 1 grain of the extract.

DOSES.—For the dog, ♏ v. to ♏ xv.

The tincture is not convenient for the horse in consequence of the large dose that is necessary; also the addition of water precipitates the resin, so that the drug must be suspended in a mucilaginous fluid before diluting it for administration.

For the horse the extract of cannabis indica is the preparation employed, and it is preferably given in the form of an emulsion, but may also be administered in the form of bolus. Preparations of cannabis indica are found to vary very much in their activity, and some are almost inert. This is usually due to the drug not being fresh, or it may be deficient in the constituents on which its action depends.

A fluid extract which is standardized physiologically—*i.e.*, its strength determined by the effects it produces on animals—can be obtained from Messrs. Parke, Davis and Co., London; this is always reliable, and produces its effects in half the doses required of the ordinary extract. No reliable active principle or alkaloid has as yet been isolated from cannabis indica, so that hypodermic injections of this drug cannot be employed.

ACTIONS.—Cannabis indica exerts *anodyne* and *hypnotic*

actions. The delirium which is induced in man by this drug is not observed in animals. It is difficult in certain instances to estimate the proper dose for the horse, as some animals are more susceptible to its action than others. The average dose of a reliable extract (B.P.) is ½ ounce, and this usually commences to act in from twenty minutes to half an hour. No primary exciting action occurs in the horse, but the animal assumes a sleepy appearance, the head is shaken in a listless manner, the eyelids droop, there is disinclination to move, and the standing posture is maintained; the animal appears unconscious to surrounding influences. These effects gradually pass off in from ten to twelve hours; constipation does not occur to the same extent as after the administration of opiates, nor is nausea so well marked. Larger doses, such as an ounce of the extract, cause in some horses an alarming condition of narcosis. The lips are retracted, the eyelids closed, the tongue hangs from the mouth, the respirations are accelerated and may be stertorous, there is partial loss of control over the hind extremities, and the animal stands persistently; the pulse becomes weak, salivation is profuse, and the penis may be pendulous; common sensibility is also interfered with, as there is no response to puncturing the skin with a needle. This state of narcosis may continue from twenty-four to thirty hours, and then gradually pass off; the degree of nausea resulting is slight, but the peristaltic action of the bowels is interfered with and constipation occurs.

We have no evidence of fatal results occurring from toxic doses of cannabis indica in the horse. According to F. Smith, who first drew the attention of the profession to the therapeutic value of this agent, very large doses will not produce death, although a profound condition of narcosis results.

In the dog, cannabis indica in doses of 10 grains to 2 drachms produces stupor and paralysis of the hind-limbs; this narcotic condition may last for two days, and the animal may recover.

MEDICINAL USES.—In consequence of its high price, cannabis indica is seldom prescribed in the present day. It has proved valuable as an anodyne in cases of volvulus, enteritis,

etc., but is contra-indicated in ordinary colic and intestinal impaction, as it interferes with the peristaltic action of the bowels. We have found that chloral hydrate given in sufficiently large doses will accomplish all that is claimed for cannabis indica.

In canine practice the drug is seldom prescribed. It has been tried in the treatment of chorea, but with indifferent results.

Apocynum.

Apocynum—the root of *Apocynum cannabinum*—also known as American Indian Hemp or Canadian Hemp, and in America as Black Indian Hemp. A fluid extract is prepared, the dose of which for dogs is 1 to 2 minims given every three or four hours.

ACTIONS AND USES.—Apocynum is a powerful diuretic, and in full doses a hydragogue cathartic. In the dog large amounts act as an emetic as well. It causes profuse diuresis, mainly by its action on the renal bloodvessels. It renders the pulse slower and fuller, and strengthens the action of the heart; but is said not to cause contraction of the arteries. In its action on the circulation it resembles strophanthus. Toxic doses cause death by syncope.

This drug is employed in human medicine as a diuretic, especially in America. It is said to produce very beneficial effects in cases of dropsy, whether of renal or cardiac origin, mainly through causing a removal of the ascitic fluid, by the kidneys. It is worthy of a trial in canine practice in the treatment of similar conditions.

Cocaine.

Cocaina—Cocaine.

An alkaloid obtained from the dried leaves of *Erythroxylum Coca*, a South American shrub.

Cocainæ Hydrochloridum—Cocaine Hydrochloride.

A crystalline salt of cocaine. This is the form in which the drug is employed.

INCOMPATIBLES.—Alkalies and alkaline carbonates, borax, carbolic acid, mercurous and mercuric chlorides, and the majority of soluble silver salts.

ACTIONS.—Cocaine, if applied in solution to mucous surfaces, or injected hypodermically, acts as a *local anæsthetic*. It produces this effect by paralyzing the sensory nerves of the part, and it also contracts the capillaries. It has no effect if applied to the healthy skin, unless combined with an agent such as oil of cloves and rubbed in. A 4 per cent. solution applied to the eye renders the superficial structures anæsthetic, paralyzes accommodation, and dilates the pupil. The latter action depends on stimulation of the sympathetic nerve fibres supplying the iris, and is more marked in the dog than in the horse.

The local anæsthetic action commences in about five minutes, and may continue for thirty minutes. Ten per cent. solutions applied to a mucous membrane blanch the part, as well as remove sensation therefrom, the former action probably being due to contraction of the local capillaries. The local vaso-constriction is due to direct stimulation of the vaso-motor nerve endings. A reaction subsequently occurs, and the vessels become dilated. If the drug becomes absorbed, no further anæsthetic action takes place. Surface application does not induce anæsthesia of the deep parts, nor does its effect last long.

When a solution of the drug is injected hypodermically, sensation is removed from the deeper parts, especially if the injection be made along the course of a nerve. Strong solutions injected hypodermically may be absorbed and induce toxic symptoms, but surface applications to the skin have little tendency to become absorbed.

Internally, in small doses, cocaine is a stimulant, tonic, and restorative.

TOXIC ACTIONS.—Cocaine may be described as a general protoplasmic poison, having a special affinity for nerve tissues. The primary action of the drug on the central nervous system is that of an excitant. The higher centres are first involved, then the medulla and spinal cord, and this is followed by depression and paralysis in the same order. Owing to stimulation of the respiratory centre, the respirations become quicker and deeper; later on this centre becomes paralyzed, and death occurs from asphyxia. In the horse, doses of from

60 to 80 grains, injected hypodermically, produce salivation, great excitement, quickened pulse, dilatation of the pupils, increase of reflex activity, and increased peristaltic action of the intestines. These effects pass off in about two hours.

The dog is very susceptible to the action of cocaine, the hypodermic injection of a strong solution of the drug producing in a few minutes epileptiform convulsions, champing of the jaws, profuse salivation, marked respiratory distress, tetanic spasms, and death from asphyxia. The convulsions are of cerebral origin. Blood-pressure is at first raised, but afterwards lowered, and the pulse is rendered slow.

ANTIDOTES.—The inhalation of amyl nitrite, stimulants such as ammonia and alcohol, and the hypodermic injection of ether. In many cases the symptoms are so violent and severe that it is impossible to administer antidotes, and death occurs rapidly.

USES.—Cocaine is seldom prescribed internally in veterinary practice. Its chief use is as a local anæsthetic in minor surgical operations.

For the dog a 4 or 5 per cent. solution may be used hypodermically for the painless removal of small tumours, etc. Stronger solutions are dangerous, as they may give rise to toxic symptoms. Indeed, in cases that are susceptible to the action of the agent, even 5 per cent. solutions may cause serious symptoms. For this reason eucaine is preferred by many practitioners as a local anæsthetic for the dog (see p. 381).

In ophthalmic surgery, cocaine in 4 or 5 per cent. solution is applied to the eye at least twice before the operation is commenced. Foreign bodies in the eye are removed with facility after the local application of cocaine. In inflammation of the superficial structures of the eye, in injuries to the cornea, and in corneal ulcer, the application of an eye-lotion containing 2 grains of cocaine, 2 grains of atropine, and 2 grains of boric acid, to the ounce of distilled water, is productive of good results in the early stages.

In the horse a 10 or 20 per cent. solution of cocaine is employed hypodermically to produce local anæsthesia during the removal of small tumours, also for the operation of firing

and for that of neurectomy. From 12 to 15 minims may be injected at three or four points underneath the skin, and into the growth in the case of tumours. For neurectomy the solution should be injected into the region of the nerve at the site selected for operation.

It has been found that a combination of cocaine with solution of adrenalin chloride greatly increases the local anæsthetic action of the former. Eucaine is often preferred to cocaine for this purpose (see p. 381).

In the diagnosis of lameness cocaine is of assistance, as by injecting a solution over the course of the plantar nerves we can decide whether the cause of lameness is in the foot or otherwise. If the case be one of foot lameness, the animal will go temporarily sound as the result of the injection, while if the cause of the lameness be seated elsewhere no effect will be produced. By injecting solutions of the drug into other regions of the limb, great assistance will be given in the diagnosis of lameness. One drachm of a 5 per cent. solution may be injected along the course of the plantar nerves above the fetlock.

As ordinary solutions of cocaine do not keep well, it is necessary to prepare them freshly when required for use, and convenient tablets or pellets of the drug are now supplied by chemists for this purpose. Cocaine solutions, containing chloretone as a preservative, are also prepared, and keep active for a long period.

Solutions of cocaine undergo decomposition if sterilized by boiling.

An ointment of cocaine is employed in the treatment of burns and scalds and in painful fissures of the heels in the horse. For these purposes the drug may be combined with boric ointment in the proportion of from 5 to 10 per cent.

β-Eucaine.

Eucainæ Hydrochloridum B—β-eucaine; beta-eucaine—is a synthetic compound, chemically allied to cocaine. Another form is known as α-eucaine, but is not now employed.

β-eucaine is of complex chemical composition, and is

technically known as the hydrochloride of benzoyl-vinyl-diaceton-alkamine.

Eucaine is a *local anæsthetic*, resembling cocaine in this respect, but it is slower in its action and less active, and requires to be used in larger amounts. The advantages it possesses over cocaine are that it is three times less toxic, and its local anæsthetic action is more prolonged and more constant, and solutions can be sterilized by boiling without undergoing decomposition.

Eucaine is preferred to cocaine as a local anæsthetic in canine practice. The strength of solution employed varies from 2 to 4 per cent., and the amount injected varies according to the requirements of the case. For ophthalmic use a 2 per cent. solution is recommended, 2 minims being applied to the eye every three minutes, until 10 minims have been used.

It is advisable to combine a solution of adrenalin with eucaine for the production of local anæsthesia.

The effect of this combination is that much less eucaine is required. Adrenalin causes contraction of the capillaries, and so diminishes the blood-supply in the part, the result being that the anæsthetic agent remains where it is injected, and exerts its effects.

We have found that a solution containing 2 per cent. of eucaine and 1 in 30,000 of adrenalin proves of sufficient strength.

In canine and feline surgery it is advisable to dilute the above with 1 or 2 parts of normal saline solution, so as to avoid any risks of the occurrence of sloughing of the skin. This undesirable sequel occasionally follows the use of the strong solution.

For the purposes of a local anæsthetic in equine surgery, the 2 per cent. solution of the drug proves effectual. If a stronger solution be desired, it is advisable to employ eucaine lactate, as it is far more soluble.

In carrying out local anæsthesia, strict attention to asepsis is essential, so as to avoid the occurrence of abscess formation and sloughing of the skin. This precaution is especially

necessary when employing local anæsthesia for the operation of castration in the dog or cat. As already mentioned, it is best to use a weak solution, as adrenalin in some cases tends to cause cutaneous sloughing. When employing weak solutions a larger amount can be injected, and the infiltration of the tissues which results assists in the production of local anæsthesia.

The difficulties attendant on carrying out the technique in the case of nervous, irritable horses can be overcome by using a short, fine hypodermic needle to which is attached a piece of thread, and by winding the latter round one of his fingers the operator can prevent the needle from being lost, should the horse make a plunge. The advantage of a very short needle is that, should the horse struggle, the needle is not likely to get broken. Of course in the case of large tumours it will be necessary to employ a longer and stouter needle.

We have already referred to the advantages gained by employing a combination of local and general anæsthesia in the performance of major operations, so as to obviate the occurrence of surgical shock (see p. 310). It is necessary to point out that, in order to obtain efficient local anæsthesia, careful attention to the technique is necessary, and a sufficient amount of the solution should be injected. In the case of surgical interference with deep-seated structures, the injections should be made sufficiently deep, and at several points in the area of operation. Also a proper period of time (ten minutes) should be allowed before commencing to operate.

Novocain (Ethocaine)

is an agent of very complex chemical composition. It is sometimes employed as a substitute for cocaine or eucaine. It is very soluble in water. Solutions can be boiled without decomposition occurring; its toxicity is very low, and it has no irritant action. A solution of from 2 to 5 per cent. proves efficient as a local anæsthetic, and is preferably combined with a solution of adrenalin (1 to 30,000).

Stovaine

resembles novocain in its actions, but is said to be slightly irritant. It is employed in human surgery for the production of spinal anæsthesia.

In addition to the above, there are other agents acting as local anæsthetics, but they are of little interest to the veterinary practitioner. They include Holocaine, Acoine, Tropacocaine, Alypin, etc.

CHAPTER XIV

THE VEGETABLE KINGDOM (*Continued*)

Belladonna.

Belladonnæ Folia—Belladonna Leaves.

The leaves of *Atropa Belladonna* (the Deadly Nightshade) collected when the plant is in flower, and dried.

Doses.—Horses and cattle, ℥ii. to ℥ss.; dogs, grs. ii. to grs. v.

Belladonnæ Radix—Belladonna Root.

The dried root of *Atropa Belladonna*. It contains from 0·3 to 0·8 per cent. of atropine.

Extractum Belladonnæ Viride—Green Extract of Belladonna.

This is prepared from the fresh leaves and young branches of *Atropa Belladonna*. It is omitted from the B.P. 1914. It does not keep well, and is not definite in composition.

Doses.—Horses, ℥i. to ℥ii.; cattle ℥ii. to ℥iii.; sheep, grs. x. to grs. xx.; pigs, grs. iv. to grs. vi.; dogs, gr. ¼ to grs. ii.

Extractum Belladonnæ Liquidum—Liquid Extract of Belladonna. This is an alcoholic extract. It contains 0·75 gramme of the alkaloids of Belladonna Root in 100 millilitres, and 110 minims contain ¾ grain of alkaloids.

Doses.—Horses, ♏xx. to ♏xxx.; dogs, ♏i. to ♏v.

Extractum Belladonnæ Siccum—Dry Extract of Belladonna. This contains in 100 grammes 1 gramme of the alkaloids of Belladonna Leaves (1 per cent. of alkaloids).

Doses.—One half those of the Liquid Extract.

Tinctura Belladonnæ—Tincture of Belladonna.

PREPARED from Belladonna Leaves, 100 grammes; Alcohol (70 per cent.), 1,000 millilitres, by the percolation process. It should contain 0·035 gramme of the alkaloids of Belladonna Leaves in 100 millilitres. A more reliable tincture is prepared from the standardized Liquid Extract. The Tincture of Belladonna, B.P., 1914, contains seven-tenths of the proportion of alkaloids contained in the B.P. Tincture, 1898.

DOSES OF THE TINCTURE.—Horses, ℥ss. to ℥i.; cattle, ℥i. to ℥ii.; sheep, ℥ss. to ℥i.; dogs, ♏ v. to ♏ xv.

Glycerinum Belladonnæ—Green Extract of Belladonna, 1 ounce; boiling Distilled Water, 1 drachm; rub together to form a smooth paste, and add Glycerin to make 2 ounces.

Unguentum Belladonnæ—Belladonna Ointment.

Liquid Extract of Belladonna, 80 millilitres; Benzoated Lard, 60 grammes; Wool Fat, 20 grammes.

Linimentum Belladonnæ—Liniment of Belladonna.

Liquid Extract of Belladonna, 500 millilitres; Camphor, 50 grammes; Distilled Water, 100 millilitres; Alcohol (90 per cent.), q.s. to yield 1,000 millilitres.

Atropina—Atropine.

This is an alkaloid prepared from Belladonna Root and other plants of the natural order Solanaceæ. It is usually employed in the form of

Atropinæ Sulphas—Atropine Sulphate.

DOSES (*by hypodermic injection*).—Horses, gr. $\frac{1}{4}$ to gr. $\frac{1}{2}$; dogs, gr. $\frac{1}{200}$ to gr. $\frac{1}{100}$.

Liquor Atropinæ Sulphatis (B.P.)—Solution of Atropine Sulphate.

This contains Atropine Sulphate, 1 gramme, and Distilled Water, 100 millilitres. It should be freshly prepared; 110 minims contain 1 grain of Atropine Sulphate.

DOSES (*by hypodermic injection*).—Horses, ♏ xvi. to ♏ xxx.; dogs, ♏ i. to ♏ ii.

Tablets and pellets containing accurate amounts of Atropine Sulphate can be obtained from chemists.

Homatropine Hydrobromidum—Homatropine Hydrobromide—is the hydrobromide of an alkaloid prepared from atropine, and is sometimes substituted for atropine in ophthalmic practice.

Actions of Belladonna and Atropine.

Externally, belladonna depresses the sensory nerve-endings, and diminishes the sensibility of sensory nerves, thus relieving pain and irritability in the part to which it is applied. This action, however, is slight unless the drug be applied in combination with alcohol or glycerin—*e.g.*, in the form of a liniment. If the application be prolonged, atropine may be absorbed into the system. Locally applied to the udder in a state of activity, it arrests the secretion of milk by paralyzing the lacteal nerve-terminations. It also checks secretion of sweat by a similar action on the secretory nerves of the sweat-glands. If applied to the eye, it causes dilatation of the pupil and paralysis of accommodation, and this effect occurs whether the drug be applied locally or given internally.

Internally, moderate doses of belladonna produce dryness of the mouth, this depending on an arrest of the secretion of saliva, resulting from the specific action of the drug on the chorda tympani nerves—*i.e.*, it paralyzes the secretory fibres of these nerves. Large doses cause excessive dryness of the mouth and throat and great difficulty in swallowing. In the stomach belladonna exerts slight anodyne effects, probably by depressing the terminations of the gastric nerves. It also inhibits gastric secretion.

On the Nervous System, the primary effect of the drug is to stimulate particularly the motor areas of the brain; it also causes increased activity of the medullary centres, evidenced by stimulation of respiration and vaso-constriction of central origin. This stimulation is followed by depression. In medicinal doses this primary exciting action is not observed, and the drug appears to have a sedative effect.

Full doses in man produce a peculiar form of delirium, in which restlessness and a desire for action are combined with a feeling of lassitude.

In the horse, full doses cause excitement, delirium, and unsteady movements.

On the Spinal Cord, the primary effect is slight stimulation of this structure

On Special Nerve-Terminations.—Atropine paralyzes the terminations of the third cranial nerve (motor oculi) in the sphincter of the pupil and in the ciliary muscle, the result being dilatation of the pupil, paralysis of the power of accommodation, and, after large doses, increase of the intra-ocular pressure. According to H. Gray, although atropine causes dilatation of the pupil in the dog, yet if exposed to sunlight the pupil will still react to a certain extent.

The peripheral nerve-endings of the chorda tympani nerve in the submaxillary gland are paralyzed, the result being an arrest of saliva and dryness of the mouth and throat.

It has a similar effect on other glands, such as the sweat-glands, the udder, and mucous glands.

Small doses are said to depress the inhibitory fibres of the splanchnic nerves in the intestinal walls, and thus cause increased peristaltic action. Full doses, however, arrest peristaltic movements; this is probably due to paralysis of the intestinal ganglia. It is said that the irritability of the intestinal muscular fibre is not interfered with.

The peripheral ends of the vagi in the bronchioles and in the heart become paralyzed as the result of large doses of atropine.

On the Heart and Circulation, atropine causes paralysis of the peripheral terminations of the vagi, and thus the cardiac action is quickened.

Owing to the stimulation of the medulla, vaso-constriction of central origin occurs, and the blood-pressure is raised. According to Dixon, the vaso-constriction is pronounced only in the splanchnic area, and the cutaneous vessels are dilated.

On Respiration.—According to some authors respiration is slowed at first. But owing to stimulation of the respiratory centre, the respiration soon becomes quicker and deeper. Toxic doses paralyze this centre.

On Temperature.—A full dose of atropine is said to cause a slight rise in temperature, and this is ascribed to a direct action of the drug on the thermogenic centre in the brain.

In severe cases of poisoning by the drug the temperature may rise to 107° F. or 108° F. (Dixon).

Atropine is rapidly excreted in the urine, and during its

passage through the ureters, bladder, and urethra, it exerts remote local anodyne actions thereon.

Toxic Actions.—In the horse, numerous experiments have demonstrated that large doses of belladonna or atropine produce restlessness, delirium, dryness of the mouth, quick pulse, gradually becoming thready, also quick, short respirations, increase of temperature, and dilatation of the pupils, but no hypnotic effects were observed. When the drug was administered in the crude form in large doses, symptoms of abdominal pain and loss of co-ordination in the hind extremities were present, in addition to the effects already mentioned. Six ounces of the dried root were stated by Hertwig to prove fatal in the horse.

Atropine sulphate, administered by hypodermic injection in doses of 2 grains, caused great acceleration and weakness of the pulse, twitching of the superficial muscles, nervous excitement, occasional hiccough, and dryness of the mouth. These symptoms gradually disappeared, but the pupils remained dilated for twenty-four hours.

In the dog, large doses of belladonna or atropine act in a more marked manner on the heart than on the cerebrum. The symptoms observed are great rapidity of the pulse, which tends to become weak, also prostration, death occurring in convulsions. The results of experiments would indicate that about $\frac{3}{4}$ grain of atropine is a toxic dose for the dog. Fifteen grains of the extract of belladonna have also proved fatal.

Antidotes.—In the dog, if the case be seen early, prompt emetics should be administered. The hypodermic injection of apomorphine is most reliable. Stimulants, such as brandy and ammonia, are indicated. The hypodermic injection of pilocarpine is recommended as a physiological antidote. Artificial respiration, the application of the hot and cold douche alternately to the head, and the judicious employment of the galvanic battery, are all of importance in the treatment of cases of belladonna-poisoning.

As atropine is eliminated by the kidneys, and as retention of the urine is apt to occur in cases of poisoning by this agent, the catheter should be employed to relieve the bladder.

A case of poisoning is recorded in the dog as the result of the animal licking belladonna liniment which had been applied to the skin. The symptoms observed were a tendency to stumble over objects, interference with vision; later on there was complete loss of muscular power in the hind-limbs, and the pulse and respirations were greatly accelerated. After the administration of stimulants the symptoms gradually disappeared in about four hours.

MEDICINAL USES.—In the treatment of *gastritis* in horses and cattle belladonna is of service. Combined with bicarbonate of soda, it gives good results in cases of inflammation of the abomasum in cattle. It is recommended as an anodyne in cases of acute abdominal pain and in enteritis occurring in the horse. In our experience, its effects in moderate doses are of little value in such cases, and if larger doses be employed the exciting effects of the drug are produced.

Some practitioners combine atropine with morphine, and state that it increases the anodyne effects of the latter, while overcoming some of its undesirable actions. This is not our experience.

Full doses of either belladonna or atropine interfere with the peristaltic action of the intestines, and hence are not suitable as anodynes in cases of colic depending on obstruction of the intestines.

In *pharyngitis* and *laryngitis*, belladonna, combined with potassium chlorate, glycerin, and honey, and administered in the form of electuary, gives good results. It relieves irritable cough, renders deglutition easier, and reduces the inflammatory condition of the affected parts.

In cases of *bronchitis* with excessive secretion, belladonna is useful, as it tends to overcome this condition; but in instances where the bronchial mucous membrane is already too dry it cannot be of any service, and is contra-indicated.

In cases of cardiac pain and palpitation depending on certain forms of disease of the heart, belladonna appears to give relief by enabling the ventricles to empty themselves more frequently, and thus preventing distension of the heart.

In tetanus, the administration of belladonna in the form of

electuary occasionally gives favourable results; but whether recoveries are to be attributed to the action of this agent or to the *vis medicatrix naturæ* is a matter of opinion. At any rate, it is a favourite drug in the treatment of this disease.

Atropine has been found useful in the treatment of obstruction of the œsophagus, and in spasm of that organ, in the horse. It also gives relief in cases of bronchial asthma, by causing relaxation of the bronchioles owing to its depressing action on the peripheral terminations of the vagi.

In irritable and inflamed conditions of the *bladder*, *rectum*, or *uterus*, the use of belladonna is indicated, and may be given internally, as well as applied in the form of injections to the affected parts.

In constriction of the *cervix uteri*, which is met with in parturition cases, the extract of belladonna, freely applied to the part, may overcome the rigidity, and permit delivery to take place.

In the treatment of *hæmorrhage*, whether internal or occurring as the result of operations, such as castration, the hypodermic injection of atropine has proved useful in the hands of several practitioners. It is believed to act by causing dilatation of the cutaneous vessels, and thus diverting a large amount of blood to the skin and lowering blood-pressure. But, according to experimental evidence, blood-pressure is raised by the drug, so further information on the subject is desirable.

As an *antisialic*, belladonna is employed in cases of mercurial salivation. It is also useful as a mouth-wash in cases of inflammation of the tongue and buccal mucous membrane.

As belladonna in small doses tends to increase the peristaltic action of the intestines, it is sometimes combined with purgatives, and is found to assist their action and also to prevent griping.

The hypodermic injection of atropine is advised by Steffen ('Special Veterinary Therapy') in the treatment of milk-fever, in conjunction with inflation of the udder. This author states that by administering atropine the course of the disease is considerably shortened. The drug is said to raise

the temperature to normal, and the observations of Steffen show that a subnormal temperature (96° F. to 99° F.) is always present in this disease. The dose advised is gr. ¼ to gr. ss., administered after the udder has been inflated.

Atropine is recommended as an antidote to morphine-poisoning.

Externally, as a local anodyne, belladonna in the form of the extract, combined with glycerin, is extensively employed in cases such as erysipelas and in acute painful conditions of *any part*.

In mammitis it proves the best local application. It checks the secretion of milk, reduces inflammatory action, relieves pain and tension, and tends to arrest impending abscess. In subacute cases of this affection it is best applied in the form of a liniment composed of belladonna extract, 2 drachms; glycerin, 2 ounces; and soap liniment, 3 ounces.

In affections of the eye, such as ophthalmia, keratitis, conjunctivitis, etc., atropine is employed in solutions containing 2 grains to the ounce of distilled water.

A useful form of collyrium is prepared with atropine, 2 grains; cocaine, 2 grains; boric acid, 4 grains; and distilled water, 1 ounce.

In using the ophthalmoscope, solutions of atropine are employed to dilate the pupil, and thus assist in carrying out the examination of the eye. Homatropine is preferred to atropine by some ophthalmologists for this purpose, as its action is far more rapid and the effects pass off more quickly.

Care is necessary in applying belladonna externally in canine practice, as toxic symptoms may occur should the dog lick the parts (see p. 389).

Hyoscyamus.

Hyoscyami Folia—Hyoscyamus Leaves.

The leaves of *Hyoscyamus niger*, or Henbane, collected from the flowering plants and dried.

Extractum Hyoscyami—Extract of Hyoscyamus, or Extract of Henbane—contains in 100 grammes 0·3 gramme of the alkaloids of Hyoscyamus Leaves.

DOSES.—Horses and cattle, ʒi. to ʒiii.; dogs, grs. ii. to grs. viii.

Tinctura Hyoscyami—Tincture of Hyoscyamus.

Hyoscyamus Leaves, 100 grammes; Alcohol (70 per cent.), 1,000 millilitres (1 in 10).

DOSES.—Horses and cattle, ʒi. to ʒii.; dogs, ♏ x. to ♏ xl.

Hyoscyaminæ Sulphas—Hyoscyamine Sulphate—is the sulphate of an alkaloid, Hyoscyamine, obtained from various plants belonging to the natural order Solanaceæ.

DOSES (*by hypodermic injection*).—Horses, gr. $\frac{1}{20}$ to gr. $\frac{1}{10}$; dogs, gr. $\frac{1}{200}$ to gr. $\frac{1}{100}$.

Hyoscinæ Hydrobromidum—Hyoscine Hydrobromide, also known as Scopolamine Hydrobromide. This is the hydrobromide of an alkaloid, Hyoscine or Scopolamine, obtained from various plants of the natural order Solanaceæ.

DOSES.—Similar to those of Hyoscyamine.

ACTIONS AND USES.—Hyoscyamus resembles belladonna in its actions, but is believed to possess certain advantages over the latter. The secondary calmative action on the cerebrum is more marked than that of belladonna, this depending on the presence of hyoscine. Its carminative and laxative effects are more pronounced than those of belladonna, and it possesses more decided remote local anodyne effects on the urinary organs.

Hyoscyamine has similar actions to atropine on the central nervous system, but its effects on nerve-endings in the salivary glands, heart, and pupil, are far more marked.

Hyoscine resembles atropine in its action on peripheral nerve-endings, but its effects are more powerful and last longer, and its depressant action is more marked. It has no stimulant effect on the medulla, and its action on the cerebrum is that of an hypnotic. In combination with morphine it is largely employed by American practitioners as a sedative for the horse, and in canine practice as an anæsthetic (see p. 372).

In cases of irritability of the bladder and genito-urinary organs, hyoscyamus is prescribed in combination with alkalies such as bicarbonate of potassium or sodium.

In cystitis and in cases of strangury arising from the absorption of cantharidin from the application of a blister, hyoscyamus is prescribed, with alkalies and demulcents.

In canine practice it is sometimes combined with purgatives to prevent griping and to assist their action. For example, it is combined with compound colocynth pill to form the Pil. Colocynthidis Composita et Hyoscyami.

Stramonium.

Stramonii Folia—The dried leaves of *Datura Stramonium*, the Thorn-apple. Its alkaloid is Daturine.

The preparation in use is the tincture (1 in 5).

Stramonium resembles belladonna in its actions. It is said to possess a more marked depressant effect on the nerves of the bronchi than the latter drug, and in human practice is found useful in the treatment of asthma. It is seldom employed in veterinary practice. On the Continent it is employed by horse-copers to conceal the symptoms of broken wind in the horse.

Duboisine.

Duboisine is an alkaloid obtained from the *Duboisia myoporoides*, an Australian plant.

It resembles belladonna and hyoscyamus in its actions, but acts more promptly than atropine in causing dilatation of the pupil.

The sulphate of duboisine is employed in human ophthalmic practice as a mydriatic.

CHAPTER XV

THE VEGETABLE KINGDOM (*Continued*)

Tobacco.

Tabaci Folia—Leaf Tobacco.

The dried leaves of the Virginian Tobacco, *Nicotania tabacum*. Contains about 6 per cent. of Nicotine.

Nicotina—Nicotine.

A colourless, volatile, liquid alkaloid obtained from tobacco.

ACTIONS AND USES.—Tobacco in toxic doses is a gastro-intestinal irritant, and produces nausea, colicky pains, increased action of the bowels and kidneys, and in the dog, vomition. Decoctions of the drug applied to the skin of dogs may cause toxic effects by absorption.

Nicotine resembles in many respects the following drugs in its actions—viz., Conine, Lobeline, Curare, Sparteine, and Gelsemine.

These actions consist of depression and ultimately paralysis of certain nerve-cells, depression or paralysis of motor nerve-endings, and convulsions which are spinal in origin.

Nicotine acts chiefly on the sympathetic nerve-cells, causing at first stimulation, then depression, and finally paralysis, of these structures. It also causes a primary stimulation of the ganglion cells in the course of the vagus, followed by depression. The heart-beat is slowed at first, and then accelerated. Vaso-dilatation and a fall in blood-pressure accompany the acceleration of the heart. Large doses cause paralysis of the motor nerve-endings. The drug causes contraction of the pupils.

Nicotine is a very powerful poison. From 5 to 6 minims are said to prove toxic to the horse, and from 1 to 3 minims to the dog; if given hypodermically, one-tenth of these doses may prove dangerous.

Livesey (*Journal of Comparative Pathology and Therapeutics*, December, 1904) recorded an interesting case of tobacco-poisoning in the dog. The animal, a large fox-terrier, was given half an ounce of plug tobacco as a vermicide. 'In twenty minutes violent straining occurred, but no action of the bowels; the animal vomited the tobacco, and convulsions ensued. All the muscles were in a state of clonic spasm, especially the masseters and those of the neck and abdomen. The eyeball was retracted, the membrana nictitans almost obscured the eye, the pupil was contracted to a marked degree. The mucous membranes were rather pale and of a bluish tinge, the pulse was quick, the respirations deep, but not accelerated in proportion to the pulse, the extremities were cold, the skin was tense, the nose cold but dry, deglutition was impossible. Signs of collapse appeared: the body was cold, the respirations shallow, the heart slow and feeble; the animal lost the use of all his limbs, which hung limp and paralyzed when he was raised from the ground; occasionally slight convulsions appeared, and the muscles of the right shoulder showed a persistent tremor. Bromide of potassium was administered, and afterwards strychnine. The pulse improved after the strychnine, and the convulsions ceased, after lasting for five hours. After the administration of diluted alcohol the animal vomited a brown-stained liquid smelling of tobacco and mixed with a small amount of blood. Next day the dog had recovered completely.'

The ANTIDOTES recommended for tobacco-poisoning are, in the dog, emetics, preferably apomorphine, followed by tannic acid or strong tea. The hypodermic injection of strychnine is advised, also stimulants, such as alcohol and sal volatile, are to be given freely. The surface of the body should be kept warm.

Tobacco is not used internally. Nicotine has been tried in the treatment of tetanus, but not with satisfactory results.

As a parasiticide, decoctions of tobacco are employed in the treatment of mange, and for the destruction of lice, ticks, and fleas, but other agents have been found safer and more effectual. A solution of nicotine impregnated with Naphthalin has recently been advised for the treatment of mange in Army horses. One part of a 20 per cent. solution of the drug is diluted with 120 parts of water, and applied to the skin with a brush, using friction. Previous to the application the hair should be singed and the skin washed with hard soap, and then dried. The dressing is repeated at intervals of three days, until four applications have been made, the parts being washed with soap previous to each dressing.* Tobacco in the form of an infusion, prepared with 4 ounces in a pint of boiling water, then cooled and strained, has been found successful as an antidote to strychnine-poisoning in the dog, and may be employed in a case of emergency when other antidotes are not at hand.

Lobelia.

Lobelia—the dried flowering herb of *Lobelia inflata*, also known as Indian Tobacco—resembles tobacco in its actions. It is seldom used in veterinary practice. In human practice it is employed in the form of tincture in the treatment of spasmodic asthma. It contains an alkaloid, Lobeline. The drug has been advised in the treatment of tetanus.

Conium.

Conium—The fresh leaves and young branches, also the unripe fruit, dried, of *Conium maculatum*, or Hemlock.

The preparations of this drug are an extract, an expressed juice or succus, and a tincture. The alkaloid is Conine, which is a very active poison. Conium is seldom used in veterinary practice. Its chief action is exerted on motor nerves, which

* Later reports state that the dressing is unreliable for universal use, as owing to rapid evaporation the destruction only of superficial parasites is effected. The dressing, however, is considered useful for applying to indirect in-contacts, and is efficacious for the destruction of lice. Cases of fatal poisoning have occurred when the solution was used in a strength exceeding 1 in 160.

it paralyzes from their extremities upwards. Large doses paralyze the motor centres of the cerebrum, and also paralyze the respiratory centre, causing death from asphyxia. Applied locally, it depresses and paralyzes the terminations of sensory nerves.

The symptoms observed in cases of poisoning by this agent were muscular weakness, drooping and swollen eyelids, dilatation of the pupils, and general paralysis.

The ANTIDOTES recommended are tannic or gallic acid, or decoction of oak bark, stimulants—brandy, whisky, etc.—warm clothing, hand-rubbing, etc. Some authorities advise the hypodermic injection of atropine.

At one time conium was prescribed in cases of tetanus and in the treatment of spasmodic cough, but proved of little, if any, use.

Curare.

Curara—Curare.

The South American Indian arrow poison, produced from species of Strychnos and other plants. It contains an alkaloid, Curarine. Curare paralyzes the peripheral ends of motor nerves, and in large doses paralyzes the vagus, the ends of the sensory nerves, and the spinal cord. It causes death by paralysis of the respiratory muscles. If given by the mouth it is uncertain in its actions, as it is rapidly eliminated, but administered hypodermically it is a powerful poison. It has been tried in the treatment of tetanus, but with little success, and is not employed in veterinary practice.

Scoparium (Broom).

Scoparii Cacumina—The fresh and the dried tops of *Cytisus scoparius*.

Sparteinæ Sulphas—Sparteine Sulphate—is the sulphate of an alkaloid contained in Broom.

ACTIONS AND USES.—An infusion or decoction of broom is an active diuretic.

Sparteine possesses similar actions to conine, but is far less toxic. It exerts very little effect on the central nervous system, but in large doses paralyzes sympathetic nerve-cells

and the peripheral terminations of motor nerves. Contrary to what was at one time believed, sparteine has no action in any way analogous to that of digitalis (Dixon). Sparteine sulphate is advised by American practitioners as a cardiac tonic in the treatment of pneumonia in the horse. It is said to increase the force of the heart's action without raising blood-pressure. Steffen ('Special Veterinary Therapy') administers 20 grains every three or four hours *per os*. It can also be given by hypodermic injection.

Gelsemium.

Gelsemii Radix—The dried rhizome and root of *Gelsemium nitidum* (Yellow Jasmine).

Tinctura Gelsemii—Tincture of Gelsemium: 1 of Gelsemium Root in 10 of Alcohol (60 per cent.).

Gelsemininæ Hydrochloridum — Gelseminine Hydrochloride—is the salt of an alkaloid prepared from Gelsemium. A powdered alcoholic extractive, Gelsemin, is also obtained from Gelsemium root.

Actions and Uses.—Gelsemium resembles conine in its actions, but is more depressant to the central nervous system. It causes dilatation of the pupil and paralysis of accommodation. Gelseminine hydrobromide, in doses of gr. ss. every half-hour, is advised by American practitioners in the treatment of cerebro-spinal meningitis and tetanus.

CHAPTER XVI

THE VEGETABLE KINGDOM (*Continued*)

Calabar Bean.

Physostigmatis Semina—Calabar Bean.

The ripe seeds of *Physostigma venenosum.* Its chief constituent is a crystalline alkaloid, Physostigmine, also known as Eserine. An extract and a tincture are prepared, but the alkaloid physostigmine is of chief importance in veterinary practice. The following salts of physostigmine are employed:

Physostigminæ Sulphas — Physostigmine Sulphate; Eserine Sulphate.

Physostigminæ Salicylas — Physostigmine Salicylate; Eserine Salicylate.

The doses of each are similar—viz., horses and cattle, gr. i. to grs. ii., by hypodermic injection. If administered by intravenous or intra-tracheal injection, the smaller dose should be employed. The drug is not used internally in canine practice.

ACTIONS.—A medicinal dose of physostigmine—*i.e.*, from 1 grain to 1½ grains—administered hypodermically, exerts prompt actions on the gastro-intestinal canal. These consist of energetic contractions of the involuntary muscular fibres of the stomach, but chiefly of the intestines, resulting in increased peristaltic action and free evacuation of fæces in a short period of time. The drug causes also an increased secretion of fluids from the intestinal walls. On the above actions the utility of this agent in equine practice depends.

On the Nervous System.—Toxic doses of physostigmine paralyze the nervous centres, but appear to have little effect

on the cerebrum, as consciousness is not impaired. The medulla is paralyzed, and death results from asphyxia, due to paralysis of the respiratory centre. This occurs before the reflex action of the spinal cord is destroyed. Some authorities state that death is due to cardiac paralysis. The spinal cord is specially acted on by physostigmine. The inferior cornua are first depressed and then paralyzed, the result being motor paralysis and loss of reflex irritability. The superior cornua are next paralyzed, the result being complete paralysis of the spinal cord.

On the Circulation.—The pulse-rate is slowed, owing to stimulation of the vagus and also to a direct action of the drug on the cardiac muscle, or to a depression of the sympathetic (accelerator) nerve-endings.

The blood-pressure is raised owing to vaso-constriction, which is mainly peripheral. It is believed that the action of the drug on bloodvessels is partly a direct one on their muscular coat.

On Respiration.—Respiration is at first accelerated and then retarded. This may depend on spasm of the bronchial tubes or on stimulation of the pulmonary terminations of the vagi.

On Muscles.—On striped muscle eserine causes fibrillary contractions or tremors due to the drug acting on the peripheral nerve-endings and causing increased irritability. It is also believed to act directly on the muscle-fibre. On plain or involuntary muscle a similar effect is produced. Hence the peristaltic action of the intestines is exaggerated, and purgation ensues; also constriction of the bronchioles occurs.

On Secretion.—The secretions of all glands are increased by physostigmine, but not to the same extent as in the case of pilocarpine. This increased secretion depends on a special action of the drug on the gland cells and on the peripheral nerve-endings.

On the Eye.—Physostigmine, whether applied locally or given internally, causes contraction of the pupil. This may depend on stimulation of the fibres of the third cranial nerve, or, according to some authorities, it is due to a direct action on the circular muscular fibres of the iris. The drug also

diminishes intra-ocular pressure, and causes spasm of accommodation.

In the horse, the action of physostigmine on the gastro-intestinal canal is usually prompt and constant. The average medicinal dose, from 1 to 1½ grains, administered by hypodermic injection, generally acts in from twenty minutes to an hour. If given by intravenous or by intratracheal injection its effects are much quicker. Slight colicky pains, loud intestinal murmurs, and the passage of flatus, are the first indications of its action; these are followed by evacuation of the contents of the rectum, and succeeded at intervals by motions which are softer and more watery in consistence. The colicky pains may continue, and, in addition, there may be straining, especially if the dose be too large, or if a firm obstruction be present in the intestine. The symptoms pass off in from two to two and a half hours, and in favourable cases a very large amount of fæces are evacuated. But instances are met with in which the ordinary dose exerts no effect when administered by hypodermic injection.

In some experiments conducted by Guy Sutton, F.R.C.V.S., on healthy horses, doses of 1 to 1½ grains only caused a slight increase in the amount of fæces passed in twenty-four hours.

The action of physostigmine is believed to be specially exerted on the large intestine, and if combined with pilocarpine its effects are said to be more marked and reliable.

Toxic doses cause profuse sweating, convulsive breathing, and in some cases spasm of the diaphragm. Death has occurred in the horse after the administration of 8 grains hypodermically.

ANTIDOTES.—Atropine is a physiological antagonist to physostigmine, and is advised as an antidote. Chloral is also recommended. In cases showing evidences of collapse, strychnine should be given hypodermically and stimulants freely administered.

MEDICINAL USES.—The chief use of physostigmine in veterinary practice is in the treatment of cases of colic in the horse depending on obstruction of the intestine with fæces, which ordinary remedies fail to overcome. In properly

selected cases it is an agent of great therapeutical value; but it is important to remember that if the intestinal obstruction depends on other causes, such as volvulus, intussusception, hernia, etc., the action of the drug hastens the fatal termination.

In cases of intestinal calculus, physostigmine fails to remove the obstruction, and is likely to produce rupture of the intestine. In cases which give evidences of the presence of enteritis this drug is also contra-indicated.

In spite of all precautions, however, errors of diagnosis will occur in connection with abdominal affections. Hence we meet with some cases in which after-events prove that the drug would have been of service, and others in which we learn when too late that by administering this agent we have accelerated death (see Part III., 'The Treatment of Obstructive Colic').

In the case of pregnant animals the employment of physostigmine may occasionally cause expulsion of the fœtus; but if the mother's life be of more importance, we should not hesitate to prescribe this agent, provided that the indications for its use are present.

In cases of broken wind (pulmonary emphysema) eserine should be prescribed with extreme caution, as serious results from the employment of the drug in such instances have been recorded. The effect produced has been the occurrence of extreme dyspnœa, due to the constriction of the bronchioles. Should this occur, Quitman advises the administration of atropine (gr. $\frac{1}{4}$ to gr. $\frac{1}{2}$) hypodermically, or of fluid extract of stramonium (ʒii.) *per os*.

In cattle, physostigmine seldom gives satisfactory results, as, although it causes painful straining, it does not produce free purgation. Cases are recorded in which a combination of eserine and strychnine has proved rapidly fatal to cattle.

Externally, physostigmine is employed in certain affections of the eye, such as ulceration of the cornea, glaucoma, and staphyloma. Used alternately with atropine, it is useful to prevent and to break down adhesions after iritis. The usual

solution employed for these purposes is prepared with 2 grains of physostigmine sulphate to 1 ounce of distilled water.

The most convenient form for dispensing solutions of physostigmine is found in the hypodermic pellets, which are supplied by chemists. As the salicylate of physostigmine is not very soluble, the drug may fail to act when injected hypodermically in an incompletely dissolved state. The benzoate of physostigmine has lately been placed on the market, and in consequence of its marked solubility it is preferred by some practitioners. The usual dose of the various salts of eserine for producing desired results is 1 grain, but if this fails to exert a purgative effect it is advisable to administer a larger dose in about two hours, and up to 2 grains may be given with safety. Here we may remark that in many instances it is safer to give repeated small doses of the drug than one large dose, more especially in cases where intestinal tympany is present. In such instances doses of ½ grain may be repeated every half-hour if necessary, until 2 grains have been given. Similar remarks apply when the drug is prescribed in the case of horses suffering from broken wind.

Jaborandi and Pilocarpine.

Jaborandi Folia—Jaborandi Leaves.

The dried leaflets of *Pilocarpus mycrophyllus* and other species of Pilocarpus.

The principal alkaloid is Pilocarpine, and on this the activity of the drug depends.

Some authorities state that an alkaloid known as jaborine is also present, which resembles atropine in its actions and is antagonistic to pilocarpine.

Tinctura Jaborandi—Tincture of Jaborandi.

Four parts of Jaborandi leaves, percolated with Alcohol to yield 20 parts (1 in 5). This is seldom employed in veterinary practice.

DOSES.—Horses, ʒi. to ʒii.; dogs, ℥ss. to ʒi.

Pilocarpinæ Nitras—Pilocarpine Nitrate.

The nitrate of an alkaloid, Pilocarpine, obtained from

the leaves of *Pilocarpus microphyllus* and other species of Pilocarpus.

DOSES.—Horses, grs. ii. to grs. iii.; dogs, gr. $\frac{1}{20}$ to gr. $\frac{1}{3}$; administered by hypodermic injection.

ACTIONS OF PILOCARPINE.

On Secretory Glands.—In man one of the characteristic actions of pilocarpine is the production of profuse sweating, due to excitation of the peripheral nerve-endings in the sweat-glands. According to F. Smith the drug has no effect on the sweat-glands of the horse. This is in accordance with our own experience. In the dog and cat the drug causes sweating from the pads of the feet only. Other secretory glands are affected by pilocarpine—viz., the salivary, gastric, pancreatic, intestinal, mucous glands of the mouth, nasal passages, respiratory and lachrymal. The salivation produced in the horse by the drug is very profuse, and depends chiefly on stimulation of the nerve-endings of the chorda tympani. The increased activity of the submaxillary gland is accompanied by vaso-dilatation. Salivation usually occurs in five to six minutes after the administration of the drug, and continues for about two hours. The pancreatic secretion is only slightly increased. The stimulation of the intestinal glands leads to increased secretion, and a semi-fluid condition of the intestinal contents is produced. There is a marked increase in the secretion of bronchial mucus.

On Involuntary Muscles.—Pilocarpine stimulates the motor nerve-endings in all plain muscles in the body, the result being increased tone and augmented automatic movements. The peristaltic movements of the intestines are increased, and diarrhœa may result. Large doses cause constriction of the bronchioles, and a condition simulating asthma is produced.

On the Circulation.—Pilocarpine stimulates the vagus and the sympathetic nerve. Small doses given by the mouth cause acceleration of the heart-beat, due to stimulation of the sympathetic; this dominates the action on the vagus. If large doses be given, or if the drug be administered by intravenous injection, it reaches the heart quickly, and stimulates

the vagus so that the heart-beat is slowed. Vaso-constriction results from stimulation of the sympathetic, and the blood-pressure is raised in consequence.

On Respiration.—Toxic doses cause constriction of the bronchioles and a free secretion from the bronchial mucosa, so that respiration becomes dyspnœic, and rhonchi are heard all over the chest by auscultation.

On the Pupil.—Pilocarpine causes contraction of the pupil, whether applied locally or administered internally. This action depends on stimulation of the nerve terminals of the motor oculi. The intra-ocular pressure is diminished.

On the Blood.—Some authors state that the drug induces a lymphocytosis—*i.e.*, an increase of the white blood-corpuscles in the blood, derived from the spleen and lymphatic glands.

ANTIDOTES.—Atropine is physiologically antagonistic to pilocarpine, and hence is a suitable antidote. It may be administered hypodermically.

MEDICINAL USES.—The chief use of pilocarpine in veterinary practice is in the treatment of intestinal impaction. For this purpose it is sometimes combined with physostigmine, and it assists the action of the latter. Its action on the intestinal glands is more marked than is the case with eserine, but it has less effect on the muscular coat of the intestine. As pilocarpine does not produce sudorific effects in animals, its therapeutic value is limited, and it is not found of service in the treatment of renal dropsy or of uræmia, instances in which it proves useful in human medicine. The drug is not used internally in canine practice. As it lessens vascular tension in the eye, it is occasionally employed, in the form of eye-drops, in acute inflammatory affections of this organ, the strength being 2 grains to the ounce of distilled water.

Tincture of Jaborandi applied locally is said to stimulate the growth of hair.

CHAPTER XVII

THE VEGETABLE KINGDOM (*Continued*)

Nux Vomica.

Nux Vomica.

The dried ripe seeds of *Strychnos Nux-vomica*.

Doses of Powdered Nux Vomica.—Horses, grs. xx. to ℥i.; cattle, ℥i. to ℥ii.; sheep, grs. x. to grs. xx.; pigs, grs. x. to grs. xv.; dogs, gr. ss. to grs. iii. Repeated twice daily. It contains from 0·7 to 1·5 per cent. of strychnine.

Extractum Nucis Vomicæ Liquidum—Liquid Extract of Nux Vomica.

This is standardized to contain 1·5 per cent. of Strychnine (110 minims contain 1·5 grains of strychnine).

Doses.—Horses, ♏xx. to ℥i.; cattle, ℥i. to ℥i.ss.; sheep, ♏x. to ♏xx.; pigs, ♏viii. to ♏xv.; dogs, ♏ss. to ♏i.

Extractum Nucis Vomicæ Siccum.

A dry extract prepared from the liquid extract of Nux Vomica, and standardized to contain 5 per cent. of strychnine.

Doses.—Horses, grs. v. to grs. xx.; cattle, grs. x. to grs. xxv.; sheep, grs. ii. to grs. v.; pigs, gr. i. to grs. iii.; dogs, gr. $\frac{1}{20}$ to gr. $\frac{1}{10}$.

Tinctura Nucis Vomicæ—Tincture of Nux Vomica.

Prepared with Liquid extract of Nux Vomica, 50 millilitres; Distilled Water, 150 millilitres; and Alcohol (90 per cent.), q.s. to yield 600 millilitres. It contains about 0·125 per cent. of strychnine. Each fluid drachm contains about gr. $\frac{1}{16}$ of strychnine. This is half the strength of the B.P. 1898 Tincture.

Doses.—Horses, ʒss. to ℥i.; cattle, ℥i.; sheep, ♏xv. to ℥i.; pigs, ♏v. to ♏xx.; dogs, ♏ii. to ♏x.

Strychnina—Strychnine.

An alkaloid obtained by a complex process from the seeds of *Strychnos Nux-vomica*.

The salts of strychnine used are the *hydrochloride* and the *sulphate*.

Strychninæ Hydrochloridum—Strychnine Hydrochloride.

DOSES.—*By the mouth:* Horses, gr. ss. to gr. i.; cattle, gr. i. to grs. ii.; sheep, gr. $\frac{1}{8}$ to gr. $\frac{1}{4}$; pigs, gr. $\frac{1}{16}$ to gr. $\frac{1}{10}$; dogs, gr. $\frac{1}{100}$ to gr. $\frac{1}{60}$. For hypodermic injection the minimum doses should be given, and this is the usual mode of administration.

Liquor Strychninæ Hydrochloridi—Solution of Strychnine Hydrochloride (B.P.)—is composed of Strychnine Hydrochloride, 1 gramme; Alcohol (90 per cent.), 25 millilitres; Distilled Water, q.s. to yield 100 millilitres (1 in 100). Eleven minims are equivalent to $\frac{1}{10}$ grain of strychnine hydrochloride.

DOSES—*By the mouth:* Horses and cattle, ℥i. to ℥ii.; sheep, ♏xx. to ♏xxx.; pigs, ♏iii. to ♏x.; dogs, ♏i. to ♏iii.

By hypodermic injection: Horses and cattle, ℥i.; sheep, ♏xx.; pigs, ♏v.; dogs, ♏i. to ♏ii.

The doses of strychnine should be computed according to the size of the patient and the requirements of the case; it is safer to commence with the minimum dose and to gradually increase. As the drug is *cumulative* in its action, the effects should be carefully watched, especially in dogs (see p. 414).

Incompatibles of strychnine: alkalies and alkaline carbonates, bromides and iodides, liquor arsenicalis.

The liquor strychninæ should not be prescribed along with iodide of potassium, as an insoluble iodide may be thrown out. When it is desirable to combine liquor strychninæ with arsenic, the (acid) liquor arsenici hydrochloricus should be used instead of the liquor arsenicalis. It is not safe to dispense liquor strychninæ with alkaline solutions, as the alkaloid may become deposited in the mixture, and the last dose may prove toxic. When prescribed along with potassium bromide, the latter should be acidulated with hydrobromic acid, for a similar reason.

The sulphate of strychnine is administered in similar doses to the hydrochloride. For accuracy and convenience in preparing hypodermic injections of strychnine, chemists supply pellets containing from gr. ss. to gr. i. for the horse, and gr. $\frac{1}{100}$ to gr. $\frac{1}{50}$ for the dog.

Brucine is another alkaloid found in nux vomica; it resembles strychnine, but is far less active. It is not used medicinally.

Syrupus Ferri Phosphatis cum Quinina et Strychnina—Syrup of Phosphate of Iron with Quinine and Strychnine.

This is also known as Easton's Syrup. It contains in each fluid drachm 1 grain of anhydrous ferrous phosphate, $\frac{4}{5}$ grain of quinine sulphate, and $\frac{1}{32}$ grain of strychnine.

Dose.—For dogs, ♏xx. to ♏xxx.

Great care is essential in prescribing this preparation in the case of small dogs, as fatalities are not uncommon as the result of overdosage.

Actions of Strychnine and Nux Vomica.

In medicinal doses strychnine and nux vomica act as vegetable bitters, improving the appetite, augmenting the secretion of gastric juice in a reflex manner, and assisting digestion.

Strychnine is rapidly absorbed from abrasions of the skin, and from the cellular tissue when administered by hypodermic injection. When given by the mouth, the drug is absorbed chiefly from the small intestines.

In the horse it is said that no absorption of the drug occurs from the stomach, while in other animals absorption from the stomach is very slight.

Experiments show that, if strychnine be injected into the rectum, its effects on the nervous system are produced in seven minutes.

H. Gray has shown that, if the drug be injected into the normal bladder of the dog, toxic symptoms do not occur; but if cystitis be present absorption takes place, and evidences of poisoning develop.

When strychnine enters the blood, its specific action is exerted on the spinal cord and the medulla.

On the Spinal Cord.—The specific action of strychnine is exerted on the spinal cord. Experiments show that the drug acts on the sensory region of the cord. A toxic dose heightens the reflex excitability of the cord, so that the slightest sound or touch is sufficient to cause convulsions, which affect all the muscles of the body. In consequence of the extensor muscles being more powerful than the flexors, the head is drawn backwards, the fore and hind limbs are extended, and the trunk is bent in the form of an arch, the concavity being towards the superior surface of the spine (opisthotonus). The convulsions resemble to a certain extent those occurring in tetanus, but differ from the latter in having periods of complete relaxation, and in affecting the muscles of the body generally, so that the tonic spasm of the muscles of the jaw, known as trismus, is not specially marked in strychnine-poisoning. In the convulsions of strychnine-poisoning, the tonic contractions of the muscles are succeeded by irregular clonic contractions, and then by a period of relaxation, after which the convulsions recur.

It has also been shown by experiments that the convulsions are not initiated in the cord, but arise from a definite stimulus, generally from the surface of the body.

On the Medulla.—Strychnine increases and exaggerates the ordinary afferent impulses reaching this structure, so that the movements of respiration are rendered quicker and deeper. The drug also stimulates the vasomotor centre and causes constriction of the peripheral vessels, besides exciting the vagal centre, so that the heart-beat becomes slower than normal.

On the Cerebrum—strychnine has comparatively little effect.

On Respiration.—As already mentioned, the respiratory centre is stimulated, and the respirations are rendered deeper and more frequent.

Toxic doses may arrest respiration by causing violent contraction of the diaphragm and the other respiratory muscles during a convulsion, and after a very large dose of the drug this effect may be quickly produced. In other cases the respirations gradually become slower and shallower as paralysis of the respiratory centre proceeds. According to some

authors, the increased movements during the convulsions cause a greatly enlarged consumption of oxygen and a larger carbonic acid output, and these factors contribute to the production of asphyxia.

On the Circulation.—Small doses increase the strength of the cardiac beat; this probably depends on a direct action of the drug on the heart muscle. The blood-pressure is raised, chiefly by the vaso-constriction induced by stimulation of the vasomotor centre, but partly by the action of the drug on peripheral vessels. The cutaneous vessels are dilated at the same time, so that strychnine, like atropine, causes constriction of the splanchnic vessels and dilatation of the vessels of the skin.

On Plain Muscle.—Strychnine increases the tone of plain muscle throughout the body. This action is due, not only to exaggerated nervous reflexes, but also to a direct stimulant action on these muscles. Hence the good effects of the drug in cases of constipation, intestinal paralysis, and atony of the bladder, etc. The drug is eliminated very *slowly* from the system, and chiefly by the kidneys; it may be found in the urine up to eight days after the last dose has been administered. Even when given by hypodermic injection, it can be detected in the stomach. It is cumulative in its action, and this is believed to depend on the contraction of the renal arteries which it induces, thus interfering with its excretion. This is an important point to remember when prescribing the drug. No tolerance is acquired to the action of strychnine.

Toxic Effects.—Strychnine-poisoning is very frequently met with in canine practice. The drug is a favourite constituent of rat-pastes and vermin-killers, and is often employed to 'poison' lands for the purpose of preventing the trespass of dogs. Accidents from these sources, as well as the malicious use of the agent, have proved very fatal to dogs. When administered for therapeutical purposes, toxic symptoms are sometimes observed, depending on either too large a dose of the drug, its cumulative action, or a special susceptibility of the patient.

The toxic dose for the dog is stated to be from $\frac{1}{6}$ to $\frac{1}{3}$ of a grain, but smaller amounts may produce the characteristic symptoms, especially in small animals. For the horse, from 3 to 6 grains given hypodermically have proved toxic. The symptoms observed are laboured respiration, accelerated pulse, abdominal pain, excitement, and violent tetanic spasms when the surface of the body is touched.

The symptoms in the dog vary in severity according to the amount of the drug taken. A large dose may cause death after two or three convulsions, as the breathing becomes arrested by violent contraction of the diaphragm and other respiratory muscles. A smaller dose may produce shorter convulsions and longer intervals of quiescence, with gradual lessening of reflex irritability, and death from asphyxia. During the convulsions the head is drawn backwards, and the fore and hind limbs are extended; all the muscles of the body are involved, but the action of the extensors generally prevails over the others. At the commencement of the convulsions tremors or involuntary twitchings occur in the limbs, and the muscles feel hard and firm. Immediately after a convulsion the muscles relax, prostration occurs, and the respirations become more regular; but a second convulsion quickly follows on the first.

Nux vomica in the form of powder is of variable strength, and large doses may be taken by horses without apparent ill-effects. To large cart-horses, 1 ounce of powdered nux vomica may be prescribed in cases of intestinal obstruction depending on paralysis of the intestines, and to horses of smaller size $\frac{1}{2}$ ounce may be given with benefit.

Post-Mortem Appearances.—Besides the usual post-mortem appearances of asphyxia, congestion of the cerebral and spinal meninges is observed, and occasionally patches of congestion are found in the intestines.

ANTIDOTES.—In the dog, emetics should be administered as soon as possible. The most reliable emetic is apomorphine, administered hypodermically, the dose being from $\frac{1}{15}$ to $\frac{1}{10}$ grain, or 5 minims of the 1 in 50 solution. The treatment in cases of strychnine-poisoning must be prompt to

be effectual; indeed, once the drug has become absorbed and exerts its action on the nervous system, emetics are of little value; besides, the vomited material may enter the trachea during a convulsion and prove dangerous. Antidotes administered by the mouth should be given between the convulsions. Bromide of potassium, ½ ounce, with chloral hydrate, 30 grains, should be given in solution, and 2 drachms of the former with 10 grains of the latter may be given every fifteen or twenty minutes if necessary. The inhalation of chloroform so as to produce light anæsthesia is useful to combat the convulsions; it is easy of administration and can be discontinued if symptoms of paralysis appear.

Other antidotes recommended are nitrite of amyl inhalations, animal charcoal, tannic acid. In cases of emergency, tobacco may be given (see p. 396). Morphine has also been tried with success (p. 372). Artificial respiration sometimes proves of benefit.

As already remarked, unless cases of strychnine-poisoning are treated early, they prove fatal, more especially when the amount taken has been large.

MEDICINAL USES.—*As a stomachic bitter and gastric tonic*, nux vomica is prescribed in cases of dyspepsia. It may be combined with sodium bicarbonate and a simple bitter, such as gentian or calumba.

As a general tonic, nux vomica is prescribed in cases of general debility in all classes of patients, and may be combined with other tonics, such as iron and quinine. It increases appetite, assists digestion, imparts tone to the gastric walls, and regulates intestinal peristalsis.

As a stimulant to the spinal cord and central nervous system, strychnine is prescribed in cases of paralysis of the limbs, bladder, or intestines. It cannot be of any benefit when distinct anatomical lesions of the central nervous axis are present, or when the paralysis depends on hæmorrhage interfering with the functions of the brain or spinal cord, or on destruction of nerve-cells. In cases of paralysis of the hind-limbs depending on chronic pachymeningitis, which are so frequently met with in canine practice, the hypo-

dermic injection of strychnine is sometimes employed, but in our experience it is of little, if any, value. The drug is *contra-indicated* in the early stages of such affections, when the paralysis depends on an inflammatory process, or where marked irritation is present.

In cases of colic in the horse depending on fæcal obstruction in the intestines, nux vomica combined with ammonium carbonate in full doses is recommended by Caulton Reeks.

As a cardiac stimulant and tonic, strychnine is employed in cases of pneumonia where cardiac failure is threatened. In respiratory affections in which marked depression of the respiratory centre is present the drug is also indicated.

It was at one time believed that the hypodermic injection of strychnine was of marked value in the treatment of surgical shock, but experiments showed that, although in lesser degrees of shock it temporarily raised the blood-pressure and caused a marked improvement, which was transient, in severe cases it proved not only useless, but harmful. 'In animals suffering from shock, the administration of strychnine caused a rise in the blood-pressure which was influenced by the degree of shock—that is, if the degree of shock was slight, there was a marked temporary rise in blood-pressure; but if it was severe, strychnine produced no effect. In all stages the animal passed into a deeper degree of shock as soon as the effects of the strychnine passed off' (Mr. Lockhart Mummery, F.R.C.S., *Lancet*, April 1, 1905).

In cattle practice, nux vomica and strychnine are largely employed. In affections of the stomach which are usually accompanied by a paralyzed condition of the gastric walls, full doses of nux vomica combined with ammonium carbonate give good results.

In cases of paralysis depending on defective nervous power, which is sometimes met with both before and after parturition in cows, the hypodermic use of strychnine is indicated after delivery has taken place.

Strychnine is sometimes employed in cases of milk-fever which do not respond to the air treatment. Occasionally it gives good results, but adrenalin is far more reliable, while

atropine is said to be preferable to either of these agents in cases which are prolonged.

In consequence of the susceptibility of the dog to the action of strychnine, discrimination is necessary in prescribing this agent, especially for the smaller breeds. In some cases it is very difficult to compute the suitable dose, and what might be considered a moderate amount may produce the characteristic toxic symptoms. The cumulative action of the drug should be remembered in the treatment of cases in which it is necessary to continue its administration for some time.

In the treatment of cases of paralysis, the doses of the drug should be carefully increased, until slight twitching of the muscles is induced. The liquor strychninæ is the best preparation to employ, as its composition is constant.

CHAPTER XVIII

THE VEGETABLE KINGDOM (*Continued*)

Caffeine.

Caffeina—Caffeine.

An alkaloid obtained from the dried leaves of *Camellia Thea* (the tea-plant), or from certain other plants.

DOSES.—Horses, grs. xv. to ℥i.; dogs, gr. i. to grs. iv.

Caffeinæ Citras—Caffeine Citrate.

A compound of caffeine and citric acid.

DOSES.—Horses, ℥ss. to ℥ii.; dogs, grs. ii. to grs. viii.

ACTIONS.—Caffeine exerts its actions on the central nervous system, the heart, kidneys, and muscles. Its primary action on the central nervous system is that of *stimulation*. It stimulates the vasomotor centre, and causes a rise in the blood-pressure, and also accelerates respiration by stimulation of the respiratory centre. In animals large doses act chiefly on the spinal cord, and in toxic amounts produce tetanic spasms resembling those occurring in strychnine-poisoning. Smaller doses induce restlessness without any alteration in the reflex excitability.

Caffeine has a special action on muscles, medicinal doses increasing their strength, extensibility, and power for work. Very large doses render the muscles stiff and hard, and induce a condition resembling *rigor mortis* of the muscle fibres; but paralysis of the respiratory centre usually occurs before this phenomenon appears.

Caffeine exerts a complex action on the heart and circulation. Medicinal doses increase the rate of the heart by a

direct action on the cardiac muscle, the force of contraction is slightly augmented, and the output of blood per minute is increased.

Toxic doses cause arhythmia, terminating in fibrillary contraction of the auricles, and finally of the ventricles. The drug causes dilatation of peripheral vessels by a direct action on the muscular coat of the vessel wall. Nevertheless, blood-pressure is raised, as the increased output from the heart, and the stimulation of the vasomotor centre, overcome the peripheral dilatation.

The drug in medicinal doses stimulates the respiratory centre and increases the number and depth of the respirations.

Caffeine acts as a diuretic; the watery portion of the urine is much increased, as the specific gravity is lowered, but the total amount of the solids excreted is increased. There is at first a temporary constriction of the renal vessels, produced by central stimulation, and a lessened flow of urine. Dilatation of these vessels next occurs, followed by diuresis. According to Dixon, this dilatation is due to the effect of the drug on the muscular coat of the vessels. Some authors state that diuresis depends on a specific effect of the drug on the renal epithelium.

MEDICINAL USES.—Caffeine is seldom employed in veterinary practice. It is recommended by Continental veterinarians as a general stimulant in the treatment of milk-fever in cows when there are symptoms of threatening failure of the circulation or respiration; for this purpose it is injected hypodermically. Adrenalin or atropine, however, appear to fulfil these indications in a more reliable manner.

Caffeine is occasionally prescribed as a diuretic in cases of cardiac, hepatic, or renal dropsy, in canine practice. Theobromine, an alkaloid obtained from the seeds of *Theobroma cacao*, is said to be more effectual as a diuretic in such cases, and may be combined with digitalis in the treatment of dropsy of cardiac origin.

Digitalis.

Digitalis Folia—Digitalis Leaves.

The dried leaves of *Digitalis purpurea*, the Purple Foxglove.

Doses of the Powdered Leaves.—Horses, grs. xv. to ℥ss.; cattle, ℥ss. to ℥i.; sheep, grs. v. to grs. x.; pigs, grs. ii. to grs. v.; dogs, gr. ¼ to grs. ii.

Infusum Digitalis—Infusion of Digitalis: 7 of Digitalis Leaves in 1,000 of Boiling Water.

Doses.—Horses and cattle, ℥ii. to ℥iv.; dogs, ℥ss. to ℥ii.

Tinctura Digitalis—Tincture of Digitalis: 1 of Digitalis Leaves in 10 of Alcohol (70 per cent.). This is four-fifths the strength of the B.P. 1898 Tincture.

Doses.—Horses, ℥ii. to ℥iv.; cattle, ℥iv.; sheep, ♏xx. to ♏xxx.; pigs, ♏x. to ♏xv.; dogs, ♏ii. to ♏x.

Incompatibles of digitalis and its preparations: Ferrous sulphate, tincture of ferric chloride, preparations of cinchona, acetate of lead. Although incompatibles, salts of iron are often prescribed with digitalis. The mixture assumes an inky colour, in consequence of the tannic acid which is present in the drug combining with the iron; this can be prevented by the addition of citric acid.

A Fluid Extract of Digitalis, which is adjusted to a definite standard by physiological assay, is also prepared, and is much to be preferred to the ordinary preparations, which are frequently unreliable. One cubic centimetre of this fluid extract represents 1 gramme of drug of standard strength.

Doses of the Fluid Extract.—Horses, ♏x. to ♏xxv.; cattle, ♏xv. to ♏xxx.; sheep, ♏iii. to ♏viii.; pigs, ♏ii. to ♏v.; dogs, ♏ss. to ♏ii.

Digitalin is one of the glucosides found in digitalis; it possesses the medicinal actions of digitalis, but is not always reliable:

Doses (*for hypodermic injection*).—Horses, gr. ⅛ to gr. ¼; dogs, gr. $\frac{1}{100}$ to gr. $\frac{1}{30}$.

Digitalis contains a number of active principles in addition to digitalin, which possess the characteristic action of the drug on the heart; these include the glucosides termed Digitoxin, Digitalein, and Digitophyllin. It also contains a glucoside termed Digitonin.

Digitonin possesses irritant actions like those of saponin (obtained from quillaia bark), and appears to be to a certain

extent antagonistic to the other active principles, as it causes dilatation of the vessels instead of contraction. All the glucosides, when pure, are insoluble in water, but are taken up from the leaves by water, and hence all are present in the infusion of digitalis, which is regarded as a powerful preparation. The infusion is said to possess a greater diuretic effect than the tincture. Digitonin is insoluble in alcohol, so that the tincture of digitalis does not contain it. Digitoxin is the most powerful constituent in digitalis.

Various proprietary preparations of digitalis are on the market, and are claimed to possess distinct advantages over the ordinary preparations of the drug.

Digipoten (Abbott) is a trituration of the glucosides of digitalis with sugar of milk. It contains the several active and medicinal glucosides of the drug, and is standardized physiologically. One grain is equivalent to 1 grain of digitalis leaves.

Digalen is a colourless solution of digitoxin. One cubic centimetre (17 minims) is equivalent to gr. $\frac{1}{250}$ of digitoxin. It is supplied in the form of solution or in hypodermic tablets.

Doses.—Horses, ʒiv.; dogs, ♏v. to ♏xv.; by intramuscular injection.

Actions of Digitalis.

Locally, digitalis exerts an irritant action on mucous surfaces. It has little effect on the skin, but if injected subcutaneously it causes inflammation, which may terminate in the formation of an abscess. Digitalis is slowly absorbed from the small intestine, and the effects of medicinal doses, especially diuresis, are not observed until about forty-eight hours after treatment is commenced. In full doses, especially if continued for some time, digitalis produces irritation of the stomach and nausea in all animals. The chief actions of the drug are exerted on *the heart, the bloodvessels, and the kidneys.*

On the Heart digitalis exerts a complex action. In medicinal doses the drug slows the rate of the heart. This effect is brought about in two ways: (*a*) By stimulation of the vagal centre in the medulla, and also of the vagal endings in the cardiac muscle; (*b*) by acting on the cardiac muscle, so that its tonus is increased and systole becomes more prolonged.

As the result of both actions the heart-beat is slowed to a moderate extent, and the organ fills and empties itself more completely—*i.e.*, diastole and systole are more efficiently performed; and in consequence the output from the heart is augmented, and the force and length of systole are increased.

The toxic action of digitalis may be conveniently considered as occurring in two stages.

The *first* stage may be termed that of excessive inhibition. In it the inhibitory action of the drug predominates, *pro tem.*, over the action on the cardiac muscle. The result is an irregular and slow heart-beat, and frequently arhythmia is present.

In the *second* stage, which occurs after very large doses of digitalis, fibrillary twitchings of the cardiac muscle are produced. This condition is believed to depend on an action of the drug on the excito-motor area of the cardiac muscle. The heart-beats become very irregular and accelerated, and ultimately a condition known as 'delirium cordis' is produced.

On the Bloodvessels.—Vaso-constriction both peripheral and central is produced; but the former is considerable, and is due to a direct action of the drug on the muscular coat of the arterioles.

On Blood-Pressure.—Medicinal doses of digitalis cause a rise in blood-pressure owing to the vaso-constriction which is present, and also the increased output from the heart. During the first stage of the toxic action of the drug, there is a fall in blood-pressure owing to the diminished output from the heart, while in the second stage the pressure rises temporarily during the cardiac acceleration, but falls again when arhythmia sets in, and it drops to zero on the occurrence of 'delirium cordis.'

Digitalis in toxic doses causes constriction of the coronary arteries, and this may occur to such an extent that death results from interference with the blood-supply of the heart.

On the Kidneys.—In the normal animal digitalis does not induce diuresis, but if the drug be given in a case of cardiac disease, especially mitral disease accompanied by venous

congestion and ascites and a scanty secretion of urine, a free flow of urine results; and this depends on an improved circulation, whereby the kidney receives a proper supply of arterial blood. The fluid portion of the urine is increased, but the salts and urea are not augmented proportionally.

If, however, very large doses of digitalis be administered, vaso-constriction may occur to such an extent that the amount of urine is lessened, or the secretion may be inhibited (anuria).

On the Central Nervous System.—The medulla is stimulated, the respirations become deeper and quicker, and excitation of the vasomotor centre also occurs. Toxic doses of the drug may produce convulsions in some instances.

Digitalis is *cumulative* in its action. This is an important point with reference to its therapeutic employment. It probably depends on irregularities in the absorption and excretion of the drug. Both absorption and excretion are slow, and if the agent accumulates in the blood toxic symptoms may ensue, evidenced by a slow and irregular pulse, muscular weakness, and nausea. These symptoms may suddenly develop in a case in which the drug is administered for some time.

Toxic Actions.—The toxic dose of powdered digitalis for the horse is stated to be from 6 to 8 drachms, and of digitalin 1½ grains. The symptoms observed are nausea and purging, the fæces being sometimes tinged with blood. The pulse is at first slow and full, but soon becomes quick and irregular; the action of the heart is accompanied by a vibratory thrill and a distinct bellows murmur; colicky pains, difficult respiration, tympanites, salivation, and frequent attempts at urination, are also present.

In the dog the toxic dose of powdered digitalis is said to be from 1 to 2 drachms, and of digitalin ¼ grain. The symptoms observed are vomiting, laboured respiration, a weak, irregular pulse, frequent attempts at urination, abdominal pain, and muscular debility.

Cases of poisoning by digitalis are seldom met with in veterinary practice, but instances in which the toxic symptoms

of the second stage have been induced by too full doses, or by continuing the drug for too long a period, occur occasionally.

The suitable ANTIDOTES are stimulants such as alcohol or aromatic spirit of ammonia. Tannic or gallic acid is also recommended.

In the dog treatment should be commenced by the administration of an emetic.

MEDICINAL USES.—The chief use of digitalis is in connection with the treatment of certain affections of the heart and of the sequelæ resulting from such diseases. It must be distinctly understood, however, that the drug is not indicated in all cases of cardiac affections, and that its employment requires discrimination and judgment.

The conditions in which it is likely to be of service are those characterized by the blood tending to accumulate in the veins, while the arteries are less completely filled than in a normal state. The uses of digitalis in equine practice are lessened by the fact that horses suffering from marked organic affections of the heart are useless for work, and are unsafe, in spite of any treatment. In canine practice, however, this need not be considered.

In functional disorders of the heart in the horse, the judicious employment of digitalis sometimes proves of value.

In cases of dilatation of the heart, with a weak and insufficient systole, digitalis, by its action on the cardiac muscle, overcomes the condition, *provided* no degeneration of the cardiac walls is present. It increases the ventricular systole, raises the blood-pressure in the arteries, and improves the nutrition of the heart itself.

In certain valvular diseases, such as mitral incompetency, digitalis, by causing stronger contractions of the ventricles, overcomes the tendency to congestion of the lungs, and also, owing to the increase in systole, it lessens the extent of the mitral orifice, and thus diminishes the proportion of blood which regurgitates into the left auricle. The congestion of the systemic veins is lessened, and the kidneys are assisted to excrete the abnormal amount of fluid which has accumulated in the body.

In cases of aortic incompetency and aortic stenosis digitalis is also prescribed with beneficial results.

In cases characterized by an irregular irritable condition of the heart, such as may occur during convalescence from influenza and allied affections, the judicious administration of digitalis in combination with iron proves of value in some instances.

Digitalis is *contra-indicated* in valvular affections when compensatory hypertrophy is present. It is when such hypertrophy is absent or tends to fail that the drug is likely to produce beneficial results.

It is also *contra-indicated* in cases of cardiac dilatation when extensive fatty degeneration of the organ is present, as the cardiac muscle is unable to respond to the stimulation, and, as the blood-pressure in the arteries becomes raised, the heart may be unable to overcome the increased resistance, and sudden death may result.

This drug is also contra-indicated in cases of extensive degeneration of the arterial walls, such as occurs in some forms of renal disease, as the increased pressure which is produced may lead to rupture of the cerebral vessels. For further details of the employment of digitalis in cardiac affections see ' The Treatment of Diseases of the Heart ' in Part III.

It must be remembered that digitalis, if administered in full and prolonged doses, may produce symptoms which might be mistaken for those of disease, and if the drug be continued with a view to combat these symptoms serious results will ensue. These symptoms consist of a quick, feeble, intermittent pulse, and suppression of urine.

Digitalin, in combination with strychnine, atropine, and arsenic, is employed by American practitioners in the treatment of pulmonary emphysema in horses. Digalen has also been used with success in the treatment of azoturia (see ' Azoturia,' Part III.).

In prescribing digitalis, its *cumulative* action must be remembered. The drug must not be continued for too long a period, and the doses should be carefully graduated. The nausea, loss of appetite, and gastric irritability, induced by

digitalis, especially in some patients, must also be kept in mind, and on the first appearance of these symptoms the doses should be reduced or the drug discontinued. Small doses, administered twice or three times daily, give the best results, the effects on the pulse and on the system generally being carefully watched.

In order to avoid the irritating effect likely to occur from hypodermic injection of digitalin, it is advisable to administer the drug by intramuscular injection.

Strophanthus.

Strophanthi Semina—Strophanthus Seeds.

The dried ripe seeds of *Strophanthus Kombé*. The active principle is a glucoside termed STROPHANTHIN.

Tinctura Strophanthi—Tincture of Strophanthus.

One part of Strophanthus Seed in 10 parts of Alcohol (70 per cent.). This is four times the strength of the B.P. 1898 Tincture.

DOSES.—One-half those of tincture of digitalis.

ACTIONS AND USES.—Strophanthus resembles digitalis to a certain extent in its actions. It is more soluble, and is absorbed more rapidly. Its action on the heart is similar to that of digitalis, but it has less effect on peripheral nerve-endings and on the central nervous system than the latter drug, and it does not produce peripheral vaso-constriction. Strophanthus raises blood-pressure without constricting to any extent the renal vessels, hence it acts as a diuretic in the normal animal. It is not so likely to produce irritation of the stomach as digitalis, and is said to be excreted sufficiently rapidly to prevent cumulative effects.

Strophanthus may be prescribed in cases where it is desirable to act on the heart, and not on the vessels. It may also be employed in cases where digitalis is found to disagree with the patient.

STROPHANTHIN is occasionally prescribed as a heart tonic in cases of valvular disease, and in pneumonia. For the horse the dose for hypodermic injection is gr. $\frac{1}{5}$, repeated hourly according to circumstances, and for the dog gr. $\frac{1}{130}$ to gr. $\frac{1}{120}$.

Squill.

Scilla—Squill.

The dried bulb of *Urginea Scilla*.

Syrupus Scillæ—Syrup of Squill.

Vinegar of Squill, 175 millilitres; Refined Sugar, 650 grammes; Distilled Water, q.s. to produce 1,000 grammes (about 1 part of squill in 18 parts of syrup).

DOSES.—Horses, ℥ss. to ℥i.; dogs, ℥ss. to ℥i.

Tinctura Scillæ—Tincture of Squill.

One part of Squill in 5 parts of Alcohol (60 per cent.).

DOSES.—Similar to those of tincture of digitalis.

ACTIONS AND USES.—Squill resembles digitalis in its actions, but exerts a more powerful action on the heart than the latter drug. Its action on bloodvessels is more marked than that of digitalis. Small doses cause a mild irritation of the stomach, and in a reflex manner produce secretion from the bronchioles, and hence the drug is an expectorant.

Large doses in the dog cause vomiting, purging, and urinary irritation.

The chief use of squill is in the treatment of chronic bronchitis in the dog. It increases the bronchial secretions and accelerates the removal of the inflammatory products. Some authorities believe that this action is a remote local one—*i.e.*, the structures of the bronchial wall are stimulated during the excretion of the drug.

It is *contra-indicated* in the early stages of acute bronchitis.

As a *diuretic*, squill is occasionally prescribed in cases where large accumulations of fluid exist in the abdominal cavity. It may be combined with small doses of digitalis and calomel.

Convallaria.

Convallaria—The flowers as well as the entire plant of *Convallaria Majalis* (Lily of the Valley).

Tinctura Convallariæ—Tincture of Convallaria.

One part of Convallaria in 8 parts of Proof Spirit.

DOSES.—Similar to those of tincture of digitalis.

ACTIONS AND USES.—Convallaria resembles digitalis in

its actions. It is said not to possess the nauseating effects of the latter drug, and not to be cumulative in its actions. It is occasionally prescribed in veterinary practice as a cardiac tonic and diuretic.

Cactin.

This is an active principle obtained from *Cactus grandiflorus* (*Cereus grandiflorus*). According to some reports it is inactive.

Cactoid (Abbott) is prepared from the fresh leaves and young stems of the above plant, and is said to contain the combined principles of the drug. It is largely employed by American practitioners as a cardiac stimulant and heart tonic in cases of disturbed circulation from any cause. It is said to have little or no effect on the normal heart. Cactoid enters into the composition of the preparation known as H.M.C. (see p. 372).

DOSES (*by hypodermic injection*). — Horses, gr. $\frac{1}{12}$; dogs, gr. $\frac{1}{60}$, repeated every four hours.

CHAPTER XIX

THE VEGETABLE KINGDOM (*Continued*)

Ergot.

Ergota—Ergot; Ergot of Rye.

The sclerotium of *Claviceps purpurea*, a parasitic fungus originating in the ovary of *Secale cereale* (rye grass).

Doses of Powdered Ergot.—Horses and cattle, ʒss. to ʒi.; sheep and pigs, ʒi. to ʒi.ss.; dogs, grs. xv. to grs. xx. This is a very unreliable form in which to prescribe the drug.

Extractum Ergotæ—Extract of Ergot. This is also known as *Ergotin*. It is not an alkaloid, but simply a soft extract of the drug.

Ergot, crushed, 1,000 grammes; Distilled Water, 7,500 millilitres; Alcohol (90 per cent.), 650 millilitres.

Doses.—Horses and cattle, ʒss. to ʒii.; sheep and pigs, grs. xv. to grs. xx.; dogs, grs. ii. to grs. viii.

Extractum Ergotæ Liquidum—Liquid Extract of Ergot.

Ergot, crushed, 1,000 grammes; Distilled Water, 7,500 millilitres; Alcohol (90 per cent.), 375 millilitres. (Strength, 1 in 1.)

Doses.—Horses and cattle, ʒii. to ʒvi.; sheep and pigs, ♏xv. to ʒi.; dogs, ♏x. to ♏xxx.

Injectio Ergotæ Hypodermica—Hypodermic Injection of Ergot.

Extract of Ergot, 33 grammes; Phenol, 1 gramme; Distilled Water, sufficient to produce 100 millilitres.

It should be recently prepared; 110 minims contain 33 grains of extract of ergot.

Doses (*by hypodermic injection*).—Horses and cattle, ♏lxxx. to ʒii.; sheep and pigs, ♏xv. to ♏xx.; dogs, ♏v. to ♏x.

Tinctura Ergotæ Ammoniata—Ammoniated Tincture of Ergot.

Ergot, 250 grammes; Solution of Ammonia, 100 millilitres; Alcohol (60 per cent.), sufficient to produce 1,000 millilitres. (1 in 4.)

Doses.—Horses and cattle, ʒi. to ʒii.; dogs, ʒss. to ʒi.

Ergot Aseptic (Parke, Davis and Co.).—This is a preparation of ergot physiologically tested and standardized, and suitable for hypodermic administration. It is twice the strength of the B.P. Liquid Extract, and is put up in hermetically sealed bulbs, each containing 1 c.c. (16·9 minims).

It is too expensive for the larger animals, but is useful in canine practice, the dose for the dog being from 2 to 5 minims, which should be injected deeply into the muscular tissues, with due aseptic precautions.

Actions.—Recent investigations have demonstrated that the actions of ergot depend on the presence of three active constituents—viz., (1) *Ergotoxine*, (2) *Tyramine*, (3) *Ergamine*. The combined action of these constituents explains the phenomena produced by the administration of the drug. Up to the present time it has not been considered advisable to prescribe any of these constituents separately, in consequence of a lack of knowledge concerning their clinical value, so that preparations of the drug itself, standardized physiologically, are employed.

Ergotoxine is the hydrate of the crystalline base ergotinine. The latter is comparatively inert. Sphacelinic acid and sphacelotoxin are now regarded as impure forms of ergotoxine.

Ergotoxine is the constituent which is responsible for causing local gangrene and other lesions which occur as the result of the toxic action of ergot. It exerts its effects on plain muscle throughout the body, increasing tone and contractile power, and acts specially on the bloodvessels, inducing vaso-constriction and stasis in certain areas of the peripheral circulation. The walls of the larger arteries

become thickened, and the lumen is diminished, while in the smaller vessels the constriction is sometimes associated with the presence of hyaline thrombi and hyaline degeneration of the intima. The result is that gangrene and sloughing of peripheral parts takes place, and if swine be fed experimentally with ergotized rye, the tips of the ears become of a dark colour, and ultimately slough away, while in some instances local patches of gangrene are observed. If fowls be the subjects of experiment, gangrene and sloughing of the comb and wattles are produced, and it is by this means that the activity or otherwise of crude samples of the drug is determined (physiological standardization). In some instances the vascular stasis induced in the alimentary canal leads to ecchymoses and ulceration of the gastro-intestinal mucosa. Full doses cause increased peristaltic movements of the intestine. Tonic contractions of the uterus are produced, provided this organ be gravid, otherwise the drug has no action in this respect. In the case of the gravid uterus, abortion may be induced. Ergotoxine augments the force of the cardiac contractions, and hence the output of blood from this organ is increased and the blood-pressure is raised.

The drug excites the ganglion cells of the sympathetic nerve-supply to all organs containing plain muscle, and is said not to exert a peripheral action like adrenalin. It causes depression of the central nervous system, and in large doses produces paralysis of this structure. Ergotoxine is not present in the Liquid Extract of Ergot.

TYRAMINE stimulates the sympathetic nerve-endings, and resembles adrenalin in this respect. It exerts its actions especially on the heart and arterioles, and causes a quicker and more vigorous cardiac beat, and a rise in blood-pressure. It induces uterine contractions which are far more marked if the organ be gravid; in some instances it exerts no action on the non-pregnant uterus. The explanation suggested by Dixon is that the sympathetic supplies both motor and inhibitory nerves to the uterus, and when the organ hypertrophies during pregnancy, the development of the motor sympathetic fibres overshadows that of the inhibitory; and

hence tyramine exerts its action in this condition, while in the non-pregnant state its effect is insignificant.

ERGAMINE exerts a direct stimulant action on certain forms of plain muscle, increasing automatic contractions and tonus. It acts specially on the uterus, and its effect thereon is as marked in the non-pregnant as in the gravid condition. It has also a marked action on the muscular structures of the bronchioles, but its effect on the heart, intestines, and bladder, is less distinct.

Ergamine causes well-marked dilatation of the peripheral arterioles and a distinct fall in blood-pressure, but the pulmonary blood-pressure rises. The drug, according to the results of experiments, exerts its effects entirely at the periphery, but its exact area of action is not known.

ACTIONS OF CRUDE ERGOT.—From a consideration of the actions of the three constituents mentioned above, we can judge of the effects produced by administration of Ergot itself. The drug causes constriction of the peripheral arterioles, this effect depending on the action of ergotoxine on the ganglion cells, and of tyramine on the nerve-endings. The vaso-constriction produced by the liquid extract of ergot depends on tyramine alone, as the former contains no ergotoxine. The vaso-dilatation induced by ergamine is overcome by the other constituents of ergot.

On the Heart.—Ergot causes more vigorous cardiac action, a more complete systole, and an increased output of blood. These effects are chiefly due to tyramine, but are assisted by the action of ergamine on the cardiac muscle.

On Blood-Pressure.—Ergot causes a rise of blood-pressure. The pressure in the pulmonary vessels also rises. This is due to the increased amount of blood sent out from the right side of the heart. The drug does not constrict the pulmonary vessels, but, on the contrary, causes passive dilatation due to the rise in pulmonary blood-pressure. Hence ergot is contra-indicated in cases of pulmonary hæmorrhage, as it would tend to increase the flow of blood from the ruptured vessel.

SECONDARY EFFECTS.—These include the effects of vaso-

constriction and changes in the peripheral vessels mentioned on p. 428, and also increased peristalsis of the intestines. In the pregnant animal ergot acts as an ecbolic, and brings about abortion by its effect on the uterus—viz., augmented contractions of the muscle fibres and more active movements of the muscular coat of the organ. Ergotoxine and tyramine produce these effects through the nervous system, while ergamine acts directly on the muscular coat of the uterus.

Toxic Effects.—Ergotized grasses produce abortion in cows and ewes, especially in wet seasons. The condition is known as *ergotism*.

Hay from ergotized pastures, being usually cut before the fungus is matured, is not so liable to cause toxic effects as the grass from such pastures. Ergotized maize has also caused toxic symptoms.

Dry gangrene, as the result of ergotism, chiefly affects the extremities, ears, and tail. The nervous phenomena consist of convulsive twitchings, spasms, convulsions, and finally paralysis and coma. These effects are believed to depend on irritation of the sensory centres of the spinal cord, succeeded by paralysis of this structure.

Antidotes.—The antidotes recommended are the inhalation of amyl nitrite and the administration of nitro-glycerin. Stimulants, such as alcohol, chloric ether, etc., are indicated, and treatment should be commenced with the administration of an oleaginous laxative.

Medicinal Uses.—One of the most important uses of ergot in veterinary practice is in the treatment of uterine inertia in the bitch and cat. This condition is rare in the larger animals, but common in canine practice, especially in the case of small bitches. Before employing the drug in such instances care should be taken that no obstruction to delivery is present, such as an abnormal presentation or a contracted pelvis, etc. Moderate doses should be prescribed, so as to avoid the risk of excessive tonic contractions of the uterus being produced, which might cause the death of the fœtus owing to constriction of the uterine bloodvessels, or rupture of the organ might be induced. A reliable prepara-

tion of the drug should always be employed. Many practitioners now prefer pituitrin to ergot in the treatment of uterine inertia.

In *post-partum* hæmorrhage ergot proves useful, by promoting contraction of the uterus, and to a lesser extent by causing constriction of the uterine bloodvessels. This condition is of comparatively rare occurrence in veterinary practice.

In the treatment of internal hæmorrhage ergot is often prescribed, but, as it raises the general blood-pressure, its therapeutic value is doubted by many observers. It is contra-indicated in pulmonary hæmorrhage, for reasons already given (see p. 429).

In combination with drugs such as veratrine and strychnine, ergot is employed in the treatment of pulmonary emphysema ('broken wind'). It enters into the composition of several advertised preparations for this purpose, and its beneficial effects must be ascribed to its effects on the muscular walls of the bronchioles.

In the treatment of surgical shock, some human surgeons employ ergot in combination with normal saline solution, administered in the form of intravenous injections.

In cases of retention of the placenta, in the mare and cow, powdered ergot is often prescribed, and forms a constituent of 'cleansing drenches.' Judging by the unreliable character of ordinary powdered ergot, its effect in bringing about expulsion of the placenta is extremely doubtful. If any real value were to be obtained from the drug in such cases, a reliable preparation should be administered either *per os* or subcutaneously.

In consequence of the tendency of preparations of ergot to cause local irritation when administered hypodermically, intramuscular injection is advisable.

In canine practice H. Gray advises the following doses of ergot, computed according to the body-weight of the animal.

Extract of Ergot (Ergotin): gr. $\frac{1}{10}$ to gr. $\frac{1}{4}$ per pound of the body-weight, for oral administration.

Ammoniated Tincture of Ergot: ℥ss. to ℥ii.

Mugwort.

The leaves and flowering tops of *Artemesia vulgaris*. A fluid extract of this drug is recommended in the treatment of retained placenta in cows. It is said by some practitioners to prove very effectual in causing expulsion of the placenta. Four drachms of fluid extract of mugwort with an equal amount of fluid extract of ergot are administered as a drench every four hours, until the desired effect is produced.

CHAPTER XX

THE VEGETABLE KINGDOM (*Continued*)

Simple Bitters and Aromatic Volatile Oils.

Calumba.

Calumbæ Radix—Calumba Root.

The dried root of *Jateorhiza Columba.*

Tinctura Calumbæ—Tincture of Calumba.

One of Calumba Root in 10 of Alcohol (60 per cent.).

This is the preparation of the drug usually employed.

Doses.—Horses and cattle, ʒi. to ʒii.; sheep and pigs, ʒi. to ʒii.; dogs, ʒss. to ʒi.

An infusion of the drug (1 in 20) is also official.

Actions and Uses.—Calumba is a bitter stomachic. It promotes secretion of gastric juice, assists digestion, and increases appetite. It is prescribed in cases of atonic dyspepsia in all animals, and may be combined with a nerve tonic such as nux vomica and an alkali such as sodium bicarbonate. As calumba does not contain any tannic acid, it may be combined with preparations of iron, without causing a change of colour in the mixture or throwing down a precipitate.

Gentian.

Gentianæ Radix—Gentian Root.

The dried rhizome and root of *Gentiana lutea*—the Yellow Gentian. It contains an active principle—Gentio-picrin.

Doses of Powdered Gentian Root.—Horses, ʒss. to

℥i.; cattle, ℥i. to ℥ii.; sheep and pigs, ℥i. to ℥ii.; dogs, grs. v. to grs. xx.

Tinctura Gentianæ Composita—Compound Tincture of Gentian.

Gentian Root, 100 grammes; Dried Bitter Orange-peel, 37·5 grammes; Cardamom Seeds, 12·5 grammes; macerated with Alcohol (45 per cent.), 1,000 millilitres (1 in 10).

Doses.—Horses and cattle, ℥i. to ℥ii.; dogs, ℥ss. to ℥i.

A compound infusion of gentian and an extract of gentian are also official, but are seldom employed in veterinary practice. A fluid extract, six times the strength of the B.P. tincture, is prepared by Parke, Davis, and Co.

Incompatibles.—Ferrous sulphate; but the combination is often employed.

Actions and Uses.—Gentian is a bitter tonic, possessing but slight astringent actions. It is more extensively employed in veterinary practice than any of the other vegetable bitters. As it contains a small proportion of tannic acid, it is incompatible with preparations of iron; but, nevertheless, the combination is frequently prescribed, and proves useful.

Gentian is a valuable agent in the treatment of certain gastric affections in all animals.

Powdered gentian, combined with sulphate of iron, forms a tonic powder which is frequently prescribed as a general tonic for horses and cattle. The addition of powdered gentian to aloes is said to increase the purgative action of the latter drug. A combination of powdered gentian, nux vomica, and bicarbonate of soda, forms a useful gastric tonic for both horses and cattle.

Quassia.

Quassiæ Lignum—Quassia Wood.

The wood of the trunk and branches of *Picræna excelsa*. It contains an active principle termed 'Quassine.'

The preparations of the drug used are an infusion (1 in 100) and a tincture (1 in 10). Of the infusion, the dose for horses is from ℥ii. to ℥iv., and for dogs, ℥ss. to ℥i. Of the tincture, the doses are similar to those of tincture of gentian.

Actions and Uses.—Quassia resembles in its actions

gentian and calumba. As it does not contain any tannic acid, it is compatible with iron salts. As a bitter tonic, it has similar uses to gentian and calumba. In the form of infusion it is employed as an enema to destroy ascarides in the rectum.

The infusion combined with glycerin, if applied to the skin of animals at pasture, prevents irritation from flies, by acting as a narcotic poison to the latter.

There are a number of simple bitters which resemble the above agents in their actions, but they are seldom employed. These include Chiretta, Pareira, Cascarilla, Serpentary, Cusparia, etc.

Hydrastis.

Hydrastis Rhizoma—The dried rhizome and roots of *Hydrastis canadensis*, the Golden Seal.

It contains the alkaloids Hydrastine and Berberine.

The chief preparations of the drug are a tincture and a liquid extract.

ACTIONS AND USES.—Hydrastis is a bitter tonic, nerve stimulant, hæmostatic, and astringent. To a certain extent it resembles nux vomica in its actions. Applied to mucous surfaces, it acts as a hæmostatic and mild astringent. It is seldom used in veterinary practice. It has been recommended as an injection in the treatment of nasal gleet in the horse, 1 ounce of the liquid extract being diluted with a quart of water. Its hæmostatic action is slight, and depends on the constriction of the bloodvessels which it produces. It is said to cause contraction of the uterus, but, according to Dixon, it is probably useless for this purpose, and similar remarks apply to its reputed value as a hæmostatic agent and a cholagogue. Hydrastine is a toxic agent which at first stimulates the nerve-centres and spinal cord, and eventually paralyzes these structures.

AROMATIC VOLATILE OILS.

A large number of agents are included in this group, but comparatively few of these are used in veterinary practice. They all possess antiseptic properties, and also exert a

carminative action on the stomach and intestines. Some exert antispasmodic effects, while the majority, during their excretion, stimulate and to a certain extent disinfect the kidneys and respiratory passages.

Externally, they act as antiseptics and stimulants to the skin. Some exert a local anæsthetic effect; others are counter-irritants.

Oil of Cloves.

Oleum Caryophylli—Oil of Cloves.

A volatile oil obtained from the dried flower-buds of *Eugenia caryophyllata*.

Oil of cloves is sometimes employed in combination with cocaine as a local anæsthetic, being painted on the skin prior to the operation of 'firing.' It has been recommended as an application in cases of open joint; but its value is doubtful.

Infusum Caryophylli—Infusion of Cloves—is prescribed in combination with dilute sulphuric acid and decoction of logwood in the treatment of diarrhœa in the dog.

Dose of the infusion for the dog, ʒii. to ℥ss.

Oil of Peppermint.

Oleum Menthæ Piperitæ—Oil of Peppermint—an oil distilled from fresh flowering peppermint, *Mentha piperita*. Its principal constituent is Menthol.

Doses.—Horses, ♏xx. to ʒi.; dogs, ♏ss. to ♏iii.

Actions and Uses.—Oil of peppermint is an antiseptic, a carminative, and an antispasmodic

Externally, it causes contraction of arterioles, and it acts as a local anæsthetic by paralyzing the terminations of sensory nerves in the part to which it is applied.

Oil of peppermint is employed by some practitioners in the treatment of spasmodic colic in the horse. It relieves pain by depressing the terminations of the intestinal sensory nerves, and also relaxes intestinal spasm. It is sometimes combined with purgative agents, in order to lessen the tendency to griping.

Aqua Menthæ Piperitæ, or peppermint water, consists of

1 part of the oil in about 1,000 parts of water. It is employed in canine practice to disguise the taste of nauseous drugs.

Menthol is a local anæsthetic, but is not used in veterinary practice.

Oil of peppermint is contained in chlorodyne (see p. 364).

Oleum Menthæ Viridis—Oil of Spearmint—is obtained from *Mentha viridis* (Spearmint). Its actions are similar to those of oil of peppermint. It is used to give a pleasant odour to drenches and liniments.

Oil of Lavender and **Oil of Rosemary** resemble the other aromatic volatile oils in their action, and are chiefly employed as components of stimulating liniments.

The former is contained in compound camphor liniment (see p. 449).

Oil of Origanum may be obtained from *Origanum vulgare* (Wild Marjoram) or from other species of Origanum. It acts as an irritant when rubbed into the skin, and is sometimes added to blisters and liniments.

Oil of Juniper.

Oleum Juniperi—Oil of Juniper, an oil distilled from the fruit of *Juniperus communis*.

ACTIONS AND USES.—It is a stimulant, a carminative, an antispasmodic, and a stimulating diuretic. It is seldom employed in veterinary practice.

As a diuretic, the dose for horses and cattle is from ʒi. to ʒii.

Juniper berries are employed for imparting the characteristic flavour to gin.

Oleum Cadinum—Oil of Cade, also known as Juniper Tar Oil (*Huile de Cade*).

It is a product of the destructive distillation of the woody portions of *Juniperus Oxycedrus*.

ACTIONS AND USES.—Oil of cade is occasionally used as a stimulating application to the skin in cases of psoriasis and chronic eczema. For such purposes an ointment composed of oil of cade 1 part, with vaseline 4 parts, may be employed.

Anise.

Anisi Fructus—Anise Fruit.

The dried ripe fruit of *Pimpinella Anisum.*

Doses of Powdered Anise.—Horses, ʒss. to ʒi.; cattle, ʒi. to ʒii.

Oleum Anisi—Oil of Anise.

Obtained by distillation from anise fruit.

Doses.—Horses, ♏xv. to ♏xl.; dogs, ♏ss. to ♏iii.

Actions and Uses.—Oil of anise has similar actions to the other aromatic volatile oils. It has in addition to these a slight expectorant action, probably exerted during the excretion of the drug by the bronchial mucous membrane.

Oil of anise is seldom prescribed internally, but is employed in pharmacy to give a pleasant odour to drenches and liniments. It is contained in compound tincture of camphor.

The powdered anise fruit forms a frequent component of cough powders for the horse, and is also used as a flavouring agent in cattle drenches.

Other agents resembling anise in their actions, and containing aromatic volatile oils, are Caraway, Coriander, Fenugreek, Fennel, Dill, and Cardamoms. They are chiefly used as flavouring agents to powders, drenches, etc., and enter largely into the composition of popular condition powders and condiments.

Ginger.

Zingiber—Ginger.

The scraped and dried rhizome of *Zingiber officinale.* It contains an oleo-resin known as Gingerin, and an aromatic volatile oil.

Doses of Powdered Ginger.—Horses, ʒss. to ʒi.; cattle, ʒi. to ʒii.; sheep, ʒi. to ʒii.; pigs, ʒss. to ʒi.; dogs, grs. x. to grs. xx.

Tinctura Zingiberis—Tincture of Ginger.

One part of Ginger in powder, percolated in Alcohol to yield 10 parts (1 in 10).

Doses.—Horses, ʒi. to ʒii.; dogs, ♏xx. to ʒss.

A fluid extract of ginger, ten times the strength of the B.P.

tincture, is prepared by Parke, Davis and Co., and is very convenient in cattle practice.

ACTIONS AND USES.—Ginger is an aromatic stimulant and a carminative. It is chiefly employed as a corrective to purgative agents, in order to prevent the occurrence of griping. Thus, it is combined with aloes for the horse and with magnesium sulphate for cattle. In cases of impaction of the rumen in cattle, one-ounce doses of the fluid extract of ginger, in combination with purgatives and nux vomica, give good results.

The tincture of ginger is sometimes employed in the treatment of simple spasmodic colic.

Gingerin is a convenient form of the drug to combine with purgative pills for the dog. The dose is from gr. $\frac{1}{4}$ to gr. ss.

Oil of Eucalyptus.

Oleum Eucalypti—Oil of Eucalyptus.

The oil distilled from the fresh leaves of *Eucalyptus Globulus*, the Blue Gum-tree of Australia, and other species of eucalyptus.

DOSES.—Horses, ʒi. to ʒiv.; dogs, ♏ss. to ♏iii.

It may be administered in the form of an emulsion or mixed with olive-oil.

ACTIONS AND USES.—Oil of eucalyptus is an antiseptic and a deodorizer.

Internally, it also exerts antiseptic actions, and is, in addition, an antipyretic. It may be employed in the treatment of all cases of a septic nature, and has occasionally given good results in canine distemper. In addition to its internal administration, frequent inhalations of the drug are indicated in respiratory affections of a septic nature. When used as an inhalation, it is of advantage to combine a little light carbonate of magnesia with the oil of eucalyptus before adding the latter to the hot water. This causes the oil to become equally diffused in the water, and the vapour is given off much more freely.

In bronchitis, broncho-pneumonia, laryngitis, etc., eucalyptus oil is largely employed in the form of inhalation (see

p. 184). It is also useful as a gastric disinfectant, as it prevents excessive fermentation of the ingesta.

Externally, it forms a useful antiseptic application in the form of ointment, the strength being from 1 in 5 to 1 in 10 of vaseline or lanolin.

Wool and gauze medicated with oil of eucalyptus are sometimes used as surgical dressings.

Tincture of Eucalyptus (Eucalyptus Leaves 1, in 5 of Alcohol, 60 per cent.) is employed as a constituent of mouth-washes in canine practice.

Oil of Turpentine.

Oleum Terebinthinæ Rectificatum—Rectified Oil of Turpentine.

A limpid liquid distilled from the oleo-resin (turpentine), obtained from *Pinus Australis*, *Pinus tæda*, *Pinus sylvestris*, and other species of Pinus.

Doses.—Horses, ℥i. to ℥ii.; cattle, ʒii. to ʒiv.; sheep and pigs, ℥i. to ℥iv.; dogs, ♏ii. to ♏xx.; six-months-old calves, ʒss.; six-months-old lambs, ℥i.

In order to prevent the irritating effect of the drug on the mouth and alimentary canal, it should be well shaken up with oil, milk, or mucilage, before administration.

A convenient emulsion of the drug for canine practice is prepared by rubbing up 30 grains of powder of gum acacia with 1 drachm of oil of turpentine and 1 drachm of distilled water, and then adding gradually 1 ounce of distilled water.

Oleum Terebinthinæ Gallicum—French oil of turpentine.

This is prepared from *Pinus maritima*. It is believed to contain ozone, and is employed in cases of poisoning by phosphorus (see p. 443).

Linimentum Terebinthinæ—Liniment of turpentine.

Soft Soap, 75 grammes; Camphor, 50 grammes; Rectified Oil of Turpentine, 650 millilitres; Distilled Water, sufficient to produce 1,000 millilitres.

Linimentum Terebinthinæ Aceticum—Liniment of Turpentine and Acetic Acid.

Glacial Acetic Acid, 110 millilitres; Liniment of Camphor,

445 millilitres; Rectified Oil of Turpentine, sufficient to produce 1,000 millilitres.

For the formula of a stimulating liniment containing oil of turpentine and more suitable for veterinary practice than those mentioned, see Appendix, under the heading of 'Liniments.'

Actions of Oil of Turpentine.

Externally, it is a rubefacient; if applied in concentrated form and if evaporation be prevented, it acts as a counter-irritant, the vesication produced being painful, and healing slowly. It is also a local hæmostatic.

Internally, it exerts stimulant, antiseptic, hæmostatic, diuretic, and anthelmintic actions.

On the gastro-intestinal canal turpentine acts in a similar manner to other aromatic volatile oils, but is more powerful.

In the stomach it acts as a disinfectant, and, by inducing a mild irritation of the gastric mucosa, it causes increased vascularity and augmented peristaltic movements.

In the intestines it acts as a stimulant to the muscular coat, producing contraction of the latter and the expulsion of gas in cases of tympanites.

Its anthelmintic action is chiefly confined to the destruction of round-worms, as it has far less effect on tape-worms. Turpentine is rapidly absorbed, diffused, and excreted. In medicinal doses it increases the secretion of urine, to which it gives an odour resembling that of violets. The drug is excreted by the kidneys, lungs, skin, and intestines. During its excretion by the kidneys, the renal vessels are dilated, owing to the irritating action of the drug on these organs.

The hæmostatic action of turpentine is not definitely understood; it probably depends on the contraction of the arterioles induced by the drug.

According to some authorities, oil of turpentine, like other volatile oils, when administered *per os*, produces a leucocytosis, especially of the polynuclear variety. This does not occur if the drug be administered by subcutaneous injection.

Toxic doses cause primary stimulation and subsequent

paralysis of the nerve-centres in the medulla, the actions resembling those of alcohol. Irritation of the kidneys and bladder is produced, and in some instances suppression of urine, strangury, or hæmaturia. Purgation may also be induced.

ANTIDOTES.—Sulphate of magnesia and demulcents. In the dog an emetic should first be given.

MEDICINAL USES.—In acute gastric tympany and in flatulent colic, oil of turpentine is a most valuable agent. It causes expulsion of the gases, arrests fermentation, and restores the muscular coat of the organs involved to its normal condition. If pain be severe, the drug may be combined with a dose of chloral hydrate dissolved in water, and administered in a full dose of raw linseed-oil. If necessary, it may be repeated. A large number of cases of simple colic yield to a dose of oil of turpentine given in raw linseed-oil. Formerly such cases were treated by administering opiates, and in many instances the results were very unsatisfactory, owing to the sedatives interfering with the peristaltic action of the intestines.

In tympanites of the rumen in cattle, commonly known as hoven, oil of turpentine combined with ammonia, and administered in a full dose of raw linseed-oil, gives good results.

In dysentery, whether occurring in horses or cattle, small doses of oil of turpentine, combined with other antiseptics and with astringents, are prescribed, and sometimes prove effectual.

In purpura hæmorrhagica this drug sometimes gives good results, probably by overcoming the tendency to extravasation that is present in this affection. It is usually combined with the tincture of perchloride of iron, 1 ounce of each being administered in wheat gruel, raw eggs and milk, three times daily. But other methods of treatment, which do not require the administration of drenches, are preferable (see 'The Treatment of Purpura Hæmorrhagica,' Part III.).

As a *hæmostatic*, in cases of internal hæmorrhage, oil of turpentine is recommended by some authorities, but its value is doubtful.

As an *anthelmintic*, oil of turpentine is frequently prescribed, and is effectual in the case of round-worms in the horse. For this purpose it is administered in raw linseed-oil. For tape-worms it is usually combined with male-fern.

In canine practice the drug must be very carefully administered, as it is apt to produce irritation of the stomach and kidneys. In properly regulated doses it is employed in combination with other anthelmintic agents in the eradication of intestinal parasites in the dog (see 'Formulæ for Anthelmintics,' Part III.).

In the treatment of parasitic bronchitis in calves, oil of turpentine is administered by intratracheal injection, and proves a most effectual remedy in this affection. Two drachms of oil of turpentine, 10 minims of pure carbolic acid, 1 drachm of olive-oil, 20 grains of potassium carbonate, and 1 drachm of water, are mixed together to form an emulsion. This amount is injected into the trachea once daily for three days.

As an antidote to phosphorus-poisoning, the French oil of turpentine is highly recommended by many authorities, the explanation of its action being that it renders the poison innocuous in the stomach by oxidizing it. Some authorities have failed to detect ozone in turpentine, and deny the efficacy of this drug in phosphorus-poisoning.

Oil of turpentine is said to be an antidote to carbolic acid poisoning in the horse.

CONTRA-INDICATIONS.—Turpentine is contra-indicated in congestion of the kidneys, also in nephritis, cystitis, gastritis, and enteritis.

Externally, oil of turpentine is employed as a constituent of stimulating liniments, embrocations, etc. It should not be used in too concentrated a form, as it is an undesirable counter-irritant, causing great irritation and having a tendency to injure the hair-roots.

The liniment of turpentine is employed as a rubefacient application in rheumatic affections of joints and muscles, also to the skin in the region of the throat in cases of laryngitis and pharyngitis.

In cases of chronic shoulder lameness, some practitioners

claim good results from the injection of very small amounts of oil of turpentine into the affected muscles. The procedure causes marked pain and irritation, which gradually subsides. Similar treatment is advised in cases of atrophy of the antea- and postea-spinatus muscles.

For the destruction of maggots in sheep, the following proves useful as a local application : 3 ounces of oil of turpentine, 1 ounce each of common salt, olive-oil, and mucilage, and ½ drachm of corrosive sublimate, mixed in a quart of water.

Terebene.

Terebenum—Terebene—is produced by the action of sulphuric acid on oil of turpentine and the distillation of same. It is a mixture of dipentene and other hydrocarbons.

DOSES.—Similar to those of oil of turpentine.

ACTIONS AND USES.—Terebene resembles oil of turpentine in its actions, but is more diffusible and less irritating in its effects on the kidneys. It is a useful agent in the treatment of gastric tympany and flatulent colic in the horse. It is largely employed as an inhalation in cases of bronchitis, laryngitis, etc., and also proves useful in a similar manner in the treatment of irritable cough depending on bronchial irritation in the dog. The addition of light carbonate of magnesia renders the drug diffusible in the hot water, so that its vapour is given off more readily.

In the treatment of parasitic bronchitis in calves, when intratracheal injections cannot be conveniently carried out, the internal administration of terebene often gives good results. It may be administered in milk, in doses of half an ounce, twice daily. This treatment is also of value in cases of bronchial catarrh in calves.

Externally, terebene is an excellent antiseptic agent when combined with equal parts of either white vaseline oil or olive-oil. The addition of creosote (℥ii. to O.i.) renders the above more useful as a dressing for wounds, especially in country practice.

Terpinum Hydratum—Terpene Hydrate; Terpene—is a crystalline derivative of oil of turpentine, prepared by the

action of nitric acid on the latter in the presence of alcohol and water. It is occasionally prescribed in the treatment of bronchitis, as it possesses expectorant actions. Combined with heroin, it sometimes proves useful in the treatment of coughs depending on chronic bronchial catarrh.

DOSES.—Horses, ℥ss. to ℥ii.; dogs, grs. ii. to grs. vi.; administered in glycerin or syrup.

Terpinol is obtained by the action of dilute sulphuric acid on terpene, and has similar actions to the latter. Terpinol disinfecting fluid is said to be non-poisonous, and also effective as a germicide and general disinfectant.

Sanitas is prepared by the oxidation of oil of turpentine; it contains hydrogen peroxide, a soluble camphor, some camphoric acid, and thymol. Sanitas fluid forms a volatile oxidizing non-poisonous disinfectant and deodorant; it is employed to disinfect and deodorize stables and kennels. Sanitas powder and sanitas sawdust are used for a similar purpose.

Oleum Pini Sylvestris is obtained from various species of pine. It resembles oil of turpentine, and is sometimes employed as a mild counter-irritant in canine practice.

Resin.

Resina—Resin. The residue from the crude oleo-resin remaining after the distillation of oil of turpentine. Internally, in doses of ½ ounce to 1 ounce, it is a diuretic and mild astringent, and forms a popular constituent of diuretic balls and powders. Externally, it is stimulant, antiseptic, and astringent, and, when melted and applied to a bleeding surface, it acts as a styptic.

Unguentum Resinæ—Resin Ointment—consists of Resin in powder, 8; Yellow Beeswax, 8; Olive Oil (by weight), 8; and Lard, 6 (1 in 3¾). It is a mild stimulating agent, which at one time was a favourite application for wounds, etc., but is seldom used in the present day. Resin ointment is sometimes employed in combination with other ointments to increase their bulk and consistency.

Emplastrum Resinæ—Resin Plaster—is composed of

resin, lead plaster, and hard soap. It is very useful in the treatment of fractures in dogs. When heated and applied to the bandages, it prevents them from becoming displaced, and also gives support to the affected part.

Thymol.

Thymol is a crystalline substance obtained from *Thymus vulgaris* (Common Thyme) and other plants. It resembles carbolic acid in its actions, but causes less stimulation of the central nervous system, and is less irritant when applied to wounds.

Toxic doses produce fatty degeneration of the liver, congestion of the lungs, and irritation of the intestines and kidneys. It possesses considerable antiseptic and disinfectant properties, but is seldom employed for these purposes, owing to its high price and very slight solubility in water. Its chief use in veterinary practice is in the treatment of strongylosis in young horses. In such cases it is usually prescribed in a dose of from 30 grains to 2 drachms, dissolved in glycerin and alcohol, and administered in milk or mucilage. These doses are given daily for four or five consecutive days, and followed up by a laxative.

But it is found that these doses are insufficient to produce beneficial results, and that amounts of from ʒiv. to ʒi. can be administered with safety to two-year-olds and upwards, while in the case of foals ʒss. to ʒi. may be given. As the dose for man is stated to be from grs. xv. to grs. xxx., it is quite apparent that the amount of the drug usually prescribed in equine practice is totally insufficient.

Thymol is sometimes prescribed as an anthelmintic for the dog, the dose being from grs. viii. to grs. xxx. per day, divided into three doses.

Venice Turpentine.

Terebinthina Veneta—Venice turpentine (contains 15 per cent. of oil of turpentine)—is obtained from *Larix Europæa* (the Common Larch).

A commercial variety is prepared by dissolving 3 parts of

common resin in 1 part of oil of turpentine. Venice turpentine is occasionally employed as a diuretic.

It has also been prescribed in the pulmonary complications of that affection known as 'white scour' in calves, but with doubtful results.

Wood Tar.

Pix Liquida—Wood Tar—is obtained from the wood of *Pinus sylvestris* and other species of *Pinus*, by destructive distillation. It is known in commerce as Stockholm Tar.

Oleum Picis Liquidæ—Oil of Tar.

A volatile oil distilled from tar.

Oleum Picis Rectificatum—Light Oil of Tar; also known as Rectified Spirit of Tar.

Unguentum Picis Liquidæ—Tar Ointment: Tar, 70 grammes; Prepared Lard, 5 grammes; Yellow Beeswax, 25 grammes.

ACTIONS AND USES.—Tar possesses antiseptic, stimulant, expectorant, and parasiticide actions. In the form of tar-water (Aqua Picis), obtained by stirring a pint of tar in ½ gallon of water for fifteen minutes and decanting, it is found of value as a palliative measure in the treatment of chronic cough and broken wind in horses. Or tar can be stirred into a barrel of water, and the latter employed as drinking-water for the animal.

Externally, tar is employed in the treatment of dry, scaly skin diseases, 1 part of the agent being mixed with 4 parts of zinc oxide ointment. As a hoof ointment and stopping for horses' feet, in cases of dryness and brittleness of the wall and deficient growth of horn, tar combined with other agents is found useful, the following being often employed for this purpose: 4 ounces each of tar, beeswax, and honey, 3 ounces of glycerin, and 1½ pounds of veterinary lanolin. The latter and the beeswax are first melted together, and the other ingredients then stirred in.

Tar, combined with soft soap, iodine, and lanolin, is employed as an absorbent application to bursal enlargements, thickened tendons, thorough-pins, bog-spavins, etc. A

number of patent absorbent preparations on the market contain these ingredients.

In the treatment of foot-rot in sheep, tar ointment is found to give good results.

Oil of tar, combined with sulphur, train-oil, and an alkali such as potassium carbonate, is largely employed as a dressing for mange in the horse.

The rectified spirit of tar, combined with an equal amount of raw linseed-oil, forms a useful absorbent liniment in cases of bursal distensions, capped hocks, etc., being applied with a brush once daily.

Spirit of tar combined with iodine is employed in the treatment of ringworm.

Oleum Betulæ—Oil of Birch Tar—is employed in the treatment of chronic eczema in the dog. For this purpose it is applied in the form of an ointment, combined with calamine and oxide of zinc, the basis being lanolin and soft paraffin.

Pitch.

Pix Nigra—Black Pitch.

The residue remaining after the distillation of tar. Two varieties are recognized — viz., *Archangel* and *Swedish*. Another form of pitch is obtained from gas-tar.

Pitch is employed in the form of plasters and charges for surgical purposes.

W. Williams advised its internal administration in the treatment of dry, scaly affections of the skin, such as pityriasis.

Pix Burgundica—*Burgundy Pitch*—is the prepared resinous exudate from the stem of *Picea excelsa*, the Spruce Fir-tree.

It is employed as a stimulant and adhesive plaster in the treatment of swollen joints, etc., and for this purpose is spread on leather or on bandages.

An imitation of the true Burgundy pitch is made by melting resin and palm-oil, and stirring in some water.

The Emplastrum Picis (Pitch Plaster) consists of—Burgundy Pitch, 26; Frankincense, 13; Resin, 4½; Yellow Beeswax, 4½; Olive Oil, 2; and Distilled Water, 2. These are melted together and evaporated to the consistence of a plaster.

Tallianine.

Tallianine is obtained by the action of ozone on a terpene-bearing volatile oil. If administered by intravenous injection, it is said to cause abundant leucocytosis, and to exert an antiseptic action on the blood. In cases of pneumonia, purpura, etc., it has been found useful by American and Continental practitioners, the dose for the horse being from 10 to 20 cubic centimetres given twice daily.

Camphor.

Camphora—Camphor—occurs in the form of a crystalline transparent solid or a white crystalline powder, and is obtained from *Cinnamomum Camphora* (the Camphor Laurel).

DOSES.—Horses, ʒss. to ʒi.; cattle, ʒi. to ʒii.; sheep and pigs. grs. xx. to grs. xl.; dogs, grs. ii. to grs. v.

Spiritus Camphoræ—Spirit of Camphor; Tincture of Camphor.

Camphor, 1; Alcohol (90 per cent.), q.s. to make 10 (1 in 10).

DOSES.—Horses, ʒss. to ℥i.; cattle, ℥ii.; dogs, ♏v. to ♏xx.

Tinctura Camphoræ Composita—Compound Tincture of Camphor; Paregoric.

Tincture of Opium, 50 millilitres; Benzoic Acid, 5 grammes; Camphor, 3 grammes; Oil of Anise, 3 millilitres; Alcohol (60 per cent.), sufficient to produce 1,000 millilitres. Sixty minims is equivalent to about ¼ grain of opium. This preparation is about one-tenth stronger than the B.P. Tincture of 1898.

DOSES.—Horses and cattle, ℥ii. to ℥iv.; sheep and pigs, ʒi. to ʒii.; dogs, ʒss. to ʒi.

Aqua Camphoræ—Camphor Water.

Camphor (in sublimed powder), 1 gramme; Alcohol (90 per cent.), 2 millilitres; Distilled Water, 1,000 millilitres.

DOSE for dogs, ʒss. to ℥i.

Linimentum Camphoræ—Liniment of Camphor; Camphorated Oil.

Camphor, 1; Olive Oil, 4 (1 in 5).

Linimentum Camphoræ Ammoniatum—Ammoniated Liniment of Camphor; Compound Liniment of Camphor.

Camphor, 5; Strong Solution of Ammonia, 10; Oil of Lavender, ¼; Alcohol (90 per cent.), q.s. to make 40 (1 in 8).

ACTIONS.—Camphor possesses sedative, antispasmodic, carminative, expectorant, diaphoretic, and feebly antiseptic actions.

Externally, its actions resemble those of volatile oils. If applied with friction to the skin it acts as a rubefacient, but after primary stimulation it produces sedative effects on the peripheral nerve-endings.

Internally, camphor is rapidly absorbed, it acts as a carminative by exerting reflex stimulating effects on the intestinal canal, it also acts as an antispasmodic, and lessens the irritability of the intestinal mucous membrane.

On the Circulation.—Small doses produce little effect on the heart. Large doses cause a slowing of the heart and a fall of blood-pressure.

On the Nervous System, it stimulates the cerebral cortex, and in full doses it causes inco-ordination of movements.

Camphor is excreted by the respiratory organs, producing expectorant effects, and also by the skin and kidneys. Its diaphoretic action is not observed in animals.

Toxic doses cause stimulation of the higher nervous centres, followed by paralysis.

The symptoms induced are excitement, restlessness, and convulsions. In some cases, instead of excitement, a condition of stupor occurs, and death results from respiratory failure.

MEDICINAL USES.—As a carminative, camphor is prescribed in cases of diarrhœa and intestinal irritation, being usually combined with astringents and antacids for this purpose. The compound tincture is preferred, in consequence of the opium which it contains.

Some authorities recommend camphor in combination with opium in the treatment of enteritis. If combined with chloral hydrate, it is said to render the former more efficient as an hypnotic and anodyne.

As an expectorant, camphor is a frequent constituent of cough mixtures. Combined with extract of belladonna and

chlorate of potash, in the form of electuary, it proves useful in the treatment of laryngitis, pharyngitis, etc.

Powdered camphor is prescribed in combination with powdered belladonna leaves, chlorate of potash, etc., in the form of powders, for the treatment of cough in horses, but its taste and smell often cause the patients to refuse it.

Subcutaneous or intramuscular injections of camphor (Camphor, 1 part; Sterilized Olive Oil, 10 parts) are sometimes employed in the treatment of pneumonia, influenza, etc., when marked prostration is present. The dose is from 3 to 5 drachms every three or four hours, but not more than 1 drachm should be injected at any one point. A stronger camphorated oil (1 in 4) may be employed if desired, and given in smaller doses.

Externally, camphor is employed in the form of liniments in cases of strains, bruises, etc.

The compound liniment of camphor is used as a mild counter-irritant.

Camphorated oil is employed in canine practice as a stimulating application to the thoracic walls and throat in respiratory affections.

Camphor water is employed in preparing expectorant and sedative mixtures and also as a flavouring agent.

Rose Water.

Aqua Rosæ—Rose Water—is prepared from the flowers of *Rosa damascena*.

It is employed in the preparation of various eye-lotions in canine practice.

Benzoin.

Benzoinum—Benzoin.

A balsamic resin obtained from *Styrax Benzoin*. It is known in commerce as Styrax Benzoin.

Tinctura Benzoini Composita—Compound Tincture of Benzoin; Friar's Balsam.

Benzoin, 100 grammes; Prepared Storax, 75 grammes; Balsam of Tolu, 25 grammes; Aloes, 20 grammes; Alcohol (90 per cent.), q.s. to produce 1,000 millilitres.

A Liquid Benzoin Compound is also prepared, which is three times the strength of the above tincture.

Adeps Benzoatus—Benzoated Lard—Benzoin, 3 parts; Prepared Lard, 100 parts.

Acidum Benzoicum—Benzoic Acid.

PREPARED from benzoin by sublimation; it may also be obtained from other organic compounds, such as toluene, or be prepared synthetically.

Ammonii Benzoas is prepared by neutralizing benzoic acid with solution of ammonia.

Sodii Benzoas is prepared by neutralizing benzoic acid with sodium carbonate.

ACTIONS AND USES.—Benzoin possesses expectorant and antiseptic actions when given internally; externally, it is a styptic and antiseptic when applied to wounds.

The compound tincture of benzoin is occasionally prescribed internally in cases of chronic bronchitis, but is chiefly employed as an inhalation in bronchial and laryngeal affections.

Externally, the compound tincture of benzoin is a very useful antiseptic dressing for wounds, although not so frequently employed in the present day as formerly. It is especially valuable in cases where the wounds are treated in an open manner.

Benzoic acid possesses stimulant, expectorant, antipyretic, and diuretic actions. It acts as a urinary antiseptic, but does not, as was formerly supposed, render the urine more acid. If, however, ammoniacal fermentation occurs in the bladder, benzoic acid may acidify the urine. It is occasionally prescribed in cases of cystitis, and is excreted in the form of hippuric acid.

The sodium and ammonium salts of benzoic acid are preferred to the acid, as they are less irritating to the alimentary canal, and more soluble. Benzoic acid resembles salicylic acid in its actions; it is toxic only when given in comparatively large doses. It may be given to the horse in doses of from ʒi. to ʒiii., and to the dog in doses of from grs. v. to

grs. xv. The doses of sodium benzoate and ammonium benzoate are similar to the above.

The toxic symptoms observed are tremors and convulsions, followed by paralysis of the limbs; there is marked depression of the heart and respiration; the drug also exerts an irritant action on the gastric mucous membrane.

Sodium benzoate is sometimes prescribed in cases of joint-ill in foals; it is said to reduce the abnormal temperature, and to act favourably on the swollen joints.

Balsam of Tolu and Peru.

Balsamum Tolutanum—Balsam of Tolu.

Balsamum Peruvianum—Balsam of Peru.

Balsam of Tolu is obtained from *Myroxylon toluiferum.*

It possesses expectorant actions, and in the form of Syrup of Tolu is added to expectorant mixtures in canine practice.

Balsam of Peru is obtained from *Myroxylon Pereiræ.*

It contains a volatile oil which is capable of destroying the acari of mange, and hence is employed in the treatment of this affection in delicate house-dogs.

For this purpose it is dissolved in 4 parts of alcohol and applied as a liniment, or employed in the form of an ointment containing 1 part of balsam of Peru in 8 parts of vaseline or lanolin.

Myrrh.

Myrrha—Myrrh.

A gum-resin obtained from *Commiphora Myrrha.*

It possesses mild astringent actions, and is also a stomachic, a carminative, and an expectorant. Myrrh is often added to electuaries for the treatment of laryngitis, etc., the dose for the horse being 2 drachms.

The tincture of myrrh (1 to 5 of alcohol) forms a constituent of mouth-washes for the treatment of aphtha, etc.

A useful mouth-wash for the dog in cases of spongy gums, etc., is prepared with—Myrrh, 1; Eau de Cologne, 16; Borax, 1; Syrup, 3; and Water, 3 parts.

Storax.

Styrax Præparatus—Prepared Storax.

A balsam obtained from the trunk of *Liquidambar orientalis*. It contains free cinnamic acid, styrol, styracin, etc. It resembles balsam of Peru and Tolu, and is employed as an antiseptic and non-irritating parasiticide in certain skin affections of the dog (see Appendix).

Arnica.

Arnicæ Flores.—The dried flower-heads of *Arnica montana* (Leopard's Bane).

Tinctura Arnicæ—Tincture of Arnica.

One part of Arnica Flowers percolated with Alcohol (45 per cent.) to yield 10 parts (1 in 10).

ACTIONS AND USES.—Arnica is a gastro-intestinal stimulant, and, in a reflex manner, it acts as a stimulant to the nervous and circulatory systems. Large doses produce irritant effects on the stomach and intestines, and in the dog cause vomiting, diarrhœa, colicky pains, and a feeble pulse.

Arnica is seldom prescribed internally.

Externally, it was credited with a special therapeutical value in the treatment of strains, bruises, etc., but many authorities believe that the beneficial effects produced depend on the spirit which the preparation contains. It is sometimes combined with the liquor plumbi subacetatis, in the treatment of inflamed and swollen tendons.

Valerian.

Valerianæ Rhizoma—Valerian Rhizome; Valerian Root.

The dried rhizome and roots of *Valeriana officinalis*.

Tinctura Valerianæ Ammoniata—Ammoniated Tincture of Valerian.

DOSES.—Horses, ʒi. to ʒii.; dogs, ʒss. to ʒi.

ACTIONS AND USES.—Valerian is a stimulant to the nervous system and an antispasmodic. It is seldom employed in veterinary practice, and, except in large doses, has little effect on horses or cattle. It has been prescribed in cases of chorea

and epilepsy in the dog, but not with any beneficial results. The valerianates of sodium, zinc, and quinine, are nerve tonics which are seldom prescribed.

Asafetida.

Asafetida is a gum-resin obtained from the root of *Ferula fœtida.*

Tinctura Asafetidæ—Tincture of Asafetida.

One part of Asafetida with Alcohol (70 per cent.) to yield 5 parts (1 in 5).

DOSES.—Horses, ℥ss. to ℥ii.; dogs, ♏xx. to ℥ss.

ACTIONS AND USES.—Asafetida is a nerve stimulant, an expectorant, a carminative, and an antispasmodic. It is occasionally prescribed in cases of flatulent colic, in combination with oil of turpentine and raw linseed-oil.

Senega.

Senegæ Radix—Senega Root.

The dried root of *Polygala Senega.*

This is a stimulating expectorant sometimes employed in canine practice in the treatment of chronic bronchitis.

DOSES of the tincture of senega for the dog, ℥ss. to ℥i., and of the infusion ℥ss. to ℥i.

Galbanum and Ammoniacum.

Galbanum and **Ammoniacum** are gum-resins resembling asafetida in their actions. They are not employed in veterinary practice.

Pepper.

Capsici Fructus—Capsicum Fruit.

The dried ripe fruit of *Capsicum minimum,* also known as Chili pepper and chillies. When ground it constitutes the familiar cayenne or red pepper. It contains a number of irritant substances, such as capsicin, capsicol, and capsaicin.

Tinctura Capsici—Tincture of Capsicum. One part of Capsicum in 20 parts of Alcohol.

DOSE for the horse, ℥ii. to ℥iv.

Piper Nigrum—Black Pepper.

The dried unripe fruit of *Piper nigrum*. When the outer covering of the berries is removed before they are ground, white pepper is formed.

ACTIONS AND USES.—The peppers are stimulants, stomachics, and carminatives. Large doses are gastro-intestinal irritants.

Capsicum is more irritant than either black or white pepper.

Externally, they exert rubefacient actions.

The Tincture of Capsicum is a constituent of chlorodyne (see p. 364). Pepper is a popular remedy for colic in horses, but is seldom employed as a therapeutical agent in practice.

Cubebs.

Cubebæ Fructus—Cubebs—the dried fruit of *Piper Cubeba*, is an aromatic, a stimulant, and an antiseptic diuretic. It has a special action on the genito-urinary mucous membrane, and is prescribed in cases of chronic purulent discharges from the urethra, which occur in canine practice. The tincture of cubebs is usually employed in doses of ʒss. to ʒi.

Copaiba.

Copaiba, an oleo-resin obtained from various species of Copaifera, has actions resembling those of cubebs, and may be prescribed in combination with it for similar cases. The Oil of Copaiba is the form usually employed, the dose for dogs being ♏v. to ♏xv.

Oil of Sandal-Wood.

Oleum Santali—Oil of sandal-wood—is distilled from the wood of *Santalum album*.

It has actions resembling those of cubebs and copaiba, and may be prescribed in similar cases, the doses being from 5 to 20 minims.

Mustard.

Sinapis—Mustard.

The powdered and mixed dried ripe seeds of *Brassica nigra* and *Brassica alba*. When mixed with water, volatile oil of

mustard is formed, and it is on this agent that the activity of the drug depends.

Oleum Sinapis Volatile—Volatile Oil of Mustard—is obtained by distillation from black mustard seeds.

ACTIONS AND USES.—*Internally*, mustard in medicinal doses is stomachic, carminative, and stimulant.

In cattle practice it is prescribed as a stimulant in combination with carbonate of ammonia and nux vomica, in order to restore nervous tone to the stomach in cases of non-inflammatory gastric affections, with a paralyzed condition of the gastric walls. For this purpose doses of from 1 to 2 ounces are given with the agents mentioned, and produce beneficial results.

In the dog, mustard acts as a local emetic, and a dessert-spoonful dissolved in several ounces of water may be employed in cases of poisoning when other agents are not at hand.

Externally, mustard made into a paste with water acts as a rubefacient, and if applied with friction is a vesicant.

Repeated or prolonged applications may produce severe effects, with sloughing and destruction of hair-roots.

Mustard is employed as a counter-irritant in the treatment of respiratory affections. (See 'The Treatment of Pneumonia,' Part III.) It is made into a paste with tepid water and applied to the thoracic walls, the amount and the degree of friction employed varying according to the effects which it is desirable to produce. Too hot water, or the admixture of vinegar or spirit, prevent the essential oil from being formed, and thus interfere with the activity of the application. When properly prepared and applied, counter-irritant effects are produced in about twenty minutes, and vesication occurs in from two to six hours. It is preferable to employ repeated mild applications than to depend on one strong dressing. When judiciously employed no blemish results. The oil of mustard is seldom used as a counter-irritant by British practitioners.

Aurantium.

Tinctura Aurantii—Tincture of Orange.

One of fresh Bitter Orange-peel with 4 of Alcohol.

Syrupus Aurantii—Syrup of Orange.

Tincture of Orange, 1; Syrup, 7.

USES.—Syrup of orange is sometimes employed in canine practice as a flavouring agent for mixtures, especially those containing agents having a nauseous or bitter taste. But simple syrup is preferable, as dogs dislike flavouring agents of any kind.

CHAPTER XXI

THE VEGETABLE KINGDOM (*Continued*)

VEGETABLE PURGATIVES.

Aloes.

BARBADOS Aloes is the variety employed in veterinary practice.

Socotrine Aloes is a constituent of compound tincture of benzoin.

Aloe Barbadensis.—Barbados Aloes.

Obtained principally from the leaves of *Aloe vera* and *Aloe chinensis*.

DOSES.—*As a purgative:* Horses, ʒv. to ʒviii.; cattle, ℥i. to ℥ii.; sheep and pigs, ʒii. to ʒiv.; dogs, grs. x. to grs. xxx. *As a bitter tonic,* $\frac{1}{8}$ to $\frac{1}{10}$ of these doses is prescribed.

Aloinum.—Aloin.

A yellow crystalline principle obtained chiefly from Barbados Aloes.

DOSES.—*As a purgative:* Horses, ʒi.ss. to ʒii.; dogs, grs. ii. to grs. x.

ACTIONS.—Aloes is a purgative, and in small doses a bitter tonic. It increases the peristaltic movements, augments the intestinal secretions, and acts chiefly on the large intestines. According to some authors, there is no evidence to show any stimulant action of the drug on the secretory glands of the intestine, and the increase of fluid in the bowels as the result of the purgative is explained by the increased rate of peristalsis, which hurries along the normal secretions from the liver, pancreas, and intestines, giving insufficient time for

their absorption. These remarks apply also to other vegetable purgatives (see p. 133).

The action of aloes as a purgative is slow, and, if the horse be unprepared for physic, the ordinary dose may not take effect for sixteen to twenty-four hours after administration. If the animal be properly prepared by feeding on bran-mashes for two days prior to administration, the purgative may take effect in about twelve hours.

In order that aloes may exert its purgative action, it must be subjected to the solvent action of the bile in the intestines, and experiments have demonstrated that the drug is emulsified and saponified by the bile. The purgative action of aloes varies in its duration from three to twenty-four hours. In some cases ordinary doses of aloes produce no purgative action, but are excreted by the kidneys, exerting a diuretic effect.

In ruminants, the effect of aloes is uncertain; but if combined with other cathartic agents, it assists their action.

In the dog its action is also uncertain, and, as compared with man, far larger doses are tolerated.

Externally, aloes in the form of solution or tincture is a stimulant and desiccant.

MEDICINAL USES.—Aloes is the purgative usually selected for the horse. Up to the present time, no other agent has been found so safe and reliable. The drawbacks to its use are: the long period before purgative effects are induced, the nausea which it produces, and the uncertainty of its action in some cases.

It is best given in the form of bolus. The mass from which it is taken should be properly prepared by melting the aloes, and adding glycerin with some volatile oil to prevent hardening and drying. The temperature employed for melting the ingredients should not exceed 120° F., otherwise the activity of the drug becomes impaired.

In order to prevent griping, it is advisable to combine 2 drachms of powdered ginger, 20 grains of extract of belladonna or hyoscyamus, and 10 minims of oil of peppermint, with each physic ball. Some practitioners advise the addition of powdered gentian, and believe that it increases the activity

of the aloes. The late Professor Robertson advised the combination of 4 drachms of aloes, 1½ drachms of powdered gentian, and ½ drachm of calomel, and found this to produce an action equal to 6 drachms of aloes ('Equine Medicine').

Physic balls are now prepared by wholesale chemists in a reliable manner, and are neatly covered with gelatine, which preserves their activity for a long period. This form of bolus is far more easily administered than the old-fashioned variety. In prescribing aloes, it is not always an easy matter to compute the dose that is necessary to induce a reasonable purgative action. An insufficient amount is apt to be retained a long time in the system and to cause extreme nausea. In cases where the ordinary dose fails to act, it is not safe to administer another until forty-eight hours have elapsed.

Certain *precautions* are necessary when prescribing aloes. The horse should be properly prepared for physic. About twelve hours after administration gentle walking exercise hastens the action of the drug; but when purging has commenced the animal should be kept in his stall and properly clothed. Cold water must be withheld, but warm drinks should be allowed instead, and bran-mashes should constitute the diet until purging has ceased. Green foods, roots, etc., should be rigidly interdicted, and on no account should the animal be worked until the physic has 'set.' Neglect of these precautions may give rise to serious results, such as superpurgation, and even a fatal termination from exhaustion of the vital powers. Sometimes, in consequence of individual idiosyncrasies to the action of the drug, a moderate dose may induce superpurgation, or even a fatal termination. Laminitis has supervened in some instances. These results may occur in spite of all precautions, and the practitioner who prescribes the drug cannot be held responsible. Such unfortunate consequences, however, are rare, and by paying attention to the points above mentioned, and to the contra-indications which we shall presently notice, properly regulated doses are usually safe.

Superpurgation from aloes will require appropriate treatment. If no constitutional disturbance be present, it would

be irrational to adopt measures to check the purging; demulcent drinks, such as thin flour-gruel, should be allowed, and the animal kept warmly clothed. If the purging continue, and if in addition there be disturbance of the pulse, loss of appetite, or colicky pains present, it will be necessary to check the purging gradually. For this purpose, and to relieve the pain, 2 ounces of the tincture of opium, or 1 ounce of chlorodyne, with 2 ounces of prepared chalk, 2 ounces of compound tincture of camphor, and 1 quart of flour-gruel, are to be administered every four hours until relief be obtained. In cases where prostration is marked, full doses of brandy or port wine should be added to the above.

In recent years the use of the drug has been revived in the treatment of the various forms of colic and fæcal obstruction of the bowels. Although many objections are brought forward to the employment of aloes in the above conditions, a large number of clinicians find that a combination of aloes in solution, with chloral hydrate and oil of turpentine, forms a safe and effectual method of treatment (see 'The Treatment of Colic,' etc., Part III.).

Contra-Indications of Aloes.—In inflammatory conditions of the alimentary canal, such as enteritis, also in peritonitis, volvulus, etc., aloes should not be prescribed.

In catarrhal or respiratory affections aloes is contra-indicated, and in all cases of a debilitating nature this drug should not be prescribed, as not only is there a danger of superpurgation ensuing, but also the system becomes weakened and less able to withstand the effects of disease. It is also contra-indicated during pregnancy and in cases of laminitis, milder purgatives being safer and quite as effectual. It should not be employed as a purgative for young animals, nor in irritable conditions of the intestinal canal.

Aloes is not a reliable purgative for cattle, but is occasionally combined with other cathartic agents, such as Epsom salt and gamboge.

Dogs require comparatively large doses to induce purgation, but the drug is not prescribed for this purpose in canine practice, except in combination with other agents.

As a bitter tonic, aloes is occasionally prescribed for the horse in cases of convalescence from acute indigestion. In such instances Robertson advised the administration once daily of 1 drachm each of aloes, asafetida, gentian, and ginger, in the form of bolus.

Aloin has been found by some practitioners to be superior to aloes as a purgative for the horse. It is said to cause less nausea and less tendency to griping, while the dose required is about one-third the quantity of aloes requisite as a purgative. Thus, 2 drachms of aloin, administered to horses properly prepared, produced effects in thirteen to fourteen hours equivalent to those of 6 drachms of aloes. In some instances purging was induced in twelve hours, and in every case there was less nausea than is usual as the result of the administration of aloes.

Aloin ʒii. with calomel ʒii. forms an efficient purgative, and may be given in the form of bolus. Some horses will take the drug in their food, and this method of administration is very convenient when there is difficulty in giving medicine in the form of bolus.

Rhubarb.

Rhei Rhizoma—The rhizome of *Rheum officinale* and other species of Rheum.

Doses of Powdered Rhubarb.—For foals and calves, ʒii.; dogs, grs. xv. to ʒss. As a stomachic tonic for the dog, grs. iii. to grs. x., for repeated administration.

Tinctura Rhei Composita—Compound Tincture of Rhubarb.

Dose.—For the dog, ʒss. to ʒi.

Actions and Uses.—Rhubarb, even in large doses, has no purgative effect on horses or cattle. In the dog it is a carthartic in full doses, but this effect is followed by an astringent action. Small doses exert stomachic, tonic, and astringent actions. It is sometimes prescribed in cases of diarrhœa, in combination with sodium bicarbonate and peppermint-water. Combined with calomel, it forms an efficient purgative for the dog. In cases of obstinate diar-

rhœa in foals and calves, rhubarb combined with carbonate of magnesia and ginger is often found effectual. In some instances it is advisable to combine with the above ½ drachm of chlorodyne and 1 ounce of brandy, and to administer them twice daily in well-boiled wheat-flour gruel.

Senna.

Senna, the dried leaflets of *Cassia acutifolia* and *Cassia Angustifolia*, is a purgative agent which is not employed in veterinary practice.

Buckthorn.

Syrupus Rhamni—Syrup of Buckthorn.

A syrup prepared from the berries of *Rhamnus catharticus*, or Purging Buckthorn.

It is employed in doses of ℥i. to ℥ii. as a mild aperient for the dog, and may be added to cathartic mixtures to disguise the taste of nauseous agents contained therein.

Cascara Sagrada.

Cascara Sagrada—The dried bark of *Ramnus Purshianus.*

Extractum Cascaræ Sagradæ Siccum—Dry Extract of Cascara Sagrada.

DOSE.—For dogs, grs. ii. to grs. viii.

Extractum Cascaræ Sagradæ Liquidum—Liquid Extract of Cascara Sagrada.

DOSE—For dogs, ℥ss. to ℥i.

A reliable preparation of cascara, known as Cascara Evacuant, is prepared by Messrs. Parke, Davis and Co. In doses of 10 to 15 minims it acts as a laxative for the dog, and 20 to 30 minims produce gentle purgative effects.

ACTIONS AND USES.—Cascara is a tonic laxative. It is chiefly employed in cases of chronic constipation in the dog, depending on an atonic condition of the stomach and intestines. It is best given in small doses twice daily, the amount being gradually reduced as the normal action of the intestines returns.

Jalap.

Jalapa—Jalap.

The dried tubercles of *Ipomœa Purga*. It contains an active resin, consisting chiefly of two glucosides—viz., *Jalapin* and *Scammonin*.

Doses of Powdered Jalap.—Dogs, grs. xx. to ʒi.; pigs, ʒi. to ʒiv.

Actions and Uses.—Jalap is a hydragogue carthartic. Even in large doses it has little effect on horses or cattle. It is an effectual purgative for the pig, especially if combined with calomel. At one time it was a favourite cathartic for the dog, but a combination of purgative agents in small bulk is now found more effectual for this purpose, and less liable to induce vomiting or nausea.

Scammony.

Scammoniæ Resina—Scammony Resin, obtained from the root of *Convolvulus Scammonia*—resembles jalap in its actions, but is more irritating to the gastro-intestinal canal. It is not prescribed alone, but forms one of the constituents of the compound colocynth and hyoscyamus pill, and of the compound extract of colocynth.

Colocynth.

Colocynthidis Pulpa—Colocynth Pulp.

The dried pulp of the fruit of *Citrullus Colocynthis*.

Pilula Colocynthidis Composita—Compound Pill of Colocynth.

Colocynth Pulp, 20 grammes; Aloes, 35 grammes; Scammony Resin, 35 grammes; Potassium Sulphate, 5 grammes; Oil of Cloves, 5 millilitres; Distilled Water, q.s.

Dose.—For dogs, grs. iv. to grs. viii.

Pilula Colocynthidis et Hyoscyami—Pill of Colocynth and Hyoscyamus.

Compound Pill of Colocynth, 50 grammes; Extract of Hyoscyamus, 27 grammes; Distilled Water, q.s.

Dose.—For dogs, grs. iv. to grs. x.

ACTIONS AND USES.—Colocynth is a powerful hydragogue cathartic. It is not prescribed for horses or cattle, but, in combination with other agents, it is a useful purgative for the dog. In the form of the pill of colocynth and hyoscyamus it may be combined with either calomel or blue pill, and is preferable to the drastic and nauseating purgatives which at one time were prescribed in canine practice. The dose will vary according to the size of the animal.

Sugar-coated pills containing suitable doses are now prepared by wholesale chemists, and are very convenient and reliable.

Podophyllum.

Podophylli Resina—Podophyllum Resin—also known as Podophyllin.

PREPARED from the dried rhizome and roots of *Podophyllum peltatum*, the American mandrake or May-apple.

DOSES.—Horses, ʒi. to ʒii.; dogs, gr. ¼ to gr. i.

Tinctura Podophylli—Tincture of Podophyllum.

Fifteen minims are equivalent to ½ grain of podophyllum resin.

DOSE.—For dogs, ♏v. to ♏xv.

ACTIONS AND USES.—Podophyllum is uncertain in its actions on horses and cattle, and ordinary doses usually produce no effect. In the dog, small doses increase the secretion of bile, and have a laxative effect; full doses act as purgatives, but usually cause irritation and griping. As a purgative and cholagogue the drug is combined with calomel and other agents.

Gamboge.

Gambogia—Gamboge.

A gum-resin obtained from *Garcinia Hanburii*.

DOSE.—For cattle, ʒss. to ʒi.

ACTIONS AND USES.—Gamboge is a drastic hydragogue cathartic. It is far too irritant for horses or dogs, but is occasionally prescribed in combination with other purgatives for cattle in cases where free purgation is indicated, such as cerebral affections depending on gastric disorders. One ounce

of gamboge, with ½ pound each of Epsom and common salt, dissolved in a pound of treacle and a quart of water, form an effectual purgative drench; or 1 ounce each of gamboge and aloes in solution may be employed (see Appendix).

Elaterium.

Elaterium—Elaterium.

PREPARED from the juice of the fruit of *Ecballium elaterium*, the Squirting Cucumber.

DOSE.—For dogs, gr. $\frac{1}{20}$ to gr. ss.

Elaterin is the active principle of elaterium.

DOSE.—For dogs, gr. $\frac{1}{80}$ to gr. $\frac{1}{10}$.

Pulvis Elaterini Compositus—Compound Powder of Elaterin.

Elaterin, 1; Milk-sugar, 39.

DOSE.—For dogs, gr. 1 to grs. iv.

ACTIONS AND USES.—Elaterium is a powerful hydragogue cathartic, producing very watery motions, its action being accompanied by much irritation of the intestinal canal and by depression. It is occasionally prescribed in cases of dropsy depending on renal or hepatic disease in the dog. In consequence of its irritant and depressing action, other agents are far safer. Elaterium is not employed for horses or cattle.

Croton Oil.

Oleum Crotonis—Croton Oil.

The oil expressed from the seeds of *Croton Tiglium*.

DOSES.—Horses, ♏x. to ♏xx.; cattle, ʒss. to ʒi.; pigs, ♏v. to ♏x.

Linimentum Crotonis—Liniment of Croton Oil.

Croton Oil, 1; Oil of Cajuput, 3½; Alcohol, 3½.

ACTIONS AND USES.—Croton oil is a powerful drastic hydragogue cathartic, which acts with great rapidity, causing frequent full fluid dejections. In large doses it is an irritant poison, causing gastro-enteritis, collapse, and death. In some instances even medicinal doses may produce serious intestinal irritation and superpurgation.

Externally, it is an irritant, and when rubbed into the skin

produces an eruption, which becomes pustular. The pustules heal slowly, and are apt to leave a blemish.

In consequence of its irritating and depressing action, croton oil is seldom employed for the horse. It is occasionally useful in cases of phrenitis and meningitis in the earlier stages, where it is desirable to obtain speedy and complete purgation, and a diminution of arterial pressure by diverting the blood to the intestinal bloodvessels.

In cattle it is sometimes prescribed in gastric affections complicated with cerebral symptoms; but its use requires judgment, as many of these cases depend on an inflammatory condition of the abomasum, in which the drug would be contra-indicated. In the present day drastic purgatives are less used in cases of obstinate constipation than in former times, as nerve tonics, stimulants, and milder cathartics, give better results. Many instances of cessation of rumination and obstinate constipation in cattle depend on a paralyzed condition of the gastric and intestinal walls, and violent purgatives do more harm than good. The drug may be prescribed as a purgative for the pig.

Croton oil may be administered in linseed oil or in mucilage. It is not prescribed in canine practice, being far too irritating and violent in its actions.

Some practitioners employ croton seeds instead of croton oil in cattle practice. From 20 to 30 seeds are powdered and combined with Epsom Salt.

Externally, croton oil is employed as a counter-irritant for cattle in the form of Linimentum Crotonis. It may be added to the ordinary blistering ointments in the proportion of 1 to 8. It is not used as a counter-irritant for horses.

Castor Oil.

Oleum Ricini—Castor Oil.

The oil expressed from the seeds of *Ricinus communis*, the Castor Oil Plant.

DOSES.—Horses and cattle, O.i.; sheep and pigs, ʒii. to ʒiv.; dogs, ʒii. to ʒii. (according to size); foals and calves, ʒii. to ʒiii.

ACTIONS AND USES.—*Externally*, pure castor oil lessens

irritation, and acts as a protective. A few drops applied to the conjunctiva lessen irritation after the removal of foreign bodies from the eye; and it is also employed as a local application after injuries to the eye by caustic substances, such as acids or alkalies.

Internally, it is a simple purgative, mild in its actions and free from any tendency to cause griping. The purgative effect is due to ricinoleic acid. No acid is present in the normal oil, and until the latter is saponified in the duodenum its purgative action is not exerted.

Cases of poisoning by castor oil seeds are recorded. The residue left after pressure of the seeds contains an active poison *Ricine* which does not pass into the oil.

For the horse, castor oil is an uncertain purgative, and produces extreme nausea. In foals, however, it is safe and reliable; and in cases of intestinal obstruction depending on retention of the meconium, the administration of castor oil in a dose of a wineglassful, repeated if necessary, constitutes the most successful treatment, enemata of warm water being given at the same time.

In cattle, castor oil is a popular purgative agent, and is often given in large doses; but in our experience raw linseed oil gives better results.

In canine practice castor oil is largely employed as a purgative. One drawback to its use is its tendency to induce vomition when the stomach is in an irritable condition. To obviate this, emulsions of the drug are prescribed. In the treatment of chronic constipation this agent should not be employed, as after the initial purgative effect constipation is again likely to occur. In such cases liquid paraffin (white vaseline oil) should be prescribed.

A useful mixture is prepared by combining equal parts of castor oil and olive oil, and adding from 10 to 20 minims of sweet spirit of nitre, and ½ minim of oil of peppermint or aniseed. Or the British Pharmacopœia Mistura Olei Ricini may be employed. This consists of mucilage of gum acacia, 1½; castor oil, 3; orange-flower-water (undiluted), 1; and cinnamon-water, 2½ parts; the dose being from 1 to 3 ounces.

In cases of diarrhœa in foals, calves, and dogs, a moderate dose of castor oil is indicated as the preliminary step in treatment. In severe cases a dose of chlorodyne may be combined with the oil.

It is important that the purest form of castor oil should be prescribed in canine practice.

Linseed Oil.

Oleum Lini—Raw Linseed Oil.

The oil expressed from the seeds of *Linum usitatissimum* (linseed) at ordinary temperatures.

DOSES.—Horses, O.i. to Oi.ss.; cattle, O.i.ss. to O.ii.; sheep and pigs, ℥iv. to ℥vi.; dogs, ℥ii. to ℥ss.

ACTIONS AND USES.—In small doses linseed oil is a laxative, in full doses it is a purgative. It is largely prescribed in equine practice for cases in which active cathartics would be contra-indicated. In spasmodic colic, flatulent colic, and impaction of the colon, it is administered in combination with other agents. The action of linseed oil is uncertain at times, and full repeated doses may induce superpurgation and laminitis. The extreme nausea which it produces in the horse renders its employment in large or continued doses undesirable. It may also be given in the form of enema in cases of impaction of the colon.

In cattle practice, full doses of linseed oil are prescribed in gastric affections where active or irritating cathartics would be productive of undesirable results.

As a menstruum, to prevent the irritating effects of agents such as oil of turpentine, linseed oil is frequently employed.

In the dog, linseed oil tends to induce nausea, and is liable to be rejected in irritable conditions of the stomach.

Small doses are readily taken by horses in their food, and prove useful in aiding digestion and improving nutrition.

Externally, linseed oil is employed as a basis for various liniments in the treatment of parasitic skin diseases. Combined with equal parts of lime-water it forms carron oil, which is a useful application for burns and scalds.

It is important to remember that *boiled* linseed oil, con-

taining litharge, is used in the preparation of paints, and if substituted for the raw linseed oil, toxic effects may be produced.

Euonymin.

Euonymin—a dry extract obtained from the root-bark of *Euonymus atropurpureus*—is a cholagogue and purgative, occasionally prescribed in canine practice in the treatment of chronic constipation and affections of the liver.

The dose for the dog is from 1 to 2 grains, which may be combined with other agents possessing similar actions.

Iridin.

Iridin, obtained from the root of *Iris versicolor*, has similar actions to Euonymin, and may be combined with it in doses of 1 to 5 grains, or with other cholagogues.

CHAPTER XXII

THE VEGETABLE KINGDOM (*Continued*)

Male Fern.

Filix Mas—Male Fern—the rhizome of *Dryopteris Filix-mas.*

The drug is chiefly used in the form of the liquid extract. This is an oleo-resin, and is sometimes called Oil of Male Fern.

Extractum Filicis Liquidum—Liquid Extract of Male Fern.

The active constituents of the drug are *aspidin* and *filicic acid.*

DOSES.—Horses, ʒii. to ʒvi.; dogs, ♏xv. to ʒi. Administered in the form of emulsion with mucilage of gum acacia, and for the dog preferably in capsules.

ACTIONS AND USES.—Male fern is an anthelmintic which is especially destructive to tape-worms, and it is one of the most effectual drugs for this purpose. In administering this agent it is advisable to give a purgative the previous day, and also on the day after the drug has been taken. Some authorities advise the dose to be divided into three parts, and each to be given at intervals of half an hour. Others recommend that oily substances, such as castor oil, should be avoided during the treatment, as they may dissolve the filicic acid, and thus facilitate absorption and the production of undesirable effects.

In large doses, or where some unknown conditions favour the absorption and retention of a large amount of the active constituents, serious symptoms may occur in the dog. These

usually consist of vomiting, purging, colicky pains, muscular weakness, slight convulsive movements or muscular twitching, occasionally blindness, and where toxic doses have been given, death results from collapse.

In medicinal doses, the quantity of the active constituents absorbed should be so small as not to produce any constitutional symptoms, the major portion of the drug escaping with the fæces.

The dose for the dog should be carefully computed, having regard to the size and strength of the individual. The drug is best administered in the form of capsules, and in cases where no results follow its employment, the dose should not be repeated until several days have elapsed.

For the horse, it may be combined with oil of turpentine and administered in linseed oil.

Santonin.

Santoninum—Santonin—a crystalline principle obtained from Santonica or Wormseed, the dried flower-heads of *Artemisia maritima.*

This must be distinguished from American Wormseed, which is obtained from Chenopodium (see p. 474).

DOSES.—Horses, ʒss. to ʒi.; sheep, grs. x. to grs. xv; pigs, grs v. to grs. x; dogs, grs. ii. to grs. v.

ACTIONS AND USES.—Santonin is an anthelmintic which is destructive to round-worms and thread-worm, but has no effect on tape-worms. It passes through the stomach unchanged, but a certain amount is absorbed from the small intestine in the form of sodium santonate. Being very insoluble, the major portion reaches the intestinal canal, and exerts its effects on the round-worms when present therein.

Authorities are not agreed as to the exact action of santonin on intestinal worms. Some believe that the parasites become narcotized, and are carried away in the fæces. Others state that solutions of the drug are not fatal to the parasites outside the body, and that the worms are often found in active movement when passed after santonin had been given internally. They conclude that the action of

santonin renders the intestine so unpleasant an abode for the parasites, that they migrate into the large intestine, and are removed by the purgative which is usually given with the drug. Santonin is excreted by the intestines and also by the kidneys, and gives a deep yellow colour to the urine, when the latter is acid in reaction.

In administering the drug to dogs it is necessary to exercise caution, as too large doses may induce toxic symptoms, as follows: twitching of the muscles of the head, rolling of the eyes, temporary blindness, grinding of the teeth, clonic spasms, and epileptiform convulsions. Toxic doses cause irregular and insufficient respiration and death from asphyxia. The antidotes are emetics and purgatives.

Santonin is best administered with castor oil; this assists in the removal of the parasites, and also causes less of the drug to become absorbed. It is advisable to administer another dose of castor oil in about six hours afterwards.

Santonin combined with other agents is effectual in eradicating round-worms from puppies, but it is not advisable to prescribe this agent until the animals are past eight weeks old.

The following is a useful formula: Santonin, grs. iv.; oil of chenopodium, ♏xx.; oil of turpentine, ♏iii.; oil of aniseed, ♏xvi.; castor oil, ℥v.ss.; olive oil, ℥ii. Mix. Of this, the dose for puppies eight weeks old and of ordinary size is 1 drachm; and if no effect be produced on the bowels, it may be repeated in two hours, along with 1 or 2 drachms of castor oil. For small puppies reduce the dose to one-half, and for the toy breeds to one-quarter. At the fourth month the dose is 1½ drachms; at the seventh month the dose is 2½ drachms; at the thirteenth month the dose is 3 drachms.

Santonin is also a useful vermicide for horses, but is too expensive for general use in equine practice.

Oil of American Wormseed.

Oleum Chenopodii—Oil of American Wormseed.

A volatile oil distilled from the fruit of *Chenopodium anthelminticum*, the Jerusalem Oak.

DOSES.—Dogs, ♏ii. to ♏xxx.; for puppies, ♏i. to ♏ii.

ACTIONS AND USES.—Oil of chenopodium is a reliable anthelmintic for round-worms in puppies, and can be given at an age when santonin or areca-nut would not be safe agents. It is best administered with castor oil and olive oil.

The following formula is safe and effectual for this purpose: Oil of chenopodium, ♏xvi.; oil of turpentine, ♏ii.; oil of aniseed, ♏xvi.; castor oil, ℥iii.ss.; olive oil, ℥iii. Mix and heat gently.

DOSES.—For a full-sized or medium puppy under six weeks old, give ½ drachm in a drachm of milk. Between six and eight weeks the dose is 1 drachm, and at eight weeks 1 drachm, to be repeated in an hour. If the bowels do not act within an hour, give ½ to 1 drachm of castor oil. For small puppies reduce the doses to one-half, and for the toy breeds to one-quarter. If no worms be expelled, the mixture may be repeated in a few days.

Areca.

Areca.—The seed of *Areca Catechu*, the Betel-nut Tree; also known as Areca-nut.

DOSES.—Horses, ℥iv. to ℥vi.; dogs, grs. x. to ℥i.

Arecoline is the chief alkaloid found in areca. It is employed in the form of Arecoline Hydrobromide.

DOSES.—For the horse, gr. ⅔ to gr. i.ss., dissolved in a drachm of distilled water and injected subcutaneously.

ACTIONS AND USES.—Powdered areca-nut is an anthelmintic. It is largely employed as a vermifuge for both tape and round worms in the dog.

The usual dose is about 2 grains for every pound of the animal's weight. Too large doses may induce narcotic effects, or cause convulsions.

Areca-nut should be freshly ground; and, being rather insoluble in water, it is best administered in milk, a dose of castor oil being given before and after the administration. Some prefer to give the drug along with a dose of raw linseed oil, and the combination is very effectual For the

eradication of tape-worm it is advisable to combine the areca-nut with half a dose of the extract of male-fern.

H. Gray is of opinion that areca-nut is not a safe agent to administer to puppies under six months of age, nor should it be given to dogs suffering from incipient distemper, catarrhal enteritis, or in cases where infrequent cardiac action is present. In such instances serious, if not fatal, results may ensue from the effects of this agent.

He states that areca-nut is not an astringent, but an intestinal stimulant, and that, by causing an outpouring of mucus and inducing increased peristalsis, it loosens the grip of the tape-worm in the intestine and sets it free; hence it is a vermifuge, and not a vermicide, as is usually stated.

H. Gray also advises that if the drug be given dry it should not be placed on the tongue, but in the buccal pouch, as, if the former method be adopted, it may be drawn into the bronchial tubes and induce bronchial catarrh.

After administration, exercise and enemata are advised, so as to prevent the drug remaining too long in the stomach and intestines.

He does not consider areca-nut safe for cats, as it may cause an outpouring of bronchial mucus, and so induce bronchial catarrh, but prefers kamala for this animal, the dose being from 10 to 15 grains (see p. 477).

Arecoline Hydrobromide.

Arecoline Hydrobromide possesses sialagogue, diaphoretic, and vermifuge actions; it also stimulates the peristaltic movements of the intestines, and causes contraction of the pupil. It thus resembles in its actions eserine and pilocarpine. In medicinal doses it is a cardiac sedative, diminishing the force and number of the pulsations.

Arecoline administered by subcutaneous injection, in a dose of 1 grain, is preferred by some practitioners to eserine in the treatment of impaction of the colon in the horse. It acts energetically, and at the same time causes most profuse salivation. We prefer small repeated doses to one full dose of the drug.

In prescribing arecoline, similar precautions to those advised with reference to eserine should be observed. In some cases the drug acts more energetically than eserine, and is more likely to cause rupture of the intestine. It is largely employed by American practitioners, the first dose given being 1 grain, followed by ½-grain doses every half an hour until free purgation results. It is also advised in cases of azoturia, and in all conditions where early purgation is indicated.

Arecoline is recommended by Continental authorities in the treatment of laminitis. One grain of the drug is given hypodermically daily for three or four days, and the results are said to be excellent. Its mode of action in shortening the duration of the disease has not yet been explained.

In the treatment of cases of 'choking,' due to a foreign body in the œsophagus, arecoline is said to have given good results. The drug is not employed in canine practice.

Tenaline is a proprietary preparation containing the anthelmintic principles of areca-nut; it is safe, convenient, and effectual for canine practice, the dose being 1 minim per pound weight of the animal. It is best administered in the form of capsule. The dog should be kept on a milk diet for one day, and the dose is administered the following morning.

Kamala consists of the minute glands and hairs obtained from the surface of the fruits of *Mallotus Philippinensis*. It possesses anthelmintic and purgative actions, and is employed for the eradication of tape-worm in cats (see p. 476).

A fluid extract of Kamala is prepared by Parke, Davis and Co., the dose of which for cats is ♏xxx. to ʒi., and for dogs ʒi. to ʒii.

There are other drugs which possess anthelmintic actions, such as Cusso or Kousso, Spigelia, and Granatum or Pomegranate Bark; but as they are seldom employed in veterinary practice, they do not merit consideration here.

CHAPTER XXIII

THE VEGETABLE KINGDOM (*Continued*)

Galls.

Galla—Galls—are excrescences on a species of oak-tree, the *Quercus infectoria*, resulting from the deposition of the ova of *Cynips gallæ tinctoriæ*.

Unguentum Gallæ—Gall Ointment.

Galls, 1; Benzoated Lard, 4.

Unguentum Gallæ cum Opio—Gall and Opium Ointment.

Opium, 7·5 grammes; Gall Ointment, 92·5 grammes.

Acidum Tannicum—Tannic acid; Tannin—is prepared from galls.

DOSES.—Horses, ʒss. to ʒii.; dogs, grs. ii. to grs. v

INCOMPATIBLES.—Mineral acids, alkalies, lead and silver, ferric salts, vegetable alkaloids, and gelatin.

Acidum Gallicum—Gallic Acid—is prepared from tannic acid.

DOSES.—Similar to those of tannic acid.

ACTIONS AND USES.—Tannic acid is a styptic and astringent. Gallic acid is inferior to tannic acid as an astringent. The latter is said to be converted into gallic acid in passing through the circulation. Tannic acid precipitates albumin and also proteids in the stomach; but as digestion proceeds the combination is broken up, as the peptones do not combine with tannin in acid solutions. It exerts an astringent action on the walls of the stomach and intestines. If the stomach be comparatively empty, tannic acid may induce vomiting in the dog.

Externally, if applied to abrasions of the skin or to mucous surfaces, it constringes the tissues of the parts, diminishes the local circulation, and reduces the sensibility of the nerve-endings. Many vegetable astringents contain tannic acid, and to this agent is to be attributed their special action. Tannic acid is seldom prescribed internally, agents containing it, such as catechu and kino, being preferred as intestinal astringents. Its action as a styptic in cases of internal hæmorrhage has not been demonstrated.

Externally, tannic acid, combined with glycerin (1 to 5), is sometimes employed as an astringent application in cases of eczema with excessive secretion. A similar combination is applied to the pharynx in relaxed conditions of the mucous membrane of this region which are met with in canine practice.

As an *antidote to alkaloids*, tannic acid acts by forming insoluble compounds with the toxic agents; but unless these are promptly got rid of by emetics in the dog and purgatives in the horse, the toxic principles become liberated; hence the antidote is but a temporary one.

The gall and opium ointment is employed as a local application in the treatment of hæmorrhoids in the dog.

Tannalbin is a combination of tannic acid and albumin, dried at such a temperature that it is unaffected by the gastric juice, but is capable of being broken up in the intestine, exerting an astringent and disinfectant action on the mucous membrane; thus any irritating effect of the drug on the stomach is avoided.

In doses of 20 to 40 grains it has been employed in cases of diarrhœa and dysentery in foals and calves, being repeated three times daily.

Tannigen, a compound of tannin with acetic acid, has similar actions and uses to the above. It is recommended in cases of intestinal catarrh in foals depending on the presence of parasites.

Tannoform.—See p. 326.

Pyrogallic Acid is obtained from gallic acid. It possesses antiseptic, astringent, and caustic actions, and has been

recommended in the local treatment of psoriasis and ringworm. In consequence of its irritant action and the risk of absorption from the skin, it is seldom employed.

Catechu.

Catechu—Catechu.

An extract of the leaves and young shoots of *Uncaria Gambier*.

Catechu Nigrum—Black Catechu.

A dried extract from the wood of *Acacia Catechu*.

DOSES.—Horses, ʒi. to ʒiii.; cattle, ʒii. to ʒvi.; sheep and pigs, ʒss. to ʒii.; dogs, grs. v. to grs. xv.

Tinctura Catechu—Tincture of Catechu.

Catechu, 4; Cinnamon Bark, 1; Alcohol (45 per cent.), 20 (1 in 5).

DOSES.—Horses, ℥i. to ℥ii.; dogs, ʒss. to ʒi.

Pulvis Catechu Compositus—Compound Powder of Catechu.

Catechu, 4; Kino, 2; Krameria Root, 2; Cinnamon Bark, 1; Nutmeg, 1.

DOSES.—Horses, ʒiii. to ʒvi.; dogs, grs. x. to grs. xx.

INCOMPATIBLES.—Alkalies, metallic salts, and gelatin.

ACTIONS AND USES.—Catechu is a powerful astringent, resembling tannic acid in its actions. It is prescribed in cases of persistent diarrhœa and also in dysentery, especially in horses and cattle, being combined with prepared chalk and a carminative such as powdered ginger. In severe cases opium may be added with benefit, and the combination is best administered in well-boiled flour-gruel.

The compound catechu powder may be employed for similar purposes.

Kino.

Kino—Kino.

The juice obtained from incisions in the trunk of *Pterocarpus Marsupium*.

The actions, uses, and doses are similar to those of catechu.

Pulvis Kino Compositus—Compound Powder of Kino.

Kino, 15; Opium, 1; Cinnamon Bark, 4.

This is sometimes prescribed for obstinate cases of diarrhœa in dogs in doses of from 5 to 20 grains.

Krameria.

Krameriæ Radix—Krameria; also known as Rhatany Root.

The dried root of *Krameria argentea* or of *Krameria triandra*.

Krameria resembles catechu in its actions; it is one of the components of compound catechu powder.

Cinnamon.

Cinnamomi Cortex—Cinnamon Bark.

The dried inner bark of shoots from the truncated stocks of *Cinnamomum zeylanicum*.

Oleum Cinnamomi—Oil of Cinnamon.

Obtained by distillation from cinnamon bark.

ACTIONS AND USES.—Cinnamon possesses carminative, astringent, aromatic, stimulant, and antiseptic actions. It is chiefly used as an adjuvant to other medicines, and is one of the components of compound catechu powder.

The oil of cinnamon has been found useful in the treatment of diarrhœa in the dog, the dose being ♏i. to ♏iv. in syrup or mucilage.

Tincture of Cinnamon may be prescribed for a similar purpose in doses of ʒi. to ʒii.

Logwood.

Hæmatoxyli Lignum—Logwood.

The heart-wood of *Hæmatoxylon campechianum*.

Decoctum Hæmatoxyli—Decoction of Logwood.

DOSES.—Horses and cattle, ʒvi. to ʒviii.; dogs, ʒii. to ʒi.

A liquid extract and a dry extract are also prepared. Doses about one-eighth of the above. Logwood contains 10 per cent. of a crystalline body named *hæmatoxylin*, which has no astringent property, but this is said to be developed as a result of keeping.

ACTIONS AND USES.—Hæmatoxylon is an astringent. It is said to be without irritating properties, and not to cause subsequent constipation. It is occasionally prescribed in cases of obstinate diarrhœa in cattle, also in dysentery. In combination with dilute sulphuric acid and infusion of cloves, it forms the most efficient remedy in cases of obstinate diarrhœa in the dog.

Hamamelis.

Hamamelidis Cortex et Folia.—The dried bark and the fresh or dried leaves of *Hamamelis virginica*, the Witch Hazel.

Extractum Hamamelidis Liquidum—Liquid Extract of Hamamelis.

A proprietary preparation of witch-hazel is known as Hazeline. A concentrated distilled extract of Witch Hazel is also prepared. These are more reliable than the official liquid extracts.

DOSE.—For dogs, ♏v. to ♏xv.

ACTIONS AND USES.—Hamamelis possesses astringent and hæmostatic actions, both locally and internally. It is a capillary astringent, and hence is employed as a nasal injection in cases of epistaxis. It is also employed in canine practice in cases of hæmoptysis and hæmatemesis. In the form of ointment prepared with lanolin (1 in 10), it is a useful application for hæmorrhoids in the dog.

Chrysarobin.

Chrysarobinum—Chrysarobin.

A yellow crystalline powder prepared from Araroba, or Goa Powder, which is obtained from fissures in the trunk of *Andira Araroba.*

When chrysarobin is oxidized, an agent known as Chrysophanic Acid is formed.

ACTIONS AND USES.—Chrysarobin is a parasiticide, and in the form of ointment (1 part in 25 parts of benzoated lard) it is sometimes employed in the treatment of ringworm. It is also found useful in cases of chronic psoriasis, but is liable to produce much irritation of the skin.

Ipecacuanha.

Ipecacuanhæ Radix—Ipecacuanha Root.

The dried root of *Psychotria Ipecacuanha*. The principal alkaloids contained in ipecacuanha are *Emetine* and *Cephaëline*.

Doses of Powdered Ipecacuanha.—Horses, ʒi. to ʒi.ss.; dogs, gr. ¼ to grs. ii.; as an emetic, grs. xv. to ʒss.

Vinum Ipecacuanhæ—Ipecacuanha Wine.

Liquid Extract of Ipecacuanha, 1; Sherry, 19 (1 in 20).

Doses.—Horses, ʒii. to ℥i.; dogs, as an expectorant, ♏x. to ʒss.; as an emetic, ʒiv. to ʒvi.

Incompatibles.—Lead and mercury salts, vegetable acids, astringent infusions.

Pulvis Ipecacuanhæ Compositus—Compound Powder of Ipecacuanha; Dover's Powder.

Ipecacuanha Root, 1; Opium, 1; Potassium Sulphate, 8. One grain of Dover's powder contains gr. $\frac{1}{10}$ of opium.

Doses.—Horses, ʒi. to ʒiv.; dogs, grs. v. to grs. xv.

Actions and Uses of Ipecacuanha.

Externally, ipecacuanha acts as an irritant to the skin and mucous membranes.

Internally, it is an expectorant. In the dog a full dose acts as an emetic. This effect is produced by direct irritation of the gastric mucosa. The emetic action is slow, and emesis may not be produced for twenty or thirty minutes. Ipecacuanha increases the secretion from the bronchial mucous membrane, and renders it more fluid, thus acting as an expectorant. According to some authors, this effect depends on a reflex action from irritation of the stomach. The diaphoretic action of the drug which occurs in man is not observed in animals.

Emetine is not employed in veterinary practice in Great Britain. On the Continent it is sometimes prescribed as a gastric stimulant for horses and cattle, in the form of emetine hydrochloride or hydrobromide administered subcutaneously in a dose of grs. iii. to grs. vi.

Owing to its action in constricting peripheral vessels, its employment is suggested in cases of internal hæmorrhage, and in hæmorrhage following castration (Steffen, *Am. Journ. Vet. Med.*, July, 1915).

Experimental evidence shows that emetine in large doses is an irritant poison, producing gastro-enteritis and collapse.

The chief uses of ipecacuanha in veterinary practice are in the treatment of dysentery and of bronchitis. While the exact manner in which the drug exerts beneficial effects in cases of dysentery is not known, there can be no question as to its value. It should be prescribed in large doses in this affection, and is usually combined with other agents. As full doses tend to cause vomiting in the dog, it is advisable to combine small amounts of opium with the ipecacuanha in cases of dysentery in this animal.

As an expectorant, it is prescribed in acute and chronic bronchitis when the bronchial secretion is thick and scanty, and it may be combined with syrup of squills for such cases in the dog. It is not a reliable emetic for cases of poisoning in the dog, but its emetic action is useful in acute bronchial affections when the upper air-passages become blocked by the secretion, as the act of vomition removes the obstruction.

The compound ipecacuanha powder is prescribed in the early stages of catarrhal affections in the dog, and is sometimes useful in cases of dysentery in this animal and in the intestinal form of distemper.

Buchu.

Buchu Folia—Buchu Leaves.

The dried leaves of *Barosma betulina*.

Infusum Buchu—Infusion of Buchu.

Buchu Leaves, 1; Boiling Distilled Water, 20 (1 in 20).

DOSES.—Horses, ʒviii. to ʒx.; dogs, ʒss. to ʒii.

Tinctura Buchu—Tincture of Buchu.

Buchu Leaves, 1; Alcohol, q.s. to yield 5 (1 in 5).

DOSES.—Horses, ʒi. to ʒii.; dogs, ʒss. to ʒi.

ACTIONS AND USES.—Buchu is a mild diuretic. It exerts astringent effects on the mucous membrane of the bladder

and urino-genital passages, and renders the urine antiseptic to a slight degree. It is prescribed in cases of cystitis, also in irritation of the bladder and urethra. It is usually combined with an alkali such as bicarbonate of potassium and with hyoscyamus, the vehicle being linseed-tea or barley-water. The infusion is too bulky for use in equine practice, so the tincture is prescribed instead.

Pareira, Uva Ursi, and **Collinsonia**, are agents possessing similar actions to buchu.

Agropyrum—Triticum.

The dried rhizome of *Agropyron repens* (Couch Grass).

Extractum Agropyri Liquidum—Liquid Extract of Couch Grass; Liquid Extract of Triticum.

DOSES.—For dogs, ʒi. to ʒii.

ACTIONS AND USES.—Triticum possesses a mild diuretic action, and also allays irritation of the urinary passages. It is prescribed for the dog in cases of cystitis, urethritis, etc. We may remark that the natural instinct of the dog leads him to seek for and ingest couch grass when he feels ill from various causes. We are not aware that it exerts any effects on the stomach or intestines.

Cherry-Laurel Water.

Aqua Laurocerasi—Cherry-Laurel Water—is prepared from the fresh leaves of *Prunus Laurocerasus*, the Cherry-Laurel.

It contains $\frac{1}{10}$ per cent. of hydrocyanic acid; 20 minims are equivalent to 1 minim of the dilute hydrocyanic acid. It is a gastric sedative, but is seldom employed for this purpose.

It is chiefly used as a local sedative for the eye, and it forms an adjunct to eye-lotions, the strength being 1 or 2 parts in 16.

It is occasionally employed to allay itching in cutaneous disorders, but its poisonous nature must be remembered.

CHAPTER XXIV

THE VEGETABLE KINGDOM (*Continued*)

Cinchona and Quinine.

Cinchonæ Rubræ Cortex—Red Cinchona Bark.

The dried bark of the stem and branches of cultivated plants of *Cinchona succirubra*.

Doses of Powdered Cinchona Bark.—Horses, ʒii. to ʒss.; cattle, ʒi.; dogs, grs. v. to grs. xxx.

Tinctura Cinchonæ—Tincture of Cinchona.

One part of Red Cinchona Bark in 5 parts of Alcohol (70 per cent.). This is standardized to contain about 1 per cent. of alkaloids of Red Cinchona Bark.

Doses.—Horses, ʒi. to ʒii.; dogs, ʒss. to ʒi.

Tinctura Cinchonæ Composita—Compound Tincture of Cinchona.

Tincture of Cinchona, 500 millilitres; Dried Bitter Orange-peel, 50 grammes; Serpentary Root, 25 grammes; Cochineal, 3 grammes; Alcohol (70 per cent.), q.s. to yield 1,000 millilitres.

Doses.—Similar to those of the ordinary tincture.

Cinchona contains a number of alkaloids, but in veterinary practice the most important of these is Quinina or Quinine, and this is prescribed in the form of Quinine Sulphate.

Quininæ Sulphas—Quinine Sulphate.

The sulphate of an alkaloid, quinine, obtained from the bark of various species of Cinchona.

Sixty grains require 60 minims of diluted sulphuric acid for solution in 2 ounces of distilled water.

INCOMPATIBLES.—All alkalies and their carbonates, benzoates, iodides, and salicylates. All infusions containing tannin throw down a quinine tannate.

DOSES.—As a bitter tonic, horses, ʒss. to ʒi.; cattle, ʒi. to ʒii.; sheep and pigs, grs. v. to grs. xv.; dogs, gr. ss. to grs. ii. As an antipyretic, horses, ʒi. to ʒii.; cattle, ʒii. to ʒiii.; dogs, grs. ii. to grs. v.

Quininæ Hydrochloridum Acidum—Acid Hydrochloride of Quinine. This contains 81·6 per cent. of quinine, and is suitable for hypodermic or intramuscular injection in canine practice. It is said to be soluble 1 in 1 of water.

DOSE.—For dogs, gr. i. to grs. ii. in 20 parts of distilled water.

Tinctura Quininæ Ammoniata—Ammoniated Tincture of Quinine.

Quinine Sulphate, 20 grammes; Solution of Ammonia, 100 millilitres; Alcohol (60 per cent.), 900 millilitres (about 1 grain of quinine sulphate in 55 minims).

This preparation, when mixed with water, should be combined with mucilage of acacia, in order to suspend the quinine, as otherwise the latter becomes precipitated and the particles adhere to the sides of the vessel.

DOSE.—For dogs, ♏xx. to ʒss.

ACTIONS OF CINCHONA AND QUININE.

Externally, quinine possesses antiseptic and disinfectant actions. When applied in sufficient concentration it paralyzes all forms of living matter.

Internally, in small doses it acts as a bitter tonic, improving appetite and digestion.

It is quickly absorbed from the duodenum, and is excreted chiefly by the kidneys. It is slowly eliminated from the system, the excretion of a single dose requiring a period of about forty-eight hours.

Action on the Blood.—Quinine, if added to blood drawn from the body, exerts marked effects on the leucocytes. It causes them to assume a spheroidal form, and their amœboip movements cease.

Experiments show that the drug arrests the movements of the protozoön on which human malaria depends, the endocorpuscular bodies become immobile, granular, and lose their affinities for certain stains.

Action on Muscle.—Experiments demonstrate that quinine first causes increased contractions, but the irritability of muscles is soon diminished, and relaxation occurs. According to Dixon, the total effect on muscle is very small, and of little practical significance.

Action on Metabolism.—The drug diminishes metabolism. The solid constituents of the urine are diminished, and the specific gravity is decreased. In the normal animal, quinine causes a slight initial rise of temperature, succeeded by a considerable fall; but if given to a case suffering from fever the fall in temperature is much more marked. The drug lowers temperature by diminishing heat-production.

Action on the Central Nervous System.—Toxic doses in the dog cause death by inducing paralysis of the brain and respiratory centre, succeeded by cardiac paralysis. Vomiting and gastro-intestinal irritation also occur.

Derangements of the sense of hearing and of sight, which sometimes occur in man as the result of full doses of the drug, are not observed in animals, nor have we noticed any idiosyncrasies in connection with its use in our patients.

On the uterus, the action of quinine is doubtful, some observers stating that it excites uterine contractions, while others deny that it has this effect. Experience of its employment in pregnant animals leads us to the conclusion that it does not exert any ecbolic action.

MEDICINAL USES.—*As a bitter tonic*, quinine is prescribed in cases of atonic indigestion, and may be combined with nux vomica and a vegetable bitter. In convalescence from debilitating diseases, it is prescribed in combination with a non-irritating preparation of iron. For the above purposes small doses of the drug should be employed.

In cases of canine distemper, quinine sometimes gives good results.

As an antipyretic, quinine is largely employed in febrile

affections. Its effects are more prolonged, and there is far less risk of depression or collapse than is the case with some of the newer antipyretic agents. It is given either in the form of bolus or of mixture, the addition of a little dilute sulphuric acid being necessary to render it soluble when prescribed in solution. The doses employed and the frequency of administration will depend on the degree of pyrexia present. Usually moderate doses repeated at intervals give the best results.

In the treatment of red-water in cattle the administration of quinine in doses of from 2 to 4 drachms, three times daily, sometimes gives good results.

In the treatment of the lesions of the mouth in canine typhus, a mouth-wash containing quinine and dilute hydrochloric acid proves very useful.

H. Gray recommends the administration of the acid hydrochloride of quinine, by intramuscular injection, in the early stages of canine typhus (see 'The Treatment of Canine Typhus,' Part III.).

The ammoniated tincture of quinine is found useful in canine practice, in cases where a stimulant such as ammonia is indicated along with the quinine.

Cinchona bark contains a quantity of tannin, and hence possesses astringent actions in addition to those mentioned. It is prescribed as a tonic in cases where an astringent effect is desirable, and is combined with other tonic agents.

The tincture of cinchona and the compound tincture are useful tonics in canine practice.

In man, hypodermic injections of quinine have not infrequently been followed by tetanus.

Quinine and Urea Hydrochloride.—This is employed as a local anæsthetic, the usual strength employed being ½ to 1 per cent. solutions. It is said to be non-irritating and non-toxic, and solutions above 1 per cent. maintain local anæsthesia for several days After injection, a period of thirty minutes should be allowed before the operative measures are commenced. It can be obtained in the form of sterilized solution (1 per cent.) or in tablets each containing 2 grains of the drug.

Salicylic Acid.

Acidum Salicylicum—Salicylic Acid.

This is principally prepared by the interaction of sodium phenate and carbon dioxide, and is known in commerce as *artificial* salicylic acid.

Natural salicylic acid may be obtained from natural salicylates such as Oil of Wintergreen (*Gaultheria procumbens*) or from Oil of Sweet Birch (*Betula lenta*).

For internal use in canine practice the natural acid is preferred, as it is free from cresotic acids.

The natural acid is, however, too expensive for equine practice.

DOSES.—Horses and cattle, ʒii. to ʒiv.; sheep and pigs, ʒss. to ʒi.; dogs, grs. v. to grs. xv.

INCOMPATIBLES.—Spirit of nitrous ether; iron salts.

Sodii Salicylas—Salicylate of Soda.

This may be obtained by the interaction of salicylic acid and sodium carbonate. It contains 86 per cent. of salicylic acid.

DOSES.—Horses, ℥ss. to ℥ii.; dogs, grs. x. to ʒss.

Salicinum—Salicin—is a glucoside obtained from the bark of various species of willow (*Salix fragilis, S. purpurea, S. alba*); also from *Populus tremula* and other species of Populus.

DOSES.—Horses, ʒi. to ʒiii.; dogs, grs. v. to grs. xv.

Aspirin—Acetyl-Salicylic Acid.

This is used as a substitute for salicylic acid and its salts. It is not liable to cause gastric irritation.

DOSES.—Horses, ʒii. to ʒiii.; dogs, grs. v. to grs. x.

INCOMPATIBLES.—Sodium bicarbonate and all alkalies.

ACTIONS OF SALICYLIC ACID AND ITS PREPARATIONS.

Externally, salicylic acid possesses antiseptic actions, and is said to be equal to carbolic acid in this respect. The salicylates also exert antiseptic actions, but are less irritant to mucous membranes than the free acid. Both of them retard or prevent the putrefaction of proteid solutions and the alcoholic and acetic acid fermentations. The action on protozoa and leucocytes is similar to that of quinine.

Salicylic acid if applied to the skin in a concentrated form causes a softening of the horny cells, which become loosened and separated from the corium without the occurrence of inflammatory changes.

Internally, the drug is absorbed very rapidly, and circulates in the blood in the form of salicylate of soda.

In the horse even large doses do not produce any appreciable toxic effects beyond temporary dyspepsia.

In the dog the *toxic* symptoms observed are vomiting, dyspnœa, weakness of the hind-quarters, and convulsions, succeeded by paralysis. Irritation of the kidneys, albuminuria, and occasionally hæmaturia, may also be observed.

The salicylates are said to possess a slight cholagogue action, increasing both the secretion and salts of the bile. They also increase the excretion of urea and uric acid; this is the result of increased metabolism.

Salicylates have no effect on the temperature of healthy animals; but in febrile cases they cause a marked fall of temperature. This depends on an increased loss of heat.

They are excreted chiefly in the urine as salicyluric acid. This is a compound formed by the combination of glycocoll with salicylic acid.

MEDICINAL USES.—One of the chief uses of salicylic acid internally is in the treatment of acute rheumatism and in cases of influenza associated with a high temperature. The salicylate of soda is usually employed, as it is less likely to cause gastric irritation.

The beneficial effects of the drug are not always observed in veterinary practice. This is probably due to insufficient doses being prescribed. Todd has shown that doses up to 4 ounces of salicylate of soda may be safely given to horses suffering from rheumatism and produce good results, while smaller doses prove useless.

The manner in which salicylic acid acts in cases of rheumatism is not yet definitely known. It can be administered in the food or in the form of electuary.

Quitman (Chicago) strongly recommends salicylic acid in the treatment of gastric tympany in the horse. He admin-

isters ℥ss. of the drug combined with ℥ii. of powdered ginger in the form of capsule, and repeats the dose in one-half to one hour if necessary (see 'The Treatment of Gastric Tympany,' Part III.).

Salicylate of soda proves useful in the early stages of pachymeningitis in the dog; it allays the pain and nervous irritability that are present in this affection.

The drug is recommended by Continental authorities in the treatment of cystitis, and, combined with tannic acid, it has been found useful in cases of obstinate diarrhœa in calves.

An ointment composed of salicylic acid 1 part, lanolin 9 parts, is useful in the treatment of chronic cracked heels in horses.

In the treatment of follicular mange, an ointment containing salicylic acid, oxide of zinc, precipitated sulphur, and prepared storax, is recommended by H. Gray (see Appendix).

Salicin becomes oxidized in the body, and converted into salicylic acid. It is said not to irritate mucous membranes nor depress cardiac action; but its effects are not so certain as those of salicylic acid.

Aspirin is a very useful agent in the treatment of rheumatism in the dog, and also in pachymeningitis. It is too expensive for equine practice.

Thioform is a basic bismuth salt of dithio-salicylic acid, prepared by mixing solutions of a soluble bismuth salt with dithio-salicylate of sodium. It is sometimes employed as a surgical dressing, is non-irritating, antiseptic, non-toxic, and possesses a marked desiccative action on wounds. Its high price prohibits its general use in veterinary surgery.

Continental authorities recommend the internal use of thioform in cases of chronic catarrh of the stomach and intestines in the dog.

Oleum Gaultheria—Oil of Wintergreen—may be obtained from *Gaultheria procumbens* or from *Betula lenta* (sweet birch). It is said to be practically identical with oleum betulæ, and should contain 99 per cent. of methyl salicylate. In the form of an ointment, combined with menthol, it is a useful

local application in the treatment of muscular rheumatism in the dog.

Methyl Salicylas—also known as Artificial Oil of Wintergreen—may be employed instead of oil of gaultheria. It may be added to ointments, liniments, etc., to disguise their composition.

Cocillana.

This is obtained from the bark of *Guarea Rusbyi*.

Cocillana is an expectorant, and is employed in conjunction with other expectorants in the treatment of chronic bronchitis and bronchial asthma in the dog. A convenient and very efficacious combination is prepared by Parke, Davis and Co.—viz., Cocillana Compound Syrup. This contains tincture of cocillana, tincture of *Euphorbia pilulifera*, syrup of wild-lettuce, syrup of squill, cascarin, heroin hydrochloride, and menthol. In our experience it constitutes the best remedy for asthma in the dog. The dose is ℥ss. to ℥ii. every four hours.

Yohimbine (Aphrodine).

This is an alkaloid obtained from the bark of the Yohimbehe Tree (*Corynanthe Yohimbi*). It is usually prescribed in the form of Yohimbine Hydrochloride.

Doses.—Stallions, gr. $\frac{5}{6}$; bulls, grs. $1\frac{1}{4}$; cows, grs. $1\frac{1}{2}$; sheep, gr. $\frac{1}{6}$; small dogs, gr. $\frac{1}{400}$ to gr. $\frac{1}{250}$; large dogs, gr. $\frac{1}{60}$; dogs over 50 pounds, gr. ss.; administered in the food or drinking-water three times daily. Tablets containing the requisite doses are prepared by chemists.

Actions and Uses.—Yohimbine in medicinal doses is an aphrodisiac, and is employed in cases of functional impotence in the male and in sterility in the female. The clinical reports with reference to the drug are very favourable. It is not cumulative in its action, and does not cause irritation of the urinary organs. It can also be administered by subcutaneous injection. Discretion as regards dosage is necessary in canine practice, as poisoning has resulted from a dose of $\frac{1}{2}$ grain. The toxic symptoms recorded were dyspnœa, cardiac depression, purging, salivation, convulsions, and partial paralysis.

Damiana.

This is obtained from the leaves of *Turnera Aphrodisiaca*.

A liquid extract of this drug, combined with nux vomica and phosphorus, has been found of value in the treatment of atonic sexual debility and functional sterility. The dose of the liquid extract for the horse is ʒii. to ʒvi., and for the dog ♏x. to ♏xxx., repeated twice daily.

Fibrolysin.

This is a liquid composed of Thiosinamine and Salicylate of Soda. Thiosinamine is obtained by heating oil of mustard with ammonia and alcohol.

Fibrolysin is employed in the treatment of thickened tendons, chronic thickening of any part of the limbs, fibrous ankylosis of joints, and fibrous swellings in any region of the body. It is said to have the power of softening and causing the removal of fibrous or scar tissue, and the clinical reports are encouraging. The agent is administered by means of intramuscular injections into the gluteal muscles, the dose being 11·5 c.c. The injections are repeated daily or at intervals of two or three days, according to the requirements of the case. Sterile glass ampullæ are prepared containing the requisite dose. Bloxsome (*Veterinary Record*, vol. xxiv., p. 350) reported a case of an enlarged fetlock joint in a horse treated with fibrolysin. Five injections were given at intervals of one day, followed by four injections at intervals of two days. The results were very satisfactory, as the enlargement disappeared. Several instances, however, are recorded in which the results were negative. Further trials are necessary in order to judge of the value of the agent.

CHAPTER XXV

EMOLLIENTS, DEMULCENTS, ETC.

Olive Oil.

Oleum Olivæ—Olive Oil.

The oil expressed from the ripe fruit of *Olea Europæa.*

ACTIONS AND USES.—Olive oil is a mild laxative and demulcent, and also possesses nutrient properties.

Externally it is an emollient. As a laxative it is prescribed in canine practice in doses of ℥ss. to ℥i., and is also employed as an enema in cases of intestinal obstruction. As a demulcent, it is given in cases of irritant poisoning.

Externally, olive oil is largely employed as a basis for liniments, and combined with carbonate of potash and water it forms an emulsion which is useful as an application to blistered surfaces (see Appendix).

Soaps.

Sapo Durus—Hard Soap—is obtained by boiling palm oil, or cocoanut oil, or tallow, with sodium hydroxide or sodium carbonate. The alkali unites with the fatty acids, displacing the basic glyceryl.

Sapo Mollis—Soft Soap—is obtained by boiling whale oil with potassium hydroxide or carbonate. The refined Pharmacopœial soaps are prepared with olive oil or purified animal fats as a basis.

Sapo Animalis—Curd Soap—is made from sodium hydroxide and purified animal fats, consisting principally of stearin.

Linimentum Saponis—Soap Liniment.

Soft Soap, 80 grammes; Camphor, 40 grammes; Oil of Rosemary, 15 millilitres; Distilled Water, 170 millilitres; Alcohol (90 per cent.) sufficient to produce 1,000 millilitres.

Ether Soap.—Dissolve 32 parts of Soft Soap in 20 parts of Alcohol (90 per cent.). Allow them to stand for twenty-four hours, decant carefully, then add Methylated Ether (specific gravity, ·720), 52 parts.

ACTIONS AND USES.—Soaps are employed for general cleansing purposes. Various forms of soaps, medicated or otherwise, are used in the treatment of affections of the skin, especially those of a parasitic nature. Soaps may be medicated with various antiseptic agents, and are useful in cleansing the hands of the surgeon prior to the performance of an operation. Fluid soaps containing ether are sometimes preferred for this purpose, and also for cleansing the site of operation. A most useful antiseptic fluid soap for all purposes is prepared by Messrs. E. Cook and Co., viz., "Cofectant" Liquid Soap.

Soap added to enemas increases their laxative action.

As an emetic for the dog, in cases of emergency, soap and water may be administered until emesis is induced.

Soap liniment is employed as a mild stimulating application, and also as a basis in the preparation of other liniments.

Glycerin.

Glycerinum — Glycerin; Glycerol — is obtained by the hydrolysis of fats and fixed oils by means of alkalies or of superheated steam.

ACTIONS AND USES.

Externally, glycerin, if applied undiluted, is slightly irritant to the skin and mucous membranes, this effect depending on its power of abstracting fluid from the tissues. It also possesses antiseptic properties, and when diluted it acts as a demulcent and emollient.

Internally, in moderate doses, it acts as a laxative in the dog. Large doses induce purgation, and may cause hæmoglobinuria. This latter action only occurs when the agent is

administered *per os* or subcutaneously; it is not observed when glycerin is injected intravenously. Restlessness, tremors, and even tetanic convulsions, may result from toxic doses.

As a solvent, glycerin is extensively employed in pharmacy, its combinations with drugs being termed 'glycerina'—example, Glycerinum Belladonnæ.

Glycerin may be added to mixtures containing iron in order to conceal the nauseous taste of the latter. In the preparation of electuaries it is also employed, and it exerts beneficial local effects in cases of pharyngitis and laryngitis.

Glycerin injected into the rectum induces evacuation of fæces, and for this purpose ½ ounce, either alone or with one-third part of water added, is employed in cases of constipation in the dog. The effect is a reflex one, and is induced by the local irritation in the rectum. From 4 to 8 ounces may be used for the horse, but in the latter the effect of the drug is not so reliable.

Suppositories containing glycerin have been found useful in canine practice in cases of habitual constipation.

Externally, glycerin is employed in combination with astringents as a liniment for the treatment of mud-fever and cracked heels in the horse. For this purpose Glycerinum Plumbi Subacetatis—which is of the same strength as Goulard's extract—may be used, glycerin being employed for the solvent instead of water. This can be further diluted with glycerin, and forms an excellent astringent application in such cases.

Treacle.

Theriaca—Treacle.

DOSE.—For cattle, lb. i. to lb. ii.

ACTIONS AND USES.—Treacle is demulcent, nutritive, and laxative. It is frequently used in cattle practice, forming a valuable adjunct to saline purgatives, increasing their action and disguising their nauseous taste.

It also forms a convenient vehicle for the administration of drugs that are likely to cause irritation of the mouth and

throat, such as chloral hydrate, and it forms an excellent basis for electuaries.

Treacle is employed in pharmacy as an excipient.

Tragacanth.

Tragacantha—Tragacanth.

A gummy exudation obtained from *Astragalus gummifer.*

Mucilago Tragacanthæ—Mucilage of Tragacanth.

Prepared with Tragacanth in powder, Alcohol, and Distilled Water.

Pulvis Tragacanthæ Compositus—Compound Powder of Tragacanth. This contains Tragacanth, Gum Acacia, Starch, and Refined Sugar.

ACTIONS AND USES.—Tragacanth possesses demulcent actions. Its chief use is for the suspension of heavy insoluble powders such as bismuth salts in mixtures, also to prevent drugs possessing irritating properties from injuring the mouth, tongue, and throat. Either the mucilage or the compound powder may be employed for these purposes.

Gum Acacia.

Acaciæ Gummi—Gum Acacia.

Obtained from the stem and branches of *Acacia Senegal,* and of other species of Acacia.

ACTIONS AND USES.—Gum acacia, in the form of mucilage, has similar actions and uses to those of tragacanth, already mentioned.

It is also employed in pharmacy in the preparation of emulsions containing oils or resinous tinctures.

Dextrin or British gum may be employed instead of gum acacia for veterinary purposes, as it is far cheaper.

Liquorice Root.

Glycyrrhizæ Radix—Liquorice root.

The root of *Glycyrrhiza glabra* and other species of Glycyrrhiza.

ACTIONS AND USES.—Liquorice root possesses demulcent and expectorant actions. It is chiefly used as a basis in preparing electuaries.

Compound Liquorice Powder contains Senna Sulphur, Liquorice, Fennel, and Sugar. It is occasionally employed as a laxative for the dog in cases of habitual constipation, and may be administered in doses of a drachm, mixed in the food.

Linseed.

Linum—Linseed ; Flax seed.

The dried ripe seeds of *Linum usitatissimum.*

Linum Contusum—Crushed Linseed.

Lini Farina—Linseed Meal.

Linseed reduced to powder.

Oleum Lini—See p. 470.

Linseed is demulcent and nutritive. In the form of linseed-tea or boiled linseed it is a valuable nutrient for sick horses or cattle, and is also indicated in irritable conditions of the throat, alimentary canal, kidneys, or bladder.

Linseed-tea is prepared by infusing linseed in 15 or 20 parts of boiling water for two hours.

Linseed and linseed cakes are largely employed as feeding-stuffs for cattle.

Externally, linseed is employed in the form of poultices (see p. 189).

The ordinary linseed poultice is prepared with 4 parts of linseed meal and 10 parts of boiling water, the former being mixed gradually with the latter and stirred constantly. The vessel should first be heated by pouring boiling water therein.

Pearl Barley.

Hordeum Decorticatum—Pearl Barley.

Decoctum Hordei—Barley-water.

One part of barley boiled in 15 parts of water for twenty minutes and then strained.

Barley-water is both nutrient and demulcent ; it is a useful adjunct in the treatment of irritable conditions of the bladder

and urinary passages, the animal being permitted to drink it *ad libitum*.

In the rearing of foals, when it is found necessary to substitute cow's milk for that of the dam, the addition of barley-water assists digestion.

Wheaten Flour.

Farina Tritici—Wheaten Flour.

The grain of wheat (*Triticum sativum*) ground and sifted.

Wheaten flour is used medicinally in the treatment of diarrhœa and superpurgation, being administered in the form of flour gruel along with suitable astringents.

Starch.

Amylum—Starch.

This is obtained from wheat, maize, and rice. It possesses demulcent and emollient actions, and in the form of starch mucilage or gruel it is administered in cases of diarrhœa, dysentery, etc.

It is an efficient antidote in cases of iodine-poisoning.

Externally, starch is protective, absorbent, and desiccant, and forms a good basis for surgical dusting-powders.

It is also employed in the form of starch paste to stiffen bandages for surgical purposes.

Marsh Mallow Root.

Althææ Radix—Marsh Mallow Root.

The root of *Althæa officinalis*.

Actions and Uses.—Marsh mallow root contains a large amount of mucilage, and possesses demulcent actions. In the form of Marsh Mallow Ointment it is a useful application in the treatment of mammitis or garget in cows.

Chaulmoogra Oil.

Gynocardiæ Oleum—Chaulmoogra Oil.

A semi-solid oil obtained from the seeds of *Gynocardia odorata*.

Actions and Uses.—Chaulmoogra oil has been employed

in human medicine as an external application in cases of psoriasis, obstinate eczema, and other skin diseases; also internally in cases of leprosy.

We have no evidence of its value in veterinary practice.

Lanolin.

Adeps Lanæ—Wool Fat; Anhydrous Lanolin.

The purified fat of sheep's wool freed from water.

Adeps Lanæ Hydrosus—Lanolin; Hydrous Wool Fat.

Three parts of distilled water incorporated with 7 parts of wool fat by rubbing together in a warm vessel. This is the form of lanolin employed in veterinary practice.

ACTIONS AND USES.—Lanolin is an emollient, and is chiefly used as a basis for ointments. It possesses certain advantages in this respect over other agents: it does not become rancid, and water can be incorporated with it without affecting its consistency.

As lanolin originates from keratinous tissues, it possesses an affinity for the skin and is readily absorbed therefrom. Hence, when used as a basis for agents such as iodine, absorption by the skin is assisted.

As a basis for blisters, it proves superior to either lard or vaseline, as the activity of the counter-irritant is largely increased; and in the treatment of skin affections it assists the action of the agents employed.

It is advisable to combine a small amount of soft paraffin or vaseline with the lanolin in order to render the latter less tenacious and easier to apply to the skin.

Lanolin is one of the best dressings for weak and brittle feet in the horse; for this purpose a cheaper form is employed.

Lard.

Adeps Præparatus—Prepared Lard.

The purified internal fat of the hog (*Sus scrofa*).

Adeps Benzoatus—Benzoated Lard. Benzoin, 3; Prepared Lard, 100.

ACTIONS AND USES.—Lard is a simple emollient. It is frequently employed as a basis for ointments, but agents such as vaseline and lanolin are preferable for this purpose.

Benzoated Lard is preferred to the ordinary form, as it is less liable to become rancid by keeping.

Spermaceti.

Cetaceum—Spermaceti.

A solid wax obtained from the head of the Sperm Whale.

Spermaceti is emollient and demulcent; it is sometimes employed as an application to blistered surfaces and irritable conditions of the skin.

Oleum Cetacei—Sperm Oil—is used as a basis for mange dressings, etc.

Gelatin.

Gelatinum—Gelatin—is obtained from animal tissues, such as skin, tendons, ligaments, and bones. Its chief use is in connection with pharmacy, where it is employed for coating boluses and pills, rendering them easy to administer and preserving the ingredients; it is also used to prepare capsules for the convenient administration of drugs in the dry form.

Keratin.

Keratin is prepared from horn shavings. Being insoluble in the gastric juice, but soluble in the intestines, it is employed to coat boluses or pills which are intended to act on the intestinal canal, but not on the stomach. Thus certain anthelmintics which tend to cause gastric irritation may be coated in this manner. Also drugs, such as intestinal antiseptics, tannic acid, lead acetate, etc., when their local action is desirable on the intestinal canal.

Carbon Disulphide.

Carbonis Disulphidum—Carbon Disulphide, also known as Carbon Bisulphide. It may be obtained by combining carbon and sulphur at a high temperature. It has been suggested as a vermicide in equine practice for the eradication of *Œstrus Equi*, also for strongyles. The doses advised are —horses, ʒii. to ʒiv.; foals, ʒi. to ʒii.; administered in gelatin capsules, and repeated if necessary in two hours or after an interval of two or three days. In the case of mature worms, the second dose should be followed by a purgative.

Cod-Liver Oil.

Oleum Morrhuæ—Cod-liver oil.

The oil obtained from the fresh liver of the cod-fish (*Gadus morrhua*).

ACTIONS AND USES.—Cod-liver oil possesses nutrient, tonic, and alterative actions. Administered in small repeated doses it acts as a food, increases weight and strength, and improves the general condition of the system.

Some authorities state that cod-liver oil does not possess any action apart from that of an easily digested food. It would appear, however, that it is more easily digested than ordinary animal fats. Large quantities induce nausea and diarrhœa.

A cheaper variety of cod-liver oil is prescribed for horses or cattle. For these animals the usual doses required are from 2 to 4 ounces, repeated twice daily.

In canine practice the agent is prescribed in cases of malnutrition and during convalescence from debilitating diseases. It may be combined with preparations of malt, or employed in the form of an emulsion. Many convenient forms of the latter, in combination with hypophosphites, are now prepared by chemists.

The usual dose of cod-liver oil for the dog is from 1 to 2 drachms, repeated twice daily, care being taken to reduce the amount should the agent disagree with the animal.

Malt.

Maltum—Malt—is prepared from barley. It is prescribed in the form of extract of malt, as a restorative in cases of debility, and also in cases of dyspepsia, as it assists in the digestion of starchy foods. A variety of preparations of malt in combination with tonics, cod-liver oil, etc., are on the market, and are suitable for use in canine practice. A special 'horse malt' is also prepared, which can be administered either in the food or in the form of electuary.

Honey.

Mel—Honey.

A secretion deposited in the honeycomb by the hive bee (*Apis mellifica*).

Honey is demulcent, laxative, and nutritive. In pharyngeal affections it increases the secretions of the mouth and throat, relieves dryness of the latter, and lessens difficulty in swallowing. It is chiefly employed as a constituent of electuaries in the treatment of pharyngitis, laryngitis, glossitis, etc.; also in the form of mouth-washes, combined with boric acid or potassium chlorate, in irritable conditions of the mouth and tongue.

Beeswax.

Cera Flava — Yellow Beeswax — is obtained from the honeycomb of the Hive Bee.

Cera Alba—White Beeswax. This is prepared from Yellow Beeswax by the process of bleaching.

The chief use of beeswax is to increase the consistence of ointments and plasters. It forms a useful constituent of the various forms of dressings for the feet of horses.

Unguentum Simplex (B.P., 1885) was composed of White Wax, 2; Benzoated Lard, 3; Almond Oil, 3; it was employed as a basis for certain ointments.

Pepsin.

Pepsinum—Pepsin—is an enzyme obtained from the fresh and healthy stomach of the pig, sheep, or calf.

ACTIONS AND USES.—Pepsin converts proteids into peptones, but has no effect on fats or starch. Hence it only proves of service in young herbivorous animals during their period of existence on a milk diet, but is useful in the treatment of dogs of all ages.

The theory on which the therapeutical value of pepsin is based is that under certain conditions sufficient of the pepsin ferment is not secreted by the stomach. According to some authors this is open to doubt, as it has been shown that in some cases it is the acid secretion that is deficient, the ferment being usually present in sufficient amount. Nevertheless, pepsin, combined with bismuth and other agents, is frequently prescribed in cases of dyspepsia, and proves useful.

As pepsin digests only in acid solution, it should not be combined with alkaline carbonates or bicarbonates.

Nutrient enemata and suppositories require to be predigested, and this is accomplished by the addition of pepsin.

The dose of pepsin for foals and calves is from 40 to 60 grains, and for dogs 5 to 10 grains.

A variety of preparations containing pepsin have been introduced by Parke, Davis and Co., and are very convenient and useful. These include Concentrated Glycerole of Pepsin, Pepsin Cordial, and Lactated Pepsin.

Nuclein.

This is a non-toxic substance found in various vegetable and animal cells, in yeast, and also in blood-serum. It is considered to be a compound of Nucleinic Acid with albuminates and hydrocarbons, and possesses germicidal actions.

When administered in a properly prepared form to animals, it causes a marked increase of leucocytes in the blood, and hence increases the natural powers of resistance to disease. The drug is now largely employed in the treatment of microbial affections, and the reports of clinicians testify to its value. It gives excellent results in the treatment of influenza, pneumonia, strangles, joint-ill, septic arthritis, septicæmia, etc., and is specially indicated when hyperpyrexia is present. In canine distemper the clinical reports with reference to the value of nuclein are very encouraging, and it is now extensively employed.

Nuclein can be administered *per os* or hypodermically, but the latter method is preferable. For hypodermic use the drug is freed as much as possible from albuminous matter. During administration due aseptic precautions should be observed, and it is generally advisable to adopt intramuscular injection rather than hypodermic. The injections can be made deeply into the muscles of the gluteal region.

Parke, Davis and Co. prepare nuclein in the following forms; these are convenient and reliable:

1. **Nuclein Solution** (10 per cent.), for hypodermic use. This is supplied in ampoules each containing 5 c.c. It can be injected without dilution.

Doses.—Horses and cattle, 5 c.c. (85 minims); dogs, ♏ss. to each pound of body-weight. Given twice daily.

2. **Nuclein Solution** (5 per cent.), for hypodermic use. This must be diluted with normal saline solution prior to injection.

Doses.—Horses and cattle, 10 c.c. (170 minims), diluted with an equal amount of normal saline solution; dogs, ♏i. per pound of body-weight, diluted with 20 minims of normal saline solution. Given twice daily.

3. **Nuclein Hypodermic Tablets.**—Each tablet is equivalent to 30 minims of a 5 per cent. solution of nuclein.

Doses.—Horses and cattle, 6 tablets dissolved in 6 drachms of boiled water, and administered by intramuscular injection; dogs, 1 tablet in 30 minims of boiled water for every 30 pounds of body-weight.

4. **Nuclein Capsules.**—Each capsule contains 2 grains of dry nucleinic acid. This form is suitable for canine practice.

Dose.—One or two capsules given *per os* three times daily.

5. **Nuclein Solution** (5 per cent.), for *oral* use only. This is not so completely freed from albuminous matter as is necessary for hypodermic use, and hence should not be given subcutaneously.

Doses.—Horses and cattle, ʒi. to ʒii. three times daily; dogs, ♏ii. per pound of body-weight, given in a little milk every three or four hours.

CHAPTER XXVI

CANTHARIDES

Cantharis—Cantharides.

The dried Spanish or Blistering Fly, *Cantharis vesicatoria*, also known as *Lytta vesicatoria*. The active principle is Cantharidin. In the B.P. 1914, Cantharides is not official, and the various preparations of the drug are made with Cantharidin.

Cantharidinum—Cantharidin—may be obtained from various species of Cantharis or of Mylabris.

Tinctura Cantharidini—Tincture of Cantharidin.

Cantharidin, 0·1 gramme; Chloroform, 10 millilitres; Alcohol (90 per cent.) sufficient to produce 1,000 millilitres.

DOSES.—Horses, ℥xxx. to ʒi.; dogs, ℥ii. to ℥v.

Unguentum Cantharidini—Cantharidin Ointment (B.P.).

Cantharidin, 0·1 gramme; Chloroform, 10 millilitres; Benzoated Lard, 290 grammes.

This preparation is not sufficiently strong for equine practice. The most reliable ointment for producing vesication in the horse is prepared by Messrs. Wyleys of Coventry, under the designation of 'Green Blister.' Although an active vesicant, it does not cause irritation, such as is produced by the ordinary fly blister. Its active constituent is Cantharidin.

Various formulæ are adopted for preparing ointment of cantharides suitable for equine practice. The usual strength is 1 part of cantharides to 6 parts of lard or vaseline. It is advisable to heat the excipient, and to digest the cantharides

therein over a water-bath for twelve hours. The heat employed should not exceed 200° F., as beyond this the cantharidin becomes volatile.

We prefer, however, to purchase the 'Green Blister' already mentioned, as its advantages over the ordinary preparations of the drug are very marked. When combined with equal parts of ointment of biniodide of mercury (1 to 8), a very efficient blister results.

Liquor Epispasticus—Blistering Liquid (B.P.).

Cantharidin, 4 grammes; Castor Oil, 25 millilitres; Resin, 12 grammes; Acetone sufficient to produce 1,000 millilitres. Dissolve.

This preparation can be employed as a counter-irritant in canine practice. It should be carefully applied with a brush, and means should be adopted to prevent the animal from licking the part.

ACTIONS—Applied to the skin, cantharides acts as a vesicant, causing smarting, pain, and the formation of vesicles, which tend to coalesce. The vesication produced is less painful than that caused by strong applications of mustard, as the irritant does not penetrate to the deeper tissues, as does the volatile oil of mustard. When applied in the form of a properly prepared ointment, vesication is produced in a period of time varying from three to twelve hours. The vesicles are of large size, and after a variable time they burst, and discharge a yellow serous fluid, which dries and forms a scaly covering to the part.

If the blistering ointment be used too strong or too freely, inflammation of the deeper layers of the skin may occur, with suppuration, and in some cases sloughing; the hair bulbs become injured, and a permanent blemish results. If applied to a large surface of skin, absorption of cantharidin may result, and produce the constitutional symptoms to be presently described.

Internally, cantharides acts as an irritant to the alimentary tract, toxic doses producing gastro-enteritis, nephritis, strangury, and hæmaturia. If administered in solution, the mucous membrane of the mouth and throat becomes blistered,

and the pain and swelling of the œsophagus may interfere with deglutition.

Irritation of the stomach also occurs, evidenced by vomiting in the dog; purging, abdominal pain, shock, and collapse, are other symptoms observed. The drug is absorbed from the alimentary canal, and to a less extent from the skin. It exerts a special irritating effect on the organs by which it is eliminated from the system—viz., the kidneys and the genito-urinary tract.

Acute nephritis occurs, with albuminuria, the urine being scanty and containing blood, or total suppression of urine may be present; there is also vesical irritation, frequent attempts at micturition, and evidences of aphrodisiac effects, such as the occurrence of frequent erections of the penis. The pulse becomes rapid and feeble, and the respirations laboured, while the presence of convulsions and coma point to a specific action on the nervous system.

ANTIDOTES.—In cases where absorption of the drug has occurred from the application of a blister to the skin, the blistered part should be washed with warm water containing an alkali such as bicarbonate of soda, and an emulsion, consisting of carbonate of potash, olive oil, and water, applied.

Oil alone should not be used, as it tends to render the cantharidin more soluble and more easily absorbed.

Internally, mucilaginous drinks and demulcents should be freely given, and, if pain be present, an opiate combined with bicarbonate of soda is indicated.

On no account should oil or fatty matters be administered as antidotes to cantharides, as they render the cantharidin more soluble, and thus facilitate absorption of the agent.

MEDICINAL USES.—The chief use of cantharides in veterinary practice is as a vesicant. When prepared of proper strength and carefully applied, the ointment of cantharides forms a safe and effectual agent for the production of counter-irritation.

When active counter-irritation is desirable, such as in the treatment of joint affections in the horse, equal parts of the

unguentum cantharidis and the unguentum hyd. biniodidi are combined.

Cantharides was formerly recommended in small doses internally, combined with mineral tonics, in the treatment of nasal gleet in the horse, but the beneficial effects were more imaginary than real. Similar remarks apply to its supposed therapeutical value in cases of chronic cystitis and incontinence of urine. Other agents are far safer and more likely to prove of service.

Cantharides ointment is not a safe counter-irritant for the dog, as it is liable to produce great irritation, and become absorbed not only from the skin, but also by the animal licking the blistered part. The Liquor Epispasticus (see p. 508) may, however, be employed, if due care be exercised in its application.

In the application of blistering agents to the skin of the horse, it is necessary to observe certain precautions in order to avoid unfavourable results.

1. Cantharides should not be employed as a counter-irritant in cases of renal affections, in irritable conditions of the bladder or urinary passages, nor in cases of debility and weakness.

2. Counter-irritants of all kinds should be avoided when a part is in an inflamed or irritable condition. The existing inflammation should be reduced by appropriate means before a blister is applied.

3. After the application of a blister, the horse's head should be secured, so that he cannot lick or bite the blistered part. The irritation usually passes off in from twelve to twenty hours. As already remarked (see p. 507), if a special cantharidin ointment be employed, the amount of irritation produced is very small, or may be absent in many instances.

4. Not more than two legs of a horse should be blistered at the same time. Three weeks should elapse before the others are blistered, and between each application. If the effects of a blister are not sufficiently apparent in about thirty hours after application, a little more may be applied;

but great discretion is necessary in order to prevent too severe an action.

In applying blisters to parts that have been fired, great care is necessary to avoid sloughing of the skin and a permanent blemish as the result. After deep firing, it is not advisable to blister immediately, especially in the case of horses with fine skins.

5. In applying blisters to the limbs, avoid the flexures of joints, such as the posterior aspect of the knee, the anterior aspect of the hock, and the hollow of the heel, as fissures of the skin may occur which prove very difficult to treat. To the latter region a little vaseline should first be applied, in order to prevent the blister from spreading thereto.

6. The blistered part should *not* be liberally dressed with oil or vaseline. The best application is an emulsion composed of carbonate of potash, olive oil, and water. This does not produce undue softening of the skin (see Appendix).

7. In hot weather severe and extensive blistering should be avoided. In some instances the application of cantharides produces marked swelling of the limbs, with a tendency to suppuration and sloughing of the skin, and the occurrence of swellings involving the sheath and inferior surface of the abdomen. These are exceptional cases, and may occur in spite of all precautions; they generally depend on an unhealthy condition of the system. In such instances the blister should be washed off, and cooling astringent lotions applied, such as the diluted liquor plumbi subacetatis, and after the pain subsides gentle exercise may be given. If the swellings on the sheath and abdomen are extensive, they may be punctured, so as to permit the contained fluid to escape.

In some animals with a nervous temperament the application of a blister may induce constitutional disturbance and a mild degree of irritative fever. Sedative treatment, both internally and locally, may be required.

Finally it may be mentioned that, if the blistered part be within reach of the tail, the latter should be secured, so as to prevent portions of the blister from being carried to surrounding parts by this organ.

Mylabris Phalerata—also known as the Chinese Blistering Fly or Beetle—is occasionally employed instead of cantharides. H. Gray prefers it to cantharides for producing vesication in well-bred horses, and finds that it causes less irritation.

Weak preparations of cantharides occasionally prove useful in promoting the growth of hair, and probably act by stimulating the hair-roots.

CHAPTER XXVII

ANIMAL EXTRACTS, VACCINES, SERA, ETC.

Adrenalin.

Adrenalinum—Adrenalin—is obtained from the suprarenal glands of animals. It was first isolated in 1900 by Dr. Takamine, and introduced into medicine by Parke, Davis and Co.

Adrenalin Chloride Solution (1 part of Adrenalin Chloride and 5 parts of Chloretone in 1,000 parts of normal Saline Solution) is the form in which the drug is employed in veterinary practice, and it can be further diluted with normal saline solution as required. It is supplied by Parke, Davis and Co. in bottles of one ounce, or in ampoules containing 0·5 c.c.

Doses.—By hypodermic injection: horses and cattle, ℥i. to ℥ii.; sheep, ♏x. to ♏xv.; pigs, ♏v. to ♏x.; dogs, ♏iii. to ♏viii.

Some practitioners administer the solution *per os*, in which case larger doses are required, but hypodermic administration is by far preferable. If intravenous injection be employed, the solution should be diluted with 10 parts of normal saline solution, and the doses for horses and cattle of the dilute solution are ℥ss. to ℥ii., and for dogs ♏ii. to ♏viii.

The solution can be sterilized by boiling if considered necessary, by immersing the required quantity, contained in a small flask or test-tube, in boiling water for a period of fifteen or twenty minutes. A synthetic adrenalin is on the market, but we have no experience of its value.

ACTIONS.—If applied to denuded surfaces or mucous membranes, a solution of adrenalin produces a blanching of the parts, owing to the special action of the drug on the arterioles and capillaries; *i.e.*, it causes vaso-constriction, and thus renders the area bloodless. A similar effect is produced if the drug be injected subcutaneously. Solutions as dilute as 1 to 30,000 possess this action.

Some authors state that, in order to obtain the specific internal actions of the drug, it must be administered intravenously. This view, however, is not in accordance with clinical experience, as subcutaneous injections do exert important actions and bring about therapeutic results. No doubt by intravenous injection the drug acts more energetically on the circulatory organs.

On the Circulatory System.—Adrenalin causes a marked rise in blood-pressure, and constriction of the smaller blood-vessels throughout the body, with the exception of those of the lungs, liver, brain, and heart, which are not innervated by the sympathetic. The above effect is believed to depend on excitation of the sympathetic nerve-endings, but some investigators attribute it in part to a direct action of the drug on the muscular fibres in the walls of the vessels. The action of the heart is slowed and strengthened.

Other Effects.—Adrenalin inhibits the movements of the stomach and intestines, but causes contraction of the ureters, vesiculæ seminales, uterus, and vagina. It causes dilatation of the pupil, retraction of the membrana nictitans, and protrusion of the eyeball.

The action of the drug on the circulation is of very short duration, even when administered by intravenous injection.

Toxic Actions.—According to the results of experiments, large doses are required to produce a fatal termination. In the dog, excessive doses caused vomiting, muscular tremors, accelerated respirations, succeeded by paralysis of the hind-limbs, dyspnœa, and failure of respiration. In some cases hæmorrhages occurred from the kidneys and mucous membranes.

USES.—Adrenalin has proved to be a most useful agent in

veterinary practice, and of late years its sphere of utility has been considerably extended. Although some practitioners claim that the beneficial actions of the drug can be obtained by oral administration, the majority of observers hold that, if given *per os*, it becomes rapidly oxidized in the tissues, and so fails to bring about systemic effects.

As a local hæmostatic, adrenalin is employed in combination with local anæsthetics, such as cocaine, eucaine, or novocain, in the case of minor surgical operations. When such a combination is injected hypodermically, the effect of the adrenalin is to cause local constriction of the arterioles and capillaries, and thus it renders the part anæmic and prevents the entry of the anæsthetic agent into the general circulation. In addition to this it localizes and concentrates the anæsthetic action, and besides facilitates surgical procedure, as, by rendering the part anæmic, it enables the surgeon to detect and ligature larger vessels before they are severed (see p. 155). A preparation termed 'Eudrenine' is supplied by Parke, Davis and Co., and forms a very useful agent for local anæsthesia. It consists of a 2 per cent. solution of eucaine and a 1 to 30,000 solution of adrenalin, with a small amount of chloretone added, which has the effect of preserving the activity of the agents. This preparation suits well for equine practice, but for canine surgery it is advisable to further dilute it with an equal amount of sterilized normal saline solution. Occasionally in the dog and cat, when a combination of eucaine and adrenalin is employed for producing local anæsthesia in cases of castration, sloughing of the skin results, probably due to the effects of adrenalin. This undesirable result can be avoided by free dilution of the local anæsthetic, attention being directed at the same time to strict asepsis of the hypodermic syringe and needle, the site of operation, the solution, and the instruments.

In internal hæmorrhage, adrenalin is often prescribed with success, but we must point out that if the bleeding occurs from the lungs, liver, or brain, the drug may be contra-indicated, as it does not cause constriction of the pulmonary,

hepatic, or cerebral vessels, while by raising blood-pressure it is likely to increase the hæmorrhage from the ruptured vessel.

In hæmorrhage from the stomach, adrenalin may be given by the mouth, as it can then act directly on the ruptured vessel.

When employed for the treatment of post-partum hæmorrhage, it should be used as a uterine injection, so that it can exert a local action. Pituitrin, however, is preferable for the treatment of this condition (see p. 518).

In cases of recurring *epistaxis* (nasal hæmorrhage) in race-horses, the hypodermic injection of adrenalin has proved useful as a preventive, the dose being 85 to 120 minims (of the 1 to 1,000 solution) (Hutschenreiter, *Vet. News*, April 30, 1910).

In certain *affections of the eye*, such as conjunctivitis, keratitis, etc., the local application of a solution of adrenalin (1 to 10,000) has given good results in the hands of several practitioners. In such cases the solution may be combined with cocaine (2 per cent.).

In *laminitis*, the clinical reports as to the value of adrenalin are very convincing. A hypodermic injection of 1 c.c. of the 1 to 1,000 solution, diluted with an equal amount of normal saline solution, should be injected in the region of the digital arteries, at the level of the fetlock, of each affected limb. Usually one dose is sufficient to produce good results, but in severe cases the injection may be repeated on the following day. In a case of parturient laminitis, P. R. Thompson injected 3 c.c. of adrenalin (1 to 1,000), diluted with an equal amount of sterile water, at two points of each coronet, about an inch above the foot. Recovery resulted in four days.

In *azoturia*, several clinical cases are recorded in which adrenalin administered by hypodermic injection gave excellent results. The dose varied from ℥i. to ℥ii. of the 1 to 1,000 solution diluted with an equal amount of normal saline solution, and it may be repeated in a few hours if necessary. In our experience, the drug is often of value in the early stages, but when convulsions set in, or paralysis of the triceps cruralis occurs, treatment of any kind is likely to fail.

In *red water of cattle*, Zehl advises the administration of 1 ounce of adrenalin (1 to 10,000) hypodermically, followed in a few hours by a similar amount. It is difficult to explain the beneficial action of the drug in this disease and in azoturia.

In *purpura hæmorrhagica*, several practitioners record good results following hypodermic injections of adrenalin. Schlamp employed 2 to 4 c.c. of the 1 to 1,000 solution diluted with sterilized water to 10 c.c., and injected subcutaneously every second day. Four or five injections usually sufficed. We administered ʒii. of the 1 to 1,000 solution hypodermically once daily for four days to an apparently hopeless case of the disease, and a rapid recovery ensued.

In *milk-fever*, adrenalin is advised in the treatment of cases which do not readily respond to inflation of the udder. A dose of ʒii. of the 1 in 1,000 solution gives good results in some cases, but further investigation on the subject is desirable.

In *collapse* and *surgical shock*, moderate doses of adrenalin given intravenously in large amounts of normal saline have been tried, but the action of the drug in raising the general blood-pressure is very evanescent, so that its practical value is doubted by many surgeons.

In the *detection of 'broken wind,'* when horses have been 'doped' by unscrupulous dealers, King (Kansas City) advises the intravenous injection of 30 minims of adrenalin solution (1 to 1,000) in ½ ounce of normal saline solution. He states that in about one minute the respirations become accelerated, and if the disease be present, even to a slight extent, the characteristic double expiratory movement will be manifested and continue for several minutes.

Pituitrin.

This is an extract of the infundibular portion of the pituitary gland, manufactured by Parke, Davis and Co.

DOSES.—By hypodermic injection: horses and cattle, 8 c.c. to 10 c.c. (ʒii. to ʒii.ss.); sheep and pigs, 1 c.c. to 2 c.c. (♏xvii. to ♏xxxiv.); dogs, 0·5 c.c. to 1 c.c. (♏viii. to ♏xvii.).

ACTIONS.—Pituitrin causes constriction of the blood-

vessels throughout the body, and raises blood-pressure, which actions are more prolonged than those of adrenalin. It is believed to exert a direct action on the muscular fibres of the bloodvessels. Unlike adrenalin, it causes constriction of the pulmonary and coronary vessels, but has less effect on the renal vessels. According to some observers, it causes dilatation of the renal vessels, while at the same time it induces a general rise in blood-pressure. The drug causes free diuresis, but whether this effect depends on the vascular changes in the kidney or on stimulation of the renal epithelium is not yet determined. It increases the force of the heart-beat, and lowers the pulse-rate.

Pituitrin exerts a marked action on the uterus; it causes strong uterine contractions of a rhythmic character, this effect being produced whether the organ is pregnant or otherwise, but it is most apparent in the last stage of parturition.

USES.—The chief use of pituitrin in veterinary practice is in the treatment of uterine inertia, especially in small bitches. This is a very serious condition in these animals, and is responsible for many fatalities in parturition cases. By administering pituitrin hypodermically uterine contractions are induced in about ten to twenty minutes, and, provided there is no mechanical impediment, delivery is brought about without instrumental aid. The clinical reports with reference to the utility of this drug show that it is safe and effectual. If the first dose fails to produce desired effects, half the amount may be given in an hour's time. In the case of small bitches 0·5 c.c. (about 8½ minims) is a perfectly safe dose. The drug should not be used in cases where a mechanical impediment to delivery is present.

Pituitrin has also been employed successfully in uterine inertia occurring in mares, cows, and sows. In the case of sows a dose of 1 c.c. has produced good results. Some practitioners advise that the drug be administered by intramuscular injection.

In cases of post-partum hæmorrhage, pituitrin has proved very useful, and also in surgical shock. It is also advised in the treatment of internal hæmorrhage. After the

administration of the drug to the bitch evacuation of the bowels and free diuresis are not uncommonly observed. The drug is supplied by Parke, Davis and Co. in ampoules containing 0·5 c.c. and 1 c.c., which are convenient and reliable for hypodermic use.

Mallein

Mallein is employed for the diagnosis of glanders. It is the sterilized and filtered liquid culture of glanders bacilli. It has proved a most reliable agent for this purpose, but requires to be carefully used, according to the following directions:

DIRECTIONS FOR USING MALLEIN, AS PREPARED AND SUPPLIED BY THE ROYAL VETERINARY COLLEGE, LONDON.

1. While under the mallein test horses ought to be left at rest in the stable and protected from draughts. The rectal temperature ought to be taken once or twice on the day before the test is applied.

2. The dose of mallein for a horse is 1 cubic centimetre, or 18 minims. It ought to be injected about the middle of the side of the neck, with a clean hypodermic syringe. The best form of syringe is one with an asbestos piston, as the whole instrument may then be sterilized by boiling it in water for five minutes before use.

3. The mallein must be injected into the subcutaneous connective tissue, and care must be taken that the whole dose is actually introduced.

4. The temperature must be taken at the time of injection, and at the ninth, twelfth, and fifteenth hours afterwards.

5. Provided the temperature was normal (under 101° F.) before the injection, it will rise 2° or more (103° to 105° F.) during the next fifteen hours if the horse is glandered; but it will remain practically unaffected (under 102° F.) if the horse is not glandered.

6. Attention must also be paid to the swelling that forms at the seat of injection. When the horse is glandered this goes on increasing in size during the second twenty-four

hours after the injection, and it seldom declines before the third or fourth day. The maximum diameter of this swelling in glandered horses varies from 5 to 10 inches.

7. In horses that are not glandered the local swelling attains its maximum size during the first fifteen hours, and by the twenty-fourth hour it has almost entirely disappeared. Its maximum diameter is usually about 3 or 4 inches.

8. When the temperature gradually rises from the normal to 104° F. during the first fifteen hours, and a large slowly disappearing swelling forms at the seat of injection, the horse may confidently be declared glandered.

9. If, with a normal temperature at the time of injection, a horse displays only the temperature reaction, or only the local reaction, the case must be considered doubtful, and the test repeated after the lapse of a week.

10. When the temperature is 102° F. or more at the time of injection, the temperature reaction is unreliable, but in such a case the diagnosis may be based on the characters of the local swelling.

11. The mallein should be kept in a cool place, and protected from light. Should it lose its transparency or become cloudy, it must not be used.

The late William Hunting held, with reference to the time at which the horse should be visited for the purpose of taking the temperature and measuring the swelling, 'that no useful information was missed by not visiting the horse, after injection, until sixteen hours had elapsed.' He also was of opinion that 'there are very few definite reactions which need for their recognition more than one visit after injection, and that should be made in the twenty-fourth hour. With reference to indefinite reactions, this authority stated that, if the temperature was under 103° F. and the swelling less than 4 inches, the case should be retested after a period of two or three weeks. As there is a possibility of the local reaction being delayed, a horse should not be pronounced free from glanders, if a rise of temperature has occurred, before the lapse of forty-eight hours.

The Intra-Dermal-Palpebral Method of Mallein Testing.

This method has been on trial in the French Army for some time, and the results are said to be very favourable. A special mallein is employed, and the dose required is 2 minims. This is injected into the skin of the eyelid (into the layers of the dermis, and not into the subcutaneous tissue). In a horse affected with glanders a typical reaction occurs—viz., about the ninth or tenth hour after injection a well-marked sensitive œdema of the eyelid is observed, accompanied by a more or less profuse mucous discharge, an injected conjunctiva, and closure of the eyelids. The reaction is at its height between the twenty-fourth and thirty-sixth hours, and sometimes remains for three or four days, and gradually disappears. In the normal animal no alteration may occur in the eyelid, or it may become very slightly swollen between the second and sixth hours, the swelling disappearing about the twelfth hour.

For further details the reader is referred to the *Veterinary Journal*, August, 1915.

With reference to the ophthalmic mallein test, see article by Mohler and Eichhorn, *Veterinary Journal*, vol. lxxi., p. 204, May, 1915.

Tuberculin.

Tuberculin is employed in the diagnosis of tuberculosis. It is the sterilized and filtered liquid culture of tubercle bacilli.

Directions for using Tuberculin, as prepared and supplied by the Royal Veterinary College, London.

1. While under the tuberculin test cattle ought to be kept in the house, fed on their usual food, and protected from draughts. They ought not to be allowed to drink large quantities of cold water between the sixth and eighteenth hours after injection. It is well to take their temperature at least once on the day preceding the test.

2. The dose of tuberculin for a medium-sized cow is

3 cubic centimetres, or 50 minims, and it may be varied above or below that, according to the size of the animal. Large bulls ought to receive 4 cubic centimetres.

3. It ought to be injected under the skin with a clean hypodermic syringe. The most convenient points are in front of the shoulder or on the chest-wall behind the point of the elbow. The best form of syringe is one with an asbestos piston, as the whole instrument may be sterilized by boiling it in water for five minutes before use.

4. The tuberculin must be injected into the subcutaneous connective tissue, and care must be taken that the whole dose is introduced.

5. Ordinarily the temperature must be taken at the time of injection, and at the ninth, twelfth, fifteenth, and eighteenth hours afterwards. When there is any reason to suppose that the animal may have been already tested with tuberculin during the preceding two or three weeks, it is advisable to take the temperature at the third and sixth hours, as well as at the times just mentioned.

6. Animals in which the temperature during the eighteen hours following the injection rises *gradually* to 104° F. or more may be classed as *tuberculous*, and those in which it remains under 103° F. as *not tuberculous*. When the maximum temperature attained is under 104° F., but over 103° F., the case must be considered doubtful, and the animal may be retested after a month.

7. The test is not reliable in the case of animals in the last stage of the disease, or in those in which the temperature is over 103° F. before injection.

8. The tuberculin should be kept in a cool place and protected from light. Should it become turbid or cloudy, it must not be used.

9. The tuberculin test does not render the milk in any way injurious.

Villar (paper on Tuberculin, National Veterinary Association, 1909) drew attention to some important practical points in connection with the employment of tuberculin, as follows:

1. 'The temperature should be registered up to the 21st

hour after injection, as in some instances, where the temperature rises to 103° F. at the 18th hour, the characteristic thermal reaction may not be produced until this period is reached. But in cases where the rise in temperature has not much exceeded 1 degree, and has fallen by the 18th hour, there is no need to continue the observation.

2. 'Ordinarily a temperature which, though risen, has dropped by the 12th hour, would not be a positive or even a suspicious reaction; an infected animal's temperature would not be on the decline at this hour, therefore in practice the first time at which it is usually necessary to take the temperature is at the 12th hour.*

3. 'Not all cattle in which there is a rise from a normal initial temperature to 104° F. are to be regarded as tuberculous. A *sudden* rise in the temperature to this point or more, with an equally *rapid fall*, is usually associated with some other morbid condition than tuberculosis. The temperature should commence to rise between the 6th and 9th hour; it should continue to gradually rise, have some persistence at its highest point, and then gradually fall.

4. 'The evening temperature of yearling bulls and heifers exceeds that of cows; in such, an evening temperature not exceeding 103° F. cannot be regarded as abnormal, and such animals can be tested without hesitation. But it is not advisable to test a cow or stock bull whose evening temperature by much exceeds 102° F.

5. 'The temperature of young calves, especially those fed from the pail, is very inconstant. Their evening temperature has been found to vary from 99·8° F. to 104° F. This erratic tendency of the temperature of calves renders the testing of such animals with tuberculin untrustworthy and undesirable.'

For information on the other methods of employing tuberculin, the reader is referred to our work, 'A System of Veterinary Medicine,' vol. i., p. 152.

THE TUBERCULIN TEST IN SWINE.—The normal tem-

* Begg and others have observed that aged emaciated animals, affected with old tuberculous lesions, often react within the first twelve hours, the maximum temperature occurring about the 9th or 10th hour.

perature of young pigs averages 104° F., and of adults 102° F. (Friedberger and Fröhner), and the dose of tuberculin is from 1½ to 5 minims. The test is applied as in cattle.

THE TUBERCULIN TEST IN THE HORSE.—This is carried out in the same manner and with similar precautions as in the case of cattle. The temperature at the time of injection should not exceed 101·5° F. The dose of tuberculin is 50 minims for a full-sized horse, 45 minims for a cob, and 40 minims for a pony. In the tuberculous horse a firm swelling practically always appears at the seat of injection ; it may attain to the size of a walnut, or may be of considerable dimensions, and disappears in from eighteen to twenty-four hours.

THE TUBERCULIN TEST IN THE DOG.—According to Gray, the dose of tuberculin varies from 0·5 to 1 cubic centimetre (8½ to 17 minims), depending on the size of the animal. Or it may be approximated at $\frac{1}{6}$ to $\frac{1}{3}$ minim to the pound of body-weight. It should be injected subcutaneously, either inside the thigh or in the abdominal region. The temperature should be taken every hour after injection, as very often the reaction takes place within a few hours (from two to five hours), and declines to normal within twenty-four hours. In some cases of advanced and generalized tuberculosis, tuberculin is said to be uncertain in its action, and may give rise to hyperpyrexia and death.

THE TUBERCULIN TEST IN THE CAT.—According to Gray, the dose of tuberculin is from 1 to 5 minims, and after injection the temperature should be taken every hour, as the maximum is reached about the fifth hour and soon declines to normal.

Black Quarter Vaccine.

Black Quarter Vaccine is employed as a preventive agent against black quarter in cattle.

DIRECTIONS FOR USING BLACK QUARTER VACCINE, AS PREPARED AND SUPPLIED BY THE ROYAL VETERINARY COLLEGE, LONDON.

Two vaccines are employed—viz., first and second. The first vaccine is put up in the tubes *without* a black ring.

The second vaccine is put up in the tubes *with* a black ring. Each tube contains vaccine sufficient for ten animals. An interval of eight to ten days ought to be allowed between the first and the second vaccination.

The apparatus necessary for the operation is—

1. A small mortar and pestle.

2. A graduated hypodermic syringe, with a capacity of 10 cubic centimetres. The needle of the syringe ought to be about as thick as an ordinary knitting-needle, and have a proportional bore.

3. A small pointed trocar or exploring needle, which ought to be a little thicker than the needle of the syringe.

Mixing of the Vaccine.—Immerse the mortar and pestle for ten minutes in water near the boiling-point. Have at hand a quantity of water recently boiled and allowed to cool. Rinse out the syringe first with 5 per cent. carbolic solution (in water), and then two or three times with boiled water.

Drain the mortar and pestle dry, and then turn into the former the contents of one of the small tubes (first vaccine for ten animals). Fill the syringe (10 cubic centimetres) with boiled (and now cold) water. Eject a few drops of this into the mortar, and triturate the powder with it so as to form a uniform paste. Continue the rubbing, and gradually add the whole of the water in the syringe. When the powder has thus been uniformly mixed with the water, suck the whole back into the syringe.

The Operation.—Clip the hair from the under aspect of the tail for about 6 inches, extending upwards from the tip. Wash this part vigorously with 5 per cent. carbolic lotion. Take the small trocar, previously purified in boiling water, and bury it under the skin on the under surface of the tail, entering it on the middle line about a handbreadth above the tip, and pushing it vertically upwards for 3 inches. Give the handle of the trocar a side-to-side movement, so as to enlarge the gallery at its upper end. Now gently shake the syringe, insert the hypodermic needle, and inject one-tenth of the contents of the syringe (= 1 cubic centimetre).

Withdraw needle and syringe together, at the same time pressing firmly on the puncture in the skin.

The Second Vaccination is carried out after eight or ten days in the same manner, the vaccine being injected under the skin of the tail, immediately above the seat of the first operation. After all the animals of one lot have been operated on, the syringe ought to be rinsed out with 5 per cent. carbolic solution. The operation ought not to be performed when the weather is very hot or very cold.

As an alternative to operating on the tail, the vaccine, mixed as above, may be injected under the skin in front of the shoulder. In that case the trocar is not required. The operation is more conveniently performed at this point than at the tail, but experience has shown that it involves a slightly increased risk of accident.

Every care is taken in the preparation of the vaccine, but no guarantee is given regarding its safety or efficiency.

'**Blacklegoids.**'—These are small pellets containing black-leg vaccine, prepared by Parke, Davis and Co. from black-leg virus of unquestionable identity. Numerous reports from practitioners indicate that the use of these agents is a reliable prophylactic against black quarter. The pellets are inserted under the skin of the neck by means of a special instrument. Immunity is not established until about fourteen days after vaccination. Prior to this period existing infection is not neutralized, nor is the animal safe from contracting the disease if exposed to infection.

'Blacklegoids' are supplied for both single and double inoculation. In the *single* form the pellet contains one dose, and this constitutes the full treatment.

In the *double* form the dose is divided into two parts, the second inoculation being made in twelve days after the first. The double method is said to give more certain and lasting results. Immunity is said to last for twelve months.

Stock Vaccines.

A number of stock vaccines are on the market, and have been largely employed of late years in veterinary practice.

Some of these are prepared in the form of hypodermic tablets; others are sent out in the fluid form in glass bulbs, each containing the suitable dose. Messrs. Parke, Davis and Co. prepare a STAPHYLOCOCCUS VACCINE (*combined*); a STREPTOCOCCUS VACCINE; a STREPTOCOCCUS AND STAPHYLOCOCCUS VACCINE (*combined*); a COLON VACCINE (*combined*); an EQUINE INFLUENZA VACCINE (for prophylaxis against influenza); and an EQUINE INFLUENZA VACCINE (*combined*), for therapeutic purposes. All these are supplied in the form of hypodermic tablets.

The above firm also prepare a STREPTOCOCCUS AND STAPHYLOCOCCUS BACTERIN (*combined*), which is sent out in glass bulbs, each bulb being numbered and containing from No. 1 to No. 6, a gradually increasing number of killed bacteria. The doses are to be administered in the order of the numbers, at intervals of three to five days. Success is claimed from the use of this vaccine in cases of fistulous withers, poll-evil, septic arthritis, strangles, and all suppurative conditions.

Anti-Distemper Vaccines.

A number of these have been brought forward from time to time, but there is a consensus of opinion with regard to the failure of certain vaccines to bring about immunity against distemper. These include the vaccines of Phisalix, Lignières, and Copeman.

Canine Distemper Vaccine (Ferry's) is prepared by Parke, Davis and Co. from various strains of a micro-organism isolated by Ferry from canine distemper, viz., the *Bacillus bronchisepticus*. It is supplied in two forms: (1) *prophylactic*; (2) *curative*. The *prophylactic vaccine* is polyvalent, and is prepared from cultures of several strains of *Bacillus bronchisepticus*. It is supplied in sets of three bulbs, containing increasing numbers of killed bacteria. The second dose contains double the strength of the first, and is administered at an interval of three to five days after the first; the third is treble the strength of the first, and is given in from three

to five days after the second. If possible the vaccine should be given one month prior to a possible exposure to infection.

The *curative vaccine* is prepared from cultures of several strains of *Bacillus bronchisepticus*, also of *S. albus*, *S. aureus*, and *S. pyogenes*, of canine origin. It is supplied in sets of six bulbs, numbered 1 to 6, for administration in that order. Dose No. 1 is to be followed by doses 2 to 6 in numerical sequence at intervals of from three to five days. It is advised that the treatment be commenced as early as possible in the attack.

The value of these vaccines is a question on which there is still diversity of opinion. A number of clinicians record excellent results, while others doubt the efficacy of the agents. (See 'The Treatment of Distemper,' Part III. of this work.)

Anti-Anthrax Vaccine.

This was introduced by Pasteur, for the purpose of protecting animals against anthrax. Two vaccines are employed, viz., Vaccine No. I. and Vaccine No. II.

Vaccine No. I. (the weaker) consists of a bouillon culture of non-sporulating anthrax bacilli, attenuated by cultivation for twenty-four days at a temperature of 42·5° C.

Vaccine No. II. (the stronger) is a similar cultivation incubated at the same temperature, but for only twelve to fourteen days. The animal is first inoculated with Vaccine No. I. In ten to fourteen days it is inoculated with Vaccine No. II. Immunity is said to be established in from ten days to a month after the second inoculation, and to last for one year. The injections should be made subcutaneously behind the shoulder in the ox, and in horses and mules in the region of the neck. The first injection should be made on one side of the body, and the second injection on the opposite side.

The dose of each vaccine for horses, cattle, and mules, is $\frac{1}{4}$ c.c., and for sheep and goats $\frac{1}{8}$ c.c.

According to Stockman, observations on several millions of cattle in various parts of the world, submitted to the Pasteur method of preventive inoculation, showed that accidents

occurred in about 0·5 per cent. of the inoculated, taken all round.

According to Caulton Reeks, although the accidents calculated on a large number of inoculations are small, yet on a particular farm they may be as high as 10 per cent.

Anti-Anthrax Vaccine and Serum.

This is known as Sobernheim's or the *simultaneous* method. It consists of injecting simultaneously an attenuated culture and an anti-anthrax serum. To obtain the necessary serum, animals already immunized by the Pasteur vaccines are taken and further injected with large quantities of a virulent culture. Their blood then yields an anti-anthrax serum with marked bacteriolytic properties. This serum is injected in a dose of 10 c.c. into one side of the animal to be protected, while into the other side is injected at the same time an attenuated culture of about the same strength as Pasteur's second vaccine. This method is said to be safer than Pasteur's, more quickly effective, and the immunity is more lasting. Most authorities agree that, as in the British Isles anthrax is not the scourge it is in hotter climates, it is doubtful whether any method of protective inoculation is warranted; but in districts where the disease is constantly present and where the losses therefrom exceed 2 per cent., the simultaneous method may be advised.

Anti-Swine-Erysipelas Vaccine and Serum.

The most reliable system of protective inoculation against swine erysipelas is the 'mixed' method of Leclainche. A combination of serum and cultures is injected, followed some days later by an injection of culture alone. The serum is obtained from horses which have been hyperimmunized by repeated and increasing doses of virulent swine-erysipelas cultures. The serum alone, when injected into a pig, confers immediately a passive immunity which lasts for about ten days. The immunity produced by the injection of serum and pure cultures lasts from six to twelve months. Leclainche advises that, in herds where the disease has already

appeared, all the pigs should receive as soon as possible a dose of serum varying from 10 to 20 c.c., according to weight. This preliminary dose of serum prevents the immediate spread of the disease, and may have some curative effect in early cases; it also minimizes the risk of vaccination proper which is to follow. The vaccination proper is performed in about ten days after the injection of the serum. It is divided into two operations. The first consists in injecting subcutaneously, at the root of the ear or inside of the thigh, a mixture of serum (1 c.c. per 20 pounds of the body-weight, the maximum dose being 10 c.c., and the minimum 5 c.c.) and 0·8 c.c. of pure culture. Twelve days later the animal receives 0·8 c.c. of pure culture without any serum.

Vaccination should not be practised on non-infected premises, except the herd is in imminent danger of infection from surrounding sources.

Hog-Cholera Serum.

This is a defibrinated blood obtained from hyperimmune animals by bleeding, and is intended as a preventive to the disease. It is largely employed in America, and, according to Lynch ('Diseases of Swine,' 1914), it gives very satisfactory results.

Two principal methods are employed, viz.:

1. The *single* or *serum alone* method, which gives temporary immunity, generally lasting about six weeks.

2. The *double* or *simultaneous* method, in which the serum and a portion of defibrinated blood taken from pigs which have been infected with hog cholera (by means of injecting into them blood of known virulency) are injected simultaneously.

The dose of serum is calculated at about 5 c.c. for every 25 lbs. body-weight above the weight of 25 lbs. Thus, a pig weighing 25 lbs. would receive 10 c.c., one of 50 lbs. 15 c.c., and so on. All pigs over 250 lbs. receive 60 c.c. The dose of the virus blood is as follows: Pigs 10 to 25 lbs. in weight, $\frac{1}{4}$ c.c.; 25 to 50 lbs., $\frac{1}{2}$ c.c.; 100 to 125 lbs., 1 c.c.; 200 to 250 lbs., $1\frac{1}{2}$ c.c. All pigs above 250 lbs. receive $1\frac{1}{2}$ to 2 c.c.

It is said that if the serum alone be injected into a pig already suffering from the disease, as evidenced by a rise of temperature, loss of appetite, etc., a permanent immunity will result.

The simultaneous method is advised in all instances where the pigs have been exposed to the disease, but have not developed any symptoms, and permanent immunity is said to be conferred. As small pigs are not capable of developing a permanent immunity, it is advised to give them the serum alone, and six weeks later to use the double method.

The reports issued with reference to the results of the simultaneous method are very satisfactory.

For full details on the subject, the reader is referred to 'Diseases of Swine,' by C. F. Lynch, M.D., D.V.S.

Phylacogens.

These may be described as modified bacterial derivatives, and consist of sterile aqueous solutions of metabolic substances generated by bacteria grown in suitable culture media. The metabolic products of the bacteria are separated from the bacterial cells by filtration through porcelain, and the bacterin-free filtrate with the addition of suitable preservatives constitutes the phylacogens. They are prepared by Messrs. Parke, Davis and Co., according to a method originated by Dr. A. F. Schäfer, and two forms are available, viz., *Mixed infection phylacogen* and *Pneumonia phylacogen.*

The theory of the therapeutic use of these agents, set forth by Dr. Schäfer, is as follows:

1. 'Practically all acute and many of the chronic diseases are caused by the metabolic products of bacteria.

2. 'The animal subject is the host of micro-organisms that are pathologically latent, but capable of setting up a diseased process under certain conditions.

3. 'The growth of infecting micro-organisms can be arrested and their effects neutralized by products derived from their development in artificial culture media.'

Mixed Infection Phylacogen.—This is a polyvalent product, being prepared from mixed cultures, including the

pyogenic staphylococci and streptococci, *Bacillus coli communis* and *Bacillus pyocyaneus*, of equine origin. It has been employed in the treatment of fistulous withers, poll-evil, quittor, and various suppurative conditions, and the clinical reports are very satisfactory. The clinical evidence of its value in cases of irregular strangles is very convincing (*vide Veterinary Record*, September 6, 1913).

In the treatment of surgical conditions with phylacogen, it is necessary also to carry out irrigation with antiseptic solutions, to afford free drainage, and to remove necrotic tissues.

Doses.—For the horse, 30 c.c. may be administered by subcutaneous injection once daily, not less than six injections being given. In obstinate cases double these doses may be given, and continued until desired results are obtained. The procedure should be carried out with due regard for rigid asepsis, and a fresh area should be selected for each injection.

Pneumonia Phylacogen.—In addition to the mixed cultures mentioned above, this preparation contains cultures of *Diplococcus pneumoniæ*.

It is employed in the treatment of pneumonia, the usual dose being 30 c.c. every twelve hours, administered by hypodermic injection.

Influenza Antitoxin.

This is prepared by Messrs. Parke, Davis and Co., and is employed both for prophylactic and curative purposes. As a prophylactic agent, it is administered by intravenous injection, the dose being 30 c.c. It is advised to give the prophylactic dose ten days prior to the horse being exposed to possible infection. American practitioners have adopted influenza antitoxin as a preventive measure in the shipping of horses, and the reports of its efficacy are very convincing. As a curative agent, influenza antitoxin is given intravenously in a dose of 30 c.c. In the early stages of the disease one dose is said to be sufficient, but in some cases, or in the later stages, the doses may be repeated every twelve hours until three doses have been given. The clinical reports published are encouraging.

Anti-Strangles Serum.

This serum is obtained from hyperimmunized horses, and, although not conferring absolute immunity, it is said to be of more practical value for protection against the disease than any other method. According to Todd, the suitable dose of the serum is 20 to 30 c.c.; it may be administered subcutaneously or intravenously. It was largely used on army horses; remounts received four 10 c.c. doses, the first being given after purchase, and the succeeding doses at intervals of one week. After the last inoculation there is an immunity of four or five weeks' duration. The serum did not prevent the development of the disease when injected during the period of incubation, but it modified the severity of the attack in such cases.

At the present time, many observers are doubtful with reference to the value of either preventive sera or vaccines for curative purposes in connection with strangles. This is not surprising when we consider that much remains to be learned as regards the bacteriology of the disease; moreover, it is doubtful whether strangles ought to be classified as a disease *per se* or as one of the manifestations of influenza. Again, such a variety of vaccines and sera are said to produce good results in connection with the disease, that it is impossible to draw any definite conclusions on the subject until further investigations are carried out.

Anti-Streptococcus Serum (Polyvalent).

This is obtained from the blood of horses which have been immunized against progressively increasing doses of killed streptococci of equine origin.

Clinical reports indicate that this serum is of marked value in the treatment of streptococcic infections, irregular strangles, septic metritis, purpura hæmorrhagica, septic arthritis, erysipelas, etc.

The dose for the horse is 30 c.c. (1 ounce) by subcutaneous injection, which may be repeated every six or twelve hours, according to the gravity of the symptoms. For foals suffering from joint-ill, 10 c.c. may be given daily until an

improvement is observed; the dose is then reduced to 5 c.c. daily.

For dogs the dose is from 5 to 10 c.c. (85 to 170 minims).

Polyvalent Serum for the Specific Treatment of Wounds.*

In 1912, Professor Leclainche, formerly Director of the Lyons Veterinary School, now Inspector-General of the Veterinary Sanitary Service, Ministry of Agriculture, Paris, and H. Vallée, Professor of Contagious Diseases, Alfort Veterinary School, introduced a polyvalent serum for the treatment of infected wounds.

A great variety of micro-organisms found in infected wounds are cultivated on agar or on Maurice Nicolle's potato agar. The microbes are killed with ethylic alcohol, desiccated and preserved dry *in vacuo* in a refrigerator.

The desiccated germs are weighed, rubbed up in an agate mortar, and then made into an emulsion with normal saline solution. From 5 mg. to 5·5 mg. of the dried microbial bodies, corresponding to a weight ten times greater than that of the fresh microbes, are injected. The inoculations are made every eight days with progressive doses. After several months of treatment the animals can support an injection of 50 cg. of fresh microbes, but there is an acute local reaction and a rise of temperature.

The animals are then bled, and the polyvalent serum thus obtained is very rich in agglutinins and sensitizers. The deviation of the complement test indicates that these last are capable of fixing in the guinea-pig quantities of fresh alexin superior to 1·3 cm., either upon the microbial mixture used for treatment or upon any of the germs composing it.

These sensitizers, which represent the essential ferment of the intraleucocytary digestion of microbes, act in the manner of a powerful specific antiseptic, and they are without doubt very favourable to cellular life, without being capable of disturbing it.

* For this note we are indebted to Mr. H. Gray, M.R.C.V.S.

These authorities have treated various wounds, such as extensive old or sluggish wounds and suppurating cavities, with surprisingly rapid results and a shortened period of cicatrization.

In military surgery, where the wounds have been terribly mutilated and infected, the soldiers whose lives were despaired of have almost miraculously been cured with this treatment.

After the wounds have been washed with boiled water, the liquid serum or the desiccated and powdered serum is applied.

Anti-Tetanus Serum.

This is prepared by rendering horses immune to the tetanic poison by repeated inoculations of increasing quantities of tetanus toxin. The animals are then bled, and the serum is obtained from the blood.

Although many clinical cases are recorded in which good results are claimed from the employment of anti-tetanus serum as a therapeutic agent, there is considerable difference of opinion amongst practitioners as to the value of the agent in the treatment of tetanus. Judging by the fact that spontaneous recoveries from the disease are by no means uncommon, and also that in many of the cases recorded medicinal treatment was adopted as well, the matter must be regarded as still *sub judice*. American practitioners claim that much larger doses are necessary than those usually prescribed, and that the lack of success is due to the dosage being imperfect. Although we are sceptical as regards the real therapeutic value of the agent, we advise that in the case of valuable horses the serum should be employed, but in larger doses than those usually regarded as efficient.

The amount generally prescribed is 1 ounce, twice daily administered by hypodermic injection. Cases are recorded in which 2 to 4 ounces were given every twelve hours and recovery resulted.

It is obvious that the earlier the treatment is adopted, the greater is the chance of a successful termination.

But while we express doubt with reference to the therapeutical action of anti-tetanus serum, we are thoroughly convinced of its value as a *prophylactic* agent. There are very few cases on record in which, after the use of a reliable anti-tetanic serum administered as a preventive, tetanus has developed. Obviously, it is essential to employ a serum of undoubted potency, and to carry out the technique in a proper manner.

The usual dose of anti-tetanus serum as a prophylactic is 1 ounce. As the immunity conferred lasts about two or three weeks, and as the incubation period of tetanus may be one month, it is advisable to administer a second dose two weeks after the first.

Rigid aseptic precautions should be employed; the usual site selected is the loose skin of the lower region of the neck; the hair is removed from the part by shaving, and the skin is sterilized by applying tincture of iodine.

It is always advisable to employ anti-tetanus serum in the case of wounds in valuable horses, more especially in punctured wounds of the foot, and prior to operations such as those carried out for the radical cure of umbilical or scrotal hernia. In districts or farms where tetanus is known to be of frequent occurrence, it is a wise precaution to administer the serum prior to all surgical operations and in all cases of punctured wounds.

For further details see 'The Treatment of Tetanus, Part III.

Dry forms of anti-tetanus toxin are prepared by Parke, Davis and Co. as follows:

ANTI-TETANUS SERUM, DRY.—This is in the form of powder, and is said to retain its activity indefinitely. To prepare for injection, fill the phial containing the dried serum with cold sterile water and shake until dissolved.

Doses.—As a prophylactic, 1 ounce of the solution; as a curative agent, 4 ounces per day in divided doses.

ANTI-TETANUS DUSTING POWDER is intended to be applied to wounds suspected of being infected by tetanus bacilli. The wound is first thoroughly cleansed with solution of hydrogen

peroxide and dried with cotton-wool. The powder is then freely applied. The antitoxic action of the powder is purely local, and can only neutralize tetanus toxin which is not absorbed. Hence the utility of this application is limited.

White Scour Serum (P., D. and Co.).

This has recently been introduced for the prophylaxis and treatment of white scour in calves. It is prepared from the blood of horses which have been immunized with gradually increasing doses of polyvalent cultures of *Bacillus coli communis*, isolated from cases of white scour in America and in Europe. The prophylactic dose is from 10 to 20 c.c. administered subcutaneously soon after birth. The curative dose is 10 c.c., repeated as frequently as the gravity of the case indicates.

Anti-Distemper Serum (Piorkowski's).

Piorkowski's Anti-Distemper Serum is employed both as a preventive and as a curative agent. The *preventive* dose is 5 to 10 c.c., according to the size of the dog. Immunity is said to last about five months, when a second injection should be given, so as to carry the dog over one year. The *curative* dose varies from 10, 15, 20, or even 50 c.c., according to the severity of the case and the size of the patient. There is a difference of opinion as regards the value of this agent.

CHAPTER XXVIII

VACCINE-THERAPY AND SERO-THERAPY

By W. M. SCOTT, F.R.C.V.S., Bridgwater.

In the consideration of this subject it is advisable to offer a few preliminary remarks on the question of immunity and immunization.

Immunity and Immunization.

In recent years there is probably no branch of medical science which has made greater progress than immunology. During the last decade an enormous amount of material has accumulated, and, further, the knowledge of the subject thus acquired has not been permitted to serve academic purposes alone; for we find that practical use has been made of its tenets, and there is scarcely a practitioner to-day, whether human or veterinary, who, consciously or unconsciously, in the performance of his professional duties, does not take on the rôle of an *immunizator*. If the sera or vaccines are supplied to him ready for use, his duties are indeed not difficult to perform. But he is not superior to a skilled mechanic, if not an empiric, for he is injecting into his patients biological products of which he may know little with reference to the method of production and the contents. The practitioner who devotes attention to the science of sero-vaccine therapy will find in the subject abundant material to exercise his intellectual energies, and much reward professionally and financially; moreover, it will awaken in him a new

interest in his calling. The day of therapeutical empiricism is rapidly drawing to a close, and, with a better knowledge of the causes of specific diseases, chemo-therapy is rightly being placed in its proper domain, while vaccine-therapy is coming into its own. With the advent of the practical application of cowpox virus as a preventive of smallpox in man, Jenner laid the foundation upon which vaccine-therapy, as we understand it to-day, is built, while the later discoveries of Pasteur clarified Jenner's work, and added enormously to our knowledge of the subject.

With a closer study of bacteriology, the important rôle taken up by bacteria in the production of disease became manifest. To-day the bacteriologist can show us a formidable array of pathogenic micro-organisms, which, if introduced into the animal body, are capable of producing disease. Fortunately, all bacteria have not the same power of becoming parasites when they reach the human or animal organism (limited bacterial aggressivity). The aggressive limitations of bacteria may be due to a series of contributory factors, which, owing to lack of space, we cannot discuss fully in this article.

Briefly, however, these factors may be found—

1. In the bacteria themselves.
2. In the protective defences of the animal body.

Bacteria may be divided into *saprophytes* and *parasites*, but the classification is only a relative one, inasmuch as under special conditions the former may take on the rôle of the latter—hence it is not possible to draw a distinct line between the two. Or we might classify bacteria as *pathogenic* and *non-pathogenic*; but here also the same objection presents itself, for we find that at one time and under certain conditions an organism may be pathogenic, and at another non-pathogenic. Further, there are many pathogenic organisms living an active existence on or in the animal body, and their aggressivity is not felt. Thus we find streptococci on the nasal mucosa of the horse; staphylococci on the skin; *Bacilli coli* in the intestines; streptococci in the milk-ducts; and yet the respective hosts remain in excellent health. Such a condition may be rightly spoken of as a *bacterial invasion*, and must not be confused with the all-important *bacterial infection*, which is indicative of a partial or complete breaking down of the host's protective mechanism, and the establishment of a condition removed from the normal. Bacteria, in order to produce an infection, must possess a given degree of

aggressivity, and be particularly active in their processes of reproduction, so that those which are annihilated may be rapidly replaced by others possessing an even greater degree of virulence. The activities of these organisms culminates in the production of toxins (e.g., *endo-toxins*, *exo-toxins*) and *bacterial proteins*, and these may be defined as bacterial weapons to fight against the cells and antibodies of the animal body. Now, if the bacteria are provided with indifferent offensive weapons, the defensive factors of the host will soon overcome the bacterial invasion, and no diseased conditions will result. On the contrary, if those weapons are sufficiently powerful to overcome and break down the defensive mechanism, disease will follow in their train.

The *aggressivity* of an organism depends upon many factors; thus, we find attenuation by heat, chemicals, subcultivation on artificial media, growth on unsuitable media (whether animal or artificial), the withholding or exhibition of certain gases, all tend to lower the aggressive index. Again, certain bacteria will only become aggressive if admitted into the body by given channels. For example, the bacillus of anthrax will not make its presence felt in passing through the intact alimentary tract. The same may be said of the tetanus bacillus, each requiring an abrasion of the skin or mucosæ before infection follows. Further, bacteria may show selective instincts as regards the situations in the body where their maximum aggressivity is felt—*e.g.*, the *Micrococcus catarrhalis* is to be found in the respiratory mucosæ; and in this situation also the streptococcus of strangles usually occurs. The tubercle bacillus, however, may be cited as an organism which will enter its host by many channels and take on an aggressive rôle in almost any situation of the animal body. Again, we find that certain bacteria before they develop aggressive propensities are selective as to species and breeds. For example, the bacillus of glanders will not grow upon bovines, and Algerian sheep are said to be proof against anthrax.

This brings us to the second question—viz., *the protective defences of the body* and what they are. These are numerous. Some are simple and well understood; others are complicated, and we know but little with reference to them. The intact skin of the lower animals serves as a perfect barrier against bacterial infection. Should an abrasion, however, occur, bacteria soon make their presence felt, and invasion takes place, which is perhaps followed by an infection. If the body cells and body fluids (the latter rich in antibodies) are sufficiently powerful to overcome the invasion, no infection follows, and the wound soon reaches a normal state. On the contrary, if the aggressivity of the bacteria be very pronounced, such as we find in anthrax, malignant œdema, etc., a true infection will most certainly follow. Or if a less virulent type of organism is the invader—such as the streptococcus, staphylococcus, or *Bacillus coli*—and the animal be in a poor state of health—in other words, the index of the defensive forces stand at a low level—even

those mildly aggressive bacteria may bring about a complete breakdown of the defensive mechanism, and infection results. One might be asked to explain why one horse suffering from extensive injuries to the poll, followed by bacterial invasion in the parts, does not develop the affection termed 'poll evil'; while another horse, that has only received a minor contusion from an ill-fitting headstall, may show evidences of the surgical condition mentioned. In each case the offensive powers of the bacteria may be the same; it must therefore follow that the defensive forces of the body are at fault. In other words, the one animal is immune to bacterial invasion of the poll, and the other is not, and it is upon the condition of the body cells and body fluids, and the manner in which these perform their function, that the great principles of immunity here depend.

The defensive elements of the body rely upon forces always present in a normal state, and also forces developed during the course of an infection.

In considering the former, we must give precedence to the phagocytes, concerning which Metchnikoff has done so much to demonstrate their real significance in completing the rôle of immunity. He divides phagocytes into *microphages* and *macrophages*. The former represent the group containing the polynuclear and polymorphonuclear leucocytes. The latter comprise a more heterogeneous group, including the large mononuclear leucocytes, the endothelial cells, the mononuclear cells of the lymphatic glands and of the spleen, the bone corpuscles, the giant cells of bone marrow, and the large epithelial cells of the respiratory mucosæ. The group is a formidable one, and widely distributed throughout the body, so much so that if bacteria invade almost any region in the system they are liable to be attacked by the phagocytes. When a micro-organism is attacked by a phagocyte, granular degeneration of the former invariably follows; on the other hand, the aggressivity of the organism may be such that the cell is destroyed.

The phagocytes are capable in themselves of attacking and destroying bacteria, but their action is greatly assisted by the presence of normal blood-serum, and the experiments of Wright proved the existence of substances in the serum which are capable of preparing bacteria for their ready assimilation by the phagocytes, and these substances he terms *opsonins*. When bacteria take up their position in or on the body, the phagocytes are attracted towards them; hence we find in an abscess an abundance of pus corpuscles which are in reality migrated leucocytes. The process by which these leucocytes are attracted is known as *negative chemotaxis*. Under certain conditions, when the bacteria are markedly aggressive, the phagocytes are repelled, and the process is called *positive chemotaxis*. Upon this view Büchner, however, casts a doubt. He asserts that the virulence of the bacteria is not the determining factor, but rather the protein which they contain. Hence

he asserts that dead bacteria in reality stimulate chemotaxis. Opsonins play a most important part in the process of destruction of bacteria by the phagocytes, and Wright even holds that a lowered opsonic index favours bacterial invasion. Upon this basis, if opsonins leave the system in excessive quantities, the animal is at once predisposed to bacterial infection. Now we are aware that opsonins pass out of the body by the secretions and excretions. Cows belonging to the heavy milking strains are more prone to tuberculosis than those which give little milk. Further, it is a fact that if a cow tainted with tuberculosis and in poor condition be allowed to become 'dry,' she will often improve in health and in condition. We know that opsonins leave the system by the milk-stream, and it is rational to suggest that the loss to the system of an excessive quantity of opsonins may be a contributory factor in the production of tuberculosis in deep milkers.

Having pointed out that the *cellular elements* of the body exert a distinctly protective action against bacterial invasion, we will next consider the influences exercised by the *fluid or humoral elements*, and with our knowledge upon this subject the name of Ehrlich will ever be associated. Büchner showed that blood-serum possessed active bactericidal properties, which he presumed were of the nature of ferments, and to these he gave the name of *alexins*. Later on Ehrlich demonstrated that this action of the serum was dependent upon *two* substances, one of which acts as a connecting link between the bacteria and the second substance, and which he calls the *amboceptor*. The second substance he names the *complement*. The latter is *thermolabile*, and is destroyed at a temperature of 56° C. in thirty minutes, while the former is *thermostabile*, becoming inactivated at 70° C. It is important to note that the amboceptor only can attach itself to the bacteria, the complement being incapable of doing so, and, further, that the complement is only found in fresh serum. There is normally existing in the serum of all animals elements which are called *antibodies* or *immune bodies*, and whose special function is to protect the system against the attacks of offensive bacteria. These elements vary in different animals, and even in the same animal at different times, and each has its own part to play in the immunizing and protecting rôle. A few of the most important are—*antitoxins*, *agglutinins*, *precipitins*, *opsonins*, *bacteriolysins*, and *cytolysins*.

Antitoxins.—The antibodies produced and found in the serum of an animal following upon the inoculation of bacterial toxins are known as antitoxins. If an animal be inoculated by gradually increasing doses of toxin, the time arrives when a high degree of immunity will be reached, and the serum from such an animal is rich in antitoxins. If the latter be injected into another animal (preferably of the same species), a pronounced degree of immunity will be conferred upon it. Such antisera, we may point out, will be *antitoxic* and not *antimicrobic*.

The best-known example of an antitoxic serum used in practice is antitetanic serum.

AGGLUTININS. — Agglutinins are antibodies capable of grouping bacteria into clumps or bundles, and, if they are motile, checking their motility. They are divided into two groups—viz., (*a*) *normal agglutinins*, which are present in all animals to a greater or less degree ; and (*b*) *immune agglutinins*, which are developed as the result of the presence in the host of bacteria or their products. It would appear that both groups of agglutinins are the same as regards composition, the only difference being the question of quantity. Agglutinins, therefore, if present in excess of the normal, suggest the presence of an antigen (an antigen may be a body cell, bacteria, or protozoa). The antigen which is capable of stimulating the production of agglutinins is known as an *agglutinogen*.

PRECIPITINS.—Following upon the discovery of the agglutinating power of certain antisera, Kraus showed that if such sera were added to the broth culture of the corresponding bacteria a turbid reaction takes place, followed by precipitation. The antigen capable of producing such phenomena is known as a *precipitogen*.

OPSONINS.—Sir Almroth Wright showed the existence in the blood-serum of substances which are capable, as we have already seen, of preparing bacteria for the action of the phagocytes, and by the following experiment he demonstrated this fact. If a small quantity of blood be placed in a test-tube containing a solution of citrate of soda, and the whole centrifugalized, the cellular elements of the blood, by reason of their density, will be found at the bottom of the tube, while the fluid content will float on the top. Further, the red corpuscles will be at the extreme bottom, while immediately overlying them will be noted a grey layer, which is practically made up of the leucocytes. The serum is pipetted off, and the white layer, now on the top, is taken up with the pipette and mixed with normal saline solution and centrifugalized, the object being to wash the cells entirely free of serum. A bacterial emulsion and the washed leucocytes are now mixed together and incubated for fifteen minutes. A slide is prepared in the usual way, stained with a suitable blood-stain, and examined. It will be found that phagocytosis has not taken place. Now, if the same procedure be adopted, but in addition if a small quantity of blood-serum be added and the whole incubated as before, and then examined, it will be seen that the leucocytes have devoured vast numbers of the bacteria, thus clearly proving the presence of a substance in the serum which appears to be capable of so altering the bacteria as to prepare them for phagocytosis. In other words, the opsonins in the serum become bound to the bacteria, and a negative chemotaxis in the first experiment becomes a positive one in the second. Opsonins are normally present in the blood, and as such are known as *normal opsonins*, to distinguish them

from *immune opsonins*, which are the result of an infection or active immunization.

Bacteriolysins are substances found in the body fluids which destroy bacteria with or without lysis.* Pfeiffer, in 1894, showed that these antibodies developed upon the injection of certain bacteria into an animal, and possessed the power of causing dissolution of the corresponding bacteria. It was anticipated that, having antitoxic sera, we might also succeed in producing an antibacteriolytic serum, but all efforts in this direction have so far failed. The discovery of bacteriolysins has, however, given us a valuable means of diagnosis—*i.e.*, the bacteriolytic reaction.

Cytolysins.—The introduction into the animal body of vegetable or bacterial cells causes the development of specific antibodies which have the power of destroying these cells, and in some cases dissolving them. These antibodies are known as cytotoxins, and where the action is lytic the antibodies are called cytolysins. Cytolysins are divided into groups, according to their antigens. Thus we have hæmolysins and, as we have seen, bacteriolysins, also epitheliolysins, neurolysins, spermatolysins, etc. Cytolysins therefore are of great importance.

It will be noted that the antibodies of the fluid content of the animal body occupy a prominent position in the protective defences; but whether they or the cellular elements stand first is a debatable point. It would appear certain, however, that if their distribution throughout the body be perfect, if their composition and vital activities are normal, and if the interaction one with the other be complete (an important point), and if the whole defensive work be carried out in perfect harmony, it would require an extremely aggressive and offensive organism to break through the barrier. We must point out, however, that, given all these means of defence, there are cases where the invading bacterium gains the mastery, and anthrax may be cited as an example; but here one protective barrier has at least to be disorganized—namely, the epithelium or the epidermis. Even then Nature puts up a bold fight, as witness the localized 'malignant pustule' in man, or some types of anthrax in animals, such as in the horse and the pig, where also the lesions tend to be kept in check by confining the invasion to the glands of throat and neck. In cattle, however, the bacteria either seem to be more aggressive or the defensive factors less resistant, for here we find the tendency is to generalization and rapid dissolution. Briefly considered, the foregoing is a summary of the *offensive* propensities of bacteria on the one hand, and the *defensive* powers of the animal body on the other, and interdependent upon these the whole question of immunity is based.

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* Certain antisera possess the power of destroying microbes by solution, and the process is known as *bacteriolysis*, or simply *lysis*; the immune bodies which bring this about are called *bacteriolysins*.

Immunity.

The term immunity in its broadest signification may be applied to many diverse subjects, and even when used in a biological sense its meaning may be very comprehensive. Thus we find there are many types of immunity, but the two principal ones which concern us here are *natural* immunity and *acquired* immunity.

Natural Immunity.—This condition is seen in certain species of animals; thus we find cattle are immune to glanders and Algerian sheep to anthrax. Further, inheritance plays an important part in conferring upon an animal a natural immunity.

Acquired Immunity.—We here find two distinct forms—namely, *active* and *passive* immunity.

Active acquired immunity is the power established within the animal body to resist infection, consequent upon the active stimulation of the protective body forces induced by the presence of a bacterial infection or the artificial inoculation of an antigen. Thus active acquired immunity may follow upon the train of a bacterial disease, or it may be brought about by the injection of a vaccine or antigen.

Passive Immunity.—As the term implies, this condition is produced without the active intervention of the defensive body factors, the immunity being acquired by the injection of serum obtained from an animal which has been previously rendered hyperimmune. It is very important to point out that passive immunity is *specific*—*i.e.*, the immune serum injected can only confer immunity against the same species of organism that infected the animal from which the serum was derived. Passive immunity is usually of short duration, while active immunity extends over a prolonged period.

Passive immunity does not strain the defensive forces, so to speak, hence it is useful in those bacterial invasions where Nature has put up a hard fight and is wellnigh exhausted. It may be noted, in support of this contention, that if active immunization were practised at this point the negative phase would become so pronounced and prolonged that dissolution might be hastened instead of guarded against.

Theories of Immunity.—When an animal has become invaded and later infected with pathogenic bacteria, a mobilization of the defensive forces of the body immediately follows the stimulus. We have already considered the nature and consistence of these forces. In like manner, if we inject a vaccine (which is an emulsion of living or dead bacteria) into a patient, we obtain phenomena of a similar nature, although it may be to a lesser degree. In order that a practitioner may watch his case with interest and success, he must become conversant with these phenomena as they occur. It is well also for him to become acquainted with the principal theories of immunity.

Various theories of immunity have from time to time been put

forward. Thus we have Pasteur's *exhaustion theory*, by which he believed bacteria invading the animal body used up all the substances necessary for their growth. Chauveau maintained that the bacteria themselves produced substances which after a time became inimical to their growth, and this was termed the *retention theory*.

Metchnikoff at a later date demonstrated that the body cells were capable of ingesting invading bacteria, and he termed the process the *theory of phagocytosis* (*see* p. 541).

Ehrlich's side-chain theory, advanced in 1885 in his explanation primarily of the processes of nutrition, is a very far-reaching and complicated one, and probably supplied the most perfect data we possess at present. He conceived the idea that a cell was composed of a central molecular complex, upon the preservation of which the existence and energy of the whole cell depended. Further, branching off from this central element were atomic groups, the so-called 'side-chains' or 'cell receptors.'

The receptors are differently composed, and each possesses its own specific affinity for food molecules brought to the cell by the circulation. These receptors bind in turn the food molecules to the cell itself, and as these are taken up and utilized in the cell metabolism, so are also toxins which may be brought to the cellular elements by the body fluids. Thus we have nutro-receptors, which take up nourishment, and chemo-receptors, which attract chemical bodies. In the case of the former the receptor combines with the food molecule, and the union is a temporary one; but in the latter case, if the toxin be not immediately destroyed, the cell sacrifices, so to speak, the receptor to which the toxin is attached. The cell then sets about to increase the number of receptors, which are produced at such a rate that many are liberated voluntarily from the cell, and if toxin molecules be present a union takes place between the two. This is the exact condition which takes place in an animal whose circulation is charged with a toxin—for example, tetanus toxin—where an immune serum is injected, for here we have the free receptors of the serum uniting with the toxin. The side-chain or receptors are divided by Ehrlich, according to their structure, into three groups.

The *first* group possess a single combining or *haptophoric group*, which enable them to unite with a corresponding group of their respective antigens, such as *antitoxins*, *anticomplements*, *antiferments*, etc.

The *second* group possess the same qualities as the first, save in addition there is another group, the *ergophoric group*, and by means of these the antigen is further acted upon. To this group belong *agglutinins* and *precipitins*.

The *third* group are called *amboceptors*, owing to their possessing two combining groups; the first belong to the haptophoric group, uniting the antigen to the cell, and the second to the complemento-

philic group, which combines the complement of the serum. To this group belong *immune opsonins* and *cytolysins*.

From what has been already stated, the reader will recognize that there are two kinds of immunization carried out in practice, viz.: (1) *active immunization*, or *vaccine-therapy*; (2) passive immunization, or *sero-therapy*.

PHENOMENA FOLLOWING ACTIVE IMMUNIZATION.—Let us take for example a case of pneumonia in the early stages. The patient shows the usual cardinal symptoms, and, if fortunate to possess a good sound constitution, the defensive forces are ready to respond to antigenic stimulation. Soon after the injection of a suitable vaccine an exaggeration of the *focal* symptoms takes place, this reaction being called the *negative phase* by Wright and his followers. It is due to the fact that there is a gathering together of the defensive factors, in this case remote from the lungs; the opsonic index falls *pro tem.*, during which the offensive powers of the bacteria in the lungs are having all their own way, so to speak. This may continue for some hours, during which it will be noted that the temperature will rise, and the pulse and respiration will become quickened. This condition will, however, be soon replaced by the second or *positive phase*, in which case a great inpouring of immune bodies to the lungs will follow. The defensive mechanism has now become activated and replenished, and the ascendant aggressivity of the focal bacteria will now have its progress checked, and then follows about two or three days of steady constitutional progress, after which defensive exhaustion may occur, the *high plateau of increased resistance* has been reached, and this indicates the necessity for a further injection. Now, it must be patent to the reader that the negative or first phase of a bacterial injection is not a desirable one, and in acute conditions, such as pneumonia, this must be reduced to a minimum, which fortunately can be done if the immunizator begins by giving his patient sufficiently small doses, in which case the negative phase would pass almost unnoticed. Against this ideal, however, it must be pointed out that, in very many instances, the more pronounced the negative phase is, in veterinary practice at least (in other words, the better the vaccine 'takes'), the more satisfactory is the response. Nevertheless, bearing this in mind, we make it a point never to give a maximum dose of any vaccine when we have to deal with acute disorders at the outset. In chronic cases small initial doses are worse than useless, as they only cause loss of time, and during their administration no benefit results. When we are dealing with a chronic condition, such as fistulous withers, the following phenomena are usually observed after the injection of a suitable vaccine: No constitutional disturbance is, as a rule, noted. A few hours after injection the focal lesions become more pronounced. The negative phase—*i.e.*, an increased hyperæmia of the parts—is observed, and if the fistula be discharging, an increased quantity of pus

is noted. This is followed *gradually* by a diminution in the symptoms mentioned, and what is more important, if the case progresses favourably, the quality and consistence of the pus becomes markedly improved. The pus prior to injection was, perhaps, thin, grey, watery, and non-adhesive in character; it now becomes thick, tenacious, and creamy. Here we must emphasize strongly the great necessity of devoting careful attention to the quality and consistence of the pus in estimating the progress or otherwise of these chronic suppurating conditions.

To enter into a description of pus formation and the determination of its quality would be beyond the scope of this chapter, but we shall explain briefly the salient points. A thin watery pus proceeding from a chronic fistulous wound indicates a deficiency in *bacteriotropic* elements. In other words, the offensive bacteria are having it all their own way, while the immunizing mechanism is thrown out of gear. This may be due to a defective condition of the phagocytes or of the immune bodies, or of both, such as we would expect to find in an animal in ill health or suffering from debility, lack of proper food, etc., and clearly the cause must be searched for and rectified. On the other hand, these defensive factors may be in perfect order, but they cannot reach the focal centre owing to the wall of the sinus being completely coated and varnished over by a layer of impervious, so-called 'organized lymph,' and this may be attributed to an alteration in the *normal calcium content* of the blood. Here removal of this layer, which, we may remark, is infected by bacteria, is imperative, either by surgical means or by caustics. A thick, creamy, so-called 'laudable' pus indicates that the defensive body factors are actively at work. The pus is rich in pus corpuscles and wandering leucocytes, which have fallen in their offensive action against bacteria, while the serum also possesses more 'body.'

Vaccines may be defined as bacterial emulsions which, when injected into the body, produce a train of symptoms consequent upon active immunization. They are therefore totally different elements to sera, as we have already seen. Nevertheless the two terms are by many practitioners used synonymously. This looseness in expression must be condemned, as it leads to confusion. Vaccines are divided into (1) *stock* and (2) *autogenous* vaccines. *Stock* vaccines are prepared from the bacterial discharges of an animal or animals (the latter being polyvalent). *Autogenous* vaccines are derived from a bacterial growth obtained from the same animal the vaccine is intended to be used upon. When it is pointed out that vaccines are specific—*i.e.*, they are only capable of stimulating the production of antibodies, which in

their turn have the power to destroy the particular bacterium to which the organism in the vaccine belongs—the reader will at once be convinced that vaccine-therapy has its limitations. Moreover, some bacteria have many strains, and unless, in some cases at least, the same strain be used to make the vaccine, no therapeutical results will follow. It does not follow that, if an animal be suffering from a streptococcal infection, and the practitioner uses a streptococcus vaccine, he will obtain good results. On the contrary, it would be surprising if favourable results ensued, and we fear this is one reason why vaccine-therapy has not proved a success with many practitioners. Not so, however, with autogenous vaccines, which should be regarded as ideal scientific products. In autogenous vaccines we have not only the causative organism or organisms present, but, what is equally important, we can rely upon having our vaccine made from the same strain. Until the time comes when every veterinary surgeon is not only a practitioner of medicine, but a practical bacteriologist and vaccine-therapist, we must, in a general way, fall back upon stock vaccines. Of these the following are in most common use:

I. *Strangles vaccine.*
II. *Mastitis vaccine.*
III. *Distemper vaccine.*
IV. *Anthrax vaccine.*
V. *Blackleg vaccine.*
VI. *Mixed vaccines for abscesses, fistulæ, suppurative wounds, etc.*

Active Immunization.

Strangles Vaccine.—When a case of strangles is running a mild and ordinary course, there is no necessity on the part of the practitioner to deviate from the orthodox line of treatment, so far as the immediate results are concerned. Nevertheless, it is advisable to circumvent the disease and diminish the risk of sequelæ, especially in the case of blood stock and hunters, as many of these become the victims of roaring and whistling as the result of strangles. This may be accom-

plished by the early use of prophylactic, and even curative, sero-vaccine therapy. If we are able to limit the parenchymatous and destructive changes which take place in the upper respiratory mucosæ, the adjoining lymph glands, and the neuro-muscular elements of the larynx, we may succeed in preventing the occurrence of whistling and roaring.

These cases of so-called *catarrhal fever*, *infectious catarrh*, etc., should be regarded as strangles in which the bacterial invasion has undergone an abortive change. In these cases a streptococcal infection has occurred in the respiratory mucosæ, but owing to the limited aggressivity of the offensive bacteria, or the pronounced resistance of the mucous secretions, combined with the phagocytic action of epithelial cells of the nasal mucosa, the bacteria do not extend beyond the mucous barrier, or, if they succeed in doing so, their numbers are negligible, the result being that no glandular lesions follow.

The bacteriology of strangles is by no means settled, but we have found that the three most common bacteria met with in the disease are coccobacilli, streptococci, and staphylococci. The first-named can only be isolated in the early stages of the disease. The streptococcus is undoubtedly the most aggressive organism of the three.

When using a prophylactic vaccine, we always include the three organisms, and secure as many strains as possible, so as to make the vaccine polyvalent. For curative purposes the coccobacilli may be omitted, and the greatest care taken to obtain as young and as virulent a streptococcal emulsion as possible. In those cases of strangles where the patient is very exhausted, or where there are evidences of acute pulmonary lesions setting in, active immunization must be carried out in a cautious manner. The dose of vaccine should be comparatively small, and repeated every twenty-four hours, with gradually increasing doses, or large doses of a polyvalent antistreptococcal serum may be used. In some cases we have obtained very good results by the simultaneous injection of virulent streptococcal emulsion and antistreptococcal serum.

Antimastitis Vaccine. — The bacterial flora found in a healthy cow's udder while secreting normal milk are often many in number and variety. Nevertheless, clinically they do not appear to take on an aggressive rôle until some disturbance of the bacteriotropic forces takes place. Thus we find streptococci, *Staphylococcus aureus*, *S. albus*, *S. citreus*, and diphtheroids, and in certain cases we have isolated the *Bacillus pyocyaneus*, without pathological lesions being present. As with strangles, so here with mastitis, the most aggressive organism appears to be the streptococcus, which should head the list in making a prophylactic or curative vaccine. If the udder be very tense and hard, with little or no secretion obtained by milking, the use of lymphagogues is indicated. A weak citrate of soda solution should be injected into the udder at a temperature of at least 1 degree higher than that of the patient at the time of injection, and 1 to 2 ounce doses of citric acid must be administered *per os* until a serous flow is established. It may be of interest to point out here that, even when the clinical lesions have disappeared, the milk may still contain bacteria, and the host in this way, although apparently cured, can still act as a 'carrier' of infection.

Distemper Vaccine.—Various attempts have from time to time been made to check and control the ravages of canine distemper by active immunization. It may at once be said that we possess as yet no effective remedy against distemper, and this is not likely to be discovered until the bacteriology of the disease is determined. There seems little doubt but that the affection depends primarily on an ultra-microscopic organism, and that the various complications should be attributed to a secondary infection.

Various vaccines are on the market, such as Lignière's polyvalent vaccine, Copeman's vaccine, Ferry's mixed vaccine; also Piorkowski's serum. For any benefit to be derived from the sera, they should be employed early, while the use of mixed vaccines may act beneficially in fortifying the system against secondary infections. Probably the use of a hyperimmune polyvalent serum, followed by the injec-

tion of virulent cultures, would give the best prospect of good results, both prophylactic and curative.

Anthrax Vaccine.—Pasteur in 1881 demonstrated that immunity against the anthrax bacillus could be produced by injecting into the animal attenuated bacilli. Other workers showed that the virulence of the bacilli could be reduced by heat, oxygen, antiseptics, and even sunlight. Pasteur prepared a vaccine of two strengths: No. 1 was made by cultivating bacilli in broth at a temperature of 42° C. for twenty-four days, and the virulence of the bacilli was so attenuated that this vaccine killed mice, but not guinea-pigs. No. 2 was prepared in the same manner, but it was less attenuated. The dose for a horse or ox is $\frac{1}{4}$ c.c. of No. 1 vaccine, and after ten days the second vaccine, $\frac{1}{4}$ c.c., is also injected. After three weeks the animal is proof against infection, and the immunity lasts about twelve months. It may be pointed out that protective vaccination for anthrax is not indicated in this country, for the following reasons: (1) The outbreaks are of a sporadic nature. (2) The cost entailed is somewhat expensive. (3) The vaccine is not altogether free from risks, and may even prove fatal.

Sobernheim has introduced the combined sero-vaccine method (see p. 529).

Blackleg Vaccine.—Here we have a vaccine which has been extensively used and is productive of excellent results. There are two kinds: (1) Arloing's or the Lyons method; (2) Kitt's or the Munich method.

Arloing's Vaccine (*Double Method*) is prepared from the diseased muscle taken from a case of blackleg. It can be used in the form of a solution injected subcutaneously, or several layers of plaited thread can be soaked in it and inserted under the skin. The second vaccine dose is to be given in ten to twelve days after the first.

Kitt's Method.—A single injection is sufficient, so that the method is more economical if it may not be quite so satisfactory.

Mixed Vaccines for Wounds, Fistulæ, etc.—These conditions are met with in practice in the form of sub-

acute or chronic lesions as a rule, and as such are likely to yield to active immunization, because the more pronounced negative phase which we should endeavour to ward against in acute bacterial infections need not be considered here. Thus we are in a position to use a more potent vaccine, potent, not only in using maximum doses, but in suitable cases virulent bacteria. As wounds and fistulæ are 'open,' the bacterial flora found in such are of a mixed character; hence it is essential that the vaccine to be used should be a mixed one, and as polyvalent as possible.

Where a wound or a sinus continues to discharge for a length of time under vaccine treatment, the whole area should be carefully searched (if this has not been already done) for foreign bodies, necrosed tissue, etc., and, if detected, these should be immediately removed. If no such state exists, and still the vaccines fail to bring about desired results, a careful examination of the discharges should be made, and in this we may detect a bacterium belonging to a different flora from which our vaccine has been made. In the case of abscesses these should be opened, and if deep-seated, free drainage must be allowed. Caustic dressings and the use of strong antiseptics are entirely contra-indicated.

The bacterial flora found in these lesions are many—*e.g.*, streptococci, staphylococci, pneumococci, *Bacillus pyocyaneus*, *Bacillus coli*, etc.; also actinomyces and botriomyces.

The doses of vaccine here are usually repeated every five to seven days, and small amounts are useless.

Passive Immunization.

This condition, as we have already seen, is brought about by the injection of hyperimmune sera into the animal intended to be immunized. The manufacture of immune sera is a prolonged and expensive process. The animal used for such purposes is usually the horse, although in some cases the ox, pig, and dog, are utilized. In any case it is much safer to use the sera on the same species from which it was

obtained originally, and by doing so the risk of *anaphylaxis** is done away with. The animal chosen to obtain the serum from is injected at regular intervals with the antigen. Taking antistreptococcic sera for example, the streptococcus is grown in a broth and serum medium, and small gradually increasing doses are injected intravenously at regular intervals for a period of six months,† after which the animal is bled, and the serum is thus obtained. Another large dose of antigen is again injected, and after the lapse of a week or ten days the animal is bled a second time. This procedure is carried out many times.

Anti-Anthrax Serum.—Mendez, Sclavo, and Deutsch, have prepared anti-anthrax serum by immunizing horses, goats, and sheep, with virulent cultures of anthrax bacilli. Such sera are both prophylactic and curative, and the results in man and animals, where used in good time, have been highly satisfactory. In this country, however, it carries with it little practical value. Our patients are either dead or dying when seen, and the disease is too sporadic to necessitate any considerable expense.

Antistreptococcic Serum.—As already stated, this serum is obtained by immunizing a horse with virulent cultures of streptococci, and to make it as efficacious as possible several strains of streptococci should be used. This serum was first introduced by Marmorek in 1895, who limited its curative powers by making it a monovalent serum. Since then many polyvalent sera have been manufactured, some giving good results, others failing in curative value. Antistreptococcic serum has given good results, if administered in the early stages, in such diseases as puerperal sepsis, mastitic sepsis,

* Briefly anaphylaxis appears to be the antithesis of immunity. The injection of an antigen brings about usually a fortification of the immunizing mechanism, but under certain conditions, often inexplicable, the opposite takes place—*i.e.*, a diminution of the powers of resistance, and, what is more, the production, in some cases, of serious and often fatal phenomena. If serum is the antigen used, the clinical picture is 'serum disease.' This condition is not common in the lower animals, and only occurs when the serum of another species is used.

† The animal is now hyperimmune.

phlegmonous cellulitis, etc. The doses must, however, be large, and we have found that mixing the serum with sodium oleate and boric acid adds greatly to its efficacy. In cases of irregular strangles the *double injection* of virulent cultures of the streptococcus with very large doses of hyperimmune serum gives better results; the former injected subcutaneously, the latter intravenously or by intramuscular injection.

Antitetanic Serum.—An effectual remedy for *acute* tetanus has yet to be discovered. In this disease, neither good nor bad results follow the injection of small doses of serum—such as 10 to 20 or 30 c.c. But where 50 or more c.c. are injected, especially intravenously, our experience is that in very acute cases death is hastened rather than retarded. When a large supply of antitoxin is injected, the free circulating toxin becomes neutralized up to a point; this has the effect of relieving the cells from the high pressure entailed in their endeavour to elaborate their own antitoxin; a cessation in their antitoxin manufacture follows, but in the meantime the flow of toxin still proceeds unchecked from its source in the wound. Reasoning thus, antitetanic serum appears only to be of value as a curative agent in severe cases, where we are in a position to cut off definitely the supply of toxin, such as in redocking, if the infection proceeds from the tail, in deep dissection of wounds and, where possible, in the severance of nerves, and in the injection—deep-seated—of tincture of iodine above the seat of the infective zone. As a *prophylactic agent* a rich antitoxic serum is exceedingly valuable, and cannot be too strongly commended in those cases where we are entrusted with the treatment of valuable animals having deep wounds, bruises, etc., and particularly where we suspect such wounds have been contaminated with road-soil, horse-manure, and such-like. One dose is usually sufficient, but a second seven to ten days later is often advisable.

Anti-Swine-Fever Serum.—Much success appears to have been obtained from the use of hyperimmune vaccine serum both as a preventive and curative agent for swine fever on the Continent. This serum is obtained by injecting simultaneously virulent and hyperimmune sera into a pig, gradu-

ally increasing the doses every fourteen days for a period of ten weeks, at the end of which time the pig is bled by cutting a piece off the end of the tail and collecting the blood in sterile glass tubes. As a rule, seven to fourteen bleedings are carried out in this way, after which the pig is killed by bleeding, and the serum collected in the usual manner. The dose of serum for an average pig is from 10 to 30 c.c., and an animal thus injected is immune for three weeks. Should, however, the pig in the meantime become infected with the virus of the disease in a natural way, that animal remains immune for life.

Sensitized Vaccines.

These consist of the combination of bacterial emulsions and immune sera. It is presumed the *sensitization* is brought about by the bacteriolytic amboceptor of the serum combining with the antigen, which when injected serves, with the animal's complement, to bring about solution of the bacteria in the emulsion, in this manner setting free the chemical elements necessary for the stimulation of antibodies.

The use of 'sensitized vaccines' in veterinary practice has so far not been extensive; nevertheless, in selected cases we have obtained very favourable results. They would appear to be specially indicated in those cases of influenza and strangles where a rapid immunity of the uninfected is desired; in septicæmias and generalized infections, particularly in the early stages; and in those conditions where pronounced toxæmia is much in evidence. Very large doses of 'sensitized vaccines' may be given, as the negative phase is almost eliminated by their use. There appears to be considerable scope in the future for the use of sensitized vaccines.

For further details on the subject of vaccines and sera, the reader is referred to 'Clinical Bacteriology and Vaccine Therapy,' written by the author of this article.

Art is born of the observation and investigation of Nature.

CICERO, Orat. lv., 183.

'It cannot be denied that we have learned more rapidly how to prevent than how to cure diseases; but, with a definite outline of our ignorance, we no longer live now in a fool's paradise, and fondly imagine that in all cases we control the issues of life and death with our pills and potions.'

OSLER.

PART III

SPECIAL THERAPEUTICS

CHAPTER I

INTRODUCTORY

In the following chapters we propose to consider briefly the treatment of those diseases which are usually met with in practice. We may preface our remarks by stating that routine methods of treatment should be avoided. We have already drawn attention to the fact that in the majority of diseases it is difficult to decide which is the best medicinal agent or line of treatment to adopt. Marked differences of opinion are not uncommon in connection with this subject, and therapeutic measures which are found to be successful by some practitioners may, in the hands of others, fail to achieve desired results. This is not surprising when we consider that disease varies in intensity in different years and localities, that the vital resistance of patients is not uniform, and also that surrounding conditions exert an important influence on the mortality from various affections.

In drawing conclusions with reference to the value of medicinal agents, and the results obtained from their administration, it is necessary to bear in mind the influence which the *vis medicatrix naturæ* exerts on the recovery of patients. Obviously, in the treatment of every disease our aim should be to assist the natural powers of recovery, and to avoid any therapeutic measures which would be likely

to exert an unfavourable influence on the course of the malady.

We have already pointed out the importance of arriving at a correct diagnosis. It is necessary, as far as possible, to ascertain the abnormal conditions that are present, before we can select the most appropriate measures to adopt in order to assist the natural powers of recovery. By a careful observation of the symptoms presented, and by physical means of diagnosis, we decide what organ is involved, and then consider the most suitable line of treatment to adopt. A knowledge of pathology is essential, so that we may be aware of the alterations produced by the disease in vital organs, and also the effect of the lesions on the functions of other organs of the body. In order to adopt rational treatment, we must go farther than simply giving the disease a name. Again, we cannot ignore the fact that, in many instances, it is not possible at our first examination of a case to arrive at a definite diagnosis, but general symptoms may be present which will indicate to us that certain therapeutic measures will be likely to prove of benefit to the patient. Thus the presence of rigors indicates the use of diffusible stimulants and warm clothing, so as to equalize the circulation and prevent congestion of internal organs; a high temperature suggests the employment of antipyretics; cardiac weakness is an indication for suitable stimulants; acute pain calls for the administration of suitable sedatives; a scanty secretion of urine indicates the judicious use of diuretic agents; constipation requires treatment according to the nature of the case. Even in instances where we are able to arrive at a definite diagnosis, these general symptoms cannot be disregarded as indications for treatment, seeing that it is not always possible to act directly on the diseased organ. Nor can we ignore the fact that unsuspected affections of other organs may be present, which may either complicate the primary disease or mask the symptoms of the latter. Hence the importance of a careful study of the leading symptoms, so that we may recognize the necessity of adopting special treatment.

It is important to remember that, whenever possible, symptoms should be ascribed to their true origin, so as to avoid prescribing treatment which is likely to be detrimental to the case. For example, when abdominal pain is a prominent symptom, it may depend on a variety of conditions, many of which would be unfavourably influenced by the administration of opiates. A scanty secretion of urine may be a symptom of nephritis, in which instance certain diuretics would be contra-indicated, because they would increase the flow of blood to the kidneys. The existence of diarrhœa is not always an indication for the administration of active astringents, as it may depend on the presence of irritating ingesta in the intestines, and the rational treatment would be a moderate dose of an oleaginous aperient in the first instance.

From a consideration of these points, the student will gather that active treatment of any kind is not to be undertaken without a careful examination of the case, and due deliberation of the effects which are likely to be produced by the therapeutic measures adopted. Even to the experienced practitioner there are many occasions on which doubts and probabilities arise in connection with diagnosis, and the most suitable line of treatment to be adopted. Self-confidence is no doubt a valuable attribute to success in practice, but it should not prevent us from giving a guarded opinion with reference to diagnosis, prognosis, and treatment, in cases where the symptoms are not characteristic of a special disease. Dogmatism and the assumption of superior skill may pass for cleverness and enhance reputation, but such a method can be adopted by a practitioner whose real knowledge leaves much to be desired. At the same time, tact is essential when giving a guarded opinion, or deferring a definite line of treatment, so that the client may not regard the procedure adopted as a confession of ignorance on the part of the practitioner. As a well-known clinical teacher once remarked: 'If you must wait before forming even a probable opinion, at any rate be decided in delay. Remember, decisive hesitation is far wiser than hesitating deci-

sion.' It is preferable to adopt simple measures until we are enabled to ascribe the symptoms to their real origin, than to prescribe potent remedies when we are in doubt as to the nature of the case.

We have already pointed out the evils of indiscriminate prescribing of drugs. Perhaps one of the most common causes of such an irrational practice is the prevalent idea, on the part of the practitioner, that he is not doing all that is possible for the patient. The popular belief in the virtues of drugs and the benefits to be derived from the adoption of active measures leads the owners of animals to expect the practitioner to prescribe drugs on every occasion. And if he omits to do this, and the patient happens to succumb, he is subjected to adverse criticism. The education of clients in this matter is of importance, and much can be done to emphasize the value of nursing, hygiene, and dietetics, in the treatment of all diseases. The junior practitioner who has not had the advantage of careful clinical training is most likely to imagine that he is not giving the patient a fair chance unless he prescribes a full course of potent remedies, and 'rings the changes' when his treatment does not appear to produce desired results. But later on, when he gains clinical experience, and observes how cases that are curable recover with simple treatment and good nursing, his ideas on therapeutics become considerably modified. He learns the importance of a careful study of his cases, he takes time to consider the line of treatment he will adopt, and, having assured himself as far as possible that the therapeutic measures are likely to benefit the patient, he gives them a fair chance, and is not in a hurry to change from one drug to another, in the hope that he may hit on a successful remedy.

We have also directed attention to the value of good nursing, hygiene, and dietetics, in the treatment of all diseases, and here we may point out the importance of *rest* as a therapeutic agent. In the case of horses, cessation from work for a proper period of time is an essential attribute to successful treatment. Another important aid to complete recovery is

to send the animal, when convalescent, on grass, provided the weather be suitable. The value of open-air and gentle exercise during convalescence is now fully recognized, and, as we shall point out when dealing with the treatment of nasal catarrh and strangles, cases of the diseases mentioned recover far more rapidly when left on grass in a sheltered paddock than when kept indoors.

CHAPTER II

THE TREATMENT OF DISEASES OF THE DIGESTIVE ORGANS

SECTION I.

THE TREATMENT OF DISEASES OF THE MOUTH AND TONGUE.

DISEASES of the mouth are of importance in all animals. Unless the mouth, teeth, and tongue, are in a normal state, mastication of the food cannot be carried out in a proper manner; besides there are morbid conditions which actually prevent the animal from feeding.

In cases showing loss of appetite, without the presence of any cause for this symptom, a careful examination of the mouth, teeth, and tongue, should always be made. This procedure should also be carried out in cases where mastication is imperfect, or when the animal 'quids' his food (*i.e.*, when portions of food drop from the mouth during mastication), or when salivation is present, or when the horse is 'out of condition,' although receiving ample food. The presence of undigested oats in the fæces is also an indication of imperfect mastication. The examination of the mouth and teeth is best carried out by means of a mouth-gag, a very convenient pattern being the instrument invented by Malloch. This examination may reveal the presence of dental irregularities, an over-grown molar, or a carious tooth, in which instances suitable surgical measures must be adopted; or stomatitis

(inflammation of the mucous membrane of the mouth) may be detected; also injuries or diseases of the tongue, the presence of a foreign body in the vicinity of the molar teeth, or embedded in the tongue; alterations in the character of the buccal mucosa, such as a sour pasty condition, which indicates dyspepsia.

In the dog, an examination of the mouth may reveal the presence of diseased teeth, pyorrhœa alveolaris, a whitish, soapy condition of the tongue, or this organ may be of a copper-coloured tint, indicative of dyspepsia; the oral lesions of canine typhus may also be detected, or foreign bodies may be found fixed between the molar teeth, or a sharp-pointed article, such as a needle or a pin, may be embedded in the buccal mucosa or in the tongue.

Stomatitis (Inflammation of the Mucous Membrane of the Mouth).

In the **Simple** or **Catarrhal** form, attention to diet is necessary. The food should be restricted to oatmeal gruel, barley-water, linseed-tea, hay-tea, etc., until the acute symptoms abate. A mouth-wash containing boric acid, or borax, or potassium chlorate, and honey, should be prescribed. In severe cases associated with profuse salivation and difficulty in mastication, extract of belladonna may be added to the above mouth-wash.

In the dog, a solution of peroxide of hydrogen is indicated. Attention should be paid to the teeth, and any of these if loose or decayed should be extracted. If dyspepsia be present, suitable treatment will be required.

Ulcerative Stomatitis.—In this condition an antiseptic mouth-wash should be employed, such as one containing borax, potassium chlorate, potassium permanganate, etc. In cases where the ulcers do not tend to heal, they should be carefully dressed with nitrate of silver.

In the dog, ulcerative stomatitis may be a serious affection, and may lead to loosening of the teeth and necrosis of the alveoli, and be associated with spongy, bleeding gums. The

mouth should be frequently cleansed with antiseptic solutions, such as peroxide of hydrogen. A mouth-wash containing dilute hydrochloric acid and quinine often proves useful (see formula, p. 568). All loose or diseased teeth should be extracted, and incrustations of tartar removed from the remaining teeth. Attention to the general health of the patient is essential, and the digestive disturbance which is usually present will require suitable treatment.

Parasitic Stomatitis (also known as **Thrush**) is occasionally met with in foals and calves, and frequently in birds. Affected animals should be isolated, and buildings and feeding utensils disinfected. The local application of borax in the form of an electuary generally gives the best results. Some authors advise the addition of an alcoholic solution of thymol and salol to the electuary.

Mercurial Stomatitis.—Stomatitis is one of the symptoms of mercurial poisoning. This is rare in the equine species, but not uncommon in cattle, sheep, and dogs. Local treatment consists in applying a mouth-wash containing potassium chlorate (2 per cent.). This drug may also be given internally, or small doses of potassium iodide may be prescribed. Loose teeth should be extracted. The diet should be of a soft nature, so as not to add to the existing irritation. In horses and cattle, albumin in the form of eggs mixed with barley-water and linseed-tea should be allowed. When the condition arises from absorption of mercury due to mercurial dressings applied to the skin, the parts should be washed with soap and water.

Congestion of the Buccal Membrane and of the Hard Palate.

This is popularly known as 'Lampas,' and consists of swelling and congestion of the membrane covering the hard palate, especially behind the incisor teeth. Undue importance is attached to the condition by horse-owners and grooms. It is a minor affection associated in the young horse with the process of dentition, and in adult or aged animals with

digestive disturbance. In the former instance, if there be any difficulty in mastication, the part may be lightly scarified with a gum lancet, taking care to make the incisions in the middle line, so as to avoid wounding the palatine arteries. When associated with digestive disturbance, attention should be directed to the diet, dental irregularities should be corrected, and bicarbonate of soda administered in the food or drinking-water twice daily.

The abominable and cruel practice of cauterizing the palate with a hot iron, adopted by farriers and empirics, cannot be too strongly condemned, and the perpetrators should be prosecuted under the Protection of Animals Act, and also the owners of the animals for permitting it to be carried out.

Glossitis (Inflammation of the Tongue).

The indications for treatment vary according to the severity of the case and the nature of the causal agent. In mild cases the use of an antiseptic mouth-wash, such as a 3 per cent. solution of boric acid or borax, will suffice. The diet should be restricted to boiled oatmeal, linseed-tea, and milk. When the organ is much swollen, scarification of the tumefied portion and repeated irrigation with antiseptic solutions are advised by some authors. When glossitis results from the action of mineral acids, mouth-washes containing alkalies such as calcined magnesia or bicarbonate of soda are indicated; lime-water is also useful. When due to the action of alkalies, weak solutions of vinegar should be employed. In glossitis resulting from the administration of irritating agents, such as oil of turpentine, chloral hydrate, etc., not properly diluted, a mouth-wash composed of boric acid, belladonna, honey, and camphor-water, relieves pain and promotes healing. When glossitis results from the presence of a foreign body, the latter should be located and removed. When arising from wounds, or the presence of an abscess in the tongue, surgical measures are indicated.

Formulæ *

Mouth-wash for Simple Stomatitis in the Horse.

℞ Potassii Chlorat. ... ... ℥ii.
Boracis ... ... ℥iii.
Glycerini ... ... ℥ii.
Aquæ ... ... ad O.i.

M. Ft. lotio. Sig.: Rinse the mouth with two wine-glassfuls of this lotion three times daily.

Mouth-wash for the Dog.

℞ Boracis ... ... ℥ii.
Sodii Bicarb. ... ... grs. xl.
Tr. Eucalypti ... ... ℥i.
Glycerini ... ... ℥ss.
Aquæ ... ... ad ℥viii.

M. Ft. lotio. Sig.: Rinse the mouth with some of this lotion three times daily.

Mouth-wash for Parasitic Stomatitis in the Dog.

℞ Boracis ... ... ℥iv.
Glycerini ... ... ℥iv.
Tr. Myrrhæ ... ... ℥ii.
Aq. Camphoræ ... ... ad ℥viii.

M. Ft. lotio. Sig.: Apply with a brush two or three times daily.

Mouth-wash for Ulcerative Stomatitis, or for Fœtid Breath, Spongy and Bleeding Gums, in the Dog.

℞ Quininæ Sulph. ... ... gr. xxiv.
Ac. Hydrochlor. Dil. ... ... ℥ii.
Mellis ... ... ℥ii.
Aq. Camphoræ ... ... ad ℥viii.

M. Ft. lotio. Sig.: Apply with a brush several times daily.

Mouth-wash for Mercurial Stomatitis.

℞ Potassii Chlorat. ... ... ℥ii.
Tr. Opii ... ... ♏xx.
Aq. Laurocerasi ... ... ℥i.
Aquæ ... ... ad ℥vi.

M. Ft. lotio.

* N.B.—In the formulæ for dogs throughout the text, the doses advised are those suitable for a dog from the size of a fox-terrier upwards. For smaller animals, and for the toy breeds, from one-half to one-quarter of these doses will be sufficient. The doses must also be modified according to the requirements of the case.

Mouth-wash for Glossitis in the Horse.

℞ Potassii Chlorat. ... ... ℥ss.
Ext. Bellad. Vir. ... ... ℥ii.
Mel. Boracis ... ... ℥iv.
Glycerini ... ... ℥iv.
Aquæ ... ... ad O.i.
M. Ft. lotio. Sig.: Use as a mouth-wash three times a day.

Section II.

THE TREATMENT OF DISEASES OF THE PHARYNX AND ŒSOPHAGUS.

Acute Pharyngitis—Acute Pharyngeal Catarrh—Inflammation of the Pharynx—Sore Throat.

Acute pharyngitis may be associated with various affections, such as severe cases of acute nasal catarrh, acute laryngitis, influenza, or strangles. In the dog it may occur in connection with distemper. The principles of treatment are similar, whether it exists as a disease *per se*, or is associated with the above affections. It is of first importance to remember that, owing to the difficulty in swallowing and the irritable condition of the pharynx that is present, medicines in the form of drenches should not be administered, as the procedure would induce paroxysms of coughing, during which portions of the fluid may be drawn into the trachea and bronchi, and cause broncho-pneumonia. Hence, any medicinal agents that are deemed necessary should be given in the form of electuary. In order to relieve the painful condition of the pharynx, an electuary containing extract of belladonna, potassium chlorate and camphor, with honey as a basis, should be prescribed. If a high degree of fever be present, antipyrin, antifebrin, or quinine, may be added to the electuary. Inhalations of steam medicated with terebene, oil of eucalyptus, camphor, or compound tincture of benzoin, assist in allaying irritation of the pharyngeal mucosa.

When there is marked difficulty in swallowing, and fluids are returned by the nostrils, a cantharides blister should be

applied to the external pharyngeal region. This treatment rarely fails to give relief, and the effect in overcoming the dysphagia is readily observed.

Some authors describe 'phlegmonous pharyngitis,' a condition in which the submucous tissue of the pharynx is infiltrated with a serous fluid and with hæmorrhages. Abscesses form in the submucosa, or the lymphatic glands in the vicinity of the pharynx and larynx become involved, and abscess formation occurs therein. In our opinion it is impossible to differentiate such cases from strangles, and the treatment is similar to that advised for the latter affection (*vide* 'The Treatment of Strangles'). Here we may remark that it is always advisable to isolate cases of pharyngitis, as in many instances the condition is associated with strangles.

In the treatment of acute pharyngitis *in the dog* the principles of treatment are similar, but instead of applying a counter-irritant to the external pharyngeal region, we employ a cataplasm composed of kaolin and glycerin. An application containing glycerin of borax may be painted over the interior of the pharynx by means of a soft brush, twice daily. Care should be exercised in administering fluid medicines, owing to the difficulty in swallowing which is present.

Chronic Pharyngitis.—This condition often proves very resistant to treatment. If the measures advised for acute pharyngitis fail to produce desired results, the internal administration of arsenic and potassium iodide may prove useful. Tar-water may be allowed for drinking in lieu of ordinary water. Hygienic surroundings are of importance.

In the dog chronic pharyngitis is a common affection, being either a sequel to an acute attack or occurring secondary to various diseases. An application composed of 3 parts of tincture of iodine in 25 parts of glycerin, painted over the interior of the pharynx, gives good results in some cases. When the affection is secondary to other diseases, the primary condition must receive suitable treatment. The internal administration of potassium iodide sometimes proves useful.

FORMULA.

Electuary for Acute Pharyngitis in the Horse.

℞ Pulv. Camphoræ ... ... ℥ss.
Pulv. Myrrhæ ... ... ℥ss.
Ext. Bellad. Vir. ... ... ℥ss.
Potassii Chlorat. ... ... ℥i.
Mellis ... ... ℥iv.
Glycerini ... ... ℥iv.

M. Ft. electuarium. Sig.: Give a tablespoonful three times daily on the tongue.

The Treatment of Diseases of the Œsophagus.

The large majority of morbid conditions of the œsophagus met with in practice are of a more or less surgical character, and hence cannot be considered in this work. For information on the subject the reader is referred to our work 'A System of Veterinary Medicine,' vol. ii., in which the treatment of foreign bodies in the œsophagus (choking), dilatation and stricture of the œsophagus, paralysis, and traumatic lesions of the organ, are fully discussed.

Œsophagitis (inflammation of the œsophagus) varies in intensity from a superficial catarrh of the mucosa to erosions and circumscribed hæmorrhages, infiltration and ecchymoses of the submucous tissue, and even ulceration and the presence of neurotic areas, which may involve the muscular as well as the mucous coat. The etiological factors include medicaments of an irritant or caustic nature administered by error, or insufficiently diluted; the swallowing of sharp foreign bodies, such as needles, pins, thorns, etc.; and the careless introduction and manipulation of the probang in cases of 'choking.'

In cases resulting from irritating or caustic medicaments, demulcents should be allowed, such as linseed-tea, barley-water, etc., and the food restricted to milk, oatmeal gruel, etc. In all instances, an electuary containing potassium chlorate, myrrh, belladonna, and liquorice, with honey as a basis, gives relief to the difficulty in swallowing. Fomentations to the region of the œsophagus may be tried in severe cases.

Œsophagismus (spasm of the œsophagus), as a purely

nervous condition depending on unknown causes, is of comparatively rare occurrence. In most instances a lesion of the œsophagus is present, such as constriction, dilatation, or ulceration, etc., and spasm of the œsophagus may then be regarded as a symptom of the morbid conditions mentioned. The affection is manifested either when the animal is feeding or shortly afterwards, and it recurs at irregular intervals. It is characterized by an abnormal contraction of the œsophagus, accompanied by dysphagia, also regurgitation of fluids and sometimes solids through the nostrils, and is associated with marked distress. In some cases the spasm is relieved spontaneously.

As regards medicinal treatment, the hypodermic injection of morphine or atropine has been found to give good results. Chloral hydrate may be administered in the form of enema. Some practitioners advise the employment of the probang in order to overcome the local spasm, and they repeat this procedure if necessary. But in cases where the œsophagus is obstructed by soft ingesta, the probang should not be used, and it is advisable to employ a stomach-tube and to remove the obstruction by means of irrigation with warm water. Hot fomentations and a stimulating liniment applied to the region of the œsophagus may assist in relieving the spasm. Preventive measures include attention to diet, and the avoidance of foods which experience has shown to be likely to induce an attack in a given case.

CHAPTER III

THE TREATMENT OF DISEASES OF THE DIGESTIVE ORGANS *(Continued)*

SECTION III.

THE TREATMENT OF DISEASES OF THE STOMACH IN THE HORSE.

ALTHOUGH acute diseases of the stomach are by no means frequently met with in the horse as compared with intestinal affections in this animal, yet they occur sufficiently often to render the subject of marked importance to the veterinary therapeutist. Owing to difficulties in diagnosis and in differentiating gastric from intestinal affections, we must admit that many occasions arise on which diseases of the stomach are not recognized. Moreover, the results of post-mortem examinations indicate that gastric affections occur more frequently than is generally imagined, and it is very desirable for the practitioner to devote more attention to the subject. One of the first points to strike the careful clinical observer is the importance of recognizing the presence of a gastric affection, so that early and suitable treatment may be adopted. So far as the acute diseases of the stomach are concerned, we may take it for granted that spontaneous recoveries rarely if ever occur, and unless prompt therapeutic measures be taken a fatal result is likely to ensue. It is quite possible that cases which are termed 'spasmodic colic' may occasionally depend on pain originating in the gastric walls, and in such instances a spontaneous recovery may

occur, as in simple colic, which is believed to depend on spasm of the intestines.

But the affections of the stomach to which we allude are those of acute impaction of the organ with ingesta, and acute gastric tympany. There are certain reasons why both of these conditions so frequently prove fatal in the horse. Owing to anatomical and physiological peculiarities in connection with the equine stomach, serious consequences are likely to result when the organ is distended either by ingesta or gases. In the case of impaction, as vomiting rarely takes place in the horse, natural relief by this means does not occur, and we cannot induce vomition by the administration of emetics. Moreover, in severe gastric impaction the walls of the stomach become paralyzed, and therapeutic agents fail to have any effect in causing expulsion of the ingesta through the pylorus into the intestine. Again, the small size of the stomach renders distension of the organ a very serious matter, as rupture of the organ not uncommonly results from gastric impaction and tympany. In severe cases of acute gastric tympany, the peculiar formation of the muscular fibres at the cardia prevents the egress of the accumulated gases by way of the œsophagus, while the 'siphon trap' arrangement of the duodenum, being pressed on and occluded by the distended stomach, prevents the escape of gas by way of the intestines. The stomach thus becomes practically a sealed cavity, and rupture of the organ is likely to occur unless prompt relief be given. Again, owing to the situation of the stomach—*i.e.*, resting on the colon, and not being in contact with the abdominal walls—the use of the trocar and cannula, to permit the gases to escape, is not practicable, although some American veterinarians now state that the procedure can be adopted when other methods of giving relief fail (see p. 581).

Here we may point out that it is not uncommon for impaction and tympany to be associated, the latter resulting from the former. Obviously, when the impaction is extreme, rupture of the organ will soon take place, if tympany occurs. Unfortunately, in many instances, we find on our

first visit to the case that symptoms suggestive of rupture are already in evidence, and treatment is useless. Some authors describe impaction of the stomach and acute gastric tympany under the heading of 'acute gastric indigestion.' But we are of opinion that an attempt should be made to differentiate the affections, although we admit the difficulties in diagnosis and the fact that both conditions may be associated. At any rate, when gastric tympany is the leading feature, special therapeutic measures are indicated.

The Treatment of Gastric Impaction, or Indigestion with Engorgement of the Stomach, in the Horse.

In this condition the stomach is overfilled or impacted with food, the walls of the organ are paralyzed, digestion is arrested, and the gastric contents cannot pass beyond the pylorus. The most frequent cause of the affection is an irrational system of dieting—*e.g.*, feeding on cooked or steamed food, such as barley, wheat, brewers' grains; also allowing large amounts of rye-grass, clover, vetches, etc., especially if the animal be unaccustomed to this form of fodder. The influence of long abstinence from food, associated with prolonged work, must be added to the above as etiological factors, as under such conditions the animal swallows his food quickly without proper mastication, and if a large amount be allowed he is likely to continue feeding until an excessive quantity is ingested.

The **Symptoms** manifested are by no means regular or constant. In some instances abdominal symptoms are in evidence; in others, nervous phenomena predominate, and mask the former. The term 'stomach staggers' is given by some authors to the affection, probably on account of the cerebral symptoms which are the prominent features in certain cases. In the *abdominal* type of the disease the pain is generally dull and continuous, the animal paws, lies down for a brief period, then rises, and again assumes the recumbent position. Occasionally the pain is more marked; in the early stages intestinal tympany is slight, but later on it may be more apparent. When impaction is extreme, neither

eructations of gas nor attempts at vomition occur. If impaction and tympany be associated, acute pain and distress are manifested, and in some instances eructations of gas and occasionally attempts at vomition, with a discharge of liquid material from the nostrils, are observed. Partial sweating, tremors of the superficial muscles, and frothing at the mouth, are sometimes present.

In the *nervous* type, the horse carries his head low, has a dull, sleepy appearance; he may rest his head on the manger or press his forehead against the wall. If forced to walk, he staggers in his gait and has a tendency to drag the toes of the hind-feet on the ground. The respirations may be slow or even stertorous, the pulse is full and slower than normal, the animal offers marked resistance to the administration of drenches, and the medicaments may be returned by the nostrils. Death may occur in a variable time, either from rupture of the stomach or from cerebral complications. Gastritis has been recorded as a complication. In some instances convulsive struggling is observed prior to the fatal termination.

The indications for **Treatment** are to get rid of the mass of fermenting ingesta from the stomach, and to restore nerve tone to the gastric walls.

In severe cases it is quite evident that drugs administered by the mouth can have little, if any, effect in fulfilling the first indication. Moreover, there is grave risk that a portion of the medicament may enter the trachea and bronchi, owing to the resistance offered by the animal. Obviously, treatment of the condition by drugs means that the impacted ingesta must be removed by way of the intestine. Remembering that we have a paralyzed gastric wall to deal with, drugs such as eserine and pilocarpine, administered by hypodermic injection, should give the best results. In our experience, they do not succeed when the impaction is extreme. Cadéac advises a combination of small doses of eserine, pilocarpine, and veratrine, so as to increase the secretions of the stomach and to stimulate gastro-intestinal peristalsis. The initial doses are as follows: Pilocarpine, gr. ii.ss.; eserine, gr. i.;

and veratrine, gr. ii.ss. If necessary, these are repeated from hour to hour in smaller doses—viz., pilocarpine, gr. $\frac{5}{6}$, and eserine or veratrine, gr. ss., until peristaltic action is restored to the gastric walls. Friedberger and Fröhner point out that full doses of eserine or arecoline may induce rupture of the stomach in cases of gastric impaction.

Merillat (*American Journal of Veterinary Medicine*, January, 1914) states that eserine, by further exhausting the stomach in the futile contractions to expel its contents, is always disastrous in impaction of the stomach, and the same applies to other powerful drugs resorted to for serious colics.

American practitioners record marked success by washing out the stomach by means of the stomach-tube. It is claimed that a large amount of ingesta can be removed by gastric lavage; moreover, the fluid which is pumped into the stomach has also the effect of softening the impacted ingesta. For details as to the technique of employing this instrument, see p. 822.

In less severe cases a drench composed of 2 to 4 ounces of oil of turpentine or terebene and 1 ounce of tincture of nux vomica, in 2 pints of raw linseed-oil, often gives good results, and also prevents the occurrence of tympany. Some practitioners prefer to give a full dose of aloes in solution, with a view to clear out the intestines, and thus to stimulate the movements of the stomach in a reflex manner.

In cases where abdominal pain is a prominent symptom, 1 ounce of chloral hydrate may be given in solution; this drug does not interfere with the movements of the stomach or intestines, and, moreover, it checks fermentation in the gastric contents. Opiates of all kinds are contra-indicated, as they inhibit peristaltic movements, and induce stasis and tympany in the gastro-intestinal canal.

When nervous symptoms predominate, some practitioners advise early venesection in addition to the administration of purgatives. Unless excitement and convulsive struggling be present, nerve sedatives are not indicated. When colicky pains are manifested, the attendant should be instructed to prevent the horse from rolling, as there is reason to believe

that, if the animal throws itself about, the risk of rupture of the stomach occurring is much increased.

The after-treatment consists in attention to diet, and large feeds should be avoided. After a severe attack, it is well to limit the diet to oatmeal gruel and linseed gruel for a few days. In order to assist in restoring the gastric functions to a normal condition, it is advisable to administer the following powder in the food twice daily : Powdered Nux Vomica, ʒss., Sodium Bicarbonate, ʒii., Powdered Gentian, ʒii., Powdered Aniseed, ʒii.

As regards preventive measures, a rational method of feeding should be advised, boiled foods ought to be avoided, and regular hours of feeding should be adopted. When horses tend to ' bolt their food,' chopped hay should be mixed with the oats. It is also advisable to examine the molar teeth, in order to detect the presence of dental irregularities which require surgical attention.

The Treatment of Acute Gastric Tympany in the Horse.

In this condition the stomach is distended with gases arising from fermentation of the ingesta. It may occur in the absence of any morbid alterations of the gastric walls. Judging by the fact that it is not uncommon to find a recurrence of the attack in the same animal, it is rational to conclude that in some cases, at least, gastric digestion is at fault. Although impaction to a varying extent may be associated with gastric tympany, still, we meet with cases in which the amount of ingesta in the stomach does not appear to exceed the normal. The extent to which the stomach of the horse may be distended by gases, without rupture of the organ being produced, is often surprising. In cases of moderate severity, a certain amount of relief may be obtained by eructations of gas—*i.e.*, the gas partially overcomes the cardiac sphincter, enters the gullet, and is expelled in small amounts by the nostrils ; this symptom when present is a valuable aid to diagnosis. But in severe cases the cardiac end of the stomach is firmly closed, the pylorus is in a

similar condition, and the organ becomes enormously distended with gases, which are unable to escape in any direction. Under such conditions it is not surprising that gastric tympany is a very fatal affection, and measures for relief must be carried out early. A common cause of death in this disease is rupture of the stomach, although cases are not uncommon in which, owing to the extreme distension of the organ, pressure is exerted on the diaphragm and asphyxia results.

As regards the **Etiology** of the affection, the causes are similar to those mentioned as etiological factors in the case of gastric impaction. It is not easy to explain why similar causes should produce impaction in one instance and tympany in another. As previously remarked, both conditions may be associated, but, obviously, if impaction were present to any extent, the occurrence of tympany would quickly produce rupture of the stomach.

The **Symptoms** in some cases of acute gastric tympany are characterized by great violence and distress. The animal becomes uncontrollable and throws itself about, sweats profusely and exhibits extreme respiratory disturbance. In the early stages of other cases, ordinary colicky symptoms may be manifested, and the nature of the attack may not be recognized at the time. Again, it is not uncommon to find the animal standing, and showing greatly accelerated respirations of a peculiar gasping character, tympanites, a weak pulse, a haggard expression of countenance, salivation, sweating, eructations of gas (see p. 51), often accompanied by a trickling of fluid ingesta from the nostrils. These phenomena may be present from the outset, or may succeed the violent symptoms. As already remarked, in cases of extreme gastric tympany eructations are absent, and the nature of the case may be overlooked. Tympanites, as a rule, is not well marked, unless the affection be complicated with intestinal tympany. Generally the abdomen presents a ' full ' appearance, and often there are evidences of tympany in the anterior region of the abdomen, on the left side, close to the last rib. ' Sitting on the haunches ' may be observed in some cases, but this is by no means a diagnostic feature

(see p. 48). When an attempt is made to administer a drench, the animal violently resists, and it is not uncommon for some of the medicament to be returned by the nostrils. Even if we succeed in administering medicines such as anodynes, no effects are produced, owing to the fact that they are retained in the paralyzed stomach.

The indications for **Treatment** are obvious, viz., to cause expulsion of the accumulated gases present in the stomach, and to prevent a recurrence. The difficulty of accomplishing this double object in severe cases is well known to all clinicians.

In less severe cases, good results follow the administration of a drench composed of terebene, 4 ounces; pure carbolic acid, 2 drachms; and raw linseed-oil, 2 pints. These favour the expulsion of gas by way of the pylorus, prevent fermentation in the ingesta, and thus inhibit the formation of further gas. Caulton Reeks advises the administration of strong solution of ammonia, combined with sulphate of iron dissolved in hot water (see formula, p. 586). The rationale of this treatment is that the free ammonia absorbs the carbonic acid gas which is present (forming carbonate of ammonia), while the freshly precipitated hydrate of iron which is formed in the mixture absorbs the sulphuretted hydrogen. This procedure is to be followed up with the administration of terebene or oil of turpentine in raw linseed-oil, and by a dose of eserine hypodermically. This latter drug by inducing energetic intestinal movements may succeed in overcoming the spasmodic contraction of the pylorus that is present. Quitman (Chicago Veterinary College) strongly advises salicylic acid (℥ss.) given in the form of capsule (repeated in one-half to one hour if necessary), and followed by a dose of eserine (gr. i. to gr. i.ss. hypodermically). He points out that arecoline should not be prescribed in gastric tympany, as it commonly causes the death of the patient.

Here we may remark that in severe cases medicinal treatment is likely to fail; moreover, when violent symptoms are present, the administration of drenches may be impossible, and, besides, are dangerous owing to the risk of the fluids gaining entrance to the trachea and bronchi. We are of

opinion that the only chance of saving the patient's life under these conditions is by the employment of the stomach-tube. If the symptoms be so violent that it would not be safe to attempt the use of this tube, we advise that chloroform be administered with the horse in the standing posture until a light degree of narcosis is induced. For the technique of the employment of the stomach-tube and the carrying out of gastric lavage, see p. 822.

Pringle (University of Toronto) advises that after gastric lavage the following solution should be injected into the stomach by means of the stomach-tube: Creolin, 1 ounce; hot water, 2 gallons. The same writer adopts puncturing of the stomach in cases where other methods of treatment fail (*vide Veterinary News*, July 24, 1915). The following are the conditions under which he considers this operation is indicated: 'When the horse is in great distress, when the stomach-tube cannot be used, when danger exists of rupture of the gastric walls, or when relief cannot be obtained by the use of the stomach-tube as, owing to the amount of ingesta in the stomach, the end of the tube penetrates the mass of food, thus preventing the escape of the gases.' A special long trocar and cannula are necessary. The site of operation is at the anterior border of the tenth rib on the left side, just at the lower border of the longissimus dorsi muscle, at the angle of the rib. The instrument is inserted, pointing it towards the opposite or right fore-foot, or downwards, inwards, and forwards, at the time of full expiration. The instrument should be pushed 'well home,' and the trocar is then withdrawn so as to let the gas escape. Pringle also points out that it is absolutely necessary for the diagnosis to be correct, as the stomach must be in a state of distension if the procedure is to be successful. Quitman (Chicago Veterinary College)* states that 'tapping of the stomach by means of an extra long trocar and cannula was tried by Dr. J. Hughes some fifteen or eighteen years ago, but was discarded as being dangerous and inefficient.'

* 'Colics and their Treatment.' Edited by D. M. Campbell, D.V.S., 1914.

Here we may point out that, if marked intestinal tympany be associated with gastric tympany, tapping of the intestine by means of a trocar and cannula should be performed. It is also well to remember that in some cases of twist of the double colon the symptoms may simulate those of gastric tympany, especially during the early stages and on the first examination of the patient. For the differential diagnosis, the reader is referred to our article on Gastric Tympany in 'A System of Veterinary Medicine,' vol. ii., p. 114.

The after-treatment of cases of gastric tympany is similar to that advised for impaction of the stomach.

The Treatment of Acute Gastritis in the Horse.

Acute Gastritis is also known as 'Acute Inflammation of the Stomach' or 'Acute Gastric Catarrh.' According to the majority of authors, it is of rare occurrence in the horse, as a disease *per se*. In our experience, uncomplicated gastritis of a serious and often fatal nature, such as we encounter in cattle and dogs, seldom occurs in the horse except as the result of irritant poisoning, either mineral or vegetable. But gastritis in varying degrees of intensity is not uncommon in connection with certain gastric and intestinal affections. In such it may be the primary disorder, or in the case of gastric impaction it may be the result of irritating ingesta in the stomach. A simple gastric catarrh is no doubt often present, but owing to a lack of diagnostic symptoms it is not recognized. Again, gastritis is not infrequently associated with enteritis, and complicated with acute brain symptoms; this is regarded as being of a toxæmic nature, but the etiological factors have not been definitely determined.

As regards the **Etiology** of simple gastric catarrh, the following are recognized as causes of the condition: Dietetic errors, general debility, mouldy hay or oats, the presence of parasites, infectious diseases such as influenza, and chronic affections of the heart or liver causing interference with the venous circulation in the stomach.

The **Symptoms** vary according to the intensity of the gastric lesions. In mild cases we observe a capricious appetite,

dulness, unfitness for exertion, a sour, soapy condition of the tongue and buccal mucosa, and in some instances diarrhœa may be present. In more severe cases, uneasiness, pawing, intermittent colicky pains, especially after feeding, an anxious expression of countenance, partial sweating, particularly on the sides of the neck and shoulders, and an intermittent turning of the head towards the flanks. In very acute cases regurgitations and eructations may be observed (see p. 51). When gastro-enteritis is present, the intestinal symptoms usually predominate.

The indications for **Treatment** are to give the stomach as much rest as possible, and to administer agents likely to allay irritation of the gastric mucosa. Hence the diet should be restricted to oatmeal gruel, linseed gruel, barley-water, hay-tea, milk, etc. Bicarbonate of soda may be given in the drinking-water twice daily. When uneasiness or actual pain is present, extract of belladonna may be prescribed in the form of electuary three times daily. If the pain be severe, a dose of chloral hydrate well diluted with linseed-tea, and administered as a drench, is indicated. Opiates should be avoided. After-treatment consists in prescribing nux vomica, sodium bicarbonate, and gentian, in the food twice daily.

When gastritis is complicated with enteritis, treatment similar to that indicated for the latter affection (see p. 637) should be ordered. Acute gastro-enteritis usually proves fatal in spite of treatment, and this also applies to gastritis complicated with meningitis.

In cases of toxic gastritis (due to irritant or corrosive poisons), gastric sedatives with demulcents, oleaginous materials, milk, raw eggs, etc., should be given.

The Treatment of Chronic Gastritis, also known as Chronic Gastric Catarrh, Chronic Indigestion, Chronic Dyspepsia.

Some authors attempt to differentiate chronic indigestion or dyspepsia from chronic gastric catarrh. The former condition is regarded as signifying a disturbance of the physiological function of the stomach without any demonstrable

alterations in the structure of the gastric mucosa. While admitting that cases of dyspepsia may occur in the absence of any lesion of the gastric mucosa, we must point out the impossibility of differentiating clinically such cases from chronic gastric catarrh. Moreover, if dyspepsia be in existence for any length of time, organic changes will be produced in the gastric mucous membrane. Hence we deem it advisable to discuss these subjects under one heading, especially as the symptoms and treatment are practically identical.

In cases of dyspepsia which do not depend on chronic gastric catarrh, it is probable that the nervous mechanism of the stomach is at fault, as in the so-called 'nervous dyspepsia' of man.

In the majority of instances, however, chronic indigestion or dyspepsia may be described as a condition in which disturbed digestion is associated with increased formation of mucus, alterations in the quantity or quality of the gastric secretion, morbid changes in the mucosa, weakening of the muscular coats, and retention of ingesta in the organ for an abnormal time. The result of these morbid phenomena is that digestion in the stomach is imperfectly performed, and the ingesta enters the intestine in an unfit condition; hence nutrition becomes deficient, and the products of imperfect digestion become absorbed and exert a deleterious effect on the system. There is sufficient evidence to show that chronic gastritis predisposes the animal to an attack of gastric impaction or tympany, and also to intestinal disorders.

The following **Causes** are recognized in the etiology of chronic gastritis or chronic dyspepsia: Continued errors in dieting, irritating or indigestible foods, damaged fodder, imperfect mastication due to dental irregularities, general debility occurring as a sequel to influenza, etc., or in connection with old age; permanent congestion of the gastric mucosa depending on chronic affections of the liver or on cardiac valvular disease; dilatation of the stomach, and the presence of parasites.

The **Symptoms** observed include a capricious appetite, a

tendency to eat clay, excrement, etc., and to lick the walls of the stall; thirst, a sour, pasty condition of the mouth, a dry scurfy skin, this structure losing its normal pliable condition, and becoming firmly attached over the region of the ribs ('hide-bound'); irregular action of the bowels, constipation being present in some instances, and diarrhœa in others, especially when the horse is worked or exercised; loss of condition, dulness, disinclination for exertion, and a tendency to sweat even at gentle exercise. In some cases intermittent attacks of colic are observed, in others an irregular or intermittent pulse is present, and cardiac palpitation occurs during slight exertion. Nervous phenomena, such as vertigo, can be traced to dyspepsia in some instances.

In the **Treatment** of chronic gastric catarrh and dyspepsia, attention must be directed to the cause of the affection. Many cases prove very obstinate in spite of therapeutic measures, because it is difficult to discover the etiological factors on which they depend. Suitable food and regular hours for feeding are of first importance in treatment. The teeth should be examined for the presence of dental irregularities. A moderate purgative is usually indicated. After the action of this has passed off, salines such as a combination of sulphate of soda, chloride of soda, and bicarbonate of soda, given twice daily in the food or drinking-water, are often productive of good results. Cases are, however, met with in which an acid treatment succeeds best, and for such dilute hydrochloric acid in a dose of 2 drachms may be prescribed twice daily in the drinking-water. When the appetite is not in abeyance, probably the time-honoured combination of nux vomica, bicarbonate of soda, and gentian, given twice daily in the food, proves as useful as any.

When there is total refusal of food, on no account should drenching with gruel, etc., be adopted, as by waiting for a time and tempting the animal with suitable diet the appetite will gradually be restored. In cases following debilitating diseases and associated with anæmia and loss of tone in the gastric walls, carbonate of iron with nux vomica and small doses of Fowler's solution of arsenic, given in the food twice

daily, often prove beneficial. Rock-salt should be placed within reach of the patient, and a plentiful supply of drinking-water allowed. In obstinate cases where drugs have failed, we have often seen the best results from putting the animal on good pasture.

Formulæ.

Drench for Gastric Impaction.

℞ Terebeni ... ... ℥iv.
Tr. Nucis Vom. ... ... ℥i.
Ol. Lini ... ... O.ii.

M. Ft. haustus. Sig.: Give at once.

Sedative Drench in Case of Cerebral Excitement.

℞ Chloral Hyd. ... ... ℥i.
Potassii Bromidi ... ... ℥i.
Mucilaginis ... ... q.s.
Aquæ ... ... O.i.

M. Ft. haustus. Sig.: Give in one dose. Repeat in two hours if necessary.

Tonic Alkaline Powders during Convalescence.

℞ Pulv. Nucis Vom. ... ... ʒvi.
Sodii Bicarb. ... ... ℥vi.
Pulv. Gentianæ ... ... ℥iii.
Pulv. Anisi ... ... ℥iii.

M. Div. in pulv. xii. Sig.: Give one twice a day in the food.

Drench for Acute Gastric Tympany.

℞ Terebeni ... ... ℥iv.
Ac. Carbol. Pur. ... ... ʒii.
Ol. Lini ... ... O.ii.

M. Ft. haustus. Sig.: Give at once.

Anti-tympanitic Drench for Gastric Tympany.

℞ Ferri Sulph. Pulv. ... ... ℥i.
Liq. Ammon. Fort. .. ... ʒiv.
Aquæ (ferv.) ... ... O.ii

M. Ft. haustus. Sig.: Administer at once. Shake mixture so as to include the resulting precipitate.

The above to be followed by—

℞ Terebeni ... ... ℥ii.
Ol. Menth. Pip. ... ... ℥i.
Ol. Lini ... ... O.i.ss.

Ft. haustus.

(H. C. REEKS.)

Capsule for Gastric Tympany.

℞ Ac. Salicylici ... ... ℥ss.
Ext. Nucis Vom. Fl. ... ... ℥ii.
Pulv. Zingib. ... ... ℥ii.

M. Sig.: Administer in the form of capsule. Repeat in one-half to one hour if necessary.

(E. L. QUITMAN.)

Electuary for Acute Gastritis.

℞ Ext. Bellad. Vir. ... ... ℥i.ss.
Sodii Bicarb. ... ... ℥iii.
Mellis ... ... ℥viii.

M. Ft. electuarium. Sig.: Give a tablespoonful every four hours.

Saline Powders for Dyspepsia.

℞ Sodii Sulph. Exsicc. ... ... ℥v.ss.
Sodii Bicarb. ... ... ℥ii.ss.
Sodii Chlor. ... ... ℥iv.ss.

M. Div. in pulv. vi. Sig.: Give one twice a day dissolved in the drinking-water.

Mixture for Dyspepsia associated with Anæmia and Debility.

℞ Ferri Carb. Sacch. ... ... ℥ii.ss.
Tr. Nucis Vom. ... . ℥ii.
Liq. Arsenicalis (B.P.) ... ... ℥v.
Mellis ... ... ℥vi.
Aquæ ... ... ad O.i.

F. M. Sig.: Give a wineglassful twice daily in the food.

CHAPTER IV

THE TREATMENT OF DISEASES OF THE DIGESTIVE ORGANS *(Continued)*

SECTION IV.

THE TREATMENT OF DISEASES OF THE STOMACH IN CATTLE.

As already mentioned, diseases of the intestines are of far more common occurrence in the horse than gastric affections. In cattle the opposite is the case; and this is not surprising when we consider the complicated arrangement of the stomach in the ruminant, and the important part this organ fulfils in the process of digestion in this species. The subject of diseases of the stomach in cattle is a very extensive one, and we may add that the diagnosis and treatment of gastric affections in the ruminant form a large proportion of the daily work of the practitioner of bovine medicine. Lack of sufficient space prevents us from entering into a full consideration of these various diseases, but for full and complete information on the subject the reader is referred to Mr. H. Begg's article in our 'System of Veterinary Medicine,' vol. ii., under the heading of 'Diseases of the Digestive System in Cattle.' Here we can only deal briefly with the treatment of these affections.

Of the four compartments or divisions of the bovine stomach, the rumen (or paunch) and the abomasum (known as the fourth stomach) are those which are most likely to suffer from disease. Much difference of opinion exists as regards the

liability of the omasum (or third stomach) to be primarily affected by impaction and paralysis, and the question is still to some extent *sub judice*. Many practitioners in the present day hold that the so-called impaction of the omasum is in reality a secondary condition associated with inflammation of the abomasum, and often accentuated by the irrational treatment adopted by owners of animals.

In spite of the fact that abundant opportunities are offered for post-mortem examinations in the digestive diseases of cattle, it must be admitted that our knowledge of the etiology, pathology, diagnosis, and treatment of gastric affections leaves much to be desired. Moreover, the mortality from such diseases in many districts is very high, as there is a tendency for the owners of cattle to administer large doses of Epsom salt in an indiscriminate manner before requisitioning the attendance of the practitioner. Hence, the veterinary surgeon not uncommonly finds that the treatment adopted has added considerably to the gravity of the case, and converted what might have been a curable condition into an incurable one. It cannot be denied that the diagnosis and treatment of gastric affections requires a high degree of discrimination, skill, and careful observation on the part of the practitioner, and when this fact is recognized by stock-owners, and professional aid sought early, the mortality from these diseases will be considerably reduced.

The special anatomical arrangement of the stomach in the ruminant, and the complex manner in which gastric digestion is performed, render derangements of this organ of very serious import. When one compartment is unable to perform its function, the remaining divisions become affected in a secondary manner; hence digestion is arrested, rumination ceases, appetite is lost, and various abnormal phenomena occur which more or less threaten the life of the animal. It is of the greatest importance to ascertain the actual morbid condition that is present, and there are many occasions on which prompt and energetic treatment is essential in order to avert a fatal termination.

The large extent of the bovine stomach, the enormous

amount of ingesta that it contains, and the facility with which atony or paralysis of its walls occurs, render the employment of successful therapeutic measures exceedingly difficult in many instances. Attempts to overcome such conditions by the administration of powerful drastic purgatives are doomed to failure, while much benefit will accrue from a careful consideration of the seat and nature of the affection which is present, and the means at our command to restore the gastric functions to a normal state.

Here we may remark that drenching should be avoided as much as possible, in consequence of the dangers attendant on the procedure when carried out by careless attendants. Many medicines can be given to cattle in the form of electuary with safety and efficiency.

The Treatment of Impaction of the Rumen.

This is also known as 'Plenalvia' or 'Mawbound.' In this condition there is an inordinate accumulation in the rumen, of food which has little tendency to undergo fermentation or putrefaction. As a rule the accumulated material is of a solid nature, but occasionally it consists of a semi-fluid farinaceous aliment. The degree of solidity varies according to the nature of the food ingested.

The following etiological factors are recognized: Dietetic errors; sudden changes of food, especially from a low to a rich diet; insufficiency of water; an excess of brewers' grains, etc.; any circumstance which interferes with rumination; a gluttonous feeder gaining access to an over-abundant supply of food (in which case impaction of the rumen may be rapidly established); any conditions which induce an atonic state of the walls of the rumen; an allowance of too much fodder to animals recovering from any illness.

The **Symptoms** observed are—A rotund condition of the abdomen; palpation of the left flank shows a doughy, sodden condition of the rumen, and, when pressure is applied, the imprint of the fingers remains for a time; in many instances the engorged organ causes a bulging of the flank; the movements in the walls of the rumen are absent; appetite is lost

and rumination is suspended; the animal is dull, arches the back, and sometimes may show restlessness and twitching of the tail; grinding of the teeth and moaning during expiration, especially when in the recumbent position; accelerated respirations may be observed, and also constipation. In acute cases, tympanites may be present. In other instances the affection is gradual in its development. Death may occur from cerebral complications and exhaustion, or gastro-enteritis may supervene.

The indications for **Treatment** are to restore tone to the walls of the rumen, to soften and cause expulsion of the retained ingesta, and to prevent fermentation and the occurrence of tympany. We prescribe first a full dose of Epsom salt, combined with 1½ ounces of fluid extract of ginger, and administered in 1 pound of treacle and 3 pints of warm water. This is followed up with carbonate of ammonia, nux vomica, gentian, and ginger, given in warm ale or strong coffee, every four hours until purging commences (see formula, p. 604). A combination of nux vomica, bicarbonate of soda, and gentian, may then be given in the form of electuary, three times daily.

If, after the purgative has acted, recovery does not occur, and a relapse seems imminent, moderate and repeated doses of common salt should be administered. H. Begg advises that the first dose (about 8 ounces) should be mixed with treacle and ginger, and given in the form of an electuary. This causes thirst, and smaller doses are then readily taken in the drinking-water. This agent, with the saliva and fluids swallowed, tends to soften the mass of ingesta in the rumen, and also exerts an aperient action, without producing irritation and subsequent inertia of the alimentary canal. Some practitioners claim success from the hypodermic injection of eserine and pilocarpine, or arecoline, but, in our experience, such agents either fail to act or hasten the fatal termination.

American practitioners advise irrigation of the rumen with large amounts of warm water, carried out by means of a stomach-tube. There is much to recommend this method, and the procedure is a comparatively simple matter.

H. Thompson advises the following treatment: Take 3½ pounds of fat bacon, cut it into small pieces, and boil for two or three hours in water containing 6 ounces of common salt. Mix with 2 pints of milk, and administer as a drench. He has found this treatment far more efficacious than giving raw linseed-oil.

If the above treatment prove futile, the operation of rumenotomy should be performed, and the contents of the rumen removed by hand. For full details of this operation, see H. Begg's article in our 'System of Veterinary Medicine,' vol. ii., p. 358. This procedure should be adopted before the patient's strength is too far reduced. During convalescence from impaction of the rumen, bitter stomachics may be given in the form of electuary twice daily. Attention to diet is necessary, small amounts of easily digested food are indicated, such as bran-mashes, oatmeal gruel, linseed gruel, hay-tea, etc. Very small amounts of good hay may be allowed, in order to induce rumination.

The Treatment of Tympanites of the Rumen.

This is also known as 'Hoven,' 'Gaseous Indigestion,' 'Tympanitic Indigestion,' etc. It is a condition characterized by an abnormal accumulation of gas in the rumen, causing distension of that organ, and associated with paralysis of its walls. It may be primary, as in cases immediately succeeding the ingestion of unsuitable food, or it may be secondary—*i.e.*, when it occurs as a symptom in connection with various gastric affections or morbid states. Whether as a primary affection of the rumen or as a symptom, it is probably the most common abnormal condition met with in bovine practice. When occurring in an acute severe form it must be regarded as a serious danger to life, owing to the pressure exerted by the enormously distended rumen on vital organs, such as the heart and lungs; hence the necessity for early and energetic treatment. On the other hand, recurring attacks of tympanites, constituting the chronic type of the disease, often prove a grave symptom, and demand the utmost care and discrimination on the part of the practitioner, in order to

discover the cause of the morbid phenomenon and to adopt suitable and efficient treatment.

It is important to point out that acute tympanites may occur in two forms: in one the gas is present in a free state in the rumen, between the ingesta and the walls of the organ; in the other it is intimately mixed up with the aliment, floating it up in a frothy, yeasty condition.

The following **Causes** of acute tympanites are recognized: (1) In cases of 'choking,' when the animal, after eating succulent roots, suffers from obstruction of the œsophagus, due to inability to swallow an awkwardly shaped, or perhaps hard, portion of root. Under these conditions the gas present is free, and readily got rid of by 'tapping,' or by eructations, when the obstruction is removed. (2) Errors in dieting, such as turning hungry cattle into a field of clover, especially the aftermath succeeding the hay-crop when wet with rain or dew. (3) Sudden changes of food, the ingestion of frozen roots, etc., damaged fodder, poisonous plants or shrubs, drinking large quantities of very cold water (in the case of dry-fed cattle). Driving animals a long journey immediately after feeding is also an etiological factor. A varying degree of tympany is often observed in cases of milk-fever, if the cow be allowed to lie flat on her side for any length of time.

The prominent **Symptoms** observed are—Rapid 'ballooning' of the left flank, which may be so marked that it reaches the level of the spinal column. The swelling rebounds when pressed, and when the gas is free the drum-like condition is best marked. The animal is restless, crouches and stamps its feet, kicks at its abdomen and arches its spine. The respirations become distressed and laboured, owing to the increasing pressure on the diaphragm and lungs; marked cardiac palpitation is present, also panting, moaning, and salivation; the nostrils are widely dilated, the mouth is open, and the tongue protrudes; the visible mucous membranes are cyanotic, and the eyes are staring. Unless speedy relief be afforded, the animal reels, staggers, and falls insensible, death occurring from asphyxia, due to

interference with respiration. In some instances the immediate cause of death may be syncope, or possibly nervous shock. Rupture of the rumen is not a common lesion, on post-mortem, but rupture of the diaphragm is of fairly frequent occurrence. An acute case may die in thirty minutes, but the patient usually does not succumb for two or three hours.

The indications for **Treatment** are to give a means of exit to the gas, and to adopt measures to prevent it recurring. In urgent cases treatment must be prompt, and if the gas be free in the rumen, the trocar and cannula should be employed. For the technique of this operation, see p. 826. If it be found that very little free gas escapes, accompanied by bubbling of a semi-fluid material from the cannula, the operation will not succeed, and rumenotomy must be carried out. (For details, consult 'A System of Veterinary Medicine,' vol. ii., p. 358.) Under such conditions the use of the hollow probang will also fail to give relief.

In cases of emergency, puncture of the rumen must be carried out by means of a knife, the site selected being the same as when a trocar and cannula are at hand—viz., a spot equidistant from the last rib, the external angle of the ilium, and the transverse processes of the lumbar vertebræ. The incision should be made in a perpendicular direction. When a number of cattle are affected simultaneously with acute tympany of the rumen, as the result of gaining access to a clover field, the practitioner must give speedy relief by making an incision into the rumen of each animal with a sharp knife, so that the foaming ingesta may to some extent escape of itself, or by the help of an assistant holding the lips of the wound apart. Further treatment can then be carried out at leisure, when the danger of fatal asphyxia has been averted.

In less severe cases of tympany of the rumen, medicinal treatment may succeed. A useful drench is composed of from 2 to 4 ounces of oil of turpentine, 2 drachms of carbolic acid, 30 minims of oil of peppermint, and 2 pints of raw linseed-oil. This may be followed up with a saline purge

composed of—Epsom salt, 12 ounces; fluid extract of ginger, 1 ounce; treacle, 1 pound; and water, 3 pints. After the purgative has acted, nerve tonics and stomachics are indicated, such as a combination of nux vomica, gentian, common salt, and ginger, administered in the form of electuary, three times daily. During convalescence attention to diet is necessary, and light food easy of digestion should be ordered. The liability of a recurrence must be kept in view, and suitable instructions should be given to the attendant with regard to the treatment in case of a return of the attack.

Chronic Tympanites signifies an habitually intermittent or persistent gaseous distension of the rumen. It may be due to a variety of conditions, and must be regarded as a symptom. The chances of success attending treatment depend on whether the morbid condition to which the symptom is due can be influenced favourably by therapeutic measures, or otherwise. Obviously, when tympany results from organic diseased states, such as the presence of enlarged glands, tumours, abscesses, etc., implicating the œsophagus and preventing the normal eructation of gases, or adhesions of the rumen to other organs or to the abdominal wall, treatment will be of no avail. Again, in the case of foreign bodies in the rumen, especially if located in the vicinity of the œsophageal groove, and impeding rumination and eructations of gas, a successful result will not be achieved unless their presence be recognized and surgical measures (rumenotomy) adopted. Similar remarks will apply to accumulations of sand in the rumen. The condition termed 'traumatic indigestion,' resulting from the passage of a sharp-pointed foreign body from the reticulum, towards the heart, is another cause of chronic tympany, and unless the case can be benefited by operation medicinal treatment is useless.

The cases in which therapeutic measures are likely to prove of service are those depending on atony of the walls of the rumen and functional derangements of the organ, or on curable instances of inflammation of the abomasum.

The **Symptoms** usually follow feeding; and the tympany varies in degree, but it is generally moderate, and the accumulated gas is free in the viscus. Rumination is very irregular, the appetite is capricious and may be depraved, and loss of condition soon occurs.

Owing to the difficulty of diagnosis in many instances—*i.e.*, in ascertaining the actual condition on which the tympany depends—treatment is often carried out in cases that are incurable. Oil of turpentine given in raw linseed-oil affords temporary relief, and a moderate saline purge is usually indicated. In cases depending on atony of the gastric walls, nux vomica combined with gentian, carbonate of ammonia and ginger, administered in ale, three times daily, may prove of service. We have observed good results from formalin, 2 drachms; fluid extract of nux vomica, 1 drachm; and fluid extract of ginger, 1 ounce; given in 2 pints of ale, once or twice daily.

If the accumulation of gas becomes extensive, the trocar and cannula must be employed, and in some cases the cannula must be kept *in situ* for long periods, as otherwise the tympany rapidly recurs. A long course of treatment is rarely justifiable, and it is better practice to perform an exploratory rumenotomy in order to discover, if possible, the cause of the tympany.

Attention to diet is necessary: the food should be sparing in amount and easy of digestion, such as bran-mashes, demulcent drinks, and a moderate quantity of good hay. Bean or pea meal should be interdicted. In cases where the practitioner suspects tuberculosis, the tuberculin test should be carried out.

Impaction of the Omasum.

There is considerable difference of opinion even amongst practitioners of experience in bovine medicine with reference to the existence of impaction of the omasum as a primary affection. Under the heading of 'Fardel-bound,' 'Dry Murrain,' and various other meaningless terms, the majority of authors who wrote on diseases of cattle described impaction

of the omasum. A clinical picture of the affection was given, also post-mortem appearances, while the treatment advised consisted of drastic purgatives. W. Williams ('Principles and Practice of Veterinary Medicine') challenged the accuracy of the existing views on the subject, and brought forward very convincing evidence to show that the condition described as 'fardel-bound' in reality depended on inflammation of the abomasum—a true gastritis. Moreover, he drew attention to the fact that it was not uncommon to find in healthy cattle, slaughtered at abattoirs, a dry condition of the contents of the omasum. In the present day there are still practitioners who profess to diagnose impaction of the omasum, and who claim that the condition must be overcome by the administration of drastic cathartics. In our opinion, when a well-marked dry, hard condition of the omasum is found on post-mortem examination, a further search will reveal some lesions of the other divisions of the stomach—generally inflammation of the abomasum. The common practice of administering large and repeated doses of cathartics, such as Epsom salt, no doubt contributes to the occurrence of gastritis. Evidence is not wanting to show that, even admitting impaction of the omasum to occur as a morbid condition, the administration of purgatives has no effect in getting rid of the contents of the viscus, or of restoring its nerve-power and overcoming the atony that is present. The more rational view would appear to be that the functions of the omasum are in abeyance when morbid conditions of other divisions of the stomach are present; the contents of the former then become desiccated, and its leaves become paralyzed. Obviously, treatment should be directed to restoring the various divisions of the stomach to a normal condition, and this indication will not be fulfilled by adopting heroic measures, and attempting to expel the contents of the omasum by administering large and repeated doses of drastic cathartics. Hence, we do not consider that it is desirable to map out a line of treatment for a condition that is problematical. If it exists, and depends on atony of other divisions of the stomach, measures calculated to restore nerve-power and functional activity to these may prove

of benefit, if carried out sufficiently early and before irrational and heroic treatment is adopted. If, on the other hand, inflammation of the abomasum be the primary affection, suitable therapeutic measures for that condition must be prescribed (see p. 600).

Unfortunately, in very many instances, the owner of the animal renders the case beyond any hope of successful treatment, owing to the pernicious custom of administering large and repeated doses of Epsom salt, prior to seeking professional assistance.

The Treatment of Acute Gastritis.

The usual seat of acute gastritis in cattle is the abomasum (the true digestive stomach). Cases of inflammation of the rumen and reticulum are occasionally met with, but are seldom diagnosed. Probably, in ordinary practice, one of the most common affections encountered is *abomasitis* (inflammation of the abomasum), and the mortality resulting is very high, especially in districts where cattle-owners administer large doses of purgatives prior to seeking professional advice. Although inflammation of the abomasum may commence as a disease *per se*, the other divisions of the stomach soon become implicated, atony and arrest of function being produced, or, *per contra*, the anterior division of the stomach may be the primary seat of disorder, and abomasitis sets in as a complication. Acute gastritis is often associated with enteritis; the condition is then termed *gastro-enteritis*, but the differential diagnosis is surrounded by much difficulty. We have already drawn attention to the so-called 'fardel-bound,' and pointed out that atony and impaction of the omasum are probably associated with inflammation of the abomasum in many instances.

Owing to the anatomical position of the abomasum, it is difficult to insure that gastric sedatives in an active state will reach the organ, as when administered the medicaments probably enter the rumen, and become mixed with the ingesta therein. Moreover, all the anterior divisions of the stomach simultaneously suffer from atony, which still further lessens

the chances of medicinal agents reaching the abomasum. Hence, acute gastritis must be regarded as a very serious affection in cattle, and one in which the resources of the clinician are severely taxed in order to devise a line of treatment which is likely to prove of benefit to the patient.

The **Etiology** of acute gastritis is often obscure, and cases are encountered in which it is impossible to ascertain the causal factor. Of course, when the condition is due to the ingestion of irritant poisons, the history of the case will suggest the etiology. Amongst the causes brought forward are—Exposure to chills (this is regarded as a contributory factor, which by lowering vital activity renders the gastric mucosa susceptible to the attacks of micro-organisms), coarse irritant pasture, mouldy and fermenting food-stuffs, decomposing roots and potatoes, artificial meal made from foreign cereals, etc. In our experience, the majority of cases are met with in autumn, especially during a very dry season, when the pastures become rank and coarse, and the water-supply is deficient. The exact manner in which coarse innutritious pasture induces inflammation of the abomasum is not yet satisfactorily explained It seems very probable that microbial infection plays an important part in the etiology of some cases of gastritis.

The **Symptoms** vary according to the severity of the gastric lesions, and they are also modified in cases complicated with an affection of the anterior divisions of the stomach, or with enteritis. Very often the only history given by the owner is that the animal went suddenly off its food, ceased to ruminate, manifested a grunt, and showed obstinate constipation in spite of large and repeated doses of Epsom salt and other purgatives. There may be an entire absence of well-marked symptoms, the animal grunts or moans at intervals, becomes weaker, and finally goes down and is unable to rise, death resulting from exhaustion.

In other instances one of the primary symptoms is diarrhœa, which is succeeded by obstinate constipation. In others, again, a primary constipation gives way to a profuse, fœtid, tarry or chocolate-coloured diarrhœa; this generally

indicates the presence of implication of the intestine. In the later stages of some cases cerebral complications develop; the animal may become delirious and show marked excitement, and be dangerous to approach; or a staggering gait and a tendency to press the head against surrounding objects may be observed, succeeded by inability to rise, paralysis, and coma. A variable degree of fever is present in many instances, and tympany of the rumen to a moderate extent is not uncommon. After large doses of purgatives have been given by the owner, a small amount of watery fæces may be ejected, but this phenomenon is deceptive, as it is usually followed by constipation.

The **Treatment** of gastritis must be carried out with great discrimination. Obviously, a correct diagnosis is of importance, as therapeutic measures suitable for other gastric affections would be contra-indicated in the disease under consideration.

The presence of fever, injected visible mucous membranes, a small, feeble pulse, a grunt or moan with each expiration, the fæces passed in small amounts and covered by mucus, or a blood-stained or tarry diarrhœa, suggest acute gastritis, probably complicated with enteritis, and strong purgatives should be avoided. A full dose of raw linseed-oil may be given at the outset. This is to be followed by a drench containing 2 drachms of extract of belladonna, 2 drachms of extract of nux vomica, and 1 ounce of bicarbonate of soda, administered in linseed-tea and treacle every four hours. Oatmeal gruel, linseed-tea, hay-tea, etc., should be placed within reach of the animal. Drenching with gruel, etc., should be avoided. If evidence of cardiac weakness be present, stimulants, such as 6 to 8 ounces of whisky, may be added to the medicines mentioned above. If delirium be manifested, chloral hydrate is indicated.

In cases where large doses of Epsom salt have been given by the owner, the outlook is very unfavourable. If severe purging be present and evidences of pain, a few doses of chlorodyne may be given in starch gruel.

In subacute cases of gastritis, there is no objection to

giving a moderate dose of Epsom salt, well diluted and mixed with treacle, at the outset, provided the owner has not already administered this agent, in which instance, if the bowels are not acting, it is advisable to order a dose of raw linseed-oil, and to give moderate amounts of common salt in the form of electuary. Later on nux vomica, gentian, and bicarbonate of soda, may be prescribed in the form of electuary, in order to assist in restoring the functions of the stomach.

During convalescence from gastritis, special attention should be directed to the dieting, so as to prevent the occurrence of a relapse.

Parasitic Gastritis occurs in young cattle and sheep, and depends on the presence of minute nematode worms in the mucosa of the abomasum. Up to the present time no successful treatment for this condition has been discovered.

The Treatment of Indigestion or Dyspepsia.

Indigestion or dyspepsia is a common affection in bovines, especially in milch cows. In many instances it is difficult to determine which division of the stomach is involved. The usual etiological factor is intensive feeding associated with lack of exercise and insufficiency of fresh air, and the affection is more commonly met with in winter-time.

Post-Parturient Dyspepsia is an interesting affection met in dairy cows a few weeks subsequent to parturition. The symptoms of digestive derangement are associated with nervous phenomena, and the success which attends inflation of the udder in such cases has led some practitioners to regard them as instances of 'deferred milk-fever.'

The usual symptoms observed in cases of ordinary indigestion are — A capricious appetite, imperfect rumination, irregular action of the bowels, a decrease in the milk-supply, loss of condition, an unhealthy, dirty appearance of the skin, this structure tending to cling to the ribs (hide-bound). In

some instances there is total loss of appetite in spite of treatment, and evidences of well-marked gastric disorder are presented.

In *post-parturient dyspepsia* a characteristic sickly odour is exhaled from the animal's breath and skin, and the milk also exhibits this smell and has a mawkish taste. If the animal be fed on rich foods, nervous phenomena are likely to develop, such as a staggering gait, a dull, listless appearance, grinding of the teeth, licking at the walls, or persistently licking or biting a leg or foot. In some instances all the symptoms of milk-fever may be present, and unless suitable treatment be adopted a fatal termination will result.

In the **Treatment** of ordinary cases of indigestion, a moderate dose of Epsom salt is indicated, given in 3 pints of water with treacle and ginger. This may be followed by nux vomica, gentian, and bicarbonate of soda, in the form of electuary. Common salt administered in 1 or 2 ounce doses, in the form of electuary, often gives good results. Attention to diet is necessary, and a plentiful supply of water should be allowed.

In *post-parturient dyspepsia*, drenches should not be administered when nervous phenomena are present, as there is danger of portion of the fluid entering the trachea and bronchi. The safest and most successful treatment to adopt is to inflate the udder with air, as is adopted in cases of milk-fever (see p. 776). When nervous phenomena are absent, good results follow the administration of 2 drachms of formalin and 1 drachm of fluid extract of nux vomica in 2 pints of ale, twice a day. Common salt in the form of electuary may be given at the same time.

The Treatment of Indigestion in Calves.

This is a very important disease, occurring especially in pail-fed calves, and is frequently a source of much loss to stock-owners. It is characterized by catarrh of the abomasum, usually associated with a varying degree of intestinal catarrh, and the formation of large, firm, some-

times hard, masses of curdled milk in the fourth division of the stomach.

Various **Causes** are recognized, such as an excessive allowance of rich milk, irregular feeding, the use of milk from cases of mammitis or from an unhealthy cow, the addition to the milk of unsuitable foodstuffs, etc.

The prominent **Symptoms** are—Dulness, loss of appetite, constipation, succeeded by diarrhœa, thin, greenish, often fœtid and frothy fæces, occasional moaning and restlessness, and a varying degree of tympany. In some instances vomition occurs and a spontaneous cure is effected. In other cases diarrhœa is absent, and nervous phenomena preponderate, the animal staggers, falls down, struggles, and dies in a state of coma.

When the abomasum contains many hard masses of curdled milk, the case is hopeless. If the first symptoms of the disease be recognized a saline aperient is indicated, such as 1 ounce of Epsom salt, 2 drachms of bicarbonate of soda, and half a drachm of powdered ginger, given in half a pint of tepid water, and repeated once or twice at intervals of twenty-four hours. If constipation be present and the above dose fails to relieve it, 2 or 3 ounces of castor-oil combined with a similar amount of white vaseline oil should be given. When diarrhœa is a prominent symptom, small doses of terebene combined with chlorodyne and administered in boiled milk prove useful. In order to relieve tympany of the rumen, 20 minims of formalin well diluted with water may be prescribed.

The addition of lime-water to the milk is of distinct advantage.

Formulæ.

Drench for Impaction of the Rumen.

℞ Magnesii Sulph. ... ... lb.i.
Sodii Chlor. ... ... ℥viii.
Ext. Zingib. Fl. ... ... ℥i.ss.

M. Sig.: Give at once, dissolved in 3 pints of warm water and 2 pounds of treacle.

In two hours give the following:

℞ Pulv. Nucis Vom. ... ... ℥ii.
Ammonii Carb. ... ... ℥i.
Pulv. Gent. Rad. ... ... ℥i.
Pulv. Zingib. ... ... ℥i.

M. Ft. pulv. i. Sig.: Dissolve in 2 pints of warm ale or strong coffee. Repeat every four hours until purging occurs.

Powders to restore Nerve Tone to the Rumen.

℞ Ammonii Carb. ... ... ℥iii.
Pulv. Nucis Vom. ... ... ℥i.ss.
Pulv. Sinapis ... ... ℥vi.
Pulv. Gent. Rad. ... ... ℥vi.
Pulv. Zingib. ... ... ℥vi.

M. Div. in pulv. vi. Sig.: Give one three times daily in a pint of warm ale.

Drench for Tympanites of the Rumen (Hoven).

℞ Ol. Terebinth. ... ... ℥iv.
Ac. Carbol. Pur. ... ... ℥ii.
Ext. Nucis Vom. Liq. ... ... ℥i.
Ol. Lini ... ... O.ii.

F. M. Sig.: Give at once.

Drench for Chronic Tympanites.

℞ Formaldehydi ... ... ℥ii.
Ext. Nucis Vom. Liq. ... ... ℥i.
Ext. Zingib. Fl. ... ... ℥i.
Aquæ ... ... ad ℥viii.

M. Ft. haustus. Sig.: Give in 2 pints of ale twice daily.

Mixture for Acute Gastritis.

℞ Ext. Bellad. Liq. ... ... ℥x.
Ext. Nucis Vom. Liq. ... ... ℥v.
Sodii Bicarb. ... ... ℥v.
Aquæ ... ... ad O.i.

F. M. Sig.: Give two wineglassfuls every three or four hours in a pint of linseed-tea and a pound of treacle.

Sedative Drench in Acute Gastritis when Pain is Acute and Hæmorrhagic Diarrhœa is Present.

℞ Chlorodyni ... ... ℥ii.
Ext. Bellad. Liq. ... ... ℥ii.
Aquæ ... ... ad ℥viii.

M. Ft haustus. Sig.: Give in a pint of linseed-tea. Repeat in two hours if necessary.

Powders to be given during Convalescence from Gastritis.

℞ Sodii Bicarb. ... ... ℥vi.
Sodii Chlor. ... ... ℥vi.
Pulv. Nucis Vom. ... ... ʒvi.
Pulv. Gent. Rad. ... ... ℥i.ss.
Pulv. Anisi ... ... ℥ii.

M. Div. in pulv. vi. Sig.: Give one twice a day mixed with treacle in the form of electuary.

Drench for Post-parturient Dyspepsia.

℞ Formaldehydi ... ... ʒii.
Ext. Nucis Vom. Liq. ... ... ʒi.
Tr. Gent. Co. ... ... ℥i.
Ext. Zingib. Fl. ... ... ℥i.
Aquæ ... ... ad ℥viii.

M. Ft. haustus. Sig.: Give in 2 pints of ale. Repeat once or twice daily if necessary.

Powder for Dyspepsia in Calves.

℞ Magnesii Sulph. ... ... ℥i.
Sodii Bicarb. ... ... ʒii.
Pulv. Gent. Rad. ... ... ʒss.
Pulv. Zingib. ... ... ʒss.

M. Ft. pulv. i. Sig.: Give in ½ pint of tepid water. Repeat once or twice at intervals of twenty-four hours.

Drench for Dyspepsia in Calves, to check Fermentation and Diarrhœa.

℞ Terebeni ... ... ʒiii.
Chlorodyni ... ... ʒi.
Mucilaginis Acaciæ ... ... q.s.
Aquæ ... ... ad ℥ii.

M. Ft. haustus. Sig.: Give in ½ pint of boiled milk to which has been added a wineglassful of whisky. Repeat in six hours if necessary.

If the diarrhœa be severe, the following is useful:

℞ Pulv. Catechu ... ... ℥ii.
Cretæ Præp. ... ... ℥ii.
Pulv. Opii ... ... ʒiv.
Pulv. Zingib. ... ... ℥i.
Aq. Menth. Pip. ... ... O.i.

F. M. Sig.: Give from 1 to 2 ounces every morning and evening in ½ pint of boiled milk.

CHAPTER V

THE TREATMENT OF DISEASES OF THE DIGESTIVE ORGANS *(Continued)*

SECTION V.

THE TREATMENT OF DISEASES OF THE STOMACH IN THE DOG

GASTRIC affections are of common occurrence in canine practice, and demand the careful attention of the clinician. The mortality from the various forms of acute gastritis (acute inflammation of the stomach) is very high, especially when the owners of dogs neglect to seek professional assistance sufficiently early, and adopt irrational and harmful treatment with irritating drugs and patent nostrums. The craze which dog-owners possess for emetics and 'worm' remedies is responsible for many cases of serious gastric affections. Again, we are aware of the evils resulting from an erroneous system of dieting, such as excessive feeding, unsuitable foods, and, in the case of pet dogs, the giving of sugar, sweets, etc., coupled with want of exercise, are potent factors in the production of dyspepsia and allied ailments. The subject is an extensive one, and we have dealt fully with it in 'A System of Veterinary Medicine,' vol. ii., p. 472. Here we can only direct attention to the therapeutic aspect of the common gastric affections.

Acute Gastric Indigestion.—This signifies the abnormal retention of food in the stomach, accompanied by irritation of the gastric mucosa, and in severe cases associated with sup-

pression of the movements of the organ and a varying degree of gastritis. Owing to the facility with which vomition occurs in the dog, impaction of the stomach to the extent met with in the horse is seldom encountered in canine practice. We are not aware of the actual factors which interfere with the natural means of recovery, viz., early vomition. Bulky indigestible food taken in large amount, especially substances such as portions of tendon, cartilage, bacon rind, etc., are recognized as the chief cause of the condition. In mild cases relief occurs by vomiting, and beyond preliminary dulness and restlessness no symptoms are observed. Not infrequently the animal will again ingest the vomited material. Occasionally recovery may be complicated with gastric catarrh. In severe cases vomiting does not occur, and the following **Symptoms** are manifested: marked uneasiness, an anxious expression of countenance, salivation, accelerated respirations, tenderness of the abdomen to palpation, abdominal distension, first of the left and later on of the right side, in some cases colicky pains, evidenced by whining or actual cries; retching, dyspnœa, an unsteady gait, and vertigo, may also be observed. The course is generally rapid, and unless relief be afforded by treatment, death may occur from nervous exhaustion or dyspnœa in from one to two hours.

The indications for **Treatment** are to cause expulsion of the gastric contents by administering an emetic, and to prescribe measures for the relief of the gastric catarrh which is usually present. The most reliable emetic is apomorphine hydrochloride administered hypodermically in a dose of gr. $\frac{1}{20}$ to gr. $\frac{1}{10}$, according to the size of the dog. In cases of emergency, ipecacuanha wine (℥ss. to ℥i.) may be employed *per os*. Continental authors advise to wash out the stomach by means of a funnel and a rubber tube. A small stomach-tube may be employed for this purpose. The gastric catarrh which remains will require suitable treatment (see p. 610). The animal should be kept on a milk diet for a few days.

Acute Gastric Tympany.—In this condition the stomach becomes greatly distended with gas, which cannot escape

either by eructation or via the pylorus. The dilated stomach causes pressure on the diaphragm, thus interfering with the action of the heart and lungs, and death occurs either from syncope, asphyxia, or toxæmia. The cause of the affection has not been definitely determined, but the ingestion of unfit and improper food is regarded as an etiological factor. The condition is chiefly met with in the large breeds of dogs.

The **Symptoms** observed are—Extreme tympanitic distension of the abdomen, marked respiratory distress, an anxious expression of countenance, restlessness, and a cyanotic condition of the visible mucous membranes. A fatal result rapidly ensues unless speedy relief be given.

Treatment consists in administering a dose of apomorphine hydrochloride (gr. $\frac{1}{10}$ to a large dog) by hypodermic injection. If relief does not occur by emesis in a few minutes, the abdomen should be tapped by means of a fine trocar and cannula. Some practitioners advise the use of a stomach-tube, and in cases of emergency a horse catheter may be employed for this purpose. When relief has been obtained by these means, gastric and intestinal antiseptics, such as β-naphthol, charcoal, formaldehyde, etc., should be administered. Some dogs are liable to a recurrence of the affection.

Dilatation of the Stomach.—This is usually a more or less chronic condition occurring especially in aged dogs. It may be associated with repeated attacks of acute indigestion and chronic gastric catarrh, the prolonged retention of food in the stomach bringing about atony of the gastric walls. Ulcers and neoplasms in the pylorus or duodenum interfere with the passage of ingesta from the stomach, cause tympany, and thus induce gastric dilatation. In puppies dilatation of the stomach in an acute form has been observed when the pylorus or duodenum was impacted with a collection of ascarides. In some instances the symptoms are similar to those met with in chronic gastric catarrh (see p. 611). In others distension of the stomach occurs in two or three hours after food has been taken, and on percussion of the space between the eighth rib and the umbilicus a tympanitic sound is elicited. If, however, impaction be also present, the percussion sound

is not well marked or may be absent, and on deep palpation a large immovable doughy mass may be detected. Fœtid diarrhœa, the dejecta containing undigested material, may sometimes be observed, also thirst, a morbid appetite, evidenced by a tendency to eat foreign bodies, etc., and retching may be present. Gastritis may occur as a complication.

As regards **Treatment**, if impaction of the stomach be present, an emetic is indicated, preferably the hypodermic injection of apomorphine. An exclusive milk diet should be ordered. Gastric antiseptics, such as benzo-naphthol, salicylate of bismuth, charcoal, etc., should be administered in the form of cachets or capsules twice daily after feeding.

Acute Gastritis is also known as 'Acute Inflammation of the Stomach' and 'Acute Gastric Catarrh.' It occurs in several forms or types, and may be regarded as the most serious disease of the digestive system in the dog. Acute gastritis is one of the prominent lesions in canine typhus, and is met with in some types of canine distemper. Irritant poisons also produce gastritis, which varies in intensity according to the nature and the amount of the toxic agent. A variety of gastritis termed *toxæmic* is recognized, in which the etiology is obscure in some cases, while in others it may be due to the ingestion of putrid meat or fish, in which instance enteritis is associated with the gastric lesions. Again, gastritis may be associated with chronic endometritis in aged bitches, or may occur as a sequel to acute indigestion, or follow the administration of irritating medicaments.

In many instances no etiological factor can be discovered. It is very probable that septic conditions of the mouth and teeth may contribute to the production of the affection.

The prominent **Symptoms** observed in acute gastritis are—Persistent vomiting, the material vomited being a frothy mucus which may be streaked with blood or bile-stained; marked distress after each attack of vomiting and retching; accelerated breathing, sometimes panting; marked thirst and a great desire for cold water, which, however, is quickly vomited; a dry tongue showing a coppery tint; a fœtid

mouth; an anxious expression of countenance, the eyes more or less bloodshot; the abdominal muscles retracted; pain is evinced on palpation of the epigastrium; a tendency to lie on cold places, and to assume a variety of postures, such as lying stretched on the belly or flat on the side; a varying degree of fever, but in advanced cases a subnormal temperature is frequent; in the later stages, nervous prostration, evidenced by partial loss of power in the loins and hind-limbs, often followed by inability to stand; constipation may persist from the start, or may be succeeded by a fœtid diarrhœa, the fæces being dark-coloured or perhaps blood-stained. In the later stages, marked exhaustion, an imperceptible pulse, feeble cardiac action, cold extremities, a subnormal temperature, finally a semi-comatose state, succeeded by death after a slight convulsive struggle, generally during an effort to vomit. In toxæmic gastritis and in canine typhus the vomit is of a chocolate or prune-juice colour, very fœtid, and alkaline in reaction. The fæces are fluid, deeply blood-stained, and stinking.

The indications for **Treatment** are to give the stomach as much rest as possible, and to check the vomiting by the administration of gastric sedatives. In our experience, the best agent to control the vomiting and irritability of the stomach is chloretone, administered in the form of powder by placing it on the back of the tongue, the dose varying from 3 to 10 grains, according to the size of the patient. When the vomiting is controlled, the animal should be allowed milk and lime-water, soda-water and milk, and Brand's Essence of Beef. Usually, however, the appetite is in abeyance, and small amounts of the above should be carefully administered. If these be rejected by vomiting, it is useless attempting to give nourishment *per os*, and nutrient suppositories should be employed (see p. 184). Stimulants, such as wine, brandy, etc., are generally useless, and the best method of sustaining the cardiac action is the administration of normal saline solution by subcutaneous injection (see p. 214). Warmth must be supplied to the body and extremities by means of hot-water bottles and suitable clothing.

For the treatment of toxæmic gastritis, see Canine Typhus (p. 813), as similar therapeutic measures are indicated in each. Both affections are very fatal in spite of treatment. In less acute cases of gastritis a mixture containing bismuth, hydrocyanic acid, and bicarbonate of soda, often proves useful.

During convalescence from gastritis great care is essential, in order to prevent a recurrence, and the diet should be strictly supervised. It may be necessary to prescribe a mixture containing bismuth, tincture of nux vomica, and bicarbonate of soda, in order to assist in restoring the functions of the stomach to a normal condition.

Chronic Gastritis — also known as 'Chronic Gastric Catarrh,' 'Chronic Indigestion,' 'Chronic Dyspepsia.'—Some authors describe chronic gastritis and chronic indigestion under separate headings, but as in the majority of instances the two conditions are associated, and a differential diagnosis is impossible, we deem it advisable to consider both affections together. Cases are recorded in which the clinical history was suggestive of chronic dyspepsia, but no lesions of chronic gastritis were present on post-mortem. The important features in connection with chronic gastric catarrh may be summed up as follows: An increased formation of mucus, alterations in the gastric secretion, and a weakened condition of the muscular coat of the stomach, causing the abnormal retention of food in the organ; the ultimate result is the occurrence of morbid alterations in the gastric mucosa. The affection may occur as a sequel to an attack of acute gastritis or acute indigestion. It may also result from improper food, such as a starchy diet, excessive feeding, septic conditions of the mouth and teeth; and as a secondary affection it is observed in connection with cirrhosis of the liver and chronic renal and cardiac diseases.

The following **Symptoms** may be present: Dulness, occasional vomiting after feeding, a hacking cough and attempts to expectorate a tenacious white mucus; irregular action of the bowels; an unhealthy coat; a fœtid condition of the mouth. Later on we observe a capricious appetite, vomiting at inter-

vals, sometimes regurgitation of a fluid containing much mucus, an intermittent diarrhœa, loss of condition, and occasionally a depraved or ravenous appetite.

Treatment consists in attention to diet and the administration of medicinal agents likely to overcome the morbid condition existing in the stomach. As a rule a meat diet suits better than starchy foods. Gray advises to try an exclusive milk diet at first, and then to allow shredded raw meat in small amounts at a time. It is usual to commence treatment by the administration of a purgative, in order to clear out the gastro-intestinal canal and remove the products of imperfect digestion and retained bile. For this purpose a dose of grey powder in the form of tablet is advisable. It is not always an easy matter to decide whether an acid or an alkaline line of treatment will best suit the case. An examination of the vomited material will assist. If it be found alkaline in reaction, small doses of dilute hydrochloric acid with pepsin, tincture of nux vomica, and compound tincture of gentian, are indicated. Excessive acidity is best treated by the administration of alkalies, such as bicarbonate of soda. Tablets containing this agent with small amounts of carbonate of ammonia and oil of peppermint ('soda-mint') often prove useful. If vomiting be a prominent symptom, a bismuth and pepsin mixture may be prescribed; and if diarrhœa be present, small doses of tincture of opium may be added to the above mixture. In cases where excessive fermentation is present, evidenced by gaseous distension of the stomach, salicylate of bismuth, carbonate of magnesia, benzo-naphthol, and bicarbonate of soda, may be given, in a form of cachet or capsule. When the secreting structure of the stomach becomes permanently degenerated, it is obvious that treatment of any kind can only be palliative.

Foreign Bodies in the Stomach.—This subject properly belongs to the domain of surgery, as the treatment consists mainly in operative measures. An extraordinary variety of foreign bodies may be swallowed by dogs, especially by young animals. Portions of cork or sponge, collections of horsehair, rubber balls, stones, etc., prove very dangerous. The usual

symptoms exhibited are frequent attempts at vomiting, loss of appetite, depression, loss of condition, irregular action of the bowels, and in some cases the fæces contain blood. In the case where the foreign body is of a sharp nature, such as a hatpin or a skewer, it often happens that the first symptom observed is swelling and abscess formation, generally in the region between the posterior ribs, in the vicinity of the œsophagus, or in the flank. The history of the case is important from a diagnostic point of view, but it must be remembered that the owner not infrequently imagines that the dog has swallowed a foreign body. Hobday advises that in the case where small bodies, such as nails, etc., have been swallowed, a diet which is likely to surround them and gradually cause them to pass along the intestine should be ordered, and for this purpose he recommends suet pudding When the foreign body is not sharp, the same author administers an emetic, preferably apomorphine, in order to cause expulsion by vomiting. Cases are recorded in which foreign bodies have remained in the stomach for a long period without any marked symptoms. For further particulars in connection with this subject, and also on the operative measures which may be necessary, the reader is referred to Hobday's 'Surgical Diseases of the Dog and Cat.'

Formulæ.

Powders for Gastric Tympany and Dilatation of the Stomach

℞ Bismuthi Salicyl. ... ... gr. xxx.
Sodii Bicarb. ... ... gr. xxx.
Carbo Ligni ... ... ʒvi.

M. Div. in pulv. vi. Sig.: Give one in a capsule after feeding.

Mixture for Acute Gastritis.

℞ Liq. Bismuthi ... ... ℥i.ss.
Ac. Hydrocyanici (B.P.) ... ♏xviii.
Sodii Bicarb. ... ... ʒii.
Aquæ ... ... ad ℥vi.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful (according to the size of the dog) every three or four hours.

In Case of Persistent Vomiting.

℞ Chloretone ... ... gr. v. to gr. x.

Ft. pulv. i. Sig.: Place on the back of the tongue. Repeat in two hours if necessary.

Tonic Alkaline Mixture during Convalescence from Gastritis.

℞	Liq. Bismuthi (B.P.)	℥i.ss.
	Sodii Bicarb.	℥i.
	Tr. Nucis Vom.	℥ss.
	Syr. Simpl.	℥i.
	Aquæ	ad ℥vi.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times daily.

Acid Mixture for Chronic Dyspepsia.

℞	Ac. Hydrochlor. Dil.	℥i.
	Pepsini	grs. xl.
	Tr. Nucis Vom.	℥ss.
	Syr. Simpl.	℥i.
	Aquæ	ad ℥vi.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times daily.

Alkaline Mixture for Chronic Dyspepsia.

℞	Sodii Bicarb.	℥ii.
	Tr. Nucis Vom.	℥ss.
	Tr. Gent. Co.	℥iv.
	Syr. Simpl.	℥i.
	Aq. Menth. Pip.	ad ℥vi.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times daily.

Mixture for Dyspepsia accompanied by Acidity and Flatulence after Feeding.

℞	Tr. Rhei	℥vi.
	Sodii Bicarb.	℥i.
	Magnesii Carb. Lev.	℥i.
	Spts. Ammon. Aromat.	℥iii.
	Aq. Menth. Pip.	ad ℥vi.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful as required.

Section VI.

THE TREATMENT OF DISEASES OF THE CROP AND STOMACH IN BIRDS.

The most common causes of diseases of the digestive organs in birds are irrational feeding and various microbial affections. Another common source of digestive disorder in graminivorous birds kept in captivity is lack of access to sand or grit, which material is necessary for the function of digestion in the gizzard. Coarse gravel, granite, broken-up earthenware, sand, or grit, should always be within reach of birds, so as to insure a proper amount of such material in the gizzard for the purpose of triturating the food.

In order to comprehend the treatment of avian gastric diseases, the student should be acquainted with the anatomy and physiology of the stomach in birds. Only a slight reference to the subject can be made in this work.

The Ingluvies, or Crop, corresponds to the rumen of the ox; it is a temporary receptacle for food, the ingesta being subjected to a softening process during its sojourn in this organ. The crop is an ovoid pouch, and its walls are similar in structure to the œsophagus. The food passes from the œsophagus into the crop, and from thence to the succentric ventricle, which is regarded as the first division of the stomach. The crop is present in the Gallinaceæ, and in parrots, canaries, and pigeons, but in Palmipeds it is represented by a dilatation in the cervical portion of the œsophagus, which, when distended with food, forms a long fusiform body. In the pigeon the crop is divided into two lateral pouches, and its interior shows glandular eminences towards the common opening of these pouches into the gullet. These are sometimes termed the 'aquiparous glands,' and when pigeons are rearing their young these glands secrete a milk-like material, which is regurgitated by the gullet, and serves as nourishment for the young birds. Finches, parrakeets, and certain other birds, also feed their young in a similar manner from the crop.

THE SUCCENTRIC VENTRICLE is also known as the PROVENTRICULUS, or GLANDULAR STOMACH. It is inconsiderable in size, its cavity is narrow, and its mucosa secretes gastric juice. The food merely passes through the succentric ventricle into the gizzard, carrying with it the gastric secretion.

THE GIZZARD is the second compartment of the stomach; it is oval in form, and is succeeded by the duodenum. Its walls are strong and muscular, and normally it contains a number of pebbles, etc., for the purpose of triturating the food.

In birds of prey the stomach is simple, consisting of a single sac provided with a thick zone of glands around the entrance of the gullet, which secrete the gastric juice.

Ingluvial Catarrh (Ingluvitis, Catarrh of the Crop, 'Soft Crop,' 'Crop-Sick').—This is a catarrhal inflammation of the mucosa of the crop. The following etiological factors are recognized: Decomposing or fermenting food; the presence of sharp-pointed foreign bodies; toxic agents, such as phosphorus, mercury, or arsenic; the presence of aspergillosis; parasitic stomatitis (thrush), and parasites.

In chickens it may depend on feeding with dry oats, and in pigeons it may be due to engorgement of the aquiparous glands with retained secretion, if the birds be deprived of their young.

The **Symptoms** observed are—Distension of the crop by gas, loss of appetite, open beak, stretching of the neck, dysphagia, nausea, and occasionally vomiting, a greyish sour fluid being expelled through the beak, and partly through the nostrils. In parrots vomiting is common. Palpation of the region of the crop reveals a marked protrusion of the organ, and on applying pressure fœtid gases escape by the beak. Percussion shows a tympanitic condition, or the organ may feel like a perforated india-rubber ball when collapsed —*i.e.*, it has no tendency to regain its resiliency. Later on emaciation and weakness set in, and unless relief be afforded death results. In chronic cases the walls of the crop become hypertrophied, and the organ becomes voluminous, so that it often forms a hanging pouch externally, which is termed 'pendulous crop.'

The **Treatment** advised is to empty the crop by holding the bird's head downwards and carefully massaging the organ in a direction towards the mouth. Following this, antiseptic and astringent agents are to be given, such as solutions of boric acid (2%), sulphocarbolate of soda (2%), peroxide of hydrogen, sulphate of soda (5%), lemon-juice, solution of salicylic acid, etc. Irrigation of the crop may be carried out by means of a funnel fixed to one end of a thin rubber tube. The free end of the tube is carefully passed into the crop via the beak. A 1% solution of boric acid is poured into the funnel, the latter being elevated, so that the fluid enters the crop. The funnel is then lowered so that the fluid escapes, and during this procedure careful massage is carried out. Irrigation may also be performed by means of a syringe attached to a small catheter, taking care that the latter does not enter the larynx and trachea—an accident that may easily happen, as the epiglottis is absent in birds. When the above measures fail or when the ingesta are putrid, operative measures to remove the contents are indicated (see p. 618). In pendulous crop similar means should be adopted, when the catarrh has disappeared. In cases of the disease occurring in the pigeon when deprived of its young, a young pigeon should be placed with the bird. Nux vomica, bismuth, and charcoal, may also be prescribed.

Impaction of the Crop (Ingluvial Indigestion, 'Hard Crop,' 'Crop-bound').—In this condition engorgement of the crop with food occurs, associated with dilatation and paralysis of the organ and a varying degree of tympany.

The **Causes** recognized are—Overfeeding, especially with dry grain, bran, chopped straw, fibrous grass, etc., particularly when the bird has been kept some time without food. The presence of foreign bodies and parasites may occasionally be etiological factors.

The following **Symptoms** may be observed: Dejection and listlessness, loss of appetite, open beak, ruffled feathers, and sometimes the expulsion of a fœtid fluid from the beak. On palpation of the region of the crop, the organ is found enlarged, prominent, and either hard and doughy in con-

sistency, or tense, according to the nature of the contents and the degree of tympany present. In severe cases asphyxia is produced, owing to pressure exerted on the trachea and bloodvessels. Ingluvitis, necrosis of the walls of the crop, and even rupture of the organ, may occur. Sharp foreign bodies may burrow outwards and form an abscess or fistula.

Treatment consists in first employing massage; this may succeed if the contents of the organ are not too hard. If massage fails, operative measures are indicated, and are generally successful if carried out sufficiently early, except in the case of pigeons, as in these the mortality is high.

The technique is as follows: Remove the feathers from the region of the crop. Make an incision in the middle line parallel with the long axis of the neck. Remove the contents of the crop. Irrigate the edges of the wound with an antiseptic solution; remove all blood-clots; suture the wall of the crop with sterilized silk (interrupted sutures), and the skin with a continuous suture of the same material. Feed for the first day or two on small amounts of bread soaked in milk, and allow no water; after this water may be given *ad lib.*

Pills containing nux vomica, gentian, and ginger, prove useful in mild cases, and also in after-treatment.

Gastritis.—In birds the lesions of acute gastritis are found chiefly in the crop and proventriculus, and are less marked in the gizzard, owing to the resisting nature of its mucosa. The affection is often associated with acute infectious diseases. It is occasionally due to the ingestion of toxic agents, such as arsenic, lead, copper, phosphorus, also sodium chloride or sodium nitrate (used as a dressing for lands). Exposure to draughts, chills, etc., is a common predisposing cause in parrots. Enteritis is a frequent complication.

The **Symptoms** observed are—Diarrhœa, trembling, convulsions, succeeded by coma and death. Treatment is very rarely successful, and the bird succumbs in a short space of time.

Indigestion in Parrots.—This is an important affection,

It may depend on a variety of causes, of which the most important are improper feeding, and not allowing the bird access to sand or grit, which substances are essential for the function of digestion in the gizzard. If the function of the gizzard be impaired, the food is unfit for assimilation in the intestine.

The **Symptoms** observed are—Frequent yawning, dulness, loss of appetite, vomiting, and in some instances nervous phenomena are manifested, such as an unsteady gait or the occurrence of a 'fit.'

Treatment consists in giving 5 to 10 minims of castor oil, either by floating it in a teaspoonful of warm water and offering it to the bird, or pouring it on a lump of sugar. If the medicine be refused, it must be carefully administered by force. Small doses of bicarbonate of soda (5 grains) may be given in the drinking-water for a few days. Sulphocarbolate of soda (2 per cent.) in glycerin and water is also useful. Tonics, such as nux vomica, are indicated.

CHAPTER VI

THE TREATMENT OF DISEASES OF THE DIGESTIVE ORGANS *(Continued)*

SECTION VII.

THE TREATMENT OF DISEASES OF THE INTESTINES IN THE HORSE.

DISEASES of the intestines in the horse are of very common occurrence. The number and variety of these affections and the difficulties encountered in their differential diagnosis render the subject of great importance to the therapeutist, because in several instances, by adopting rational treatment based on a correct diagnosis, the lives of many horses will be saved. On the other hand, if we do not seek to ascertain the pathological condition that is present, but simply treat the leading symptom, viz., pain, the therapeutic measures adopted are likely to prove inimical to the recovery of the patient. Obviously, with the limited space at our disposal in this work, it is only possible to deal briefly with so extensive a subject, and discuss the principles of treatment in a more or less general manner.

In spite of the fact that intestinal affections constitute a large portion of the equine practitioner's work, and that the mortality from some of these diseases is very high, our knowledge with reference to diagnosis and treatment leaves much to be desired. In far too many instances there is a tendency to adopt routine treatment and to neglect post-mortem examinations, with the result that progress in con-

nection with the subject is not by any means proportionate to that which obtains in the case of many other diseases.

There are certain intestinal affections which prove fatal in spite of treatment, as the lesions cannot be influenced by the therapeutic measures at our command, and abdominal surgery has not yet advanced beyond the experimental stage. Probably, in the present day, 'twists' are responsible for the majority of deaths from bowel diseases. We arrive at this conclusion because more careful post-mortem examinations demonstrate that acute enteritis is not so common a lesion as was formerly believed, and depends in many instances on the presence of twists which were overlooked. Again, owing to the adoption of a more rational line of treatment, recoveries from impaction of the colon are far more frequently observed than in the days when opium or morphine was regarded as the 'sheet-anchor' for every case of intestinal disorder.

If it were possible to diagnose accurately the presence of 'twists' of the bowel or of acute enteritis, or other fatal intestinal lesions, it is quite evident that, considering the inutility of the therapeutic measures at our command, the proper course to adopt would be to order the destruction of the patient. Such a course would save trouble and expense to the owner and much pain and distress to the animal. Unfortunately, the symptoms in many instances of abdominal affections are not sufficiently definite to enable us to arrive at a correct diagnosis, and it is not uncommon to find cases which recover, although the outlook, judged by the phenomena present, was distinctly unfavourable.

As we shall point out farther on, there is a marked danger in concluding, without a very careful consideration of the symptoms, that fatal lesions are present. Such a diagnosis would induce us to prescribe sedatives in a lavish manner to 'smooth the path to death,' and the post-mortem might reveal the existence of an impaction of the bowel which would probably have yielded to a different line of treatment. A recognition of this fact should lead the practitioner to exercise extreme caution in arriving at a

diagnosis and prognosis, and in prescribing medicinal treatment. We quite admit the limitations of our skill in these matters, and the facility with which erroneous opinions may be given. But it is quite possible to err in the opposite direction, and to become routine in the employment of powerful agents, such as eserine or arecoline. There is a tendency in the present day to administer such drugs in all cases, ignoring the fact that contra-indications to their employment may be present, and that they may prove inimical to recovery. The argument that if a necessarily fatal lesion be in existence the drugs mentioned will hasten death, while if a curable condition be present they will prove beneficial, is not in accordance with our ideas of rational treatment. Moreover, from a humanitarian standpoint, it must be regarded as cruel to add to the sufferings of the patient. If we are in doubt as to the nature of a case, we can, by administering chloral hydrate, relieve pain, without at the same time interfering with the peristaltic action of the intestines. If skill in the treatment of abdominal cases be limited to the routine administration of a dose of eserine or arecoline, then, indeed, all the time and labour devoted to the subject has been in vain, because a layman who can handle a hypodermic syringe can achieve as much as the qualified practitioner.

Obviously, we should endeavour to treat each case according to the phenomena presented, and not on routine lines. But we must fully recognize the fact that, in spite of all precautions, the evidence disclosed by post-mortem examinations will not infrequently prove the limitations of our skill in diagnosis, and demonstrate the inefficiency of the therapeutic measures at our command.

In the majority of cases of intestinal affections, in which recovery is possible, the leading indication for treatment is to restore the functions of the bowels to a normal condition. Loss of peristaltic action, the accumulation of ingesta, the irritation produced by the latter, the auto-intoxication resulting from stasis of the intestine, and the tympany so often associated with the conditions named, are the phenomena which should engage the attention of the therapeutist. If

he can succeed in overcoming the intestinal stasis, and in promoting a free action of the bowels, his cases will recover, provided, of course, that no organic disease is present. Obviously, his efforts should be directed to adopt measures likely to fulfil the indications mentioned; but in selecting his remedies he must remember that in many instances he has a paralyzed intestinal wall to deal with, and that powerful drastic purgatives are likely to induce rupture of the affected bowel. In the case of affections, such as twists of the intestine, displacements, invagination, intestinal calculi (which defy manual removal), and acute enteritis, it is quite apparent that we cannot exert any beneficial influence by therapeutic measures, and a fatal termination is inevitable.

Here it is necessary to draw attention briefly to the subject of **Colic.** The term 'colic' is applied in a very wide and loose manner to a variety of affections in which the patients present abdominal pain as a prominent symptom. As this symptom is an exceedingly common one in equine practice, it follows that colic as a diagnostic term is very frequently employed, not only by horse-owners, but by veterinary surgeons. Evidences of abdominal pain occur in such a large number of affections that it does not seem rational to include such conditions under the general heading of 'colic.' In reality, colic should be regarded as a symptom rather than as a disease, and the evidences of abdominal pain might with propriety be described as 'colicky' symptoms.

On p. 42, we have pointed out that colicky pains may be manifested in diseases of the liver, kidneys, and in the early stages of pleurisy and azoturia, as well as in gastric and intestinal affections, and we have also fully discussed the subject of abdominal pain.

From a clinical point of view, it seems desirable to deal first with the treatment of what has been known from the earliest times as *simple* or *spasmodic colic*, while admitting at the same time that it is impossible, at the commencement of a case manifesting 'colicky' symptoms, to foretell what the ultimate result is likely to be.

Simple or Spasmodic Colic.—This is regarded as a func-

tional disorder, depending on a spasmodic contraction of the muscular coat of the intestines. As to the cause of the 'spasm' or 'cramp,' many theories have been suggested, but in all probability the presence of digestive disturbance is the chief etiological factor. Of course, the 'spasmodic contraction' is assumed rather than demonstrated, as there is no post-mortem evidence to support it. Such cases may recover in a short space of time, either spontaneously or with the assistance of a diffusible stimulant, while in some instances they may be prolonged, and require an anodyne and an aperient. The assumption that the spasm depends on irritation of the bowel from the presence of irritating ingesta is supported by the results—viz., in spontaneous recovery the irritant is removed by the peristaltic action of the intestine, while in cases aided by therapeutic measures a similar result is obtained. The border-line between a prolonged case of simple spasmodic colic and colic depending on obstruction due to accumulation of ingesta is very difficult to define, but the therapeutic measures adopted exert an important influence with reference to the simple condition terminating in the more serious impaction of the colon. On referring to p. 43, the reader will find the symptoms of simple colic described. Absence of any serious alterations in the character of the pulse, no rise in temperature, the intermittent character of the pain, and the comparatively rapid recovery, are the leading features in this disorder. It is not uncommon for the practitioner to be hurriedly summoned to a case of this kind, in which rather violent symptoms were manifested, and to find on his arrival that the patient has recovered spontaneously.

From a consideration of the points we have mentioned, the rational treatment of this disorder is apparent. In many instances the administration of a simple diffusible stimulant, such as 2 ounces of sweet spirit of nitre, with a carminative, such as 1 ounce of tincture of ginger, will give relief. The time-honoured oil of turpentine in a dose of 2 ounces, given in a pint of raw linseed-oil, is a favourite remedy, and often succeeds. If the pain be severe, 1 ounce of chloral hydrate

dissolved in 4 ounces of water may be added to the above. If no relief be obtained from these measures, we may conclude that the case is something more serious than simple spasmodic colic, and special treatment will be required (see p. 630).

We have already drawn attention (see p. 370) to the evils resulting from the employment of opiates in the treatment of spasmodic colic, but the matter is of such importance that we deem it essential to repeat the advice given. Opium, morphine, or preparations containing these agents, no doubt give temporary relief in cases of this nature; but in addition to their analgesic action they inhibit intestinal peristalsis, and thus interfere with the natural means of recovery—*i.e.*, the removal of irritating ingesta. Obviously, they tend to convert a simple case into one of impaction of the colon, and if the latter condition be present from the commencement, they accentuate its gravity and interfere with the action of agents administered for its relief. In chloral hydrate we have a drug which does not interfere with peristalsis or intestinal secretion, while it is an efficient anodyne; moreover, it possesses an antiseptic action, it does not tend to bring about intestinal tympany, it is not followed by nausea, and it can be repeated without inducing delirium. Opiates, on the contrary, are likely to produce these undesirable phenomena, especially if administered in full or repeated doses.

Some practitioners administer a dose of aloes in every case showing symptoms of abdominal pain, with the object of removing the irritating ingesta which is assumed to be present, and thus directly removing the cause of the disorder. There are certain objections to the employment of aloes in this direction, such as the necessity of leaving the horse idle on the following day, or even longer, in order to avoid serious consequences from the purgation which ensues; also, in an animal unprepared for physic, the drug may fail to act, and produce instead extreme nausea. In simple cases of colic milder measures are usually preferable at first; but if the symptoms continue beyond a reasonable time, especially in

heavy draught-horses, we consider that the administration of aloes is good practice. The drug may be given in the form of bolus, or dissolved in warm water as a drench. A useful combination in the case of draught-horses fed on bulky food is prepared with aloes in solution, chloral hydrate, and oil of turpentine, shaken up with raw linseed-oil.

Enemata of warm water are indicated to assist the action of the purgative.

Here we may remark that horses do not die as the result of spasmodic colic, even though the pain be severe. In every instance where a fatality occurs, the post-mortem reveals either an intestinal lesion, such as twist or enteritis, or intestinal impaction.

Intestinal Tympany.—This is also known as 'Flatulent Colic,' 'Wind Colic,' or 'Acute Gaseous Intestinal Indigestion.' Although tympany of the intestine may occur as a symptom in various affections of the bowels, the condition known popularly as 'flatulent colic' depends on the presence of a large amount of gases, especially in the double colon, originating as the result of ingesting unsuitable and fermenting foods, and causing marked distension of the viscus involved and a tense, drum-like condition of the abdomen. Occasionally tympany occurs simultaneously in the stomach and intestines, in which instance gastric symptoms will be associated with the intestinal phenomena. Tympany to a varying degree is met with as a symptom in intestinal obstruction, especially during the later stages, also in cases of rupture of the stomach or intestine, twists of the bowel, peritonitis, enteritis, etc., and in such instances it arises from paralysis of the bowel and the accumulation of gases resulting from fermentation of the ingesta.

The **Symptoms** in flatulent colic appear rather suddenly. The pain varies in degree. In some instances the pain may in the early stages be violent and intermittent, as in spasmodic colic; but when marked tympany develops it is generally of a dull type, and the prominent symptoms are the enlarged, drum-like appearance of the abdomen and the extreme respiratory distress, due to pressure of the distended intestines

on the diaphragm. The animal generally lies down carefully, but only remains a short time in the recumbent position. In severe cases he stands persistently. Amongst other symptoms observed we may mention—A quick, small, weak pulse, a tumultuous action of the heart, injected visible mucous membranes, sweating in patches, drooping head, cold extremities, etc.

In extreme cases, unless early relief be afforded, a fatal termination will result in a short space of time. Death may occur from asphyxia, rupture of the intestine, or rupture of the diaphragm. As regards **treatment**, when the tympany and associated symptoms are alarming, relief should be afforded by puncturing the intestine with a trocar and cannula. For the technique of this operation, see p. 825. After removal of the gas by this means, a full dose of oil of turpentine or terebene with raw linseed-oil should be given, so as to get rid of the undigested material in the bowel and to check fermentation, and thus prevent a recurrence of the condition. The case ought to be carefully watched, so that if the tympany recurs immediate measures can be carried out. The employment of eserine is advised by some practitioners, after the employment of the trocar and cannula. We do not consider that the drug is a safe one to administer in cases of acute intestinal tympany, as there is a risk of inducing rupture of the intestine.

In less urgent cases, a full dose of oil of turpentine or terebene, with 2 drachms of pure carbolic acid and 1 pint of raw linseed-oil, will generally give relief. When the pain is severe, 1 ounce of chloral hydrate in solution may be added to the above. Enemata of warm water assist in causing the expulsion of gas.

In heavy draught-horses, a dose of aloes is advised by some practitioners, in addition to the treatment mentioned. Opiates should be studiously avoided in flatulent colic, as they check peristaltic movements, inhibit intestinal secretions, and tend to increase tympany. We observed a most extreme case of intestinal tympany in a hunter, as the result of a full dose of morphine administered for the purpose of rendering

him quiet to clip. This animal was a wind-sucker. On two occasions chloral hydrate was given to this horse as a sedative previous to clipping, but no undesirable effects were produced. This case shows the baneful action of morphine on the intestines of the horse.

During convalescence from flatulent colic attention to diet is necessary. Horses that are subject to this affection should be allowed a proper rest after feeding. The teeth should be examined, so as to detect and remedy dental irregularities.

Obstructive Colic due to Impaction.—It is necessary to distinguish intestinal obstruction depending on surcharge of the intestines with indigestible alimentary material, from acute occlusion of the bowels due to the presence of twists, displacements, etc. Impaction of the intestine, with the exception of impaction of the cæcum, is a condition which may yield to rational treatment, while twists, displacements, etc., invariably prove fatal. Up to the present, we are not aware of any successful treatment for impaction of the cæcum. The subject is a most extensive one, and hence in this work only the general principles of treatment can be considered. For full information on the various forms of obstructive colic, the reader is referred to our article on the subject in 'A System of Veterinary Medicine,' vol. ii., p. 188. The most common form of colic due to impaction, met with in practice, is—

Subacute Obstruction of the Double Colon.—We have already pointed out that spasmodic colic *per se* does not cause death, even though violent pain be manifested. Prolonged cases of so-called colic usually depend on impaction of the large colon to a greater or less extent; and the chances of recovery are largely influenced by the therapeutic measures adopted. Obviously, if we recognize the nature of the disorder, we must arrive at the conclusion that if we aim at relieving the pain only, and administer opiates, such treatment is inimical to recovery. If, on the other hand, we prescribe measures to overcome the paralyzed condition of the intestinal wall and to bring about removal of the impacted material, before organic changes occur in the bowel and

the patient becomes exhausted from pain and auto-intoxication, we can hope for a successful termination of the case.

It is rational to assume that treatment by opiates is responsible for many hopeless cases of intestinal impaction. We may go even farther and say that such treatment is likely to convert an ordinary case of spasmodic colic into one of impaction of the bowel, because by inhibiting peristalsis we interfere with the natural mode of recovery and bring about retention of the intestinal contents.

The **Symptoms** of impaction of the colon are by no means constant, and, as already remarked, it is difficult in many instances to draw the border-line between this condition and prolonged cases of spasmodic colic. In the early stages of cases due to overfeeding, colicky symptoms may not be observed until actual impaction occurs. The animal is dull and may show loss of appetite, but occasionally takes food in a listless manner. Dull abdominal pain is next in evidence (see p. 43), and the animal presses the hindquarters against the nearest post or wall. On examination *per rectum*, the impacted intestine can be felt by palpation, and may be either solid in consistence or easily indented by pressure with the fingers. A moderate degree of tympany is present in some instances. The rectum is 'ballooned,' and on rectal examination the animal may strain violently or make frequent efforts at defæcation. Auscultation of the abdominal region shows an entire absence of peristaltic sounds. Evidences of acute pain may present themselves either early in the attack or later on. The respirations may be greatly accelerated and of a 'sobbing' character, the temperature raised to 101° F. or 103° F., the pulse becomes frequent, and the visible mucous membranes are injected. In fatal cases the duration of the attack may vary from thity-six to forty-eight hours, and sometimes from three or four to eight or ten days. The pulse assumes a 'running-down' character, the animal becomes gradually weaker, and death occurs from exhaustion, and is accelerated by the presence of tympany. Cases treated in a rational manner may recover in from twelve to twenty-four hours.

The indications for **Treatment** are to adopt measures likely to get rid of the impacted material and to restore the paralyzed intestinal wall to its normal condition. These are fulfilled by the administration of eserine, assisted by nerve stimulants such as nux vomica and carbonate of ammonia.

The treatment advised by Caulton Reeks is as follows:

For a full-sized horse, 2 ounces of carbonate of ammonia and 1 ounce of powdered nux vomica are made into four balls and given at once. After this a drench composed of 2 ounces each of oil of turpentine and aromatic spirits of ammonia in 1 pint of raw linseed-oil is administered. If pain be shown at the expiration of three to four or five to six hours, a similar dose of carbonate of ammonia without the nux vomica is given, powdered ginger being substituted for the latter. Should the case tend to become protracted and show a strong but not too frequent pulse, a hypodermic injection of eserine sulphate 1 grain, with pilocarpine 2 grains, is given. On the next visit, if the bowels have not responded and peristalsis is still in abeyance, 2 grains of eserine are administered. The carbonate of ammonia in 1 to 2 ounce doses is continued at intervals of three hours until relief from pain is obtained. Frequent enemata of hot water are also given. No sedatives are prescribed.

The above treatment has proved very successful in the hands of many practitioners. We must, however, point out the difficulty that arises when the case occurs in a country district some distance from the surgery, as it is seldom that either the owner or the attendants are able to administer drugs prescribed in the form of bolus. Hence a modification of therapeutic measures is necessary under such conditions. Obviously, it would not be possible to administer such large amounts of carbonate of ammonia in the form of a drench, but the nux vomica can be given in this manner by prescribing the fluid extract of the drug, which, we may remark, is a far more reliable preparation.

With reference to the employment of eserine, some practitioners hold that if tympany be present this drug should not be employed, as there is a risk of inducing rupture of

the bowel. With this view we are in agreement, and if the tympany be marked we have no hesitation in giving relief by the employment of the trocar and cannula. Later on eserine can be given. Whenever possible, we think that it is safer to give this drug in small doses repeated at intervals until the bowels respond to its action. It must be admitted that cases occur in which eserine fails to act, and it is useless to continue the adminstration in larger doses.

As regards the value of aloes in impaction of the colon, there is a diversity of opinion. Its action may be described as erratic: in some instances it succeeds, while in others it fails. Generally speaking, if the intestinal paralysis is well marked, aloes will not exert its purgative action. But in less severe forms of the affection a dose of aloes administered in solution in the early stages acts in an efficient manner.

Raw linseed-oil is largely employed as a purgative, but, like aloes, it often fails in severe cases, and not infrequently, when large amounts have been given, superpurgation and laminitis result. Moreover, it induces extreme nausea. Arecoline hydrobromide is preferred by some practitioners to eserine, but in our experience the latter drug is safer and quite as effectual.

Intestinal irrigation, by means of the long rectum-tube, constitutes one of the most important details of treatment in connection with impaction of the colon. For the technique of its employment, see p. 188.

This therapeutical measure should always be carried out, and it assists in a marked manner the action of the drugs administered. It requires patience and perseverance to render it efficacious, but it will amply repay the time and trouble expended. If we can succeed in getting the fluid to enter the colon, we can generally hope for a successful termination of the case.

The Treatment of Pain in Connection with Intestinal Impaction.—Much difference of opinion exists on this subject. Some practitioners hold that sedatives should not be administered, as all drugs of this kind interfere with intestinal peristalsis, also that pain *per se* is not a factor in the fatal termination, and when the cause is removed the pain will cease·

It is hardly necessary to repeat here that opiates of all kinds should be avoided. But in cases where the pain is severe—and these are not uncommon—we see no objection to administering chloral hydrate. We are satisfied from experience that the drug does not interfere with intestinal peristalsis, nor is it antagonistic to agents such as eserine or aloes. It does not tend to induce tympany, and even in large doses it does not cause excitement, such as occurs after full doses of opium or morphine. Few owners of animals will be satisfied unless measures are adopted to give relief to acute pain, in spite of the assurance that the symptom will disappear when the action of the bowels is restored.

Here we may point out the importance of a careful clinical examination in all cases of intestinal obstruction, before giving an opinion with regard to diagnosis and prognosis, and prior to adopting treatment. Atypical cases are not uncommon, and in spite of all precautions errors will occur.

The principles of treatment which we have mentioned will apply to all forms of impaction of the large intestines.

In **impaction of the pelvic flexure of the double colon,** eserine should not be employed in the early stages. The impacted mass should first be softened by the administration of aloes, raw linseed-oil, and by intestinal irrigation, before eserine is given.

In **impaction of the cæcum**, as already remarked, no line of treatment has up to the present proved successful. The administration of large amounts of water *per os* by means of the stomach-tube is suggested, with the idea that the fluid may reach the cæcum and soften its contents. But it seems doubtful if, owing to the impacted condition as found on post-mortem, the fluid could enter the organ.

In **impaction of the single colon**, eserine or aloes generally fail to give relief, and reliance must be placed on enemata administered by means of the long rectum-tube. If this fails, surgical measures might be considered, but, needless to remark, an operation of this kind is hardly likely to be attempted by the general practitioner.

Obstructive Colic in Foals due to Impaction of the Colon or Rectum.—This is a very important affection, as, owing to the condition being overlooked or treated in an irrational manner, many valuable foals are lost. The obstruction depends on the presence of hardened masses of meconium in either the double colon, the single colon, or the rectum, and the symptoms may develop very shortly after the birth of the animal. The manifestation of colicky pains in a foal always suggests digital examination of the rectum, and if the presence of round hard masses of meconium therein be detected, the line of treatment to be adopted is obvious. The usual **Symptoms** observed are as follows: The animal is restless, rolls frequently, and may try to lie on his back for a few seconds. He may struggle a few times, then rise and make a listless attempt to suck the dam, and walk around her in an uneasy manner. In some instances the animal makes frequent attempts at defæcation, but no fæces are passed. Unless relieved, the symptoms become more violent, and the animal dies of exhaustion.

Treatment should be commenced by administering a wineglassful of castor-oil. Enemata of warm water should be given; the contents of the rectum must be carefully removed as far as the finger will reach. A special long gum-elastic rectum-tube is required, and this must be very carefully manipulated so as not to injure the bowel. Very often a hard, dry, round portion of meconium will block the passage and prevent the entrance of the tube; this obstruction must be carefully broken down by means of a special blunt spoon-shaped instrument. By the exercise of patience and tact, the tube can be inserted its full length, and the injection made to reach the floating colon. In obstinate cases we have found the injection of white vaseline oil very efficacious. This oil should also be administered *per os*. The enemata should be persevered in at suitable intervals, until the bowels act in a normal manner.

As regards the pain which is present, we find that it disappears when the obstruction is removed. If, however, it is severe, the most suitable anodyne is spirit of chloroform; or

a small dose (gr. xx.) of chloral hydrate may be given in milk. Opiates of all kinds should be avoided. Many cases of the kind are rendered hopeless owing to the owner giving laudanum or chlorodyne with a view to relieve the pain, while failing to grasp the real nature of the condition. Attendants on foals should be instructed in this matter, and cautioned with reference to the necessity for administering castor-oil when the bowels do not act in a normal manner. Professional assistance should be sought as soon as possible, as foals rapidly succumb to intestinal obstruction unless relief be speedily given.

Intestinal Calculi.—Occasionally by rectal exploration a calculus can be discovered, and if within reach of the hand it can be removed. Small calculi in the single colon or rectum may be expelled, after the administration of copious enemata by means of the long tube.

Agents such as eserine and arecoline are contra-indicated, as they are likely to induce rupture of the bowel. If the calculus can be located, but if owing to its situation it cannot be extracted manually, and if it be unaffected by enemata, further treatment is useless, unless the practitioner is bold enough to attempt operative measures. As only one successful case is on record, the outlook is not encouraging.

Enteritis.—Acute inflammation of the intestines may be regarded as one of the most fatal affections to which the horse is subject. In spite of the fact that the disease has been recognized from earliest times, nothing definite is known as regards its etiology, and a successful line of treatment has yet to be discovered. There are certain points in connection with the disease which merit the attention of the clinician: (1) Many cases termed enteritis are in reality 'twists of the intestine.' Unless a careful post-mortem be made, the presence of the twist is likely to be overlooked, and the lesions attributed to enteritis *per se*. (2) There are marked difficulties in the diagnosis of the affection, and there is a tendency to mistake cases of impaction of the intestine, manifesting acute pain, for enteritis, and in consequence to adopt a line of treatment which is inimical to the former condition.

As regards an error in diagnosis between twist of the intestine and enteritis, from a therapeutical point of view the matter is of no importance, as both conditions are fatal, and treatment is limited to the relief of pain. We admit that it is possible for localized cases of enteritis to recover, but in the type of the disease usually met with, judging by the lesions revealed at autopsies, we fail to see how treatment of any kind can prevent the death of the patient. Formerly it was held that unrelieved and prolonged cases of ordinary colic could terminate in enteritis, but careful observation has shown that acute diffuse enteritis originates as a disease *per se*. It seems very probable that in the future acute diffuse enteritis will be proved to have a microbial origin; this is at present surmised, but further investigation is very desirable. The subject is still *sub judice*, and beyond mechanical causes (volvulus, etc.), verminous aneurism, anthrax, and certain other infectious diseases, we know nothing definite as regards the etiological factors of the affection.

The following **Symptoms** are regarded as suggestive of the presence of enteritis, but, as already remarked, the differential diagnosis is often attended with considerable difficulty: In the early stages, rigors, accelerated respirations, a rapid hard pulse, the frequent passage of small amounts of fæces, occasionally diarrhœa, but obstinate constipation soon follows; evidences of abdominal pain are next observed, with no intervals of ease, and gradually increasing in intensity; an anxious expression of countenance; pawing; looking towards the flanks; striking at the belly with the feet; constant rolling, lying down, and rising; the visible mucous membranes deeply injected; the temperature raised, 2° to 3° F.; a hard wiry, quick pulse, becoming later on gradually thready and imperceptible; cold extremities; sometimes general sweating; a variable degree of tympany; a hard, tense condition of the abdominal muscles; in some cases, constant walking round the box.* In the later stages a haggard expression of countenance, cold sweats, short, quick

* As already remarked (p. 48), the 'circus' mode of progression is often due to large doses of opiates.

respirations, a varying degree of tympany; all evidences of pain subside, the animal stands persistently, the pulse is imperceptible. If made to move, staggering and muscular trembling is observed; finally the animal falls forward and dies after a few convulsive struggles. The usual duration of the case is from eight to twenty-four hours.

Having arrived at the conclusion that acute enteritis is present, and knowing from previous experience the nature of the lesions, the practitioner is aware that any line of **treatment** he may prescribe cannot influence the course of the disease in a favourable manner. All that can be done is to give relief to the pain by administering full and repeated doses of chloral hydrate. Cannabis indica at one time was regarded as the most reliable anodyne agent, but we fail to see any advantage it possesses over chloral; besides, its high price is prohibitive for the purpose. In some instances chloral will fail to give relief; we then advise that chloroform be given by inhalation, and the patient be kept under light anæsthesia. Opiates should be avoided, as ordinary doses fail to exert anodyne effects, and if full amounts be given delirium and excitement will be produced. We have no belief in the value of local applications to the abdominal walls.

We have already remarked that recovery is impossible in cases of acute diffuse enteritis. The cases of recovery from this disease claimed by some practitioners can be explained on the grounds of an error in diagnosis.

In the treatment of cases of limited enteritis associated with impaction of the colon, the measures already advised for this latter condition should be carried out.

We may here remark that by employing chloral hydrate as an anodyne in enteritis, in the event of our diagnosis being incorrect, the treatment will not prejudice any other measures which may be deemed advisable later on.

With reference to the treatment of twists of the intestine, invagination, and other organic diseases of the bowel, which from their nature are of necessity fatal, therapeutic measures should be conducted on similar lines to those mentioned for

enteritis. All that can be done is to give relief to pain. But the possibility of errors in diagnosis must be remembered; and it sometimes happens that a case regarded as hopeless recovers, much to the surprise of the practitioner and the owner of the animal. Here, again, by employing chloral or chloroform, we do not prejudice the chances of recovery, should it happen that the case proves to be one amenable to treatment.

Enteritis in Foals.—This must not be confounded with ordinary diarrhœa, popularly known as 'scouring,' which, if treated in a rational manner, seldom proves fatal (see p. 640), but if neglected may terminate in enteritis. The intestinal lesions are frequently associated with gastritis. In many instances, the evidences of pain are little marked, but the constitutional disturbance is severe. It must be remembered that parasitic invasion of the intestines by *Strongylus tetracanthus* may induce similar symptoms.

The following **Symptoms** are observed: Dulness, disinclination for movement, a tendency to lie down for long intervals, refusing to suck the dam, a 'tucked-up' appearance of the abdomen; colicky pains in some cases, in others only uneasiness and pawing; diarrhœa, with liquid light yellow, very fœtid fæces, which later on assume a greyish-white or greenish tint, and contain particles of mucus; marked debility; gradual exhaustion; haggard expression of countenance; accelerated respirations; and an imperceptible pulse. Death may occur in from three to ten days.

Treatment in severe cases is seldom successful. In the early stages a laxative dose of castor-oil or white vaseline oil is indicated. A mixture containing chlorodyne, prepared chalk, and peppermint-water, should be prescribed to check the diarrhœa. In some instances, tannoform and subnitrate of bismuth prove useful. If the animal can be persuaded to take fluids, rice-water, barley-water, and then starch gruel, should be offered. To combat extreme weakness, port wine and brandy are necessary, also subcutaneous injections of normal saline solution.

Dysentery is a comparatively rare disease in the horse.

The lesions are found in the mucosa of the large intestine, and consist of hyperæmia, hæmorrhages, removal of epithelium in patches, the presence of diphtheritic deposits, followed by the formation of ulcers.

The **Symptoms** observed are—Diarrhœa, fever, marked prostration, occasional colicky pains, liquid fæces composed largely of mucus and a jelly-like material mingled with shreds of membrane or blood, very offensive and gluey in character; in severe cases, thirst and abdominal pain, and death from exhaustion in a short period of time.

Treatment consists in allowing emollient and nutritious food, milk, barley-water, linseed-tea. Glycerin of carbolic acid and chlorodyne prove useful in some cases. Robertson advised 1 drachm of ipecacuanha and ½ drachm of powdered opium in bolus, two or three times daily.

Diarrhœa.—This should be regarded as a symptom rather than a disease *per se*, as it is met with during the course of various affections. Some horses are subject to diarrhœa without any apparent cause, and some nervous, excitable animals are prone to purge when starting on a journey. Again, diarrhœa may be observed as a premonitory symptom in certain intestinal affections, such as enteritis and impaction of the cæcum. It is also a symptom in certain parasitic affections of the alimentary canal.

Sudden changes of diet are well known to induce diarrhœa, especially an allowance of grass, roots, etc., to animals not accustomed to these foods. New hay, new oats, chills, and drinking of cold water after feeding, may also be etiological factors. In prescribing **Treatment**, the cause of the affection should be ascertained if possible. When depending on the presence of undigested material in the alimentary canal, a moderate dose of raw linseed-oil is indicated. The horse must be kept at rest, boiled starch or flour gruel should be allowed, and, unless the diarrhœa is profuse, a small amount of hay may be given. Cold water should be interdicted, but lukewarm water may be allowed. Astringents ought not to be given unless the diarrhœa persists, in which instance it is well to administer a moderate dose of chlorodyne with pre-

pared chalk in the form of a drench. Should depression be present, 8 ounces of brandy may be added to the above. After an attack of diarrhœa the horse must not be put to work too soon, otherwise a recurrence or complications may set in.

Superpurgation is an aggravated form of diarrhœa, and is characterized by excessive, long-continued purging, associated with serious constitutional symptoms and a tendency to certain complications. There are two chief conditions under which superpurgation may occur. Thus, it may set in as the result of the administration of purgatives for therapeutic purposes, or it may depend on the ingestion of certain foods. An ordinary dose of aloes may cause superpurgation in some horses, but more commonly it results from too large a dose, or from neglect of precautions which should be observed in connection with the administration of this drug (see p. 461). Raw linseed-oil, given in full and repeated doses in cases of intestinal impaction, may be followed by superpurgation (see p. 470). Certain foods, such as raw potatoes, especially if half sprouted, are well known to produce superpurgation, and even prove fatal by setting up enteritis. But cases are observed in which posting-horses leave the stable in apparently good health, and before half the journey is completed they purge violently, become exhausted, and have to be left in the nearest stable. In some of these cases acute laminitis occurs as a sequel. The etiology of such attacks cannot be determined in many instances.

The following **Symptoms** are observed in superpurgation: Free purging, a frequent pulse tending to become weak, thirst, depression, in some cases colicky pains and slight tympany. Unless relief be obtained, prostration sets in, the pulse becomes weak and thready, the extremities are cold, and death may result from exhaustion. Acute laminitis is a common complication. Pneumonia may develop in some instances.

Treatment must be carried out with discretion. In cases following the administration of a cathartic, if constitutional symptoms be absent, it is not desirable to check the purging

too quickly with opiates or astringents, as intestinal stasis with tympany may set in. The horse should be warmly clothed, and allowed demulcent drinks, such as thin flour gruel, but cold water should be prohibited. Should, however, constitutional symptoms be present, accompanied by pawing and other evidences of abdominal pain, a moderate dose of chlorodyne with prepared chalk must be administered in flour and starch gruel. If marked prostration be in evidence, from 10 to 15 ounces of brandy, or a bottle of port wine, may be given.

When superpurgation depends on irritating ingesta similar treatment is indicated, but care should be taken not to check the purging too quickly. If severe pain be present, a dose of chloral hydrate combined with compound tincture of camphor often proves beneficial.

Diarrhœa in Foals.—This is probably one of the commonest affections in foals from one to two weeks old. The diarrhœa varies in severity, and mild cases readily yield to simple treatment. In other instances constitutional symptoms are manifested, and the clinical picture resembles that occurring in enteritis (see p. 637).

The following etiological factors are recognized: Separating the foal from the dam for long intervals while the latter is kept at work; the milk then undergoes alterations rendering it unfit for digestion, while the foal, being kept without nutriment for a long period, takes more milk than it can digest. Dyspepsia results, and the irritating products formed induce diarrhœa. Certain foods given to the dam may produce changes in the milk which cause diarrhœa in the foal. When a foal has to be reared on cow's milk owing to the death of its dam, diarrhœa is not uncommon, unless a proper proportion of water and sugar be added to the milk as a prophylactic measure.

Treatment should be commenced by administering a dose of castor-oil, so as to cause removal of irritating ingesta. If depression be manifested, sweet spirit of nitre and brandy are indicated. Should these measures fail, a combination of chlorodyne, prepared chalk, and peppermint-

water, must be prescribed in starch gruel. Care should be taken to cease the administration of astringents when the diarrhœa is checked, otherwise constipation will result. In obstinate cases, catechu, prepared chalk, and compound tincture of camphor should be given (see formulæ, p. 644). When colicky pains are manifested, chlorodyne is indicated. In cases where marked weakness is present, with total loss of appetite, stimulants, such as brandy or port wine, must be carefully administered. Antacids, such as sodium bicarbonate, should be given to the dam in cases where the cause of diarrhœa in the foal can be traced to alterations in the quality of the milk.

Here we may draw attention to the necessity for exercising great care in the administration of medicines to foals. Many of these animals succumb to pneumonia as the result of careless drenching. Owners and attendants are frequently very ignorant in such matters, and the practitioner must instruct them in a practical manner how to administer the necessary medicaments.

Constipation.—This is a symptom present in a variety of abdominal affections, and it varies in degree. The term is applied in a general sense to (1) a condition in which the fæces are abnormally retained in the intestines, and (2), when passed, are less in amount and harder in consistence than normal. The former condition has already been dealt with under the heading of Impaction of the Intestine. Here we shall deal with the treatment of the other condition mentioned above. Various etiological factors are recognized, such as — Atony of the muscular walls of the intestines, liver derangement, too dry a diet, insufficiency of drinking-water, lack of exercise, the presence of febrile disorders.

Treatment consists in allowing food of a laxative nature. Moderate doses of sulphate of magnesia or sulphate of soda may be given in the food or drinking-water; small amounts of raw linseed-oil given in a bran-mash also prove useful. In some instances a nerve tonic, such as nux vomica, is indicated. We have observed good results from a combination of bicarbonate of soda, common salt, and sulphate of soda,

given twice daily in the food. The teeth should be examined for the presence of dental irregularities. A proper supply of drinking-water should be allowed.

Formulæ.

Drenches for Simple Spasmodic Colic.

(1) ℞ Ol. Menth. Pip. ... ... ℥i.
Spts. Ammon. Aromat. ... ... ℥ii.
Ol. Lini ... ... O.i.
Ft. haust. Sig.: Give at once.

(2) ℞ Ol. Tereb. ... ... ℥ii.
Ol. Menth. Pip. ... ... ℥i.
Ol. Lini ... ... O.i.
Ft. haust. Sig.: Give at once.

(3) ℞ Chloral Hyd. ... ... ℥i.
Aquæ ... ... ℥iv.
Ol. Lini ... ... O.i.
Ft. haust. Sig.: To be given if pain be severe.

Drench for Flatulent Colic.

℞ Ol. Tereb. ... ... ℥ii.
Spts. Ammon. Aromat. ... ... ℥ii.
Ac. Carbol. Liq. ... ... ℥i.
Ol. Lini ... ... O.i.ss.
Ft. haust. Sig.: Give at once.

Drench for Colic with Impaction of the Colon.

℞ Aloes Barb. ... ... ℥v.
Aquæ Ferv. ... ... q.s.
Ol. Tereb.... ... ... ℥ii.
Chloral Hyd. ... ... ℥i.
Ol. Lini ... ... O.i.
Ft. haust. Dissolve the aloes and the chloral in the hot water, and shake up well with the oil of turpentine and raw linseed-oil.

Stimulant and Nerve Tonic Balls for the Treatment of Subacute Obstruction of the Double Colon.

℞ Ammonii Carb. ... ... ℥ii.
Pulv. Nucis Vom. ... ... ℥i.
Saponis Mollis ... ... q.s.
M. Div. in bol. iv. Sig.: The four balls to be given at once.

N.B.—In cases of young animals and in those of small size the dose of nux vomica should be reduced to ½ ounce.

The above to be followed up with—

℞ Ol. Terebinth. ... ... ℥ii.
Spts. Ammonii Aromat. ... ... ℥ii.
Ol. Lini ... ... O.i.

Ft. haust.

If still unrelieved give the following:

℞ Ammonii Carb. ... ... ℥i.
Pulv. Zingib. ... ... ℥ii.
Saponis Mollis ... ... q.s.

F. bol. i. Sig.: Repeat every three hours until relief from pain is obtained.

If the case tends to become protracted and the pulse is strong and not too frequent, administer hypodermically 1 grain of eserine sulphate. On next visit, if no action of the bowels, administer 2 grains of eserine sulphate hypodermically.

Anodyne Drench for Enteritis.

℞ Chloral Hyd. ... ... ℥i.
Tr. Camph. Co ... ... ℥ii.
Mucilaginis ... ... ℥iv.
Aquæ ... ... ad O.i.

Ft. haust. Sig.: Give at once. Repeat in two hours, and as often as required.

Mixture for Enteritis in Foals.

℞ Cretæ Præp. ... ... ℥ii.
Chlorodyni ... ... ℥i.
Aq. Menth. Pip. ... ... ad ℥viii.

F. M. Sig.: Give half a wineglassful every three or four hours in ½ pint of starch gruel.

Mixture for Dysentery in the Horse.

℞ Ol. Tereb. ... ... ℥x.
Ac. Carbol. Liq. ... ... ℥ii.ss.
Tr. Camph. Co. ... ... ℥v.
Vini Ipecac. ... ... ℥v.
Ol. Olivæ ... ... ad O.i.

F. M. Sig.: Give two wineglassfuls every four hours in a pint of flour gruel. If pain be present, 2 drachms of chlorodyne may be added to each dose of the above.

Mixture for Superpurgation in the Horse.

℞ Chlorodyni ... ... ℥x.
Cretæ Præp. ... ... ℥ii.ss.
Tr. Camph. Co. ... ... ℥v.
Aquæ ... ... ad O.i.

F. M. Sig.: Give two wineglassfuls every three or four hours in a pint of flour gruel until relief is obtained.

For Simple Diarrhœa in Foals up to a Week Old.

℞ Ol. Ricini ... ... ℥i.
Liq. Potassæ ... ... ℥xxx.
Mucilaginis ... ... q.s.
Ol. Menth. Pip. ... ... ℥v.
Aquæ ... ... ad ℥ii.

Ft. haust. Sig.: Give at once. In older foals give double the quantity of castor-oil.

If stimulants are indicated, add to the above ½ ounce of brandy, or from 1 to 2 drachms of Spts. Æth. Nit., or Spts. Ammon. Aromat.

If the above fails to check the diarrhœa, and if the latter be severe, the following mixture may be given:

℞ Chlorodyni ... ... ℥iii.
Cretæ Præp. ... ... ℥i.ss.
Tr. Camph. Co. ... ... ℥i.
Aq. Menth. Pip. ... ... ad ℥vi.

F. M. Sig.: Give two tablespoonfuls every three or four hours in starch gruel.

Or:

℞ Catechu Pulv. ... ... ℥iii.
Cretæ Præp. ... ... ℥iii.
Spts. Ammon. Aromat. ... ... ℥ii.
Tr. Opii ... ... ℥i.
Aq. Menth. Pip. ... ... ad ℥xii.

F. M. Sig.: Give from 1 to 2 ounces, repeated as required, in a little of the mare's milk.

If constipation should occur as a sequel, give—

℞ Ol. Ricini ... ... ℥i.
Gylcerini ... ... ℥ss.
Ol. Menth. Pip. ... ... ℥x.
Aquæ ... ... ad ℥ii.

Ft. haust. Sig.: Give in one dose.

Laxative Powders for Habitual Constipation in the Horse.

℞ Sodii Sulphat. ... ... ℥iv.ss.
Sodii Chlor. ... ... ℥ii.ss.
Sodii Bicarb. ... ... ℥iv.ss.

M. Div. in pulv. vi. Sig.: Give one twice daily in the food or drinking-water.

CHAPTER VII

THE TREATMENT OF DISEASES OF THE DIGESTIVE ORGANS *(Continued)*

SECTION VIII.

THE TREATMENT OF DISEASES OF THE INTESTINES IN CATTLE.

DISEASES and disorders of the intestines in cattle are of minor importance as compared with gastric affections in these animals. Although cessation of the action of the bowels is a common symptom, it is usually associated with diseases of one or more of the compartments of the stomach, the atony of the intestines appearing to be coincident with a similar condition of the gastric walls. Again, when the functions of the stomach are arrested, intestinal digestion is also inhibited. The most important pathological conditions of the intestines, so far as the therapeutist is concerned, are the various forms of enteritis, acute and chronic diarrhœa, etc. Here we may remark that, although inflammation of the intestines is of a serious nature, yet it is by no means so rapidly fatal in cattle as in horses. Again, enteritis may be present in the bovine without the animal manifesting any evidences of acute abdominal pain.

Spasmodic colic is uncommon, flatulent colic is practically never met with, and impaction of the colon may be regarded as a comparatively rare condition.

Spasmodic Colic is evidenced by incessant restlessness, crouching, stamping, kicking at the abdomen, switching of the tail, getting up and down, an anxious expression of countenance, looking towards the flank, etc. The symptoms

are transient and gradually subside, and usually recovery is spontaneous.

Treatment consists in giving a full dose of castor-oil or raw linseed-oil, and 1 ounce of chloral hydrate in solution.

Impaction of the Colon can only be diagnosed by rectal exploration. Full doses of raw linseed-oil are indicated, and common salt may be given in the form of electuary, also nux vomica. Enemata should be administered by means of the long rectum-tube. Eserine or arecoline are advised by some authors, while others point out that such agents are not safe in cattle practice.

Acute Enteritis.—In cattle the lesions are found more frequently in the small intestines, and the affection is very often associated with gastritis.

The following symptoms may be observed: Loss of appetite, cessation of rumination, injected visible mucous membranes, lachrymation, sometimes colicky pains, fever, a small, weak pulse, thirst, constipation at first, succeeded after a day or two by diarrhœa, fæces blackish or tarry in appearance, straining after defæcation, tympany of the rumen in some cases, in others a 'tucked-up' appearance. Later on, haggard expression of countenance, sunken eyes, moaning, fœtid breath, and death from exhaustion.

Treatment in the early stages may be commenced by administering a full dose of castor or linseed oil. To combat the pain and diarrhœa when present, chlorodyne is indicated. Intestinal antiseptics such as salicylate of soda prove useful, or formalin in 1 drachm doses largely diluted with water may be given twice daily. Demulcents should be allowed *ad lib.* In cases of gastro-enteritis, the treatment suggested for acute gastritis (see p. 598) should be adopted.

Croupous Enteritis.—In the treatment of this condition in the early stages, a moderate dose of Epsom salt well diluted, and combined with treacle, is indicated, so as to cause removal of the croupous material. Full doses of hypo-sulphite, bicarbonate or salicylate of soda may be given in the form of electuary, and later on nerve tonics and vegetable bitters, such as nux vomica and gentian.

Dysentery is more common in cattle than in horses. In many instances it may be regarded as an advanced stage of acute enteritis, and it is at all times a grave affection. Some cases are rapidly fatal, while others run a chronic course.

Treatment is rarely successful. A full dose of raw linseed-oil is advised as a preliminary measure. Various internal antiseptics may be tried, such as carbolic acid, creosote, cyllin, salicylic acid, etc. Small doses of oil of turpentine are said to prove useful in some cases. If pain be a prominent symptom, a dose of chlorodyne is indicated. Enemata containing antiseptics may be tried. In cases where weakness is present, whisky, eggs, milk, and rice or flour gruel, should be administered. Linseed-tea, hay-tea, barley-water, etc., should be allowed *ad lib.*

Chronic Enteritis is evidenced by chronic diarrhœa. It is a common affection amongst Ayrshire cattle, and seldom proves amenable to treatment. Many cases gradually merge into dysentery. In considering the question of treatment, it must be remembered that chronic diarrhœa is the chief symptom in Johne's disease, coccidian enteritis, tubercular enteritis, and parasitic gastritis. Again, it may be an accompaniment of chronic diseases of the liver, heart, and lungs, and also of septic conditions of the uterus.

In cases not depending on the above causes, benefit may occasionally result from the administration of dilute sulphuric acid and sulphate of iron. But in the majority of instances of well-marked chronic diarrhœa treatment is useless.

Simple Diarrhœa is a common affection in cattle, and is readily induced by sudden changes in diet, improper and irritant food, etc. Cattle removed from poor land to a rich and succulent pasture often suffer from this disorder.

Treatment consists in administering 1 ounce of chlorodyne, 1 pint of lime-water, and 1 pint of raw linseed-oil. The diet should be restricted to good hay and bran mashes.

In more persistent cases, small repeated doses of chlorodyne may be prescribed, or a combination of powdered opium, catechu, prepared chalk, and ginger, may be administered in flour gruel twice daily.

Diarrhœa in Calves.—This very frequently depends on dyspepsia (see p. 602). It is also a symptom occurring in parasitic gastritis and in the disease known as 'white scour.' In order to adopt suitable treatment, it is necessary to ascertain the disease on which the diarrhœa depends.

White Scour is a microbial affection of new-born calves, of which the leading symptom is a white frothy diarrhœa. In slight attacks the animals apparently recover, but subsequently pulmonary lesions develop. Arthritis in one or more joints is a common complication.

Medicinal treatment has not proved successful. Preventive measures consist in securing cleanliness of the surroundings prior to parturition, and the application of an aseptic ligature and antiseptic dressings to the umbilical cord of the calf.

Jensen prepared a polyvalent coli serum which proved very successful as a prophylactic in Denmark.

A 'White Scour Serum' is prepared by Messrs. Parke, Davis and Co. from the blood of horses which have been immunized with gradually increasing doses of polyvalent cultures of *Bacillus coli communis*, isolated from cases of white scour. This serum is intended for prophylaxis and also for therapeutical use. The prophylactic dose is from 10 to 20 c.c. administered subcutaneously soon after birth. The curative dose is 10 c.c., which is to be repeated according to the indications of the case.

Formulæ.

Drench for Simple Diarrhœa in Cattle.

℞ Chlorodyni ... ... ℥i.
Liq. Calcis ... ... O.i.
Ol. Lini ... ... O.i.
Ft. haust. Sig.: Give at once.

Powders for Persistent Cases of Diarrhœa.

℞ Pulv. Opii ... ... ℥vi.
Pulv. Catechu ... ... ℥i.ss.
Cretæ Præp. ... ... ℥iii.
Pulv. Zingib. ... ... ℥vi.
M. Div. in pulv. iii. Sig.: Give one every twelve hours in a pint of flour gruel until the diarrhœa ceases.

Mixture for Chronic Diarrhœa.

℞ Ferri Sulph. ... ... ℥x.
Ac. Sulph. Dil. ... ... ℥x.
Tr. Zingib. ... ... ℥v.
Aquæ ... ... ad O.i.
F. M. Sig.: Give two wineglassfuls once daily in a pint of flour gruel.

Mixture for Dysentery.

℞ Ol. Tereb. ... ... ℥ii.ss.
Ac. Carbol. Liq. ... ... ℥v.
Ext. Bellad. Liq. ... ... ℥x.
Aquæ ... ... ad O.i.
F. M. Sig.: Give two wineglassfuls twice daily in a pint of flour gruel.

Mixture for Diarrhœa in Calves, due to Dyspepsia.

℞ Chlorodyni ... ... ℥x.
Cretæ Præp. ... ... ℥ii.
Tr. Camph. Co. ... ... ℥ii.ss.
Tr. Zingib. ... ... ℥x.
Aquæ ... ... ad O.i.
F. M. Sig.: Give a wineglassful three times a day in ½ pint of starch gruel.

Section IX.

THE TREATMENT OF DISEASES OF THE INTESTINES IN THE DOG.

Affections of the intestines are of common occurrence in the dog. In many instances they depend on irrational feeding and lack of exercise; but intestinal lesions associated with specific diseases such as canine typhus, canine distemper, and tuberculosis, are frequently encountered. Owing to the simple anatomical arrangement of the large intestine in the dog, twists and displacements of this organ do not occur. Volvulus, or twist of the small intestine, is very rare, while invagination, or intussusception, is a rather common condition. As the calibre of the colon is comparatively small, and the food of the dog not liable to excessive

fermentation, intestinal tympany can only occur to a moderate extent.

Spasmodic Colic is seldom observed in the dog. No doubt colicky pains, evidenced by restlessness, whining, or actual yelping, crouching down first on one side and then on the other, are observed as symptoms in various intestinal affections, but the phenomena manifested by horses suffering from spasmodic colic do not occur in the dog. Young puppies suffering from impaction of the bowels due to collections of ascarides, utter constant piercing cries, but in other instances no cause can be discovered to account for this symptom, which is often relieved by administration of an anodyne and an aperient. It must be remembered that a serious and often fatal enteritis may be present in the dog without the animal manifesting any evidences of pain, and the lesions discovered at the post-mortem come as a surprise. Similar remarks apply to many cases of invagination of the intestine.

Again, in cases of pachymeningitis and acute muscular rheumatism, the dog utters piercing cries if handled, or when he attempts to alter his position. In such instances, unless the history of the case be obtained, and the symptoms carefully studied, the pain may be erroneously ascribed to the intestines, more especially when the abdominal muscles are involved and fæcal obstruction of the colon is present (see p. 748).

In considering the **Treatment** of cases manifesting colicky pains, the source of the symptom should be discovered if possible, and a careful examination made of the abdominal region by palpation. A digital examination of the rectum should always be carried out. If we decide that the symptoms do not depend on an organic lesion of the intestine, a dose of spirit of chloroform, given in castor-oil, is indicated. If this fails to give relief, chlorodyne may be prescribed, in a dose suitable to the size of the patient, or a hypodermic injection of morphine may be given. In some cases flatulence is associated with colicky pains, and carminatives, such as tincture of ginger, are indicated, in addition

to the agents mentioned. If the pain depends on fæcal obstruction or the presence of foreign bodies, such as sharp-pointed pieces of bone, in the rectum, special treatment for such conditions is required.

Enteritis.—Inflammation of the intestines may occur in an **acute** or in a **chronic** form.

Several varieties of the **acute** form are recognized, but for practical purposes it will suffice to deal with acute catarrhal enteritis and a dysenteric or croupous gastro-enteritis.

Acute Catarrhal Enteritis, when not depending on invagination of the intestine or on irritant poisons, is not a common affection in the dog. It may be associated with gastritis. Little is known with reference to the etiological factors. Either the small or the large intestine may be involved. The **Symptoms** are not constant. In some cases, constipation succeeded by diarrhœa is observed, also vomiting, especially if gastritis be present; the fæces contain mucus and sometimes blood; tenesmus occurs when the large bowel is affected; palpation of the abdomen causes pain; fever, loss of appetite, marked thirst, a 'tucked-up' condition of the abdominal muscles, an anxious expression of countenance, restlessness, prostration, etc., may also be present. Jaundice is observed in some instances. As already remarked, cases occur in which, beyond a 'drawn-up' condition of the abdomen, obstinate constipation, loss of appetite, and a mournful expression of countenance, no other symptoms are observed, yet the post-mortem reveals acute enteritis. Mild cases tend to recover, but when the lesions are severe, prostration occurs, followed by death in a variable period of time.

Treatment in the early stages consists in administering a small dose of chlorodyne with white vaseline oil. This combination removes undigested material from the bowels and relieves irritation of the intestinal mucosa. As regards diet, milk with lime-water, raw white of egg, etc., should be allowed; solid food must be withheld. When diarrhœa is a prominent symptom, salts of bismuth, Dover's powder, etc., may be prescribed. Intestinal disinfectants, such as salicylate

of bismuth, acetozone, etc., prove useful in some cases. When prostration is marked, subcutaneous injections of normal saline solution are indicated.

Dysenteric or Croupous Enteritis.—This is an intense hæmorrhagic gastro-enteritis, associated in some instances with the formation of croupous membranes. It may arise as the result of ingesting infected or decomposing meat. Similar lesions are observed in cases of canine typhus and the gastro-intestinal form of distemper.

The following **Symptoms** may be present: Persistent vomiting, the vomited material being hæmorrhagic in character and very fœtid; sometimes colicky pains; marked prostration; temperature elevated at the start, but soon becoming subnormal; a small, weak pulse; diarrhœa, the fæces being hæmorrhagic, very fœtid, and containing shreds of tissue; also tenesmus. In the later stages, profound prostration, muscular contractions, staggering, fœtid condition of mouth, and finally coma and death within two days, or even in twenty-four hours.

Treatment should be directed to check excessive vomiting, to combat extreme prostration, and to disinfect the gastro-intestinal canal. Chloretone given as a powder on the tongue, and repeated at intervals, is the best agent to check vomiting; it is also a gastric disinfectant. Acetozone (gr. v. to O.i. of water) is useful as an internal antiseptic. Normal saline solution administered by subcutaneous injection at frequent intervals constitutes the best means of overcoming extreme prostration; moreover, it dilutes the toxins and brings about their removal from the system by way of the kidneys. Some authors advise lavage of the stomach. It is useless administering either food or stimulants *per os*, as they are quickly rejected by vomiting. Nourishment should be given by means of nutrient suppositories (see p. 184).

The disease is very fatal in spite of every form of treatment. Mayall advises enemata composed of a solution of common salt in water, followed by the administration of liquid paraffin (see p. 655).

Chronic Enteritis.—This is one of the causes of chronic

diarrhœa in the dog. It may result from recurring attacks of acute enteritis, and is also associated with chronic affections of the heart, liver, or kidneys, or it may depend on tuberculosis or coccidiosis.

The leading **Symptoms** are—Obstinate chronic diarrhœa and gradual emaciation and anæmia. In some cases constipation and diarrhœa may occur alternately.

The principles of **Treatment** are similar to those advised for acute enteritis. Solid food should be prohibited until the diarrhœa is checked. Full doses of bismuth subnitrate, in the form of powder, prove useful in some cases. A mixture containing bismuth, pepsin, and opium, gives good results in other instances. In cases where the diarrhœa is very obstinate, a mixture containing dilute sulphuric acid, decoction of hæmatoxylin, and infusion of cloves, often proves of benefit.

Fæcal Impaction of the Intestine. — This is a very common condition in the dog. It varies in degree and extent, some cases yielding readily to simple medicinal treatment, while others are very obstinate, and occasionally require surgical interference.

The following **Causes** are recognized: Want of sufficient exercise; the use of dry or concentrated foods, or aliment large in bulk and of an indigestible nature; gluttonous feeders which swallow large masses of meat, bones, etc.; habitual constipation when neglected; deficient innervation of the intestine met with in old fat dogs; chronic disorders of the stomach, intestines, or liver; abdominal tumours causing pressure on the bowel; obstruction of the anus due to swelling and inflammation of the anal glands, or depending on an accumulation of fæcal material matted with the hair. A common form of obstruction in the rectum is an impacted fæcal mass containing spicules of bone. Fæcal impaction should be distinguished from fæcal stasis due to loss of nervous power. The latter condition may depend on paraplegia (paralysis of the hind-limbs), etc., such as occurs in cases of recurrent pachymeningitis (see p. 747). Rheumatism affecting the abdominal muscles is also a cause

of fæcal stasis. In such instances the peristaltic action of the intestines is inhibited, and, owing to the painful condition of the abdominal muscles, defæcation is rendered so painful that the act is suppressed.

In fæcal impaction the obstruction may occur in the colon, the cæcum, or the rectum. Unless relief be obtained, enteritis, necrosis, and occasionally perforation of the bowel, may take place, also auto-intoxication, exhaustion, etc.

The leading **Symptoms** observed are—Constant straining and painful attempts at defæcation, but no fæces are passed; in some instances the dog utters painful cries; occasional vomiting, loss of appetite, distension of the abdomen, and tenderness on palpation of this region; sometimes stercoraceous vomiting, the vomit being composed of material from the intestine due to anti-peristaltic action.

Treatment must be directed to bring about removal of the obstruction. In mild cases (fæcal stasis) success is generally obtained by administering a full dose of castor-oil, followed up with liquid paraffin (white vaseline oil). Enemata of warm water should also be given. Glycerin suppositories may be tried.

When the obstruction is more extensive, and irritability of the stomach is present, it is useless administering medicines *per os*, as they are quickly vomited. Chief reliance must be placed on enemata given by means of the long gum-elastic rectum-tube. Care and patience are required in carrying out this procedure, so as to avoid injury to the bowel. It is of advantage to raise the hind-quarters of the animal while the enema is being administered, the hind-feet being held up by an assistant, and the fore-feet resting on the ground. Mayall has had successful results by administering in this manner from 3½ to 4 pints of warm saline solution (1½ drachms of common salt to each pint of water). This induces vomiting, and when the vomit alters to clear fluid, from one to two teaspoonfuls of liquid paraffin (white paraffin oil) are given *per os*. The amounts of the saline solution and of the liquid paraffin must, of course, be regulated according to the size of the dog. This method is deserving of further trial.

The employment of liquid paraffin in cases of intestinal obstruction in the dog has proved of marked value.

When the above measures fail, an exploratory laparotomy must be carried out. (See Hobday's 'Surgical Diseases of the Dog and Cat.')

Here we must point out that, should evidences of pain be manifested during an attack of fæcal impaction, opiates should not be freely administered, as they mask the symptoms and increase the intestinal stasis.

In cases where the rectum is obstructed by fæcal masses, spicules of bone, etc., these must be carefully removed by means of the finger, assisted by enemata of warm water or liquid paraffin.

There are various pathological conditions of the intestines in the dog in addition to those mentioned. Some of these are amenable to surgical interference, others are inoperable. With reference to foreign bodies in the intestine, the reader is referred to our article on the subject in 'A System of Veterinary Medicine,' vol. ii.

The Treatment of Diseases of the Anal Glands.—This is an important subject to the canine practitioner.

CATARRH OF THE ANAL GLANDS is a very common affection in house dogs, and, unless the condition be recognized and understood, diagnosis and treatment will be erroneous. The following symptoms are present: The anus is hot, swollen, reddish, and painful. The irritation causes the dog to draw or rub the anus along the ground, and he is constantly licking the part. Pain during defæcation is often observed, and the fæces may contain small amounts of blood. If the anal glands be pressed between the thumb and index-finger, a variable amount of a yellowish, purulent, very fœtid liquid material squirts out of the openings of the glands.

As regards **Treatment**, H. Gray advises irrigation of the glands with an antiseptic solution, such as 1 in 1,000 solution of perchloride of mercury or chinosol, and repeated every two or three days, for a few times. The solution should be injected with a syringe having a capacity of half

an ounce, and fitted with a fine bulbous-pointed nozzle, 1 to 1½ inches in length. The openings of the glands are located on the lateral margins of the anus, and sometimes it is necessary to pass the finger into the anus, so as to render the margin tense and to prevent it curving inwards. No force should be used, nor should irritant solutions be employed. The affection is likely to recur, especially in old dogs suffering from hepatic or renal diseases. Mild laxatives, such as liquid paraffin, should be given as adjuncts to the above treatment.

Impaction of the Anal Glands.—In this condition these culs-de-sac become impacted with a thick, brownish, putty-like material, which causes discomfort in the anal region.

Treatment consists in exerting gentle compression on the glands so as to cause evacuation of their contents. Irrigation is then carried out as already described.

FORMULÆ.

Anodyne Mixture for Colic.

℞ Tr. Belladonnæ ... ... ℥ss.
Spts. Chloroformi ... ... ℥ii.
Spts. Ammon. Aromat. ... ... ℥ii.
Aq. Menth. Pip. ... ... ad ℨvi.
F. M. Sig.: Give from two teaspoonfuls to a tablespoonful every three hours until pain is relieved.

Aperient and Anodyne Draught for Colic.

℞ Tr. Rhei ... ... ℥ss. to ℥i.
Chlorodyni ... ... ♏ x. to ♏ xv.
Ol. Ricini ... ... ℥ii. to ℥iv.
Aq. Menth. Pip. ... ... ad ℨi. to ℨii.
M. Ft. haust. Sig.: Give at once.

Mixture for Colic associated with Flatulence.

℞ Magnesii Carb. ... ... ℥i.ss.
Tr. Rhei Co. ... ... ℨi.
Spts. Chloroformi ... ... ℥i.
Aq. Menth. Pip. ... ... ad ℨvi.
F. M. Sig.: Give from two teaspoonfuls to a tablespoonful every three hours until relief is obtained.

Mixture for Puppies suffering from Colic and Flatulence.

℞ Tr. Rhei Co. ... ... ℥ii.
Spts. Ammon. Aromat. ... ... ℥ss.
Spts. Chloroformi ... ... ℥ss.
Aq. Menth. Pip. ... ... ad ℥ii.

F. M. Sig.: Give from half a teaspoonful to two teaspoonfuls every hour until relieved.

Or:

℞ Magnesii Carb. ... ... gr. xx.
Tr. Zingib. ... ... ℥iii.
Spts. Chloroformi ... ... ♏ xx.
Aq. Menth. Pip. ... ... ad ℥ii.

F. M. Sig.: Give from half a teaspoonful to a teaspoonful every hour as required.

Draught for Enteritis in the Early Stages.

℞ Chlorodyni ... ... ♏ x. to ♏ xv.
Paraffini Liq. ... ... ℥i. to ℥ii.

M. Ft. haust. Sig.: Give at once.

Mixture for Enteritis.

℞ Bismuthi Subnit. ... ... ℥ss.
Sodii Salicylatis ... ... ℥iii.
Tr. Camph. Co. ... ... ℥vi.
Mucilaginis Tragacanthæ ... ℥i.ss.
Aq. Menth. Pip. ... ... ad ℥vi.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful every three or four hours as required.

Powders for Enteritis when Diarrhœa is a Prominent Symptom.

℞ Bismuthi Subnit. ... ... gr. x. to gr. xx.
Pulv. Ipecac. Co. ... ... gr. v. to gr. x.

M. Ft. pulv. i. Sig.: Give every three hours as required.

Mixture for Diarrhœa accompanied by Intestinal Irritation.

℞ Bismuthi Carb. ... ... ℥i.ss.
Sodii Bicarb. ... ... gr. xl.
Chlorodyni ... ... ♏ xl.
Mucilaginis Tragacanthæ ... ℥i.
Aquæ Cinnamomi ... ... ad ℥vi.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful every three hours as required.

Mixture for Obstinate Diarrhœa.

℞ Acidi Sulph. Dil. ... ... ℥ii.
Decocti Hæmatoxyli ... ... ℥ii.ss.
Infusi Carophylli ... ... ℥ii.
Aq. Menth. Pip. ... ... ad ℥vi.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times daily.

Mixture for Diarrhœa in Puppies.

℞ Bismuthi Carb. ... ... gr. xl.
Tr. Camph. Co. ... ... ℥i.
Mucilaginis Tragacanthæ ... ℥ss.
Aq. Chloroformi ... ... ad ℥iii.

F. M. Sig.: Give from half to one teaspoonful every three hours until the diarrhœa is checked.

Mixture for Dysentery.

℞ Bismuthi Carb. ... ... ℥ss.
Pulv. Ipecac. Co. ... ... ℥i.
Mag. Carb. Levis ... ... ℥i.
Mucilaginis Tragacanthæ ... ℥i.ss.
Aq. Chloroformi ... ... ad ℥vi.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times daily.

Or:

℞ Chlorodyni ... ... ℥ii.
Vini Ipecac. ... ... ℥ss.
Liq. Bismuthi ... ... ℥ss.
Aq. Camphoræ ... ... ad ℥vi.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times a day.

Pills for Habitual Constipation.

℞ Ext. Cascaræ Sagradæ ... ... gr. xii.
Aloini ... ... gr. ii.
Ext. Nucis Vom. Sicc. ... ... gr. i.
Ext. Gentianæ ... ... q.s.

Div. in pil. xii. Sig.: Give one twice a day. (For toy dogs the amount of extract of nux vomica should be reduced by half. For large dogs the doses may be doubled.)

Mixture for Habitual Constipation.

℞ Ext. Cascaræ Sagradæ Liq. ... ℥ii.
Paraffini Liq. ... ... ad ℥vi.

F. M. Sig.: Give from a teaspoonful to a tablespoonful as required.

Section X.

THE TREATMENT OF DISEASES OF THE INTESTINES IN BIRDS.

Enteritis.—This condition occurs in several of the infectious diseases of birds. A primary croupous enteritis is met with in various species of birds, and the symptoms observed are—Loss of appetite, marked prostration, stiffness in progression, a brown discoloration of the skin of the inferior abdominal region, violent diarrhœa with yellowish-coloured fæces. The course is rapid, death occurring within four to twenty-four hours.

Enteritis is frequently observed in parrots and cage finches, either as a disease *per se*, following exposure to draughts, chills, etc., or associated with gastritis. Coccidiosis is a common cause in canaries, finches, etc. A gangrenous form of enteritis is also encountered in which a haggard expression of countenance and a purple discoloration of the skin of the abdomen is observed.

Treatment is rarely successful in any form of enteritis in birds. Intestinal disinfectants such as salicylate of bismuth or β-naphthol may be tried. Aromatic chalk powder with opium,* in a dose of from 5 to 10 grains, is advised by some authors. Sulphocarbolate of soda (2 per cent. solution) is also recommended.

Intestinal Obstruction.—This is a rare affection in domestic fowls kept in the open, but occurs in birds subjected to a sedentary life and fed on indigestible foods. It is occasionally seen in birds confined in cages.

The following causes are recognized: Fæcal accumula-

* Powdered Cinnamon Bark ... ... 1¼ drachms.
Powdered Nutmeg ... ... 1 drachm.
Powdered Cloves ... ... ½ drachm.
Powdered Cardamom Seeds ... ... 20 grains.
Refined Sugar ... ... 6 drachms.
Prepared Chalk ... ... 3 drachms.
Powdered Opium ... ... 15 grains.

Mix.

tions matted by feathers forming around the cloaca, and progressively increasing so as to obstruct the opening (occurring as a sequel to diarrhœa); the ingestion of large amounts of gravel, etc., when atony of the gizzard is present, so that they accumulate in the anterior region of the bowels; imperfect trituration of the food in the gizzard owing to the bird not being supplied with sand or grit. In young turkeys fed on improper food, engorgement of the cæca is not uncommon.

The symptoms observed are — The passage of small amounts of dry, hard fæces, accompanied by much straining, marked depression, a stiff gait, loss of appetite, rapid emaciation. On palpation of the abdominal region the distended bowel may be felt. In the female bird the affection must not be mistaken for the condition known as 'egg-binding.'

Treatment.—If the obstruction be within reach, it can be removed by means of a blunt curette assisted by the injection of warm olive-oil or liquid paraffin. In small birds enemata of glycerin administered by means of a syringe are indicated. In the female, care should be taken that the enema enters the rectum, and not the oviduct. If the obstruction be situated more anteriorly, castor-oil or liquid paraffin should be given internally. Either Epsom salt or Glauber's salts in weak solution (1 in 200) may be added to the drinking-water. Rhubarb in a dose of 3 to 10 grains (according to the size of the bird) is advised by some authors, also calomel (1 to 3 grains), while pills containing nux vomica are also useful. The diet should be restricted to green food and soaked grain.

CHAPTER VIII

THE TREATMENT OF DISEASES OF THE LIVER

A.—The Horse.

DISEASES of the liver, so far as the horse and ox are concerned, possess little interest for the veterinary therapeutist, as, owing to the obscure nature of the symptoms, it is seldom that such affections are diagnosed. No doubt, when jaundice is manifested, the liver is regarded as the seat of disease. But we must point out that in many far-advanced cases of hepatic disease jaundice may be absent. Again, jaundice may be a symptom in certain infectious diseases in the absence of any morbid alterations in the liver.

Generally speaking, diseases of the liver are of more interest to the pathologist than to the clinician, as the existence of lesions of this organ are usually discovered as a surprise at post-mortem examinations. It is not uncommon in cases presenting dulness, lack of spirit, pale-coloured fœtid fæces, and a capricious appetite, for a diagnosis of 'liver out of order' or 'liver derangement' to be made, and to find that improvement takes place after the administration of calomel, saline laxatives, etc. In such instances it is very probable that the good results should be attributed to these agents bringing about a removal of the bile from the small intestine, and thus preventing its absorption into the system (see p. 139). As bile should be regarded as both a secretion and an excretion, it is quite apparent that it is capable of exerting toxic effects if absorbed into the system. We have already pointed out (p. 138) that very few drugs are capable of increasing the secretion of bile, also that, although cholagogues are often

prescribed in a routine manner in the treatment of various hepatic diseases, it is difficult to explain why an increase in the secretion of bile is desirable. No doubt there are some morbid conditions of the liver in which the flow of bile into the intestine is interfered with, while there are others in which, owing to destruction of the liver tissue, the secretion of bile is arrested, but in neither of these conditions can cholagogues be of service. Obviously, the influence which the therapeutist is able to exert on the liver is very limited, and consists chiefly in adopting measures to remove bile and the products of imperfect digestion from the system. This is accomplished by purgatives and salines. It is important to remember that all organic hepatic diseases are more or less associated with digestive disturbance, and after a time other organs become involved. A consideration of the complex functions of the liver will indicate the serious and far-reaching effects of hepatic disease, although we must admit that in the horse extensive lesions of this organ may be present without symptoms suggestive of their existence being manifested. Usually digestive disturbances of obscure origin are observed from time to time, but, unless jaundice be present, the nature of the case is not suspected. Again, passive congestion of the liver occurs in connection with chronic valvular diseases of the heart, fatty degeneration of the heart, pericarditis, and every condition leading to venous stasis in the right side of the heart.

According to F. Smith, the functions of the liver are as follows: 'It forms bile, regulates the supply of sugar to the system, and stores up as glycogen what is not required. It guards the systemic circulation against the introduction of certain nitrogenous poisons, such as ammonia, by transforming them into urea, and against other poisons of proteid origin by converting them into harmless products by conjugation with alkaline sulphates' ('Veterinary Physiology'). As regards the function of bile, this author regards it as having a solvent and emulsifying effect on fats, and assisting in their absorption. He does not agree with the view so frequently held, that bile exerts an antiseptic effect on the intestinal

contents and prevents putrefaction; but he points out that bile is not a true antiseptic, and its real action in this direction consists in promoting peristalsis, and thus preventing stasis and putrefactive decomposition in the ingesta.

From this brief résumé of the functions of the liver we can comprehend in a general manner the results of disease of this organ. These include digestive disturbances; interference with the secretion of bile or with its passage into the intestine; effects produced on the system owing to toxic materials not being transformed and removed by the liver, and thus entering the general circulation; interference with the nutrition of the tissues owing to derangement of the glycogenic function of the organ; alterations induced by mechanical interference with the portal circulation, such as occur in hepatic cirrhosis, and comprising gastric catarrh, abdominal dropsy, etc.

In the absence of jaundice, the only means we possess of ascertaining the presence of hepatic disease in the horse is by examining the urine for the presence of bile-pigments (see p. 61), and by observing if the fæces are clay-coloured (see p. 665).

Obviously, if we are able to detect the existence of an organic disease of the liver in the horse, treatment is not desirable on economical grounds, as such affections are incurable and the animal is useless for work. Unfortunately, in the majority of instances, we are not aware of the presence of such diseases until they are revealed by a post-mortem examination.

Jaundice.—Owing to the peculiar notions which are sometimes held with reference to jaundice, we deem it advisable to discuss the subject briefly from a therapeutic aspect. The term jaundice or icterus signifies a deep yellow coloration of the mucous membranes, the unpigmented parts of the skin, and the fluids of the body, by bile-pigments. Jaundice has been aptly described as a symptom with symptoms, and properly speaking it should not be regarded as a disease *per se*. Its presence is suggestive of the existence of an hepatic affection, but it may also occur in certain infectious diseases, such as influenza, and is one of the symptoms in piroplas-

mosis. As already remarked, it may be absent in many organic diseases of the liver. Formerly two types of jaundice were recognized, viz.: (1) *Hæmatogenous*, depending on pathological changes in the blood; and (2) *Hepatogenous*, arising from obstructive changes in the bile-passages. It is now held that the bile-pigments in all instances are produced by the liver, and doubt is expressed as to the existence of true non-obstructive cases. The jaundice associated with certain infectious diseases, piroplasmosis, etc., is explained as follows: Destruction of blood-corpuscles occurs by hæmolysis, and a large amount of hæmoglobin is liberated, from which excessive quantities of bile-pigment are formed by the liver-cells (polychromia). The bile becomes viscid, as its fluid constituents are not increased in proportion, and, owing to the low pressure at which it is secreted, its passage through the liver is accomplished with difficulty or temporarily arrested, so that reabsorption occurs and jaundice results.

Nevertheless, some authors, for clinical purposes, still retain the term 'obstructive' jaundice, and group under it conditions associated with obstructive changes in the bile-passages. These include gastro-duodenal catarrh, associated with tumefaction of the duodenum, or of the lining membrane of the bile-duct and of its branches (catarrhal jaundice); compression of the duct due to enlarged portal lymphatic glands or to neoplasms; compression of the small bile-passages by passive hyperæmia of the liver in connection with acute or chronic hepatitis; and the presence of gall-stones in the bile-duct. Jaundice may also be caused by the action of certain poisons, such as arsenic and phosphorus.

When jaundice is present, the urine may be of a dark yellow, lemon, brownish-yellow, or greenish-yellow colour, and it contains bile-pigments, which, according to most authors, can be recognized in the very early stages by an examination of the urine Friedberger and Fröhner, however, state that in the horse staining of the visible mucosæ may occur without the presence of bile-pigments in the urine.

In obstructive jaundice, owing to the absence of bile from the intestine, constipation is present, the fæces are pale in

colour and very fœtid, but in hæmatogenous jaundice the intestinal contents are usually bile-stained. There are certain constitutional symptoms generally associated with jaundice, and depending on the toxic action of bile on the system. These phenomena are as follows: The animal is dull, sleepy, and easily fatigued; the appetite is in abeyance, the pulse is slow, and the temperature is subnormal. In persistent cases emaciation occurs, and nervous symptoms are manifested, such as a staggering gait, cramp-like convulsions of the muscles, either localized or general, and in some instances delirium and dyspnœa may be observed.

From a therapeutic aspect the presence of jaundice offers but few definite indications for treatment, because it may be a symptom in a variety of morbid conditions. The most important indication to fulfil is to bring about the removal of the toxic material from the system by administering purgatives and diuretics. Attention to diet is also necessary; the food should be restricted to milk, linseed-tea, hay-tea, bran-mashes, etc. In the treatment of jaundice associated with influenza, a combination of sulphate of soda, chloride of soda, and bicarbonate of soda, proves useful, and, obviously, active cathartics should be avoided in a debilitating disease of this kind.

In consequence of the difficulties attached to the diagnosis of hepatic diseases, and the fact that therapeutic measures are very limited in organic affections of the liver, we do not consider it necessary or advisable to devote much space to a consideration of these disorders. Theoretically a number of these affections are described, but from a clinical aspect we must confess that, in many instances, beyond the results obtained from administering aperients and treating any special symptoms that arise, we cannot exert a favourable influence on cases of hepatic disease.

Active Congestion of the Liver is said to be a common affection in tropical climates. The symptoms recorded are—Dulness, half-closed eyes, slight colicky pains, jaundice, polyuria, etc. The treatment advised is the administration of a purgative, followed by repeated doses of salines.

Passive Congestion of the Liver (Nutmeg Liver) is associated with every condition leading to venous stasis in the right side of the heart, such as chronic valvular disease, fatty heart, pericarditis, pulmonary emphysema, etc. The symptoms of the primary disease usually predominate, and unless jaundice be in evidence the presence of hepatic lesions will be overlooked.

The principles of treatment will vary according to the nature of the primary disease. In the majority of instances treatment is not desirable on economical grounds, as there is no hope of a permanent recovery.

Acute Catarrh of the Bile-Duct.—This is also known as 'Catarrhal Jaundice.' The inflammation may extend to the biliary passages (angiocholitis), but the severity of the lesions in these is not definitely known. Gastro-duodenal catarrh is regarded as the most common cause of the condition, the inflammation extending up the duct from the duodenum. In some cases complete obstruction is said to occur, owing to a plug of inspissated mucus blocking the terminal end of the duct. The jaundice which is sometimes observed in cases of influenza is believed by some authors to depend on catarrh of the bile-duct; when the latter lesion is associated with duodenal catarrh, diarrhœa may precede the onset of jaundice. Cadéac regards microbial infection originating from the intestine as an etiological factor. In mild cases, where the duct is not completely obstructed, jaundice is slight or absent. In other instances jaundice is present, the fæces are pale in colour and very fœtid, and the urine contains bile-pigments. Colicky pains are sometimes observed.

As regards treatment, small doses of calomel, followed by sulphate of soda and bicarbonate of soda, sometimes prove useful.

Acute Hepatitis.—Although this affection is described by many authors, there are no diagnostic symptoms; hence it possesses little interest for the clinician. If its presence be suspected, therapeutic measures would be limited to aperients and salines.

Chronic Interstitial Hepatitis (Cirrhosis of the Liver).—This is an interstitial inflammation characterized by proliferation of the connective tissue of the liver, and associated with lesions in the parenchyma of the organ. It cannot be regarded as a common affection in the horse, but probably, owing to the obscure nature of the symptoms, many cases are overlooked. According to Robertson, 'many cases of anæmia with ascites, in young horses, which proved fatal, have, on examination after death, shown well-marked cirrhosis of the liver' ('Practice of Equine Medicine'). W. Williams observed cases of hepatic cirrhosis, both in foals and adult horses, following insufficient nutrition, the animals having been fed on damaged and mouldy corn.

The **symptoms** are obscure, and as jaundice is often absent, it is seldom that the condition is diagnosed. In some cases the symptoms point to disturbance of the digestive organs, and in others to cerebral disorder. The following phenomena have been recorded: A capricious appetite; loss of condition; either constipation or diarrhœa; colicky pains after the ingestion of coarse food; inaptitude for work; a sleepy appearance, followed in some instances by a staggering gait and a tendency to push the head against surrounding objects; W. Williams observed icterus; very offensive, glazed fæces; marked thirst; high-coloured urine passed in large amounts, in some instances being of a reddish-brown colour. Bile-pigments are present in the urine in some cases. In the later stages evidences of ascites may be observed, and well-marked nervous phenomena. In one case which came under our notice there was a history of four attacks of obstructive colic in eighteen months; in the fatal illness the animal showed dull continuous pain lasting for five days; only small quantities of fæces were passed, although large amounts of raw linseed-oil had been administered; sweating, especially on the right side; a weak pulse, drooping eyelids, muscular tremors, constant pawing, and coldness of the surface of the body and extremities. Jaundice and ascites were absent. As regards **treatment,** once the disease is established, therapeutic measures are of no avail. Symptomatic treatment

no doubt will be adopted in the early stages, but, as already remarked, it is seldom that the real nature of the case will be recognized, unless jaundice be manifested.

There are several organic diseases of the liver met with in the horse in addition to those mentioned, but they are of little interest from a therapeutic aspect, as the symptoms are obscure and treatment hopeless. For a full description the reader is referred to our article on 'Diseases of the Liver' in 'A System of Veterinary Medicine,' vol. ii., p. 531.

B.—Cattle.

Very little is known with reference to the clinical aspect of hepatic diseases in cattle. The subject is of more interest to the pathologist than to the practitioner, as, unless jaundice be present, there are no symptoms which lead us to suspect the presence of disease of the liver. In the large majority of cases therapeutic measures would be useless, even if it were possible to arrive at a diagnosis.

C.—The Dog.

Hepatic diseases are of common occurrence in the dog, the chronic types being more frequently met with than the acute forms. Generally speaking, the diagnosis of these affections is much facilitated in the dog by the fact that palpation of the liver can be more readily carried out than is the case with the larger animals. At the same time it is not uncommon for well-marked lesions to occur in the liver without their presence being suspected during the life of the animal. Jaundice is more frequently observed in the dog than in the horse, but it is often absent even in extensive disease of the liver ; moreover, a special affection termed 'enzoötic jaundice' occurs in the dog, independent of organic lesions of this organ.

Jaundice.—This, as in the horse, is a symptom which may occur in a variety of hepatic disorders. Although many authors hold that the most frequent cause of jaundice is gastro-duodenal catarrh, associated with a catarrhal condition of the larger bile-ducts, this is not borne out by post-mortem

evidence. It is true that gastro-duodenal catarrh may at times be associated with jaundice, but the latter condition is far more commonly met with in the absence of lesions of the bile-duct, stomach, and duodenum.

Enzoötic Jaundice.—This is also known as 'Infectious Jaundice,' and popularly as 'the Yellows.' It is a very important affection which attacks especially young dogs of the sporting breeds, and is the source of enormous losses in some districts. Although its clinical aspects are familiar to canine practitioners, little or nothing is known with reference to its etiology or pathology, while its successful treatment has yet to be discovered. Enzoötic jaundice has many features in common with biliary fever (canine piroplasmosis), but, up to the present, examinations of the blood conducted in Great Britain have proved negative, and treatment with trypan blue has not been successful. The connection between enzoötic jaundice and canine distemper is a vexed question. The older writers regarded the former affection as an hepatic complication of distemper. We must admit that during some outbreaks of distemper cases presenting all the symptoms of enzoötic jaundice make their appearance; also that, in isolated cases of ordinary distemper, evidences of jaundice may be manifested at any time during the course of the disease. Yet there are many districts in which distemper is prevalent and jaundice is never encountered. The bulk of evidence supports the view that enzoötic jaundice is a condition in which morbid alterations occur in the blood, leading to the presence of a large amount of hæmoglobin in solution, from which excessive quantities of bile-pigment are formed by the liver. As to the cause of the alterations in the blood we know nothing definite. Various lesions are described as occurring in the liver, but in some cases no morbid alterations can de detected in this organ.

The clinical history is as follows:—In some cases, jaundice is the first symptom observed; in others, loss of appetite, dulness, nausea, thirst, and vomiting, occur as premonitory symptoms, and jaundice develops gradually. When distemper is prevalent in a kennel, the ocular and nasal

phenomena of that disease may succeed the jaundice, or, *per contra*, the latter may be the primary symptom. In many cases, retching, vomiting, and excessive thirst, may be prominent symptoms; in others, evidences of marked nervous prostration occur early, the animal is dull and sleepy, and seems indifferent to his surroundings. The jaundice varies in intensity; in some cases the visible mucosæ, the sclerotic membrane of the eye, and the unpigmented portions of the skin, are stained a deep saffron yellow. Constipation may be present from the outset, but may be succeeded by diarrhœa; the fæces are very fœtid, and may contain blood; in some cases they are clay-coloured, in others they are dark in colour; the urine is scanty and of a deep yellow or brownish-yellow colour. As the disease advances, the temperature becomes subnormal, the pulse is weak, clonic spasms of the temporal, scapular, and crural muscles are observed prior to the fatal termination, also hæmorrhage from the nostrils and gums, and a slimy mucus containing blood may issue from the anus in some cases. In a large number of instances invagination of the intestine occurs as a complication, and its presence is generally overlooked. Some authors state that this lesion is produced during the 'death-agony,' but, judging by the condition of the invaginated portion of bowel, this complication would appear to have been in existence for some time prior to death. In ordinary cases the course of the disease is from five to six days. In the virulent form death may occur in two days.

Treatment is notoriously unsatisfactory. It is not uncommon to find that an entire litter of puppies succumbs to the affection. Various remedies have been tried with no success, although 'doggy' papers teem with advertisements of 'sure cures' for 'the yellows.'

As we know nothing with reference to the etiology and pathology of the affection, treatment at best can only be empirical. In mild cases the administration of alterative doses of calomel (gr. $\frac{1}{10}$ to gr. $\frac{1}{5}$), three or four times daily, until purgation ensues, occasionally seems to prove useful. Gray has had success with small doses of perchloride of

mercury. When vomiting is a prominent symptom, chloretone may be given in the form of a powder placed on the tongue. Acetozone (gr. v. to O. i. of water) may be tried, in doses of 1 to 2 ounces. Subcutaneous injections of normal saline solution are indicated as a cardiac stimulant, and also to cause elimination of toxins from the system by way of the kidneys.

The animal should be kept in warm surroundings, and the diet should consist of Brand's Essence of Beef, and milk mixed with lime-water or soda-water. Obviously, when invagination of the intestine occurs the case is hopeless, as, even if the presence of the lesion were recognized, operative measures would not succeed, in consequence of the nervous depression and weakened state of the animal's system.

Research into the nature of enzoötic jaundice is urgently needed, as the losses due to this disease are enormous, especially in fox-hound kennels.

Acute Catarrh of the Bile-Ducts.—This is sometimes termed 'Catarrhal Jaundice.' There is some difference of opinion as to the frequency of this condition, some authors holding that it is of rare occurrence; others state that it is a common cause of sporadic jaundice, and is associated with gastro-duodenal catarrh. We know that some cases presenting symptoms of gastric catarrh may be complicated with jaundice, but the autopsy may not reveal any evidence of catarrh of the common bile-duct. It is possible that microbial infection, entering by way of the bile-duct from the intestine, may be an important factor in setting up catarrh of the biliary passages. The usual symptoms observed are jaundice and persistent vomiting.

Treatment similar to that advised for enzoötic jaundice is indicated. Gastritis should be treated as in ordinary cases of that affection (see p. 610).

Congestion of the Liver.—We have no definite clinical knowledge of active or acute congestion of the liver in the dog.

In **Passive Congestion** treatment must be carried out according to the nature of the primary disease on which the hepatic lesion depends. If associated with valvular disease of the

heart, suitable remedies for this condition must be prescribed. Ascites, if present, must be treated by paracentesis abdominis and the administration of iodides (see p. 680).

Acute Hepatitis is rarely diagnosed in the dog. According to Friedberger and Fröhner, the affection is of subordinate importance clinically, owing to the difficulty in diagnosis, and also because it usually represents secondary changes in various infectious diseases, or in cases of poisoning. The **symptoms** as given by Hutyra and Marek are—Pain on palpation being applied over the region of the liver, painful defæcation, and finally jaundice. As regards treatment, when the presence of the affection is suspected, mild saline purgatives are indicated, a hot cataplasm composed of kaolin and glycerin should be applied over the region of the liver, and the diet should be light and restricted in amount.

Chronic Interstitial Hepatitis (Cirrhosis of the Liver).—This is a common lesion in the dog, especially in aged animals. The etiology is obscure. The affection is frequently associated with valvular disease of the heart, interstitial nephritis, and chronic bronchial catarrh.

The following **Symptoms** may be observed: In some instances vague evidences of digestive disorder, but advanced lesions may be present without any special symptoms being manifested. Jaundice is generally absent during the development of the disease, but may sometimes be observed during the later stages. In the hypertrophic form, the hepatic enlargement can be detected by palpation and percussion. Ascites is often present, and may be extensive; in some cases it is the most prominent symptom, and the first to be observed. In the later stages, œdematous swellings on the inferior abdominal wall and on the limbs may occur, also chronic gastro-intestinal catarrh (due to interference with the portal circulation), evidenced by attacks of vomiting and diarrhœa. Emaciation is marked, and the animal has a pot-bellied appearance. In old animals the external abdominal veins are enlarged, dilated, and tortuous. The affection runs a slow, insidious course, and, although temporary improvement may occur with treatment, a fatal termination is certain.

Treatment can only be symptomatic and palliative. Ascites must be relieved by 'tapping,' at intervals as required. Saline aperients are indicated, but often cause vomiting, and hence cannot be continued. Occasional doses of grey powder may prove useful. Potassium iodide is advised by some authors, but its value is doubtful. Cardiac complications must be treated according to the symptoms presented. In the case of valuable pet dogs the operation of 'omentopexia' may be tried. This consists in suturing a portion of the great omentum between the oblique muscles of the abdominal wall, and thus establishing a collateral circulation between the portal and the systemic vessels.

Various lesions of the liver are met with in canine practice in addition to those mentioned. As they are seldom diagnosed, and as treatment cannot exert any favourable influence on them, they possess little interest for the therapeutist.

Formulæ.

Saline Laxative Powders for the Treatment of Catarrhal Jaundice in the Horse.

℞ Sodii Sulph. ... ... ℥v.ss.
Sodii Chloridi ... ... ℥ii.ss.
Sodii Bicarb. ... ... ℥iv.ss.
M. Div. in pulv. vi. Sig.: Give one twice a day dissolved in the drinking-water.

Mixture for Gastric Irritability and Vomiting in Chronic Hepatitis in the Dog.

℞ Bismuthi Subnit. ... ... ℥ss.
Ac. Hydrocyanici (B.P.) ... ♏xxiv.
Mucilaginis ... ... q.s.
Aq. Chloroformi ... ... ad ℥iv.
Sig.: Give from two teaspoonfuls to a tablespoonful every three hours as required.

Pills for Jaundice in Puppies.

℞ Hydrarg. c. Creta ... ... gr. ss.
Sodii Bicarb. ... ... gr. iii.
Excip. ... ... q.s.
Ft. Pil. i. Mitte xii. Sig.: Give one three times a day until the bowels are acted on.

Mixture for Jaundice in the Dog.

℞ Liq. Hydrarg. Perchloridi ... ℥iv.
Tr. Cinchonæ Co. ... ... ℥iv.
Syr. Rhamni ... ... ℥i.
Aq. Chloroformi ... ... ad ℥iv.

F. M. Sig.: Give from a dessertspoonful to a tablespoonful every four hours for the first day until purgation is induced. Then omit the Syr. Rhamni, and give the mixture three times daily.

Mixture for Cases of Ascites in the Dog depending on Cirrhosis of the Liver.

℞ Tr. Digitalis ... ... ♏ lxxx.
Syr. Scillæ ... ... ℥ii.
Potass. Acet. ... ... ℥ii.
Potass. Iod. ... ... ℥i.
Syr. Simpl. ... ... q.s.
Aquæ ... ... ad ℥iv.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times daily.

CHAPTER IX

THE TREATMENT OF PERITONITIS

Acute Peritonitis (Acute Inflammation of the Peritoneum) is generally a fatal affection in the horse and dog.

A.—The Horse.

It is occasionally met with as a disease *per se*, but in the large majority of cases it results from microbial infection originating in accidental wounds of the abdominal cavity; operations such as castration; septic metritis; rupture of the stomach or intestine, etc. Cases are recorded in which peritonitis was said to occur as the result of exposure to cold or immersion in cold water, but such influences act as predisposing causes by lowering the vital powers of resistance. It is now held that micro-organisms may migrate through the apparently normal intestinal walls to the peritoneal cavity under certain unknown conditions, but this is more likely to occur when the abdominal wall has been subjected to contusions, etc., or when lesions of the bowel wall are present. The so-called 'idiopathic' peritonitis is rarely met with, and equine peritonitis is generally a complication of surgical conditions.

The most important form of peritonitis is that following castration. (For full details, see 'A System of Veterinary Medicine,' vol. ii., p. 599.) Although this condition is always due to microbial infection, it is often difficult to trace the source of the infection, as the disease may occur in spite of all precautions. No doubt some animals are specially susceptible, while others show marked resistance, as they escape even when the surroundings, etc., are distinctly

favourable to infection. The influence of exposure to cold, chills, etc., in predisposing to peritonitis after castration is well known. The rapid course observed in some cases suggests a general toxæmia rather than a peritonitis, and this is borne out by the insignificant character of the peritoneal lesions in such instances.

The **Symptoms** observed in cases following castration are as follows: Loss of appetite, dulness, a rise of temperature to 104° F., a rapid, weak pulse, stiffness in progression, arching of the back, a tucked-up appearance of the abdomen; swelling may be absent from the site of the operation wounds, but there is generally a thin, sanious, fœtid discharge therefrom. There may be no evidences of abdominal pain, and the animal stands persistently in one spot and exhibits an anxious expression of countenance. The first symptoms usually occur on the fourth or fifth day after operation, and death takes place in a few days, or even sooner when the infection is very virulent. Tympanites may precede the fatal termination. In some cases the animal may live for four or five days.

In peritonitis resulting from other causes, we observe rigors, arching of the back, stiffness in progression, intense fever, a small, hard, wiry pulse at first, which later on becomes thready. The pain varies in degree, in some cases being severe and in paroxysms, but the animal rarely rolls; in others it is dull and continuous. Diarrhœa may be present at the start, but is generally succeeded by obstinate constipation; the respirations are superficial, incomplete, and frequent, being of the 'thoracic type' (see p. 27); the 'tucked-up' appearance of the abdomen is usually succeeded by tympanites.

Treatment hardly ever proves successful. Various methods have been tried, but up to the present time all that the practitioner can accomplish is to give relief to pain, by administering chloral hydrate or by giving hypodermic injections of hyoscine and morphine (see H.M.C., p. 372).

Prevention of peritonitis is a most important consideration in the treatment of accidental abdominal wounds and in the technique of castration. In the former case the wounds are usually more or less infected before coming under the care of

the surgeon. Careful irrigation with reliable antiseptic solutions should be carried out, and efficient drainage should be provided. (See 'The Treatment of Wounds,' p. 843.)

The prevention of peritonitis in castration deserves the most careful consideration of the practitioner. As already remarked, cases will occur in spite of all precautions, but there is in every instance a source of infection, and an introduction of virulent micro-organisms, although we may not be able to recognize the mode of entry.

The following points, if observed, will at any rate assist in the prevention of septic peritonitis following castration. (1) Operate only on healthy animals; refuse to castrate those which are out of condition or have lately recovered from any infectious disease; also, when cases of strangles are known to be on the premises, postpone operating. (2) Avoid operating during the prevalence of east winds or cold, wet weather. (3) Let the animals be kept on sheltered pasture as much as possible; avoid ill-drained, dirty buildings. (4) The operator's hands should be thoroughly cleansed and disinfected. Avoid operating immediately after dressing septic wounds, or opening abscesses in cases of strangles, or, in fact, after handling any suppurative conditions. (5) See that the bed for casting is clean. (6) Sterilize the instruments, and place them in an instrument tray containing an antiseptic solution. (7) Paint the skin of the scrotum with tincture of iodine prior to operation. (8) Make the incisions in the scrotum of sufficient length, so as to afford efficient drainage. (9) See that the incision in the tunica vaginalis corresponds with that in the skin, so that a pouch or sac may not be formed which will retain discharges. (10) Avoid handling and bruising of the spermatic cord. (11) Use a reliable antiseptic oily dressing by pouring it into the scrotal wounds, before the animal is permitted to rise. (12) See that no portions of straw, etc., gain entrance to the wounds during the operation. (13) Give exercise daily, even if the animal is at grass. (14) Avoid interference with the wounds unless there is an absolute necessity for such; if the incisions have been made of sufficient length, and a proper amount of the spermatic cord removed, the owner or atten-

dant need not 'open up' the wounds unless the parts close too quickly and thus retain discharges. (15) Finally, we may remark that fruitful sources of septic peritonitis after castration may be summed up as follows: Infection from the hands of the operator or from instruments; infection from the casting bed or from the stable; infection from after-treatment—*i.e.*, from the contaminated hands of the owner or attendant, and from dirty vessels and germ-laden sponges, cloths, water, etc.

B.—The Dog.

Acute peritonitis is not uncommon in the dog. It may result from surgical conditions, such as perforating wounds of the abdominal wall, the operation of laparotomy, violent contusions of the abdominal region, rupture of the bladder or intestine, etc. It also occurs in connection with septic metritis, septicæmia, pyæmia, etc.

The following symptoms may be observed: Pain, evidenced by whining or actual cries; a tense, 'tucked-up' condition of the abdomen, which is painful on palpation; arched back, disinclination for movement, a tendency to assume the recumbent position; nausea and vomiting; fever, a weak, thready pulse, short accelerated respirations, anxious expression of countenance, cold extremities. In the later stages the abdomen becomes tympanitic.

Some cases may terminate fatally in forty-eight hours. In less acute types the patient may live for three or four days.

The disease usually proves fatal, in spite of treatment. Hypodermic injections of morphine are indicated to relieve pain. Subcutaneous injection of normal saline solution may be administered, to act as a cardiac stimulant and to assist in the elimination of toxins. Some authors advise drainage of the peritoneal cavity by an incision in the abdominal wall.

The Treatment of Ascites (Abdominal Dropsy).—Ascites signifies an accumulation of fluid in the peritoneal cavity. This fluid is serous, non-inflammatory, clear, and sterile, and

thus differs from peritoneal effusion, which varies in character according to the type of peritonitis present.

Ascites is a symptom in various diseases. It is common in the dog and comparatively rare in the horse. It may be associated with debilitating affections, lesions causing interference with the portal circulation; cardiac diseases, cirrhosis of the liver, chronic nephritis, affections of the peritoneum (tumours, tuberculosis, etc.). It is often very difficult to distinguish between chronic peritonitis and ascites. The most extensive ascites we have ever met with was in a one-and-a-half-year-old colt that died one month after castration, and the lesions present were those of diffuse chronic peritonitis.

Ascites is recognized by a physical examination of the abdomen. The abdomen is increased in size, and seems to be drawn downwards and distended in its inferior aspect. In the horse, if the examiner's hand be placed flatwise on the abdominal wall, and an assistant be instructed to place his hands on the opposite side of the body and give a series of short thrusts, a sensation of fluctuation or undulation is felt, if fluid be present. In the dog the examiner can carry out this test unaided.

Treatment consists in removal of the fluid by means of a trocar and cannula (see p. 827). All the fluid should not be removed at one time, as the animal might collapse from a sudden fall in blood-pressure. This treatment should be followed by the administration of diuretics and cardiac tonics, also potassium iodide.

Obviously, when ascites depends on incurable lesions of any organ, treatment can only be palliative.

CHAPTER X

THE TREATMENT OF DISEASES OF THE KIDNEYS

A.—The Horse.

THE results of post-mortem examinations teach us that renal diseases in the horse are by no means uncommon, although they are not often recognized during life. In this respect they resemble diseases of the liver, as in both the symptoms are often obscure, and the lesions are revealed as a surprise at autopsies. We have already pointed out (see p. 52) that renal affections can only be diagnosed by a chemical and microscopical examination of the urine. If this procedure be neglected, it follows that on the one hand a haphazard diagnosis of 'kidney disease' will be given, while on the other the existence of a renal affection will be overlooked. Owners of animals, and grooms, ascribe many and varied symptoms to 'something wrong with the water,' and as a result large amounts of nitre and other diuretics are given to horses, with the idea that such agents will 'cure' every variety of kidney disorder.

In the diagnosis of renal affections, it is important to point out that frequent attempts at micturition are not to be regarded as characteristic of nephritis, as this symptom may also be observed in cases of obstruction of the small colon, intestinal calculus, inflammation of the bladder, etc. Again, a paralyzed condition of the bladder associated with distension of the organ, or any obstruction in the urethra, prevents the normal passage of urine, and the symptoms manifested are often incorrectly ascribed solely to renal disease. In reality, when no urine is passed in cases of nephritis, the symptom

depends on suppression of the secretion due to pathological changes in the kidneys. Generally speaking, the majority of cases of nephritis met with in practice do not present symptoms suggestive of a renal affection. It is not uncommon to find, on our first attendance, the patient in the recumbent position, unable to rise, manifesting convulsive struggling at intervals, and sweating. Unless the urine be examined, the case may be mistaken for an affection of the brain or spinal cord. Stiffness of the hind-limbs and arching of the back are no doubt present in many cases of nephritis, but also occur in other diseases. The chronic forms of nephritis are quite as obscure in the symptoms presented; moreover, the flow of urine may be in excess of the normal in some cases.

On pp. 54 and 58, we have dealt fully with the examination of the urine, and the various tests employed, also the clinical significance of the morbid alterations found in the urine.

We have now to consider the therapeutic influences which we can bring to bear on the kidneys when these organs are the seat of disease. We must confess that our powers in this direction are very limited. The function of the kidneys is a very important one, and when from any cause it is interfered with or inhibited, disturbance of the digestive, circulatory, respiratory, or nervous system may be produced.

The elimination of effete products must be secured by the administration of purgatives, and in the case of acute nephritis the kidneys should have as much rest as possible. This is accomplished by acting on the intestines and by allowing light, easily digested food. In the case of certain chronic renal affections the judicious administration of diuretics is sometimes of service. Unfortunately, in veterinary practice, diaphoretics seldom act efficiently; hence we cannot utilize the skin as a means of hastening elimination of effete products from the system. If, however, a Turkish bath be available, diaphoresis can be induced, with marked benefit.

Obviously, on economical grounds, it would not be desirable to treat chronic diseases of the kidneys in the horse.

When we have decided by a careful chemical and microscopical examination of the urine that a chronic renal affection is present, the owner should be informed of the incurable nature of the case. Discretion is necessary in giving a definite opinion, as the fact of finding albumin in the urine is by no means an indication of a hopeless condition (see p. 56). Several examinations should be made, and also a microscopical examination carried out for the detection of casts, etc., before a definite opinion is formed.

Although post-mortem examinations have rendered us familiar with a large number of pathological conditions of the kidneys, yet, owing to a lack of characteristic symptoms, a definite diagnosis is seldom possible. Hence affections of the kind are of more interest to the pathologist than to the therapeutist; moreover, the treatment is limited to palliative measures. For these reasons only the treatment of the more common renal diseases will be considered here. These affections will be found fully discussed in our article on the subject in 'A System of Veterinary Medicine,' vol. ii., pp. 660 to 714.

Acute Congestion of the Kidneys.—This may be an ephemeral condition which is readily overlooked, or it may be the first stage of acute nephritis. In the former instance recovery is rapid. Severe cases of a hæmorrhagic type are recorded, but clinically it is difficult to draw the border-line between these and acute nephritis.

The following **Symptoms** may be observed: A stiff gait, accelerated respirations, sweating, and dull colicky pains. According to Robertson, the only attractive symptom may be an alteration in the urine, which is lessened in amount, of high specific gravity, and may contain albumin, blood, or hæmoglobin. Leblanc observed that micturition is absent at first, but in an hour or so a large amount of urine of low specific gravity is passed. In hæmorrhagic cases in which rupture of capillaries takes place, blood occurs in the urine, also albumin. Rupture of the kidney has been recorded in cases of very intense renal congestion.

Treatment consists in administering a purgative dose of

raw linseed-oil. Full doses of bicarbonate of soda may be given in the food or drinking-water. A large hot cataplasm of kaolin and glycerin should be applied to the loins and covered with cotton-wool. The food should be restricted to boiled flax-seed, bran-mash, barley-water, hay-tea, milk, etc. Diuretics such as nitrate of potassium should be avoided. Although theoretically sweet spirit of nitre is contra-indicated, as it causes dilatation of the renal vessels, yet it is often prescribed in the early stages when micturition is in abeyance, and does not appear to prove harmful. It should not be prescribed in severe cases characterized by hæmorrhage.

Passive or Chronic Congestion of the Kidneys.—This is associated with chronic valvular diseases of the heart, pulmonary emphysema, pressure on the renal veins by tumours, etc. The effect of such conditions is to impede the outflow of venous blood from the kidneys, and to induce blood-stasis.

There are no characteristic symptoms, and usually the phenomena of the primary disease predominate. The urine is diminished in amount, its specific gravity is increased, it contains a variable amount of albumin, and on microscopical examination hyaline tube-casts and blood-corpuscles may be detected.

Therapeutic measures must be directed to the primary disease. Generally speaking, an animal suffering from such conditions will not repay the cost of treatment.

Acute Nephritis (Acute Inflammation of the Kidneys).—This is not a common affection in the horse, but, as already mentioned, it is often overlooked. In many instances it is associated with, or secondary to, other affections.

The following causes are recognized: Injuries in the vicinity of the kidneys, such as contusions, strains, over-exertion, etc.; exposure to cold and chills; toxic agents, such as large doses of oil of turpentine, cantharides, coal-tar products, carbolic acid, etc.; damaged fodder; infectious diseases, such as influenza, and septicæmic conditions. In many instances the etiological factors cannot be determined.

The **Symptoms** are often obscure. The following may be observed:—A stiff, straddling gait, dragging of the hind-

limbs, arching of the back, a difficulty in turning round, tenderness on palpation being applied to the region of the loins (many healthy horses, however, flinch if pressure be applied to this region); dull, colicky pains, frequent attempts at micturition, but only small amounts of high-coloured urine are passed at short intervals: in some cases total suppression of urine for some days has been observed.

The urine is diminished in amount, the specific gravity is increased; the colour, in the early stages especially, is smoky or a brownish-red; in many cases it resembles linseed-oil; albumin is present in variable amounts, also renal epithelium, and various forms of casts—viz., hyaline casts, blood-casts, and epithelial tube-casts. In the later stages, œdematous swellings occur in the subcutaneous connective tissue of the sternum, abdomen, sheath, and extremities, and effusions may take place in the serous cavities of the body. The animal assumes the recumbent position, and is unable to rise; convulsive struggling with fore and hind limbs is manifested, and death occurs from uræmia. Various complications may occur in nephritis. The diagnosis of the disease is based on a chemical and microscopical examination of the urine (see p. 58).

An acute attack may be followed by chronic lesions in the kidneys.

We have already indicated the line of treatment to be adopted (see p. 682).

If evidence of pain be present, a moderate dose of chloral hydrate may be administered. Opiates are contra-indicated, not, as was formerly supposed, because they interfere with the secretion of urine, but by reason of the constipation which they induce. If the flow of urine be scanty, mild diuretics, such as citrate of potassium or acetate of potassium, may be given, but powerful diuretics are contra-indicated. After the early symptoms are lessened in intensity, and if the arterial tension be low and the cardiac impulse not forcible, digitalis in small doses may be prescribed as a diuretic. When evidences of uræmia are present, the case is hopeless. All that can be done is to prescribe chloral hydrate to check the convulsions.

Some authors advise pilocarpine in the treatment of nephritis, but, as this agent produces salivation in the horse instead of diaphoresis, we fail to see how it can prove of benefit.

In our experience, severe attacks of acute nephritis usually prove fatal. The cases that recover are generally of a milder type.

Chronic Nephritis.—As already remarked, this affection in the horse is of more interest to the pathologist than to the therapeutist. It occasionally happens that cases of interstitial nephritis, if subjected to rational treatment, may be capable of performing slow work for a time. But all forms of the disease are progressive, and ultimately terminate fatally. The interstitial form is said by some authors to occur more frequently in the horse than the parenchymatous type. The symptoms in both types are of an obscure character, and unless an examination of the urine be carried out, the true nature of the case is not recognized.

In the *parenchymatous form*, the following symptoms may be observed: Loss of condition without apparent cause, dulness, lessened capacity for work, a capricious appetite, a tendency to swelling of the hind-limbs. Later on we observe stiffness in progression in the hind-limbs, dropsical swellings beneath the sternum and inferior abdominal region; thirst, dull, colicky pains, a tendency to assume the recumbent position for long periods. The urine is scanty, and contains albumin, tube-casts, hyaline casts, also epithelial and fatty casts, and epithelium from the uriniferous tubules, and in some cases red blood-corpuscles. In the later stages the urine is increased in amount. It must be remembered that a latent renal affection may be in existence for some time without manifesting any marked symptoms, but if the animal be exposed to chills, excessive fatigue, or allowed too large amounts of nitrogenous food, without proper exercise, acute symptoms of nephritis may develop.

Death may occur from uræmia, or from complications, such as pleurisy, pneumonia, pericarditis, gastro-intestinal lesions, etc.

In *chronic interstitial nephritis*, the disease sets in insidiously and the course is very protracted. Polyuria, loss of condition, inaptitude for work, thirst, and cardiac palpitation on slight exertion, may be observed. The urine is of low specific gravity, and contains a moderate amount of albumin and a small number of epithelial cells and hyaline casts. Death may occur from various complications. The principles of treatment in the parenchymatous form are similar to those advised for acute nephritis. When the lesions are advanced, treatment is useless.

In the interstitial type, symptoms must be treated as they arise. We are not aware of any medicinal agents which can exert a beneficial action on the altered renal structure. Highly nitrogenous foods, idleness, severe exertion, and exposure to chills, should be avoided. Cardiac complications must be treated according to the conditions present. When uræmia sets in, the animal should be destroyed. As already remarked, care should be taken not to give a diagnosis of nephritis simply on the fact that albumin has been detected in the urine. Frequent examinations of the urine should be carried out, and the symptoms presented must receive careful consideration.

B.—Cattle.

The principles of treatment are similar to those mentioned in the case of equines. We know very little clinically with reference to renal diseases in bovines, and obviously, even if by chance we succeed in arriving at a definite diagnosis of nephritis, treatment would not be advisable on economical grounds.

C.—The Dog.

In consequence of the sentimental value attached to the dog, the treatment of renal diseases in this animal is of far greater importance than in the case of the horse. Moreover, chronic interstitial nephritis is an affection of very common occurrence in aged dogs, although its presence is frequently overlooked. This type of nephritis is often associated with cardiac lesions. While all types of chronic nephritis are incurable, yet it is possible by suitable treatment to prolong

the life of an animal suffering from such affections, and this is an important matter in the case of favourite dogs.

Although there are a large number of pathological conditions of the kidneys met with in canine practice, lack of space prevents us from considering the subject fully; hence we shall only deal briefly with those diseases more commonly met with, and in which we can exert a favourable influence by treatment.

Acute Nephritis.—The majority of authors state that acute nephritis is a rare disease in the dog. According to Müller, the usual causes are certain infectious diseases, toxic agents (oil of turpentine, cantharides, carbolic acid, mercury), and injuries to the lumbar region.

The following symptoms are recorded: A stiff gait in walking, especially in the hind-limbs; sensitiveness of the lumbar region to palpation; scanty, albuminous, dark-coloured urine; nausea and vomiting in the early stages; in the later stages uræmia sets in, evidenced by vomiting, a weak thready pulse, a subnormal temperature, exhaustion, and convulsions succeeded by coma. The urine contains albumin, tube-casts, cylindrical casts, epithelial cells, and blood-corpuscles.

Treatment consists in administering a purgative. The animal should be put on a milk diet. Some authors advise hot baths. A cataplasm of kaolin and glycerin, heated to a proper temperature, should be applied to the lumbar region. When the urine is scanty, mild diuretics, such as citrate of potash, may be prescribed; some authorities advise diuretin.* When cardiac weakness is present subcutaneous injections of normal saline solution should be given. When uræmic symptoms develop, chloral hydrate and bromide of potassium are indicated; such cases almost always prove fatal. In nephritis due to toxic causes, alkalies with hyoscyamus prove useful.

Chronic Nephritis.—Nothing definite is known with reference to the etiology of this condition, although its frequency in the dog is admitted by all authors and observers. The most common type is chronic interstitial nephritis.

* Diuretin is a sodio-salicylic compound, containing about 50 per cent. of sodium theobromine. It is regarded as a safe diuretic for the dog, the dose being 5 to 10 grains.

The **Symptoms** are obscure. In the majority of cases that we observed the presence of the disease was not suspected. Occasionally dulness, a capricious appetite, loss of condition, polyuria, and an exaggerated cardiac impulse, are present. Persistent vomiting, prostration, weakness in the hind-limbs, and a feeble pulse, may be manifested. Gray has observed polyuria, excessive thirst, a ravenous appetite, emaciation, anæmic visible mucosæ, and occasional vomiting. Chronic eczema is a common complication. In some cases ascites or hydrothorax may be present. Diagnosis is based on an examination of the urine. Gray has found that, in some cases of chronic nephritis, a single examination of the urine may not reveal the presence of any abnormal constituents. Frequent examinations should be made.

Treatment in the majority of cases will be symptomatic, but, as already remarked, in a large number of instances there are no appreciable symptoms. Laxatives should be given at intervals, so as to maintain free elimination by way of the intestine. Iodide of potassium is advised, to lessen excessive arterial tension; it is best given in the form of iodalbin (see p. 267).

Care should be taken to avoid chills; also in the treatment of chronic eczema, when present as a complication, it is important not to apply dressings over too large an area of the skin, as serious results would be likely to ensue. When evidences of cardiac dilatation, anæmia, and ascites, are present, the judicious employment of digitalis or strophanthus, with a mild preparation of iron, is indicated; also tapping if the ascites be extensive. If the flow of urine be scanty, suitable diuretics must be prescribed (see formulæ, p. 690).

Formulæ.

Diuretic Powders for the Early Stages of Acute Nephritis in the Horse.

℞ Sodii Bicarb. ... ... ℥ii.
Potass. Cit. ... ... ℥iii.
M. Div. in pulv. vi. Sig.: Give one every four hours in the drinking-water.

Diuretic Mixture for the Secondary Stages of Acute Nephritis in the Horse.

℞ Potass. Acet. ... ... ℥ii.
Tr. Digitalis ... ... ♏x.
Aquæ ... ... ad O.i.

F. M. Sig.: Give two wineglassfuls every four hours in the food or drinking-water.

Sedative Mixture for Uræmic Convulsions in the Horse.

℞ Chloral Hyd. ... ... ℥ii.ss.
Potass. Bromidi ... ... ℥v.
Mucilaginis ... ... q.s.
Aquæ ... ... ad O.i.

F. M. Sig.: Give two wineglassfuls in ½ pint of linseed-tea every three hours.

Saline Diuretic Mixture for Acute Nephritis in the Dog.

℞ Potass. Acet. ... ... ʒiii.
Sodii Bicarb. ... ... ʒi.ss.
Liq. Ammon. Acet. ... ... ℥ii.
Syr. Simpl. ... ... q.s.
Aquæ ... ... ad ℥iv.

F. M. Sig.: Give from two teaspoonfuls to a table-spoonful three times daily.

Hæmatinic Diuretic Mixture for Chronic Nephritis in the Dog.

℞ Ferri et Ammon. Cit. ... ... ♏ss.
Potass. Cit. ... ... ʒii.
Spts. Æth. Nit. ... ... ♏iv.
Syr. Simpl. ... ... q.s.
Aquæ ... ... ad ℥iv.

F. M. Sig.: Give from two teaspoonfuls to a table-spoonful three times daily.

The Treatment of Cystitis.

Cystitis, or inflammation of the bladder, occurs in either an acute or a chronic form.

Acute Cystitis varies in severity from a simple catarrh of the mucosa of the bladder to an intense inflammation with deep-seated lesions in the walls of the organ.

A. *In the Horse* the following causes are recognized: The administration of toxic doses of drugs having an irritant

action on the vesical mucosa, such as cantharides and oil of turpentine; bacterial invasion of the bladder, such as may occur in suppurative nephritis, pyelitis, metritis; injuries inflicted during the careless passage of a catheter; vesical calculi; certain infectious diseases; prolonged retention of urine, leading to rapid decomposition of the latter, and thus favouring infection; injuries to the urethra and bladder occurring during parturition; infection from the use of a dirty catheter.

The **Symptoms** observed are — Frequent and painful attempts at micturition, but only small amounts of urine are passed in intermittent jets or in drops (strangury); restlessness, pawing, twitching of the tail; the bladder is generally found almost empty, and palpation of the organ causes marked pain. Defæcation is often painful, hence the fæces may be retained in the rectum. The urine is generally cloudy, thick, and high-coloured; it contains a small amount of albumin, also mucus and flocculi of pus, and occasionally portions of false membranes or shreds of tissue, and it undergoes ammoniacal fermentation in the bladder. A copious sediment is present, consisting of pus cells, red corpuscles, and epithelium.

The indications for **treatment** are to lessen the irritating properties of the urine, to disinfect the bladder, and to reduce the vesical inflammation. Perfect rest and a non-stimulating diet should be ordered; mucilaginous drinks should be allowed *ad lib.*, such as linseed-tea, barley-water, etc.; and the more fluid ingested, the better. Mild alkaline diuretics, such as bicarbonate of soda, with fluid extract of hyoscyamus, may be given in the drinking-water. Some authors advise urotropine as a disinfectant for the bladder and urine. It is said to give off formaldehyde during its excretion by the kidneys, and thus to diminish ammoniacal fermentation in the urine and render the latter less alkaline. Urotropine is prescribed in doses of 1 to 2 drachms, well diluted, two or three times daily. Salol and benzoic acid are also recommended. Irrigation of the bladder often gives good results; the organ is first washed out with a ½ per cent.

solution of sodium chloride, by means of a syringe attached to a catheter (in the case of the male); this is allowed to flow out, and a disinfectant solution is then injected, and removed after a few minutes. The following solutions are advised: Boric acid, alum, lead acetate (1 to 3 per cent.); resorcin (3 to 5 per cent.); helmitol (2 per cent.). (Helmitol is known as 'new urotropine,' and is said to be the anhydromethylene citrate of urotropine.)

B. *In the Dog*, the majority of cases of acute cystitis, according to H. Gray, are due to retention of urine depending on urethral calculi; occasionally the affection is associated with suppurative prostatitis or vesical calculi.

Various drugs have been suggested in the treatment of the disease, such as urotropine, buchu, hyposulphite of soda, boric acid, monobromide of camphor, etc. Irrigation of the bladder with a 2 per cent. solution of boric acid is the most important measure. Attention to diet is necessary. Meat and meat extracts should be prohibited. Milk, barley-water, and such-like demulcents, should be allowed *ad lib.*

Chronic Cystitis.—The principles of treatment are similar to those advised for acute cystitis.

In the dog, Müller advises the administration of alkaline salts with balsam of copaiba, balsam of Peru, etc.

CHAPTER XI.

THE TREATMENT OF DISEASES OF THE RESPIRATORY ORGANS

A.—The Horse.

In recent years progress can be claimed in the treatment of respiratory diseases in the horse. This progress does not depend on the discovery of any new drugs by means of which we are enabled to influence favourably the course of such diseases. On the contrary, we have learned the limitations of our skill as regards any direct beneficial influence we can exert on these affections so far as medicinal agents are concerned. It took many years before the profession became convinced of the inimical results of counter-irritation and drenching with alcoholic stimulants, as first pointed out by W. Williams. In the present day practitioners, with few exceptions, recognize the evil effects of administering medicaments in the form of drenches, the necessity for pure air and careful nursing, and the advantages to be gained in the treatment of pneumonia and pleurisy by early paracentesis thoracis (tapping the chest). The knowledge that all acute respiratory affections are infectious has also contributed to a more rational method of treatment, and has led to early isolation of cases, the result being that complications are less likely to occur, while prophylaxis has been materially assisted. Horse-owners are commencing to appreciate the importance of promptly removing the animals from work on the first appearance of symptoms, and are learning the fact

that the 'simple cold' may be the forerunner of a serious respiratory affection, if the horse be exposed to chills and fatigue. Another important fact is also commencing to dawn on the owners of animals—viz., that a horse presenting symptoms of nasal catarrh may be suffering from strangles in disguise. Hence the necessity for early isolation of all 'catarrh' cases, and prompt measures of disinfection.

In the space at our command, it is impossible to enter fully into the subject of the treatment of respiratory diseases; hence our remarks must be directed to general therapeutic principles. In Part I. (pp. 30 to 37) we have drawn attention to the general symptoms of these diseases, and indicated the various points in connection with the physical examination of the chest. A correct diagnosis is of great importance, but it is also necessary to devote attention to the leading symptoms in seeking indications for treatment.

Acute Nasal Catarrh.—This in popular language is known as a 'cold,' and is a very common affection in the horse. The nasal mucosa becomes the seat of an acute catarrhal inflammation which varies in degree and extent. It may occur as an independent affection, or it may precede or accompany other morbid conditions of the respiratory system.

In mild cases the catarrh is limited to the nasal mucosa, but in severe types the inflammation may extend to the pharynx or to the air sinuses of the head, and is accompanied by febrile symptoms. Of late years the connection between acute nasal catarrh and strangles has been much discussed, and up to the present time the distinction either on bacteriological or on clinical grounds has not been clearly defined, since the fact has been established that a submaxillary abscess is not an essential phenomenon in strangles.

Acute nasal catarrh is without doubt an infectious disease, as is demonstrated by the fact that, if one case be introduced into a large stable of horses, many animals may become affected. The infection seems to increase in virulence as it passes from animal to animal. Exposure to chills, ill-ventilated buildings, overcrowding, over-fatigue, etc., act as predisposing factors by lowering the vital power of resistance.

The **Symptoms** in the mild form are as follows: At first a clear, watery discharge appears from both nostrils. Later on the nasal discharge becomes more profuse, and is turbid in character, owing to increased mucous secretion and desquamation of epithelial cells. In a few days it becomes purulent. The animal snorts frequently, a slight, soft cough may be present, but there is no constitutional disturbance.

In the **severe** form the following symptoms are observed: Slight fever, partial loss of appetite, lachrymation, dulness; a varying degree of pharyngitis and laryngitis may be present, evidenced by cough, difficulty in swallowing, and tenderness on palpation of the pharyngeal region.

Treatment.—In both forms of the disease pure air is essential, also prompt cessation from work, and light, easily digested diet. In the mild type simple salines, such as potassium nitrate and magnesium sulphate, may be given in the drinking-water. Inhalations of steam medicated with terebene or oil of eucalyptus reduce the irritation of the nasal mucosa and assist in clearing the nasal passages.

In the severe form accompanied by pharyngitis and laryngitis, a cantharidin blister should be applied to the pharyngeal region, and an electuary composed of extract of belladonna, potassium chlorate, and treacle, may be administered on the tongue three times daily. The febrile symptoms rarely require any special treatment beyond the simple salines already mentioned. Useful additions to the diet are—hay-tea, oatmeal gruel, and linseed gruel. On no account should aloes be given. Simple treatment is all that is necessary, as the affection tends to recover spontaneously. When a large number of cases occur together, as in army remount depots, experience shows that, provided the weather be fine, recovery is far more rapid and satisfactory when the animals are put on pasture.

All cases of nasal catarrh should be isolated from healthy horses.

Chronic Nasal Catarrh.—This may occur as a sequel to an attack of acute nasal catarrh, or it may be associated with various surgical conditions (see p. 28). Treatment will

depend on the etiological factor present. In many instances surgical interference will be necessary. When the affection occurs as a sequel to an attack of acute nasal catarrh, in addition to medicated inhalations of steam, constitutional treatment is indicated. Sulphate of iron and arsenious acid should be given twice daily in the food. When the weather is suitable, the animal should be put on pasture. In doubtful cases the mallein test should be applied in order to exclude the possibility of glanders being present.

Acute Laryngitis.—Inflammation of the mucous membrane of the larynx is very frequently associated with pharyngitis. It may also accompany other affections, such as strangles or influenza. The disease shows various degrees of intensity, and assumes a very serious character when the structures forming the glottis and the epiglottis are involved by œdema, with infiltration and thickening of the mucous and submucous coats by exudation. The affection is microbial in nature, and chills, exposure to cold and wet, etc., act as predisposing causes. In some outbreaks of influenza, laryngitis is one of the leading features present.

In ordinary cases the following symptoms are usually observed: Difficulty in swallowing; tenderness evinced on manipulation of the laryngeal region; a muco-purulent nasal discharge; extension of the head on the neck (head 'poked out'); a dry, hard, paroxysmal cough, especially when the animal attempts to swallow solids or liquids. In severe cases a wheezing or roaring sound accompanies respiration; fever is present; the external region of the larynx is swollen; there is marked difficulty in swallowing, fluids being returned by the nostrils; and attempts at deglutition produce violent fits of coughing.

When œdema of the structures forming the glottis is present, we observe marked difficulty in respiration, an anxious expression of countenance, dilated nostrils, and, unless relief be obtained, asphyxia is liable to occur.

Treatment.—In mild cases, medicated inhalations of steam, potassium chlorate given in the drinking-water, and the application of a stimulating liniment to the external

region of the throat, comprise the necessary therapeutic measures. The diet should be of a soft nature, and the stable well ventilated. In severe cases a cantharidin blister should be applied to the region of the throat, and an electuary composed of belladonna, potassium chlorate, camphor, and honey, administered on the tongue three times daily. Medicaments in the form of drenches are contra-indicated, as they induce violent fits of coughing, during which a portion of the fluid is likely to enter the trachea and bronchi and set up broncho-pneumonia. When marked respiratory distress is manifested, tracheotomy should be performed. This operation should not be delayed, as sudden œdema of the larynx may set in and cause death from asphyxia.

Chronic Laryngitis may occur as a sequel to an acute attack. It often proves very resistant to treatment. A cantharidin blister to the laryngeal region is indicated, and the internal administration of powders containing arsenic, sulphate of iron, and potassium iodide, often gives good results.

To give relief to the cough, an electuary containing heroin, camphor, and belladonna, may be prescribed. Tar-water substituted for drinking-water is also useful. Chronic laryngitis is not uncommonly followed by whistling or roaring.

Acute Bronchitis.—This is an acute catarrhal inflammation of the bronchial mucous membrane. It may affect the large tubes and those of medium size, or it may involve the bronchioles. The latter is known as 'capillary bronchitis,' and, as it is nearly always associated with inflammation of the pulmonary tissue (constituting 'broncho-pneumonia'), its treatment will be considered under pneumonia (see p. 702).

Acute bronchitis affecting the large and medium-sized tubes is not common as a disease *per se;* more often it is associated with a severe attack of acute nasal catarrh, or with influenza. Capillary bronchitis, however, is more likely to accompany infectious diseases. Exposure to chills, etc., is a predisposing cause of bronchitis, and acts by lowering the vital powers of resistance of the bronchial mucosa to microbial infection.

The following **Symptoms** are observed: A variable degree

of fever; a quick, soft pulse; accelerated respirations; a dry, hard, distressing cough, in the first stages, which afterwards becomes looser and softer; a muco-purulent nasal discharge; loss of appetite; in some instances the usual symptoms of acute nasal catarrh may precede those of bronchitis, and a varying degree of laryngitis may also be present.

Auscultation.—In the early stages, a harsh, blowing bronchial sound is heard over the lower region of the trachea and the upper border of the middle third of the chest. In the latter region sibilant râles of an intermittent character may be detected (see p. 36).

Percussion.—In uncomplicated bronchitis percussion reveals nothing abnormal.

Treatment.—Early treatment, rest, and attention to hygienic and dietetic details, are of first importance. Medicated inhalations of steam are indicated to allay irritation of the bronchial mucosa, to promote secretion and facilitate its discharge by the nostrils. If laryngitis be present, suitable measures must be prescribed (see p. 696). Salines may be given in the drinking-water. It is doubtful if expectorants exert any beneficial action in equine bronchitis. If the cough be distressing, belladonna, heroin, and camphor, may be given in the form of electuary. Drenches should never be ordered —and this rule applies to the treatment of all respiratory affections. In this form of bronchitis simple treatment is all that is necessary, and an abundance of fresh air should be allowed. Care should be taken not to send the horse to work too soon, as capillary bronchitis may result. As regards the value of counter-irritation in this affection, opinion is divided. In our experience, neither counter-irritants nor local applications to the thoracic walls are of any benefit; moreover, they tend to annoy and irritate the patient.

Chronic Bronchitis.—This may follow an acute bronchial catarrh, but in most instances it occurs as a sequel to capillary bronchitis. Cases, however, are met with in which we are unable to trace any history of an acute attack. Chronic bronchitis may also occur in aged debilitated animals kept

under insanitary conditions, and occasionally it is a complication of chronic valvular diseases of the heart. It is also observed in many cases of pulmonary emphysema (broken wind), and the border-line between these affections is difficult to draw, as the former often merges into the latter.

The following **Symptoms** are observed: A loud, hard cough often occurring in paroxysms, especially when the animal is exposed to cold air; slight exertion causes accelerated respirations, or even respiratory distress; and an intermittent whitish or flocculent nasal discharge occurs after exercise or after a fit of coughing. In some cases the nasal discharge is scanty and the paroxysmal cough is frequent, the condition being termed 'dry catarrh,' and it is often the forerunner of 'broken wind.'

Auscultation may reveal high-pitched or deep rhonchi; expiration is prolonged, and accompanied by sounds of a wheezing character.

Treatment.—Medicated inhalations of steam are indicated. A combination of arsenic, belladonna, and potassium iodide, often proves useful. Bicarbonate of soda may be given in the drinking-water. Tar-water substituted for the drinking-water produces good effects. Bulky food should be avoided; young gorse-tops, chopped, should be added to the dietary, if such are available. Strychnine, combined with veratrine and arsenic, proves useful in obstinate cases. Pure air is a *sine quâ non* in the treatment. Unfortunately, many cases terminate in asthma or 'broken wind,' in spite of therapeutic measures.

Bronchial Asthma (Spasmodic Asthma).—This affection is not common in the horse. It is characterized by sudden intermittent attacks of dyspnœa of variable duration, the symptoms subsiding in an abrupt manner. Although possessing certain features in common with 'broken wind,' it should be regarded as distinct from that disease.

Spasmodic asthma usually terminates in 'broken wind,' while in the latter affection it is not uncommon for asthmatic attacks to occur at variable intervals. Many authorities regard asthma as having a neurotic origin, and depending on

disturbed innervation. This is generally reflex in character, and may arise indirectly from the stomach or intestines. The following phenomena result: Spasm of the bronchial muscles, and congestion and turgescence of the mucous membrane of the smaller bronchial tubes, accompanied by an exudation of thick mucus.

The following **Symptoms** may be present: Sudden attacks of dyspnœa, which have a tendency to recur at indefinite periods, while during the quiescent intervals no symptoms are observed. The dyspnœa may be severe; the neck is extended and the nostrils dilated; respiration is of the abdominal type, and is accompanied by peculiar wheezing sounds. A paroxysmal, short, suppressed, dry cough occurs at intervals. A nasal discharge of a frothy character or containing thick tenacious mucus may be present. The duration of the attack varies from several hours to a few weeks.

Treatment.—Medicated inhalations of steam should be prescribed. Belladonna combined with arsenic and potassium iodide often proves useful (see formula, p. 722). Plenty of fresh air should be allowed, and food of a bulky nature must be prohibited. The medicinal agents should be given in the food or drinking-water, as drenching is dangerous.

Acute Pulmonary Congestion.—A special form of pulmonary congestion is met with in the horse when the animal, not being in fit condition, is subjected to severe exertion. This is most commonly observed in the hunting-field. Under such conditions respiratory distress is manifested, and phenomena due to engorgement of the pulmonary vessels and over-distension of the right side of the heart are observed.

The following **Symptoms** are presented: A tendency to hang heavily on the bit, followed by a 'sprawling' action in progression. If the animal be not quickly pulled up, he stops voluntarily, or may fall and succumb to asphyxia resulting from pulmonary engorgement, or to syncope from over-distension of the right side of the heart. Slight pulmonary

hæmorrhage may occur in some instances. In other cases, when the horse is pulled up, we observe laboured breathing, heaving at the flanks, fore-legs stretched out and wide apart, dilated nostrils, eyes protruding and blood-shot or sunken and dull, head extended, visible mucous membranes injected, a blue tinge of the nasal mucosa, marked coldness of the extremities, cold sweating, general muscular tremors, tumultuous cardiac action, a small, weak, rapid and indistinct pulse, and sometimes a frothy nasal discharge which is slightly hæmorrhagic. In the less severe cases, provided rational treatment be adopted, recovery may ensue in one or two days. Pneumonia may develop as a sequel to the attack.

Treatment.—If the case occurs in the hunting-field, the saddle should be removed, the horse's head turned towards the breeze, and every effort ought to be made to stimulate the cutaneous circulation by briskly rubbing the surface of the body and applying clothing and bandages, if available. If a stimulant, such as whisky, can be procured, a dose (½ pint) suitably diluted with water should be carefully administered as a drench. In from half an hour to two or three hours the urgent symptoms pass off, and the horse can be slowly walked to the nearest suitable stable. The case should be carefully watched so as to detect any symptoms suggestive of the onset of pneumonia. Many practitioners advise the application of mustard paste to the thoracic walls, and if carried out with discretion in the early stages we think it is beneficial. If the cardiac action be weak, a hypodermic injection of strychnine and adrenalin is indicated. In very severe cases venesection to the extent of 4 quarts of blood is advised by some authorities, to relieve the engorged pulmonary vessels and right side of the heart.

The horse should not be put to work too soon, otherwise pneumonia is likely to develop.

Pulmonary Hæmorrhage.—The hæmorrhage may arise from acute hyperæmia of the bronchial mucosa or of the pulmonary tissue, or from a ruptured bloodvessel. It may occur under a variety of conditions, and in some instances may have serious or fatal results.

The **Symptoms** usually observed are—The sudden appearance of hæmorrhage from the nostrils, accelerated respirations, and cough. The amount of blood varies from a slight trickle to a full stream. The flow may be continuous or intermittent, and the blood is of a bright red colour and frothy in character. In severe cases we observe marked respiratory difficulty, restlessness, an anxious expression of countenance, pallidity of the visible mucosæ, a weak, thready pulse, and sweating followed by coldness of the extremities. In profuse hæmorrhage the animal has imperfect control over his movements and may fall down. The hæmorrhage is increased after coughing and when the head is depressed. When it is extensive in amount the bronchial tubes may be inundated with blood, and suffocation then results.

Treatment.—Perfect rest is essential. Agents such as adrenalin are contra-indicated, for the reasons given on p. 515. The hypodermic injection of morphine is stated to give good results, but, as opiates lessen the tendency to cough, the blood tends to accumulate in the bronchi instead of reaching the nostrils, and asphyxia is likely to be induced. Atropine is strongly recommended by American practitioners (see p. 390).

When cardiac weakness is marked, the subcutaneous injection of large amounts of normal saline solution should be carried out at intervals. After-treatment consists in ordering a long rest.

Pneumonia (Inflammation of the Lungs).—This subject is a very extensive one with reference to etiology, pathology, and symptoms, but from a therapeutic aspect, we find that the beneficial influences which we can exert on an inflamed lung and on the concomitant conditions associated with the disease are very limited. In former times there were very few diseases which were subjected to more heroic treatment than pneumonia, and the mortality was very high. The greater degree of success which attends the treatment of the affection in the present day must be attributed to the more rational views held with reference to the pathology of the disease, to the

necessity for abundance of fresh air, and to the fact that the administration of fluid medicaments in the form of drenches has been abandoned by the majority of practitioners.

The therapeutic measures which experience has shown to be productive of the best results are no doubt limited to a great extent, and practically we admit that more dependence must be placed on the *vis medicatrix naturæ* than on the administration of medicinal agents. Although pneumonia is a condition with which the clinician is quite familiar, yet there are many points in connection with its pathology which still await investigation. It is generally admitted that all forms of pneumonia are infectious, but the bacteriology of the disease is as yet far from being settled.

Many authors recognize certain forms of pneumonia as follows: (1) A SPORADIC type occurring in isolated cases, having a low degree of infectivity, running a more or less regular course, showing a high percentage of recoveries, and presenting lesions which are croupous or lobar in character. (2) EPIZOÖTIC PNEUMONIA, characterized by marked infectivity, an irregular course, a high mortality, a tendency to pulmonary gangrene and other complications, the lesions being of the lobular type. (3) PNEUMONIA occurring in connection with INFLUENZA.

This classification must be regarded as a very artificial one, for the following reasons: A case of so-called sporadic pneumonia may, if introduced into a stable, convey the disease to other horses, and the characters of the affection may be altered to those of the epizoötic type. This fact has been observed by Cadéac, and he has seen cases conforming to the characters of the sporadic and epizoötic type in the same stable. He holds the view that the type of the disease depends on the degree of virulence of the micro-organisms, on their individuality, and on their association with other microbes.

As regards differentiating epizoötic pneumonia from the pneumonia of influenza, we do not believe that such a diagnostic feat can be carried out clinically, although it may be attempted on paper. Moreover, Hutyra and Marek

do not recognize contagious pneumonia and influenza as affections distinct from each other, but regard pneumonia as one of the complications of influenza.

From a clinical aspect we recognize sporadic pneumonia, but in our experience, if cases of this type be kept in an overcrowded, badly ventilated stable, and if drenches be administered, the mortality will be high, and the lesions found on post-mortem will be similar to those of contagious pneumonia.

Owing to the fact that many sporadic cases recover, it is not possible to speak definitely with reference to the exact pulmonary lesions that existed; we can only judge of these from the evidence obtained by percussion and auscultation of the chest. According to the observations of MacFadyean, the lobar pneumonia of the horse is not similar pathologically to the croupous pneumonia of man.

It must also be remembered that pneumonia is often observed as a secondary affection. Thus, it may occur in connection with strangles, purpura hæmorrhagica, septic diseases, laminitis; also as the result of careless drenching (inhalation pneumonia), or from the inhalation of smoke from burning buildings, or from the entrance of blood into the bronchi during operations in the pharyngeal or laryngeal regions. Again, during prolonged chloroform anæsthesia, secretions from the nasal and pharyngeal mucosæ may enter the bronchi and set up pneumonia; also horses remaining in the recumbent position for long periods may become affected, while the disease is very common in animals on board ship. It may also arise as the result of traumatic injuries of the chest. At one time cold and chills were regarded as important etiological factors in the production of pneumonia, but in the present day such influences are believed to act by lowering the natural powers of resistance, and thus permitting the entrance and development of micro-organisms.

Lack of space prevents us from entering further into the question of the unicity or otherwise of the pneumonias of the horse. The subject is fully discussed in our article on Pneumonia in 'A System of Veterinary Medicine,' vol. ii. Here

we are mainly concerned with the therapeutic aspect of the subject, and the most important points to remember are that all forms or types of pneumonia are microbial in character, and that the principles of treatment are similar in each. It will not be possible for us to enter into the symptomatology or the diagnosis of the disease. As regards the latter, we may remark that it is based on a physical examination of the chest, and the subjects of auscultation and percussion have already been dealt with in the section on Diagnosis (see p. 34). There are, however, a few matters which claim our attention before discussing the question of treatment. These refer to the causes of death in pneumonia, and obviously it is of importance to decide what measures are likely to maintain life and to overcome the tendency to a fatal termination.

Death in pneumonia may occur from—

1. *Asphyxia*, depending on extensive consolidation and general œdema of the lungs, or considerable effusion into the pleural cavity in cases associated with pleurisy. It must be remembered that the majority of cases of pneumonia occurring in connection with influenza, or so-called 'contagious pneumonia,' are complicated with pleurisy.

2. From *failure of the right side of the heart*, owing to a progressive weakness depending on overwork of the organ in carrying on the circulation through the consolidated lung. Degeneration of the myocardium plays an important part in the cardiac failure, and is of comparatively frequent occurrence in the epizoötic type of pneumonia. It probably depends on the action of toxins.

3. *Toxæmia.*—This is a frequent cause of death in the epizoötic form of pneumonia. The toxins are believed to act on the vasomotor centre, on the walls of the blood-vessels, and on the heart itself, and to produce a progressive lowering of blood-pressure.

From a clinical aspect we must admit that cases of pneumonia are met with which run a definite course, occur in a sporadic fashion, and, if treated in a rational manner, tend to recover. The stages of crepitation, consolidation, and

resolution, can readily be recognized, and the crisis occurs about the sixth or seventh day. Usually one lung only is affected, the rusty coloured nasal discharge (see p. 28) is usually present prior to the stage of hepatization, and respiratory distress is seldom well marked.

In dealing with the question of **treatment**, we must first consider how we can influence the course of the disease in a favourable manner. Post-mortem examinations teach us that when both lungs are involved, and consolidation is extensive, all our therapeutic measures are likely to fail. In the epizoötic form of the disease, when myocarditis is present as a complication, a fatal result is the rule.

The first essential is *fresh air*, and of late years this fact is more generally appreciated. The beneficial effect of opening all doors and windows in the stable, or, what is better still, removing the patient to a large airy shed, is well known to all practitioners who have devoted attention to the subject. Much prejudice has to be overcome in this matter, not only on the part of owners of animals, but of practitioners. The fear of cold air and of draughts is responsible for many unfavourable results in the treatment of pneumonia. When we consider the morbid alterations in the lungs in this disease, we must be convinced of the necessity for pure air; moreover, experience confirms the views we express on the matter. Careful nursing is also an essential in treatment, and for full details the reader is referred to p. 77. If the patient's appetite continues fair and the pulse gives no cause for anxiety, it may be assumed that the case is progressing favourably. When, however, the appetite is completely in abeyance, and continues so, the outlook is serious. But the common tendency is to adopt forced feeding and the administration of stimulants when the animal refuses to take food of his own accord. In the section on nursing (p. 84) we have pointed out the proper course to pursue under these conditions, and here we may state that drenching either with fluid foods or stimulants should be rigidly avoided. We are convinced that many cases are rendered hopeless by drenching, and also that the occurrence

of pulmonary gangrene is often induced by fluids gaining entrance to the bronchi.

We know of no drug which has a specific influence on the course of pneumonia If hyperpyrexia be present it may be deemed advisable to administer antipyretics, such as quinine, antifebrin, salicylate of soda, etc., and these can be given in the form of electuary. But in uncomplicated cases the temperature tends to descend spontaneously. and all that is necessary is to give simple salines in the drinking-water. Plenty of cold water should be allowed ; this is a simple matter which is frequently neglected by the attendant. In epizoötic pneumonia accompanied by high fever and marked depression, nuclein often proves beneficial. It should be given by intramuscular injection twice daily, the dose being 10 c.c. combined with an equal amount of normal saline solution (see p. 506).

Cardiac weakness, total loss of appetite, and marked depression, are indications for stimulants, and in our experience the subcutaneous injection of normal saline solution is the most suitable and efficacious agent for this purpose (see p. 505). The hypodermic injection of digalen and strychnine may be tried as an adjunct to the above, and often proves useful. As regards artificial feeding *per rectum* when the appetite is completely in abeyance, see p. 198. It rarely proves of any value.

Operative Treatment.—We have already remarked that many cases of epizoötic pneumonia are complicated by pleurisy and effusion into the pleural cavity, and the latter is frequently the cause of a fatal termination. This being so, the indication for the operation of *paracentesis thoracis* ('tapping the chest') is apparent. Formerly this operation was not carried out until a large amount of fluid had accumulated and symptoms suggestive of its presence were detected. The results were seldom satisfactory, and the usual practice was to delay the operation as long as possible. E. E. Martin, A.V.C.,* pointed out the advantages of early 'tapping,' and his results were confirmed

* *Veterinary Record*, January 25, 1913

by other practitioners. He has shown that the procedure is a safe and simple one, and can be employed as a method of diagnosis as well as a therapeutic measure. It is carried out when respiratory symptoms become at all urgent, and prior to the appearance of phenomena suggestive of the presence of fluid. As an exploratory measure 'tapping' is harmless, while, if fluid be present, its removal proves distinctly beneficial to the case. Our experience confirms these observations, and we never hesitate to employ the trocar and cannula in the early stages of pneumonia as well as pleurisy. The amount of effusion which can be present without being detected by a physical examination of the chest is often surprising, and emphasizes the necessity for the early performance of an exploratory *paracentesis thoracis.* The site selected is the right intercostal space about 4 inches behind the point of the elbow (when the horse stands with both fore-legs level). The hair is removed and the part painted with tincture of iodine. The trocar and cannula are sterilized by boiling, and are introduced between the ribs; the trocar is then withdrawn, and the cannula left *in sitû;* and if fluid be present the entire amount is drawn off, the cannula is removed, and the part again painted with iodine. The left side may be tapped without risk of injuring the heart. Tapping may be repeated as often as is deemed necessary, and, provided aseptic precautions are observed, no harm ensues.

Counter-Irritation.—Opinion is divided with reference to the value of counter-irritation applied to the thoracic walls in cases of pneumonia. At one time it was almost universally adopted; but W. Williams pointed out that it was both unnecessary and detrimental. In our experience, the moderate application of mustard paste in the early or congestive stage of pneumonia is productive of good results, but when effusion has taken place counter-irritation is of no value. The distress and excitement caused by the application of mustard in the case of well-bred, nervous horses cannot but prove inimical to recovery, and we cannot overlook the probability that the good results claimed by the supporters of counter-

irritation may be imaginary, as practitioners who have abandoned this method claim a higher degree of success. Of one thing we are convinced, viz., that severe counter-irritation is not only irrational, but distinctly detrimental to the patient.

The application of *heat* to the thoracic walls, in the form of blankets wrung out of hot water, is said to prove beneficial; but however this may be, there are marked difficulties in carrying out the procedure, and the risks of chills resulting must be considered. In our experience this measure is of no practical value.

Medicated Inhalations.—In broncho-pneumonia the inhalation of steam medicated with terebene, oil of eucalyptus, etc. (see p. 184), if carried out with discretion, seems to give a certain amount of relief, and may have some influence in preventing the exudates from becoming septic.

Intratracheal Injections of antiseptic solutions are advised by some authorities and condemned by others. Lugol's solution of iodine administered in this manner is said to give good results in cases where there is a tendency to pulmonary gangrene. Up to the present, the clinical evidence as to the value of this treatment is not sufficiently convincing to warrant us in advising its employment.

In septic pneumonia and pulmonary gangrene, all forms of treatment usually fail, and the few cases that chance to recover generally remain chronic invalids.

As regards the value of internal antiseptics in the treatment of pneumonia, Sir A. Wright* states that doses which would almost certainly be lethal would have to be administered before antiseptics such as lysol, creosote, or guaiacol, could come into operation in the blood.†

Vaccine-Therapy.—Some practitioners claim good results from the use of a polyvalent stock vaccine; others are in favour of an autogenous vaccine. Further experience is desirable before the value of this treatment can be definitely stated. For full details the reader is referred to the section on 'Vaccine-Therapy as applied to Diseases of the Respi-

* 'Drugs and Vaccines in Pneumonia,' 1914.

† See Note on use of Formalin on p. 910.

ratory Organs in the Horse,' by W. M. Scott, in 'A System of Veterinary Medicine,' vol. ii., p. 929.

In concluding our remarks on the treatment of pneumonia, we may point out that in some outbreaks of the epizoötic type of the disease, or what many observers would regard as the pulmonary complications of influenza, the action of the toxins is so rapid and profound that death occurs in a comparatively quick manner from cardiac complications. Such cases are not uncommon when outbreaks occur in remount depots, more especially if horses are exposed to chills, long railway journeys, etc., when suffering from the disease in the early stages. We have observed instances in which horses were apparently healthy, and, being sent a long journey by rail, arrived at their destination presenting evidences of pleuro-pneumonia of a very severe type. Death occurred rather rapidly in several cases, and the post-mortem examination showed well-marked lesions of pleuro-pneumonia and extensive effusion into the pleural cavity. In addition, myocarditis was present. In such instances treatment of any kind fails to exert beneficial effects.

Up to the present time it cannot be said that the treatment available for epizoötic pneumonia is either satisfactory or successful, and further research on the subject is eminently desirable. When recoveries ensue they should be attributed to pure air, good nursing, and the vital resistance of the patients, rather than to the medicinal agents administered.

Chronic Alveolar Emphysema of the Lungs ('Broken Wind').—The condition known as 'broken wind' commonly depends on a permanent dilatation of the pulmonary alveoli, accompanied by atrophy of the intra-alveolar and inter-infundibular septa and of the bloodvessels contained therein. But exceptions occur as follows: In some cases of pulmonary emphysema, the symptoms of 'broken wind' may not be observed, while occasionally horses suffering from 'broken wind' do not show on post-mortem any lesions of pulmonary emphysema, or any other structural alterations in the lungs. Various theories have been advanced to account for the occurrence of the disease, but up to the

present the etiology of many of the cases met with is involved in mystery. We are well aware that the condition not infrequently occurs as a sequel to broncho-pneumonia, and is often associated with chronic bronchial catarrh. But we know little definite as regards the etiology of the large number of cases that develop in an insidious manner, usually in obese animals possessing inordinate appetites, and leading a more or less idle life. Cobs and ponies seem especially liable to become affected. Some authors put forward the theory that excessive amounts of bulky, indigestible foods cause irritation of the gastric nerves, and this irritation is said to be reflected to the pulmonary branches of the vagus, the result being a paralyzed condition of the muscular walls of the smaller bronchi and well-marked dilatation of the pulmonary alveoli. Well-bred horses are seldom affected, except as the result of bronchitis or pneumonia.

The **Symptoms** usually appear in an insidious manner. An obstinate cough is observed, and an abnormal acceleration of the respiratory movements on being subjected to moderate exertion. These phenomena gradually become accentuated until dyspnœa and the characteristic 'broken-winded' cough become prominent symptoms. The type of respiration is as follows: Inspiration is shorter than normal, but expiration is lengthened to a marked degree, and is characterized by a double expiratory effort in order to overcome the loss of elasticity in the pulmonary alveoli.

The *cough* in the early stages is paroxysmal and dry in character, and is heard especially when the horse first leaves the stable. Later on it becomes feeble, jerky, abortive, shallow, and single, but when the animal is exerted or when the larynx is pressed by the fingers a series of these shallow coughs is heard. In advanced cases the dyspnœa and irregular respiration are manifested during repose, the nostrils are dilated, and the alternate rising and falling of the flanks are accompanied by a similar action of the muscles of the croup and by a protrusion and contraction of the anus. Cardiac palpitation is not uncommon, and dilatation

of the right side of the heart occurs in the later stages, evidenced by a weak and irregular cardiac impulse and an accelerated, irregular, and feeble pulse. A flatulent condition of the intestines is often present, and the abdomen assumes a 'pot-bellied' appearance. When 'broken wind' is associated with chronic bronchitis, a slight nasal discharge, mucous in character and whitish in colour, is observed. When the condition occurs as a sequel to broncho-pneumonia, we find that, after the acute symptoms of the latter subside, respiratory distress still continues, and the characteristic phenomena of broken wind develop, often in an aggravated form.

Treatment.—It is quite obvious that, once the lesions of chronic pulmonary emphysema develop, the case is incurable. Palliative measures, such as attention to hygienic and dietetic details, and suitable therapeutic measures, may succeed in rendering cases, that are not too far advanced, suitable for slow work. The amount of hay should be limited, and the patient should be prevented from eating his bedding. The animal ought to be fed about two hours prior to being worked, and should be driven slowly, especially up hills. As regards drugs, arsenic is often employed, and occasionally gives good results. One ounce of Fowler's solution of arsenic may be given twice daily in the food, and the dose gradually increased. A combination of arsenic, extract of belladonna, and iodide of potassium, sometimes proves useful. Continental authors advise a combination of arsenic, strychnine, and veratrine. Cagny claims good results with ergot and veratrine. Several patent preparations on the market contain these drugs. Aconite is also employed in combination with arsenic, tartar emetic, and veratrine. Treatment with drugs can only be palliative, and when we hear of cases of 'broken wind' that have been 'cured,' we may be quite certain that the diagnosis has been erroneous.

In cases associated with chronic bronchial catarrh, inhalations of steam medicated with terebene give relief. Tar-water, allowed in lieu of drinking-water, is useful, and young chopped gorse may be substituted for hay. Occasional doses of raw linseed-oil given in the food assist digestion by keep-

ing the bowels regular. It is important to remember that drugs such as eserine and arecoline should be prescribed with extreme caution for horses suffering from 'broken wind.'

The prevention of the disease is of importance. Regular exercise, attention to diet, and the early treatment of persistent coughs, constitute the preventive measures.

Pleurisy.—Inflammation of the pleura usually occurs as a secondary affection, but occasionally the disease develops without any appreciable cause. The influence of exposure to cold, chills, etc., must be regarded as a predisposing cause, by lowering the vital powers of resistance, as all types of pleurisy are now regarded as microbial in origin.

Various forms of **acute pleurisy** are met with—viz.:

1. **Acute Sero-Fibrinous Pleurisy,** in which a sero-fibrinous effusion occurs. It is the type most commonly encountered in the horse, and is generally a secondary affection. Thus, it is frequently associated with pneumonia, influenza, pericarditis, and strangles, and is also met with in acute articular rheumatism, tuberculosis, chronic glanders, pyæmia, septicæmia, etc. Pleurisy may also depend on traumatic causes, such as penetrating wounds of the thorax, compound fractures of ribs, etc.

2. **Purulent Pleurisy** (Empyema), in which the effusion is of a purulent character. This may result from a variety of conditions, all of which favour the entrance of pyogenic organisms into the pleural cavity.

3. **Fibrinous or Plastic Pleurisy** (also known as 'Dry' or 'Adhesive' Pleurisy), in which there is no appreciable effusion; it is more commonly a chronic affection.

The **Symptoms** in acute pleurisy are not regular or constant, especially when the affection occurs as a complication of pneumonia.

In the early stages, pain and rigors are often observed. The pain varies in intensity from slight uneasiness to symptoms resembling those met with in spasmodic colic, and is of short duration, being succeeded by stiffness and a distinct groan or grunt if the animal be forced to move.

When the disease is developed, the following phenomena

are observed: Fever; a quick, hard, wiry pulse, which assumes a soft character when effusion occurs, and when the amount of fluid becomes extensive the pulse becomes rapid, small, and weak. The respirations are accelerated, and are of the type known as 'abdominal' (see p. 27). Cough is not a prominent symptom; when present it is short, dry, painful, and suppressed. On the occurrence of extensive effusion the respirations become quick and laboured, accessory muscles are called into play, and what is known as the 'pumping' type of respiration is present. The cardiac impulse becomes feeble, and the sounds of the heart may be weak. An œdematous swelling appears on the sternum, and may extend along the dependent parts of the abdominal region.

The diagnosis is based on a physical examination of the chest. *Percussion* in the early stages causes marked pain. Later on, when effusion is advanced, dulness on percussion is well marked, and its upper limit corresponds to the height to which the fluid has risen in the thoracic cavity. *Auscultation* in the early stages may reveal the presence of a friction sound, of short duration and easily overlooked. When effusion takes place, the respiratory murmur disappears over an area corresponding to the extent of the fluid.

Treatment.—In the early stages, if pain be present, a dose of chloral hydrate (℥ss.) may be given in the form of bolus. The presence of rigors is an indication for the administration of a diffusible stimulant, such as sweet spirit of nitre, and the application of warm clothing. At this stage, moderate counter-irritation by means of mustard paste applied to the thoracic walls is of benefit. After effusion has occurred counter-irritation is harmful. Attention to diet and surroundings is as necessary in pleurisy as in pneumonia (see p. 706). In cases where the temperature is high, salicylate of soda should be given in the form of electuary. Early 'tapping' should be carried out (see p. 708), and repeated if necessary. There are many cases in which a moderate amount of fluid is present, and a physical examination of the chest may fail to reveal it. Clinical experience teaches that a large amount of fluid should not be allowed to collect; hence the impor-

tance of an early diagnosis by the employment of the trocar and cannula, and the prompt removal of the fluid.

In ordinary cases that are tapped early, as much as possible of the fluid should be removed at one time. When there are evidences of cardiac weakness, the subcutaneous injection of large amounts of normal saline solution is indicated. During convalescence from pleurisy, potassium iodide may be given in the drinking-water, in order to assist in the removal of false membranes.

The treatment of **purulent pleurisy** is generally unsatisfactory. Continental authors advise surgical measures, such as an incision in the intercostal space at the anterior border of the ninth rib, carried out so as to cause evacuation of the fluid and efficient drainage, and to permit thorough disinfection of the pleural cavity by irrigation with a non-irritating antiseptic solution.

As the symptoms of **dry adhesive pleurisy** and of **chronic pleurisy** are obscure, diagnosis is seldom possible. When either condition is suspected, little can be done in the way of medicinal treatment beyond the administration of potassium iodide and tonics, while in chronic pleurisy, if the presence of fluid can be detected, tapping should be carried out.

Hydrothorax (Dropsy of the Pleura).—This is a condition characterized by the transudation of a non-inflammatory fluid into the pleural cavity. It occurs independently of pleurisy; the fluid is clear, yellowish or slightly reddish in colour, and contains no fibrin; the pleura is smooth, and false membranes are absent. Hydrothorax may be associated with the following conditions: Chronic affections of the heart and kidneys, chronic pulmonary lesions, general dropsy, and certain diseases of the blood. The amount of fluid is rarely so extensive as in the case of pleural effusion. Treatment is to be conducted on similar lines to those advised for pleural effusion, but is rarely successful, as the affection usually depends on chronic incurable conditions; moreover, on economical grounds such cases do not repay the cost of treatment.

B.—Cattle.

The principles of treatment of respiratory diseases in cattle are similar to those advised for the horse. In ordinary practice the majority of cases of pulmonary affections depend either on the effects of careless drenching or on tuberculosis. In calves, however, serious outbreaks of septic pneumonia are met with, while parasitic bronchitis ('hoose') is a common and important condition.

In the treatment of respiratory diseases in cattle, the remarks already made with reference to drenching in equines equally apply, and medicines should be administered in the form of electuary. When drenches are administered in such affections in cattle, our experience is that the procedure leads to a fatal termination, as a hopeless broncho-pneumonia is likely to ensue owing to portions of the fluid entering the bronchi.

Pure air is quite as essential in the treatment of pneumonias in bovines as it is in the case of these affections in the horse.

C.—The Dog.

Respiratory diseases are of frequent occurrence in canine practice. In many instances it is difficult, if not impossible, to ascertain whether acute nasal catarrh, bronchitis, and pneumonia, are diseases *per se*, or conditions associated with distemper. Probably there are many cases in which such affections are erroneously diagnosed as distemper. *Per contra*, we know that a case diagnosed as a primary nasal catarrh, bronchitis, or pneumonia, not infrequently proves to be distemper with respiratory complications. The most advisable course to adopt, in our present state of knowledge, is to regard all cases of respiratory diseases as infectious, and to carry out isolation in a prompt manner. From a therapeutic aspect, the principles of treatment for ordinary or sporadic pneumonia and distemper with respiratory complications do not differ to any extent.

Acute Nasal Catarrh.—This may occur in the dog as a disease *per se*, but in many instances, as already remarked, it

is a symptom of the catarrhal form of distemper. None of the suggestions put forward by authors with reference to the distinguishing features of the nasal discharge in distemper are reliable.

As regards treatment, inhalations of steam medicated with oil of eucalyptus or terebene are indicated. Hazeline ointment may be applied to the nostrils. Irrigation of the nasal cavities is advised by some authors, but is not a safe procedure, as the animal resists violently, and some of the fluid may enter the trachea and bronchi. All cases of nasal catarrh should be isolated.

Acute Laryngitis.—The treatment consists of medicated inhalations of steam, and the application of glycerinum boracis and honey to the laryngeal mucosa by means of a camel-hair brush. A cataplasm of kaolin and glycerin should be applied to the external laryngeal region. Small doses of heroin and glycerin may be given if the cough be troublesome, but great care is essential in administering fluid medicines, in order to avoid the danger of any of the medicament entering the trachea and bronchi.

In **chronic** laryngitis similar treatment is indicated. In obstinate cases the external laryngeal region may be painted with tincture of iodine.

Acute Bronchitis.—In the treatment of this condition the animal should be placed in comfortable quarters and kept at rest. Medicated inhalations of steam are indicated. During the dry stage a mixture containing ipecacuanha wine, solution of acetate of ammonia, and sweet spirit of nitre, proves useful. If the cough be distressing, a few doses of Dover's powder will give relief. Later on, when free bronchial secretion is established, sedatives are contra-indicated, as they interfere with the expulsion of secreted material from the bronchi, and at this stage a moderate degree of coughing is beneficial. Good nursing is of great importance, and exposure to chills should be carefully avoided. During convalescence a course of cod-liver oil is indicated.

Chronic Bronchitis.—This is a very common affection, especially in aged, obese animals. It is frequently associated

with chronic eczema, and tends to recur in cold or damp weather. Chronic bronchitis may occur as a sequel to an acute attack of the disease, or may be associated with chronic cardiac or renal affections. Owing to the marked respiratory distress that is present, the disease is often mistaken for asthma (see below).

Treatment is often unsatisfactory. The hard, husky, dry, paroxysmal cough and the dyspnœa prove very distressing to the observer as well as to the animal. A mixture containing heroin and glycerin gives temporary relief in some cases. We have observed good results from the administration of compound syrup of cocillana (see p. 493). Syrup of tar combined with small doses of apomorphine or codeine sometimes proves useful. H. Gray advises a mixture composed of equal parts of syrup of apomorphine, syrup of ipecacuanha (syrupus ipecacuanhæ acetatis, U.S.P.), and syrup of squill, the dose being 2 drachms three times daily for a dog of medium size. When the cough becomes moist, he prescribes a glycerole containing codeine phosphate $\frac{1}{4}$ grain and strychnine phosphate $\frac{1}{100}$ grain in each fluid drachm. The dose for a dog the size of a fox-terrier is 1 drachm, three times daily. Medicated inhalations of steam assist the above treatment.

Bronchial Asthma.—Many cases diagnosed as asthma are in reality chronic bronchitis. True asthma is not a common disease in the dog; it is characterized by distressing attacks of dyspnœa which occur at irregular intervals; cough may be absent in some cases. The attacks appear suddenly, last for some time, and may cease abruptly for a variable period. The animal gasps for breath and makes strenuous inspiratory efforts, but little air enters the lungs, owing to the spasmodic constriction of the bronchioles. In some cases, during the attack, the abdominal muscles contract in a spasmodic manner. Asthma is not uncommonly associated with valvular disease of the heart or dilatation of the right side of the heart, also with ascites.

Treatment can only be palliative. Various medicinal agents have been tried, but their effect is only temporary.

H. Gray advises syrup of chloral hydrate, and finds it gives better results than any other drug. We have found compound syrup of cocillana (see p. 493) very useful as a palliative remedy; it can be continued for long periods without damage to the animal's system. Glyco-heroin sometime proves of value in relieving the respiratory distress. Pulmonary emphysema may be present in some cases of asthma, and it adds to the difficulty in breathing. A course of arsenic and potassium iodide may be tried, but its value is doubtful. Medicated inhalations of steam sometimes assist in giving relief. When asthma is associated with cardiac disease and ascites, these conditions must receive special treatment. If the symptoms present, and the evidences obtained from a physical examination of the heart, indicate the employment of digitalis (see p. 421), this drug should be cautiously prescribed. When ascites occurs as a complication, *paracentesis abdominis* should be carried out, and the fluid removed (see p. 827). The diet should be regulated, and large feeds ought to be avoided. Sudden death may occur at any time when cardiac complications are present, and the owner should be prepared for this event.

Pneumonia.—As already pointed out, it is extremely difficult to differentiate a primary pneumonia in the dog from the pulmonary complications of canine distemper. Pneumonia is such a common phenomenon in distemper that it is rarely possible to state, on examining a given case which presents evidences of pneumonia, whether the pulmonary symptoms are due to a primary inflammation of the lungs or to a complication of distemper.

In addition to distemper as an etiological factor in pneumonia, the latter may be caused by the careless administration of fluid foods or medicines (inhalation pneumonia), or the affection may result from the entry of blood into the trachea and bronchi during operations on the mouth or pharyngeal region. The most common type of the disease is broncho-pneumonia. Many authors state that croupous pneumonia is of rare occurrence in the dog.

In the **Treatment** of pneumonia good nursing and suitable

surroundings are very essential. Full details will be found in the section on the treatment of the pulmonary complications of distemper (see p. 789).

Nuclein given by hypodermic injection often proves useful. When stimulants are indicated, subcutaneous injections of normal saline solution are often preferable to whisky, brandy, or wine. The mortality is high in spite of treatment.

In 'inhalation' pneumonia the outlook is serious, more especially if the medicament which has entered the bronchi was of an oily nature or a solution of Epsom salt. When a large amount gains entrance to the lungs, a fatal termination may occur rapidly.

Pleurisy.—Although pleurisy may occasionally occur in the dog as a disease *per se*, it is usually a secondary affection, and in the majority of instances is associated with tuberculosis. Pleurisy may occasionally be observed in connection with distemper, and as the result of injuries to the thoracic walls, fracture of ribs, etc. A septic or purulent pleurisy results from penetrating wounds of the thorax, perforation of the intrathoracic portion of the œsophagus by sharp pieces of bone, etc., or from the careless use of the probang in cases of choking.

The sero-fibrinous is more commonly met with than the dry form of the disease. In the pleurisy of tuberculosis, the disease may remain latent for a long period, and then without any apparent cause—or in some instances from exposure to chills—evidences of pleuritic effusion appear rather suddenly.

In order to detect the presence of pleuritic effusion, a physical examination of the chest is necessary, and by changing the position of the patient the alteration in the line of dulness can be observed. In all doubtful cases, an exploratory *paracentesis thoracis* should be carried out.

As regards the **Treatment** of pleurisy, acute cases are seldom observed in the early stages. If, however, we meet with instances characterized by the abdominal type of breathing, and when marked pain is evinced on percussion of the thoracic walls, a cataplasm of kaolin and glycerin

should be applied to the sides of the chest, and salicylate of soda or aspirin may be given internally. It is of importance to decide whether pleurisy depends on tuberculosis or otherwise. This can be determined either by applying the tuberculin test (see p. 524), or by removing some of the fluid from the pleural cavity by means of an aspirator and subjecting it to a bacteriological examination. Several writers point out that, in the case of an old effusion, tubercle bacilli may be absent, although the vegetations on the costal and diaphragmatic pleura contain the micro-organisms in abundance. Obviously, if the case be one of tuberculosis, the animal should be destroyed, as it would be a source of danger to human beings. In non-tubercular cases, if evidences of pleuritic effusion be present, *paracentesis thoracis* should be carried out by means of a trocar and cannula, or by an aspirator. The site selected is usually between the sixth and seventh or the seventh and eighth ribs, about an inch above and behind the point of the elbow. In operating on the left side, care should be taken to avoid wounding the heart.

Small doses of potassium iodide should subsequently be prescribed.

D.—Birds.

Simple Nasal Catarrh.—This occurs in cage-birds, poultry, and parrots. Exposure to draughts, chills, etc., seems to be an important predisposing cause, but probably the affection is microbial in character.

The surroundings should be kept at a high temperature. Small doses of aspirin or tincture of camphor may be given in the drinking-water. The nostrils should be frequently cleansed with a warm solution of boric acid.

Acute Bronchitis.—In the treatment of this affection an equable temperature of the surroundings of not less than 80° F. is desirable. Inhalations of steam medicated with oil of eucalyptus are indicated; but care should be taken not to induce suffocation. Syrup of squill and glycerin may be given in doses of from 1 to 10 drops, according to the size of the patient.

Pneumonia.—The treatment consists in placing the bird in warm surroundings and attending to its general comfort. Salicylate of soda or antifebrin may be given in the drinking-water.

FORMULÆ.

Electuary for Acute Laryngitis in the Horse.

℞ Ext. Belladonnæ Vir. ... ... ℥ii.ss.
Potass. Chlorat. ... ... ℥iv.
Pulv. Myrrhæ ... ... ℥iv.
Pulv. Camphoræ ... ... ℥i.
Glycerini ... ... ℥iv.
Mellis ... ... ℥viii.

M. Ft. elect. Sig.: Gi e a tablespoonful on the tongue three times daily.

Electuary for Cases of Bronchitis and Pneumonia in the Horse, associated with a High Temperature.

℞ Sodii Salicylatis ... ... ℥iv.
Mellis ... ... ad ℥viii.

Ft. elect. Sig.: Give a tablespoonful every four hours on the tongue.

Mixture for Chronic Bronchitis or for Asthma in the Horse.

℞ Ext. Belladonnæ Liq. ... ℥x.
Potass. Iod. .. .. ℥x.
Liq. Arsenicalis ... ... ℥x.
Glycerini ... ... ℥iv.
Aquæ .. .. ad O.i.

F. M. Sig.: Give a wineglassful twice daily in the food or drinking-water.

Powders for Chronic Cough and 'Broken Wind' in the Horse.

℞ Pulv. Ext. Aconiti (P., D. and Co.) ℥i.
Ac. Arseniosi ... ... ℥i.
Veratrinæ ... ... gr. xii.
Strychninæ Sulph. ... ... gr. vi.
Pulv. Fruct. Anisi ... ... ℥ii.

M. Div. in pulv. xii. Sig.: Give one every evening in the food.

Febrifuge Mixture for Acute Nasal Catarrh in the Dog.

℞ Potass. Cit. ... ... gr. lxxx.
Vini Ipecac. ... ... ♏ lxxx.
Liq. Ammon. Acet. ... ... ℥i.
Aquæ Camphoræ ... ... ad ℥iv.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful every four hours.

Mixture in the Early Stages of Acute Bronchitis in the Dog.

℞ Pulv. Ipecac. Co. ... ... gr. xl.
Spts. Æth. Nit. ... ... ℥i.
Liq. Ammon. Acet. ... ... ℥ii.
Aquæ Camph. ... ... ad ℥iv.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful every four hours.

Stimulating Expectorant Mixture in the Secondary Stages of Bronchitis in the Dog.

℞ Ammonii Carb. ... ... gr. xx.
Syr. Scillæ ... ... ℥ii.
Spts. Chloroformi ... ... ℥i.
Infusi Senegæ ... ... ad ℥iv.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful every four hours.

Mixture for Chronic Bronchitis in the Dog.

℞ Syrupi Apomorphinæ ... ... ℥i.
Syrupi Ipecac. Acet. (U.S.P.) ℥i.
Syrupi Scillæ ... ... ℥i.

F. M. Sig.: Give from one teaspoonful to a tablespoonful three times daily.

Or:

℞ Syrupi Cocillanæ Co. (P., D. and Co.) ... ... ℥ss.
Aquæ ... ... ad ℥iv.

F. M. Sig.: Give from a teaspoonful to a tablespoonful three times a day.

Inhalation for Chronic Bronchitis in the Dog.

℞ Terebeni Pur. ... ... ℥ss.
Mag. Carb. Levis ... ... gr. xx.
Aquæ Ferv. ... ... O.ss.

M. Sig.: Use as an inhalation three times daily.

CHAPTER XII

THE TREATMENT OF DISEASES OF THE CIRCULATORY ORGANS

A.—The Horse.

Diseases of the heart in the horse are of less interest and importance to the therapeutist than similar affections of the dog, for the following reasons :

1. If we are satisfied that a horse is suffering from a chronic valvular affection of the heart we know that any therapeutic measures we adopt can only be palliative. Again, such cases are only fit for slow work, and there is a liability to sudden death at any time. Obviously it would not be safe to recommend a horse known to be suffering from heart disease as fit for harness or saddle work. As regards cases presenting positive evidence of chronic cardiac disease, and unable to undergo any exertion without manifesting distress, it is quite clear that treatment is useless, and, on economical grounds, destruction is advisable. But it is necessary to be extremely careful in arriving at a diagnosis in cases presenting symptoms suggestive of cardiac disease; and, as we shall point out farther on, the differentiation of functional from organic affections of the heart is by no means an easy matter.

Again, it must be remembered that some cases of acute endocarditis may recover—at any rate to a certain extent—and a guarded opinion must be given in such instances with reference to prognosis.

2. The difficulties in the diagnosis of cardiac diseases

render the selection of therapeutic measures a difficult matter. Further, we know that in many instances advanced cardiac lesions may be present without manifesting symptoms suggestive of heart disease.

Post-mortem examinations furnish us with evidence which leads us to the belief that cardiac diseases are by no means uncommon in the horse, although in practice their presence is frequently overlooked in consequence of the lack of diagnostic symptoms. But it must also be admitted that a systematic examination of the heart is not always carried out in veterinary practice, owing to the prevalent idea that cardiac diseases are either of rare occurrence or cannot be diagnosed.

For full information on the physical examination of the heart the reader is referred to p. 23. Here we can only deal briefly with the therapeutic aspect of those diseases which are amenable to treatment. The general symptoms of cardiac disease will be found on p. 17.

Before discussing the treatment of cardiac affections, it will be necessary to consider the treatment of diseases of the **Pericardium.**

Acute Pericarditis (Acute Inflammation of the Pericardium). — This is also known as 'Pericarditis with Effusion,' in order to distinguish it from what is known as 'Acute Fibrinous, Plastic, or Dry Pericarditis,' which is characterized by a small amount of fibrinous exudation, a slight amount of effusion, and a benign course; but as this form is usually overlooked, it is of little interest from a therapeutic point of view.

The following **Causes** are recognized in connection with the etiology of pericarditis with effusion :

As a *primary* affection it is associated with articular or muscular rheumatism. As a *secondary* disease it is found in connection with influenza, pleurisy, pneumonia, septicæmia, tuberculosis, purpura hæmorrhagica, etc. Probably all cases of the disease are microbial in character. Traumatic causes include the presence of sharp foreign bodies in the pericardial sac (rare in the horse), a punctured wound involving this

structure, or a fractured rib, one of whose ends penetrates the pericardium.

The following **Symptoms** may be observed :

In the early stages, a variable degree of fever, sometimes hyperpyrexia ; rigors ; dull pain ; tenderness evinced on percussion of the cardiac region ; disinclination for movement ; shallow respirations of the abdominal type ; a frequent, wiry pulse ; increased intensity of the cardiac impulse ; irregular heart-beats ; a feeble, suppressed cough ; cardiac palpitation if the patient be forced to move ; spasms or cramps of the superficial muscles of the neck and pectoral region ; sometimes lameness in one fore-limb. When effusion occurs into the pericardial sac, we observe an abatement of fever ; a small, thready, intermittent, and irregular pulse ; a weak cardiac impulse, and, if the effusion be extensive, the heart-beat can only be detected with difficulty ; laboured respirations ; distension of the jugular veins, œdematous swellings of the sternum and anterior abdominal region, may also be present.

Palpation.—In the early stages, palpation of the cardiac region causes pain. Sometimes a fremitus or thrill can be detected. When effusion occurs, a gradual diminution of the cardiac impulse is observed, and when the amount of fluid is extensive the heart-beats cannot be felt.

Percussion.—In the stage of effusion, when the latter is extensive, the area of cardiac dulness is greatly increased.

Auscultation.—In the early stage, friction sounds can be detected in some cases, but they are often ill-defined. In the stage of effusion, the friction sounds disappear. The cardiac sounds are muffled and indistinct, and in extensive effusion they become inaudible.

Treatment.—Perfect rest is essential. In the early stages, salicylate of soda should be given in the form of electuary. Later on, if cardiac weakness be present, hypodermic injections of strychnine and caffeine are indicated, also full amounts of normal saline solution administered by subcutaneous injection. Potassium iodide assists in promoting absorption of the effusion. In extensive effusion, evidenced

by dyspnœa, serious interference with the action of the heart, and a small, rapid pulse, *paracentesis pericardii* (puncture of the pericardium) should be performed. The site selected is the fifth or sixth intercostal space on the left side. A fine trocar and cannula is employed, with strict aseptic precautions; the instrument should be directed upwards and inwards, so as to avoid wounding the heart.

Chronic Pericarditis.—This condition is seldom diagnosed. Beyond the administration of potassium iodide, nothing can be done in the way of treatment. Similar remarks apply to chronic adhesive pericarditis (adherent pericardium).

Functional Affections of the Heart.—It is of great importance to differentiate functional from organic diseases of the heart. These functional disorders generally depend on nervous disturbance, which in its turn may originate from a variety of causes, such as dyspepsia; the presence of parasites in the gastro-intestinal canal; the effects of a recent attack of an acute infectious disease, such as influenza; also conditions of general debility.

Palpitation is an irregular or forcible action of the heart which shows various grades of intensity.

Disturbance of the Rhythm of the Heart, which includes an *intermittent* or an *irregular* cardiac action, occurs under a variety of conditions. In some instances either irregularity or intermittency of the heart's action may be observed in apparently healthy horses; in others these phenomena may be temporary and depend on various causes (see p. 20).

Again, palpitation, irregularity, and intermittency may be among the symptoms observed in cases of chronic valvular disease of the heart. But a diagnosis of cardiac disease should never be given on the presence of these phenomena *per se*. Several examinations of the case should be carried out, and, unless there are clear indications of a valvular disease present, diagnosis and prognosis should be guarded.

As regards the treatment of functional affections of the heart, the first essential is to ascertain the cause of the morbid phenomena. If depending on dyspepsia or on internal parasites, treatment suitable for these conditions

should be prescribed. When occurring during convalescence from influenza, etc., a long rest is essential, and nux vomica combined with a mild preparation of iron should be given in the food twice daily.

Myocarditis (Inflammation of the Myocardium, or Heart Muscle).—In severe cases a fatal termination is the rule. The disease is frequently associated with influenza and pneumonia, and is seldom diagnosed. The occurrence of cardiac weakness during the course of the above diseases suggests the employment of digitalin, caffeine, and strychnine, by hypodermic injection. Large amounts of normal saline solution should be given subcutaneously. Unfortunately, in most cases the presence of the disease is overlooked, and the lesion is discovered as a surprise at the post-mortem.

Similar remarks apply to **fatty heart** and other organic diseases of the myocardium.

Acute Endocarditis (Acute Inflammation of the Endocardium, usually confined to the Valves).—This in the majority of cases should be regarded as a local process in an acute infection rather than as a disease *per se*.

Two forms are recognized by some authors—viz., a *simple, benign,* or *verrucous,* and a *malignant, ulcerative,* or *infective* endocarditis—but, as various gradations can be traced between them, many authorities now consider these types as representing different degrees of intensity of the same process. All forms of endocarditis should be regarded as microbial in origin. It is important to remember that, although a distinction is made between acute and chronic endocarditis, yet the latter may at any time be complicated by an acute attack.

As compared with the chronic form, acute endocarditis must be regarded as rather uncommon in the horse; but it is probable that, in consequence of the difficulty in diagnosis, and the fact that the disease is generally associated with other maladies, its presence is likely to be overlooked. Many authors state that the benign type is frequently associated with rheumatism.

The *malignant* or *infective* type is rare as a primary disease. It is usually a secondary affection occurring in connection

with influenza, pneumonia, strangles, various pyæmic and septicæmic conditions, suppurative arthritis, joint-ill, etc.

Exposure to cold, chills, and over-exertion, act as predisposing causes by lowering the vital resistance of the animal and rendering the endocardium vulnerable to micro-organisms.

The **Symptoms** are not constant, and are often overlooked, especially in the early stages and in the benign type of the disease. A careful examination of the heart during the course of influenza, pneumonia, acute rheumatism, etc., will in some cases enable the practitioner to detect evidences of cardiac disease, and to suspect the nature of the affection. Of course the history of the case must be taken into consideration, as the animal may have been suffering from a chronic valvular disease prior to the attack of influenza, etc.

In the malignant type, the intensity of the symptoms is very variable. An increase in the existing fever of the primary disease may be observed, also marked constitutional disturbance and alterations in the character of the pulse. Auscultation may reveal the presence of various abnormal sounds when several valves are involved; the cardiac sounds appear to run together. Respiratory disturbance, dyspnœa, sweating, and dull colicky pains, are met with in some cases, also weakness in the hind-limbs and a staggering gait. Various complications may occur. An apparent recovery may take place, and later on, when the horse is put to work, he may die suddenly. The course of the disease is very irregular, and the prognosis unfavourable. A mild attack of influenza may, without warning, develop symptoms of endocarditis.

Treatment.—Perfect rest is essential. If high fever be present, quinine may be given in the form of electuary. In cases associated with rheumatism, salicylate of soda in full doses is indicated. When the action of the heart is rapid and irregular, digitalin or digalen with strychnine may be given by hypodermic injection. Subcutaneous injections of normal saline solution should be administered when cardiac weakness is present. Potassium iodide may be given with a view to preventing fibrous organization of the exudate on the valves.

A long rest should be ordered, and frequent examinations of the heart ought to be made in order to detect the presence of permanent valvular lesions. The owner should be warned of the serious nature of the case and the tendency to complications suddenly arising, such as the occurrence of embolism in various organs.

Chronic Endocarditis (Chronic Valvular Disease).—As already remarked, chronic valvular disease in the horse is not of special interest from a therapeutic aspect. To the clinician, however, it is of importance, as he has to give a definite opinion with reference to the existence of chronic heart disease, and advise whether treatment is desirable or otherwise. Obviously, this is a duty which requires considerable discrimination, and a practical knowledge of the physical examination of the heart (see p. 23). Except in a case where there are well-marked evidences of cardiac disease, it is advisable to give a guarded opinion, and to make several examinations, before we decide definitely that an incurable heart affection is present. There are few practitioners who cannot recall instances of an erroneous diagnosis in cases of the kind. Not infrequently it has happened that a horse condemned as unsafe and useless from cardiac disease has changed hands and worked for several years. We must point out, however, that a case of latent heart disease may perform even severe work without apparent distress. In such an instance an acute attack of endocarditis may develop at any time, and well-marked symptoms are then manifested. When the acute symptoms abate, the animal may again be capable of working. Whenever it has been possible to trace the history of such cases, the usual termination has been the sudden death of the animal while at work.

We are quite willing to admit that certain cases presenting evidences of valvular disease may after suitable treatment be capable of carrying on the work required of them, for an indefinite period. The point we wish to emphasize is that the fact that a horse is capable of work does not indicate that valvular disease is not present.

On p. 25 will be found information with reference to

'cardiac murmurs.' As we are chiefly concerned here with the therapeutic aspect of valvular diseases so far as treatment is desirable or is possible, we cannot enter into the subject of diagnosis, or the differentiation of one form of organic cardiac disease from another. Full information on the subject will be found in our article on 'Diseases of the Heart' in 'A System of Veterinary Medicine,' vol. ii.

Cases are met with in which, owing to the absence of well-marked symptoms, a doubt may arise in the mind of the practitioner as to the advisability of adopting treatment or otherwise. Moreover, the owner may insist on treatment being carried out or given a trial.

Generally speaking, the symptoms occurring in a case of valvular disease, which lead the owner to seek professional advice, are as follows: Distress on slight exertion; in some cases the animal may fall down while at work, or exhibit symptoms resembling those of so-called 'staggers.' Swelling of the limbs and palpitation of the heart may also be observed.

The following table will assist in the diagnosis of the forms of valvular disease usually encountered. As regards the most common seat of the lesions, opinion is divided. Some regard the aortic valves as being most frequently affected. Others state that mitral insufficiency is the most common lesion.

	Palpation.	Auscultation.	General Symptoms.
Aortic insufficiency	Cardiac impulse strong. A thrill, diastolic in time.	A 'blowing' murmur which may accompany the second cardiac sound or take its place.	*Pulse:* Of the 'Corrigan' or 'water-hammer' type (see p. 20). A thrill in the carotid arteries. When compensation fails, cardiac palpitation and dyspnœa. Sometimes irregular respiration or a double expiratory movement.

	Palpation.	Auscultation.	General Symptoms.
Aortic stenosis	A systolic thrill over the base of the heart, simultaneous with the heart-beat. Cardiac impulse slow and forcible.	A prolonged systolic murmur, heard chiefly over the base of the heart. It covers the first sound of the heart, and is propagated into the carotid arteries.	*Pulse:* Small, slow, and regular. Vertigo in some cases. When compensation fails, mitral insufficiency may set in, and the symptoms of that condition are manifested.
Mitral insufficiency	Cardiac impulse forcible in compensation period; feeble when compensation fails. A systolic thrill of a purring character, simultaneous with the heart-beat.	A systolic murmur which wholly or partly obliterates the first sound of the heart. The second sound is louder than normal.	*Pulse:* Irregular, small, and intermittent, when compensation fails. Jugular pulse present. Dyspnœa, cough, œdematous swellings of limbs and dependent parts of the body.
Mitral stenosis	A presystolic thrill over the base of the heart, immediately preceding the cardiac impulse.	A diastolic murmur over the apex.	*Pulse:* Small and soft; in later stages weak, irregular, and intermittent. Respiratory disturbance similar to that in mitral insufficiency.
Tricuspid insufficiency	A systolic thrill in the region of the third to the fourth intercostal space.	A soft systolic murmur coincident with the pulse, best heard at the posterior border of the third rib, in the groove formed between the caput magnum and the chest wall.	A venous pulse. Ascites, hydrothorax, dyspnœa, vertigo, a cyanotic condition of the visible mucosæ.

Treatment.—As already remarked, it is not advisable to adopt treatment in cases presenting definite evidence of chronic valvular disease.

In the large majority of instances, horses will not be brought for treatment until compensation commences to fail and symptoms of such are manifested.

No hard-and-fast rule can be laid down with reference to therapeutic measures in cases where it is deemed advisable to adopt treatment. Rest is an important detail in treatment, and when the condition of the animal indicates that exercise is safe, care should be taken that only walking is permitted. Tincture of strophanthus is often preferable to digitalis in cases presenting cardiac weakness, an irregular pulse, dyspnœa on exertion, and œdematous swellings in the limbs and on the dependent parts of the body. This drug may be given in 2-drachm doses combined with an equal amount of tincture of nux vomica, three times daily in the food, or in the form of electuary.

If after a reasonable time no improvement is observed, and well-marked evidences of chronic valvular disease are present, further treatment is seldom desirable. When, however, the owner insists on treatment being continued, the leading symptoms must receive consideration. The indications and contra-indications of digitalis and allied agents in the treatment of cardiac diseases will be found on p. 421.

Diseases of the Bloodvessels.—These possess little interest from a therapeutic aspect, as, so far as we are aware, there are no drugs which can exert a favourable influence on any of the lesions included under this heading.

B.—Cattle.

With the exception of traumatic pericarditis, little attention has been devoted to the diseases of the circulatory organs in cattle. Obviously, in traumatic pericarditis, it is seldom that therapeutic measures will be attempted, except in instances where an erroneous diagnosis has been made. An exploratory operation may be tried in the early stages, if the presence of the foreign body be suspected. Probably the best course to adopt, if the animal be in good condition, is to order slaughter. This applies also to every form of cardiac disease in cattle. But in most cases such diseases are latent, and only detected at post-mortem examinations.

C.—The Dog.

Cardiac affections are common in the dog, and have been studied to a greater extent than in horses or cattle. Owing to the sentimental value attached to this animal, it is necessary to make a careful study of cardiac diseases in canine medicine, and to discuss the therapeutic measures at our command, with which we can alleviate distressing symptoms and prolong life. Although the diagnosis of cardiac affections is carried out with more facility in canine than in equine practice, yet it is not uncommon to find cardiac lesions at post-mortem examinations, although no symptoms suggestive of such conditions were apparent during the life of the animal. If, however, the stethoscope be employed in a systematic manner in the diagnosis of canine diseases, it is very probable that many cases of heart disease will be detected which otherwise would be overlooked.

Pericarditis.—*Acute Sero-Fibrinous Pericarditis* in the large majority of cases occurs as a secondary affection and is associated with tuberculosis. Very frequently it is accompanied by tuberculous lesions of the pleura and of the mediastinal lymphatic glands. Occasionally pericarditis occurs as one of the lesions of distemper.

Chronic Pericarditis may occur as a sequel to the acute form, or it may assume a chronic aspect from the outset. It is generally associated with tuberculous pleurisy, and is said to be more common than the acute sero-fibrinous type.

The **Symptoms** are usually obscure. Dyspnœa is probably the first symptom to attract attention, and its intensity depends on the amount of effusion present. When the latter is extensive, compression of the heart and lungs is produced. The pulse is frequent, and generally irregular, but later on becomes small and weak.

After effusion has occurred, palpation of the cardiac region reveals a weak cardiac impulse, and when the amount of fluid is extensive the heart-beats may not be detected.

Percussion reveals an increase in the area of cardiac dulness. *Auscultation* shows that the sounds of the heart are muffled and can only be heard with difficulty. Complications may be present, such as endocarditis, hydrothorax, and ascites. The patient has an anxious expression of countenance, and stands with the elbows turned out.

Treatment.—In tuberculous pericarditis treatment should not be undertaken. In order to arrive at a diagnosis, either the tuberculin test should be applied, or a bacteriological examination of portion of the fluid removed by aspiration from the pericardial sac should be made.

In non-tubercular cases the principles of treatment are similar to those advised for pericarditis in the horse (see p. 725). In the case of extensive effusion the fluid should be removed by means of an aspirator.

Myocarditis may occur in connection with distemper, purulent metritis, tuberculous pericarditis, septicæmia, etc.

There are no diagnostic symptoms. The cardiac impulse is weak, the action of the heart is intermittent and irregular, the first cardiac sound becomes indistinct, and dyspnœa due to passive pulmonary congestion is observed. These symptoms are in addition to those of the primary malady.

The indications for **Treatment** are to administer agents likely to sustain the action of the heart. Hypodermic injections of digalen and caffeine are advised, also subcutaneous injections of normal saline solution.

Acute Endocarditis.—This may occur as a complication in many local and general infections. The benign or verrucous type is said to be more common than the ulcerative. The disease may be observed in connection with distemper, broncho-pneumonia, pericarditis, piroplasmosis, ulcerative stomatitis, rheumatism, etc. Several authors have recorded cases which followed insignificant wounds of the skin, ulcers of the tip of the tail, and operative wounds which were septic. The type of the affection—*i.e.*, whether benign or ulcerative—is believed to depend on the virulence of the causal micro-organisms. The bacteriology has not been determined.

The **Symptoms** in the ulcerative type are—accelerated respirations, followed by dyspnœa; a dry paroxysmal cough; fever; an anxious expression of countenance; and marked prostration. The character of the pulse varies according to the valves which are involved. If the aortic valves be affected, the pulse may be accelerated and hard, while in lesions of the mitral valve it is feeble and irregular. Renal complications are not uncommon. The character of the murmurs heard on auscultation will vary according to the valves affected (see Chronic Valvular Diseases, p. 731). In our experience, the abnormal sounds heard in acute endocarditis are of so confusing a character that it is seldom possible to decide which valves are involved. The course may be so rapid in the ulcerative type of the disease that the real nature of the case is not discovered until the post-mortem is held. Complications may occur owing to the production of embolism in various organs.

Treatment is similar to that advised for the disease in the horse. In the ulcerative type the mortality is very high. The benign form may lessen in intensity, and gradually merge into chronic valvular disease. Perfect recovery very rarely takes place.

When the fever is high, quinine or antifebrin may be prescribed. Bromide of soda is advised to reduce cardiac irritability. Salicylate of soda or aspirin sometimes gives good results. To combat cardiac weakness, subcutaneous injections of normal saline solution are useful. Complications must be treated as they arise.

Chronic Valvular Diseases.—These are very common in the dog. The lesion most frequently met with is mitral insufficiency, and, according to several observers, very few aged dogs are free from this lesion. The physical signs of chronic valvular disease in the dog are practically similar to those already mentioned for the horse.

Treatment.—The leading symptoms present must receive attention. Here we must point out that digitalis and allied agents are often prescribed in a routine manner in the treatment of valvular disease, and often do more harm than good.

It is when compensation is failing that such agents are indicated (see pp. 421, 422). They should be prescribed with discretion, and if they appear to cause palpitation they should be discontinued. Digalen (see p. 418) is preferable to other forms of digitalis, and is best administered by hypodermic injection. In mitral or tricuspid insufficiency associated with ascites, *paracentesis abdominis* (see p. 827) should be carried out, and potassium iodide administered internally. Dogs suffering from valvular disease ought not to be subjected to exertion. The owners should be informed that sudden death may occur at any time. With careful dieting and judicious treatment, cases of valvular disease may be kept alive for a long period.

Formulæ.

Electuary for Acute Pericarditis in the Horse.

℞ Sodii Salicylatis ... ... ℥iv.
Sodii Bicarb. ... ... ℥iv.
Mellis ... ... ℥viii.

M. Ft. elect. Sig.: Give two tablespoonfuls on the tongue every four hours.

Powders for Cardiac Palpitation following Influenza in the Horse.

℞ Ferri Carb. Sacch. ... ... ℥iii.
Pulv. Nucis Vom. ... ... ℥ss.
Pulv. Anisi ... ... ℥iii.

M. Div. in pulv. xii. Sig.: Give one twice daily in the food.

Mixture for Acute Endocarditis in the Dog.

℞ Sodii Salicylatis ... ... ʒi.ss.
Sodii Bromid. ... ... ʒi.
Syr. Simpl. ... ... q.s.
Aquæ ... ... ad ℥iii.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times daily.

Mixture to be given during Convalescence from Acute Endocarditis in the Dog.

℞ Potass. Iod. ... ... gr. xxx.
Potass. Bicarb. ... ... ʒi.
Tr. Cinchonæ Co. ... ... ℥ss.
Syr. Simpl. ... ... q.s.
Aquæ ... ... ad ʒiv.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times daily.

Mixture for Cases of Chronic Valvular Disease in the Dog when Compensation is failing.

℞ Tr. Digitalis ... . ♏ xl.
Spts. Ammon. Aromat. ... ʒiv.
Syr. Simpl. ... ... q.s.
Aquæ Chloroformi ... ... ad ℥iv.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times daily.

Cardio-Vascular Stimulant and Diuretic Mixture for Chronic Valvular Disease in the Dog, accompanied by Ascites.

℞ Potass. Acet. ... ... ʒii.
Tr. Digitalis ... ... ♏ xl.
Tr. Scillæ ... ... ʒi.
Tr. Nucis Vom. ... ... ♏xl.
Syr. Simpl. ... ... q.s.
Aquæ Chloroformi ... ... ad ℥iv.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times a day.

Diffusible Stimulant Mixture for Chronic Valvular Disease in the Dog.

℞ Spts. Ætheris ... ... ʒiii
Spts. Ammon. Aromat. ... ʒiii.
Syr. Simpl. ... ... q.s.
Aquæ Camphoræ ... ... ad ℥iv.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful every three hours when the dog shows evidences of cardiac weakness.

CHAPTER XIII

THE TREATMENT OF DISEASES OF THE NERVOUS SYSTEM

A.—The Horse.

ALTHOUGH nervous affections in the horse are by no means uncommon, our knowledge of their pathology is very indefinite, while diagnosis is attended with considerable difficulty. Again, many of the diseases are incurable, some are invariably fatal, while others, again, render the animal useless for work or even dangerous. The subject cannot be considered of marked importance, more especially as the therapeutic measures at our command, with reference to nervous affections, are very limited. From a clinical point of view, it is necessary to differentiate functional nervous disorders from those depending on organic diseases of the brain or spinal cord, and to recognize that in some cases nervous phenomena may depend on reflex irritation from various organs.

Lack of space prevents us from dealing fully with the subject, hence we shall only consider those affections in which treatment is likely to prove of benefit, and simply point out the palliative measures to be employed in cases characterized by excitement and convulsions, etc.

Generally speaking, the prominent phenomena calling for therapeutic measures in nervous affections are—Loss of nervous power or paralysis of certain regions; excitement and convulsions, depending on reflex stimulation of the brain or on inflammation of this structure and its membranes; and

a sleepy or comatose condition, arising from various causes. In cases of paralysis, nerve stimulants, such as nux vomica or strychnine, are indicated; in excitement and convulsions, nerve sedatives such as chloral hydrate and potassium bromide are advisable; while in cases depending on reflex causes, such as digestive disturbance, purgatives are necessary. In the large majority of instances we have to treat symptoms rather than the actual diseased condition that is present, as the pathology of many of the affections is not determined. Moreover, it is not uncommon to find that cerebral and spinal diseases are associated, and it is by no means easy to determine which was the primary condition. Post-mortem examinations are often very unsatisfactory, as it is not rare to find that, although the most intense and violent symptoms may have been manifested during life, yet the macroscopic morbid changes in the brain after death may be very slight or not apparent. Obviously, in the detection of lesions in the brain or spinal cord, a skilled pathologist is essential, who should also be fully acquainted with the normal histology of these structures.

Acute Meningitis (Acute Inflammation of the Meninges).—This is probably the most common acute inflammatory affection of the nervous system met with in equine practice. The majority of authors agree that meningitis is always associated with lesions of the brain itself (meningo-encephalitis).

Nothing is definitely known with regard to the **Etiology** of the affection, either in the sporadic form or in the infectious malady known as 'epizoötic cerebro-spinal meningitis'; probably all types are microbial in character. Secondary meningitis may depend on a variety of etiological factors, all of which are associated with the entrance and development of micro-organisms in the meninges. These include traumatic causes, surgical operations in the vicinity of the cranium, wounds of the orbit which become the seat of malignant œdema or erysipelas; influenza; ulcerative endocarditis. Pyæmic diseases, such as strangles or 'joint-ill,' may be complicated with a suppurative form of meningitis.

Tubercular meningitis is rare in the horse as compared with bovines.

The **Symptoms** of meningitis are by no means constant. The leading phenomena consist of general symptoms of brain disturbance. In many instances the primary symptoms presented are a staggering gait, a sleepy appearance, and marked depression. In a variable period the animal assumes the recumbent position, and exhibits violent convulsive movements of the fore and hind limbs; these occur in a spasmodic manner with short periods of ease. The animal is unable to rise, the head is constantly forced in a backward direction, nystagmus and sometimes strabismus are observed, the struggling becomes more violent, and finally death occurs from exhaustion. In many instances the horse is found by the owner in the morning struggling violently and unable to rise, although he was left apparently healthy the previous evening. Cases are met with in which the horse rushes around the stall in a delirious manner, and may even manifest maniacal symptoms and be dangerous to approach. After a time he goes down, struggles violently and sweats profusely, and finally gets into a comatose condition. Such cases correspond with the clinical description of so-called 'mad staggers' given by the older writers.

Hyperpyrexia is usually present, and some very high temperatures have been recorded.

Treatment.—Although true meningitis is always fatal, yet there are occasions in which violent cerebral symptoms are presented and recovery occurs, but in such instances paralysis is absent, and probably they are not cases of true meningitis. Hence in the early stages it is advisable to try the effect of treatment, as the diagnosis is doubtful. But when the horse is down and unable to rise, and struggling in a violent and convulsive manner, treatment of any kind is useless, and the animal should be destroyed.

A quick-acting purgative is indicated, and probably a hypodermic injection of eserine or arecoline is likely to give the best results. Some practitioners give calomel and croton oil in the form of bolus. In violent cases, with the animal

rushing about, it is not possible to administer drugs by the mouth ; but if free venesection can be carried out, it will have a temporary quietening effect. Chloral hydrate can then be administered in the form of bolus, and repeated until its soporific effect is produced. Opiates are useless.

It is difficult in the early stages to give a prognosis until the effect of treatment has been observed, but, as already remarked, we may be tolerably certain that the cases which recover are not true meningitis, but probably depend on reflex causes—*e.g.*, gastritis.

There are various affections of the brain met with in equine practice, in addition to meningitis ; but, as therapeutical measures cannot be productive of any beneficial effects, such diseases do not merit attention in this work. Owing to difficulties in diagnosis, it is probable that symptomatic treatment will be attempted in the early stages ; but beyond administering an active cathartic, and prescribing chloral hydrate when evidences of nervous excitement are present, nothing more can be attempted.

Acute Spinal Meningitis (Inflammation of the Spinal Meninges).—As practically all cases of this nature are resistant to treatment, and paralysis eventually sets in, or death results from complications, it is not desirable to discuss acute spinal meningitis in this work. For full details the reader is referred to our article on 'Diseases of the Spinal Cord and its Membranes' in 'A System of Veterinary Medicine,' vol. ii.

Similar remarks apply to Myelitis (Inflammation of the Spinal Cord).

Concussion of the Spinal Cord.—This condition is not uncommon in hunters, and, as it is often amenable to treatment, it is of importance to the clinician. It may be regarded as a temporary aberration of function in the spinal cord, caused by falls, etc. Loss of power in the limbs is not complete, but generally on the following morning the horse shows stiffness in the loins, a lack of control over the movements of the hind-limbs, and a tendency for the hind-fetlocks to come in contact with each other. The lack of control is

very obvious when the animal is forced to trot, turn round, or move backwards, and there is some difficulty in rising from the recumbent position.

Treatment.—A long period of rest is desirable. A cataplasm of kaolin and glycerin should be applied to the region of the loins, and covered by a layer of cotton-wool. Nux vomica and potassium iodide may be given in the food twice daily.

Here we may point out the necessity for extreme caution in arriving at a diagnosis and prognosis in cases of disease or injury of the spinal cord. Hasty conclusions should be avoided, and a careful examination is essential before a pronouncement is made either that the case is incurable or that destruction is advisable. In case of doubt it is wise to defer giving a definite opinion for a reasonable time, and it may also be desirable to attempt treatment.

In reality, the therapeutic influences which we are enabled to exert on the spinal cord are very limited. They comprise local applications to the spinal region—*e.g.*, fomentations, cataplasms, and counter-irritation; stimulants to the cord when its functions are in abeyance—*e.g.*, the internal administration of nux vomica or strychnine; sedatives to this structure when it suffers from hyperexcitability —*e.g.*, bromides, etc. Again, there are certain organic affections in which the internal administration of potassium iodide may assist in restoring the nervous tissue to a normal condition. The indications for these various agents must be ascertained by a careful clinical study of thc case.

Megrims.—This is also known as 'vertigo.' It is regarded as a neurosis without definite anatomical basis, as nothing is known with reference to the morbid anatomy of the affection. In common parlance, megrims and 'staggers' are often regarded as synonymous, but the term staggers is a very indefinite one, and should be expunged from veterinary nosology.

Clinically, the affection termed megrims is well known to practitioners, although its pathology is wrapped in mystery.

While vertigo may be a symptom in connection with certain brain diseases and cardiac affections, we are aware

that megrims as a disease *per se* occurs in the absence of such conditions.

Nothing is definitely known with reference to the etiology of megrims. In some instances a tight or badly fitting collar may be a contributory factor, while in others digestive disturbance may be a predisposing cause. Attention to both these matters does in some instances ward off an attack, but in many instances the affection occurs at irregular intervals, in spite of all precautions and preventive measures.

Megrims is not so commonly met with in the present day as formerly; probably improved stable management has taken part in its prevention.

The **Symptoms** are as follows: The horse leaves the stable in apparently perfect health, and, after travelling a variable distance, and especially when ascending a hill, he slackens his pace, or suddenly stops and shakes his head as if a foreign body had entered one of his ears. The ear may be directed backwards, the head is carried to one side or may be elevated, and the neck is held in a rigid manner. Rapid twitching of the facial and cervical muscles, a wild, staring condition of the eyes, and accelerated respirations, may be present. If the horse be quickly taken out of harness and the collar removed, the symptoms may shortly subside, and he may be able to resume his journey. But in more severe cases, or if the animal be forced to proceed, marked excitement occurs, muscular tremors are present, he may rear or plunge forward and rush into surrounding objects, and then fall to the ground. When down he struggles in a convulsive manner, but soon recovers, and, on regaining his feet, has a dazed appearance. In some instances there is no preliminary warning, and the horse goes down suddenly.

Treatment.—In confirmed cases treatment is useless, and the animal is dangerous to drive. Although in most instances the affection is met with in harness horses, yet it sometimes occurs in saddle horses.

In the case of a first attack it is advisable to adopt treatment, but the owner should be warned of the probability of a recurrence, and he should be instructed that on the first

appearance of symptoms the horse ought to be pulled up and unharnessed.

As disturbances of digestion sometimes predispose to an attack, it is best to commence treatment by the administration of a cathartic. The diet should receive attention. It is of importance to see that the collar fits the animal properly. Occasionally one attack is observed, and for a long period a recurrence does not take place. Horses subject to megrims frequently change hands, as treatment in confirmed cases is known to be useless. There are no signs by which the tendency to the disease can be detected.

Spasm of the Diaphragm.—This is a peculiar affection characterized by a convulsive jerking of the body accompanied by a dull, thumping sound, unconnected with the beats of the heart. According to Thomassen and Zürn, it depends on a neurosis of the diaphragm, probably of reflex origin. It tends to disappear spontaneously, some cases lasting only a short time; others continue for twelve to twenty-four hours. Some authors advise the administration of a diffusible stimulant; others prescribe morphine or chloral hydrate. It is not a common affection.

B.—Cattle.

Our knowledge of diseases of the nervous system in cattle is very limited. On economical grounds it is evident that nervous affections depending on organic changes in the brain and spinal cord would not repay the cost of treatment. It is important to remember that, in cattle, acute nervous phenomena are not uncommon in connection with certain gastric disorders, and until the latter are treated and the results noted, it is often difficult to arrive at a diagnosis.

In cases of bovine nervous diseases, if treatment be demanded, the general principles are similar to those mentioned for the corresponding affections in the horse.

C.—The Dog.

Nervous diseases in the dog are more frequently observed than in horses or cattle, and have received more attention. Treatment can be adopted without involving considerable

expense, and, except in cases where pain and distress cannot be relieved by therapeutic measures, the practitioner is justified in treating the patient, even for a prolonged period of time. The influence which distemper exerts on the production of nervous diseases in the dog is now recognized by practitioners who have studied the subject.

Nervous symptoms are not uncommon in this animal as the result of reflex irritation arising from various morbid conditions of internal organs, but the influence of parasites in the gastro-intestinal canal on the production of nervous phenomena is often greatly exaggerated. Many cases in puppies, attributed to 'worms,' in reality depend on the nervous type of distemper. 'Fits' and 'worms' constitute the 'stock' diagnosis of the dog-breeder, the empiric, the kennel-man, and the veterinary editors of 'doggy' papers, hence vermicide nostrums form the most profitable part of the stock-in-trade of the patent-medicine vendors. Needless to remark, such irrational treatment leads to a high mortality, and many cases of distemper succumb to the 'dosing for worms,' and not to the disease *per se* (see also p. 787).

In this section we shall only discuss those diseases which are more or less amenable to treatment. Further details will be found in the section on 'Canine Distemper' (see p. 792).

Acute Meningitis.—This is a common complication of distemper. It may also result from injuries to the cranial region, depressed fractures of the skull, canker affecting the middle and internal ear, and sometimes it is observed in connection with tuberculosis. Occasionally it occurs as a disease *per se*, without any appreciable cause.

The following symptoms may be observed: In the early stages, whining, restlessness, an anxious expression of countenance, congestion of the sclerotic membrane, vomiting, and elevation of temperature. Later on we observe, in some instances, marked excitement, spasmodic convulsions at intervals, loud cries, a tendency to bite if handled, a stiff gait, hyperæsthesia of the skin, nystagmus. In some cases, turning in a circle, amaurosis, and inability to stand, are the prominent symptoms present.

Chronic Meningitis may be manifested by a partial loss of muscular co-ordination, so that the animal moves sideways when walking; the head is carried stiffly or to one side; strabismus, deafness, partial loss of vision, nystagmus, a tendency to fall while walking, may also be observed.

Treatment.—Every case of true meningitis either terminates fatally, or permanent nervous lesions remain, which ultimately render destruction of the animal inevitable.

All that can be done, when treatment is demanded, is to place the patient in quiet surroundings, and administer an active cathartic. Chloral hydrate and potassium bromide are indicated to relieve the irritability of the nervous system and keep the convulsions in check. An ice-bag may be applied to the cranial region.

Further details will be found in the section on 'The Treatment of Canine Distemper' (see p. 792).

Chronic meningitis resists all treatment.

Spinal Pachymeningitis (Inflammation of the Spinal Dura Mater).—This is a very common affection in the dog, and deserves an extended notice. In consequence of the special character of the lesions, it is known as 'chronic ossifying spinal pachymeningitis.' In Great Britain the attention of the profession was first directed to the disease by H. Gray (*Veterinary Record*, July 16, 1904).

The leading character of the disease is a chronic inflammation of the dura mater, resulting in the formation of osseous plates of various sizes, which cause compression of the roots of the spinal nerves and of the cord itself, followed by a painful neuralgic condition of the peripheral nerves. After a series of attacks, paraplegia may occur. For a variable length of time the lesions may not cause any appreciable symptoms.

As regards the **Etiology** of the affection, nothing is definitely known; but there is a strong probability that rheumatism has an important influence on the production of the lesions. Gray is of opinion that the disease is hereditary. The following symptoms are observed: Pain on movement; sharp cries when the animal gets up or lies down, or when

he is lightly handled; stiffness in movement; considerable difficulty in ascending or descending stairs. In some cases the cervical muscles are swollen and painful; in others the abdominal muscles become painful and tense. These symptoms may continue for a variable time, and in the case of a first attack may disappear completely, but are likely to recur at irregular intervals, especially in cold, damp weather.

In recurrent cases, paraplegia may develop gradually, commencing with weakness of the hind-quarters; ultimately the animal drags the hind-quarters in his efforts to move about. In some instances paralysis sets in suddenly, and the case may be mistaken for one of spinal injury. Constipation is present; this depends on retention of fæces owing to the condition of the abdominal muscles, which renders the act of defæcation painful.

In a primary attack the symptoms may gradually disappear, and recovery results. Recovery depends on absorption of the exudate. Fresh attacks are more likely to occur if the animal be exposed to cold or damp, and the lesions increase in degree until permanent paraplegia results and destruction is called for. A guarded opinion should be given as regards prognosis, because cases sometimes recover sufficient power in the hind-limbs to move about, after a long period of treatment. In such instances the hind-limbs remain weak, and there is more or less atrophy of the muscles of the hind-quarters.

Treatment.—An active cathartic should be given, also enemata of warm water. Aceto-salicylic acid (aspirin), administered three times daily, relieves pain, and is probably the best agent for the purpose; moreover, it exerts a special action on the rheumatism, which is probably the cause of many cases of pachymeningitis. Salicylate of soda is useful for a similar purpose. In the secondary stages, potassium iodide is indicated, or preferably iodalbin, which is less liable to cause gastric irritability. The bladder should be relieved by the use of the catheter when necessary. Liquid paraffin (white vaseline oil) may be administered at intervals to keep the bowels regular, also enemata of warm water.

The hind-limbs should be protected by means of wool and bandages, so as to prevent excoriation of the skin, when paraplegia is present. In cases where paraplegia persists, the galvanic battery should be tried.

Epilepsy.—In true epilepsy, attention to diet is necessary, and the triple bromides (potassium, sodium, and ammonium bromide) should be given as required. In cases where the attacks succeed each other quickly, chloroform or ether may be administered *per rectum* by means of a special apparatus. In secondary epilepsy, the treatment must be directed to the primary disease on which the symptoms depend. If the affection be associated with permanent lesions of the brain, treatment is useless (see also p. 792).

Chorea.—For the treatment of this condition, see the section on ' Canine Distemper,' p. 793.

Eclampsia.—This is also known as puerperal eclampsia or puerperal convulsions, and is a peculiar nervous affection met with in the bitch during the first few days after parturition. It is sometimes ascribed to nervous irritation and exhaustion, in cases where the bitch has too many puppies to nurse. Cases have also been seen during the last stages of pregnancy.

The following symptoms are observed: Restlessness; an anxious expression of countenance; quick, laboured respirations; a rise in temperature; sometimes the emission of sharp cries; a staggering gait; falling on the side; a rigid condition of the limbs; chronic convulsions at intervals, especially in the extremities; panting; protrusion of the tongue; salivation, etc. In some instances the affection only lasts for a few hours; but severe cases may continue for twenty-four hours to three days. Spontaneous recoveries are not uncommon.

Treatment.—Chloral hydrate and potassium bromide are indicated, and are best given in the form of enema, as oral administration during a paroxysm is likely to be followed by inhalation pneumonia. Some authors advise the subcutaneous injection of morphine. If the bitch be nursing a large number of puppies, some of the latter should be removed.

Formulæ.

Sedative Bolus for Acute Meningitis in the Horse.

℞ Chloral Hyd. ... ... ℥i.
Potass. Bromid. ... ... ℥i.
Ext. Cannabis Ind. Fl. ... ℥ss.
Excipient. ... ... q.s.

Ft. bol. ii. Sig.: Give both balls at once. Repeat in two hours, and as often as necessary.

Sedative Mixture for Acute Meningitis in the Dog.

℞ Chloral Hyd. ... ... ʒi.
Potass. Bromid. ... ... ʒii.
Syr. Simpl. ... ... q.s.
Aquæ ... ... ad ℥iv.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful every three or four hours as required.

Sedative Mixture for Epilepsy in the Dog.

℞ Ammon. Bromid.
Sodii Bromid. } ... ... āā ʒi.ss.
Potass. Bromid.
Syr. Simpl. ... ... q.s.
Aquæ ... ... ad ℥iv.

F. M. Sig.: Give from two teaspoonfuls to a tablespoonful every three or four hours as required.

CHAPTER XIV

THE TREATMENT OF INFLUENZA, STRANGLES, AND PURPURA HÆMORRHAGICA

The Treatment of Influenza in the Horse.

INFLUENZA may justly be described as a protean disease, as it may occur in a variety of forms and be complicated with diseases of various organs, Although it is an affection of very common occurrence in equine practice, there is still much to be learned as regards its bacteriology, pathology, and treatment. We may preface our remarks by stating that there is no specific treatment for influenza; each case must be treated on its merits and according to the organs which are involved.

In simple uncomplicated cases, little medicinal treatment is necessary. Attention to hygienic and dietetic details is of importance, and early cessation from work is essential. When the temperature runs high, antipyretics such as salicylate of soda or quinine are indicated, and are best given in the form of electuary. Simple salines may be administered in the drinking-water. Drenches should be avoided, as there is abundant evidence to show that the administration of medicaments in this form is a fruitful cause of pneumonic complications. When pharyngitis or laryngitis is present, the usual treatment for these conditions is indicated (see pp. 569, 696).

In cases where cardiac weakness is a prominent symptom, subcutaneous injections of normal saline solution should be given, also strychnine by hypodermic injection. The pneu-

caffeine

monia of influenza, which, as we have already pointed out, cannot be differentiated from the so-called 'contagious pneumonia' (see p. 703), is to be treated on similar lines to those mentioned on p. 706. Nuclein administered by hypodermic injection often gives good results.

In the abdominal type of influenza, characterized by gastric or intestinal catarrh, diarrhœa, slight colicky pains, etc., small doses of chlorodyne are indicated, and may be combined with intestinal antiseptics such as salol or sulphocarbolate of soda. When acute enteritis occurs, a fatal result is inevitable, and full doses, of sedatives such as chloral hydrate and chlorodyne should be given to relieve pain.

In the 'bilious' type of influenza, which is evidenced by jaundice, powders composed of sulphate of soda, chloride of soda, and bicarbonate of soda, may be given in the drinking-water.

In the nervous complications of influenza, when meningitis is manifested, a fatal termination is certain, and beyond giving chloral hydrate nothing further can be done.

In that type of influenza known as 'pink-eye' or 'epizoötic cellulitis,' salicylate of soda with quinine, in the form of electuary, gives good results, also bicarbonate of soda administered in the drinking-water. In severe cases nuclein should be administered hypodermically. In the rheumatic complications of influenza potassium iodide is indicated. During convalescence from all types of influenza, a long period of rest is essential, and tonics such as nux vomica and carbonate of iron may be given in the food twice daily. Of late years 'influenza antitoxin' has been tried in the treatment of the disease, and the results are encouraging (see p. 532).

Influenza in the Dog.—Although this affection is described by some authors, there is no evidence to show that such a disease exists. The clinical descriptions given correspond to those of canine distemper in some instances, and canine typhus in others. In our opinion, attempts to introduce new terms into veterinary nosology without clear evidence of

the existence of new and distinct diseases are calculated to mystify rather than to enlighten both the professional and the layman.

The Treatment of Strangles.

Of late years the views held with reference to strangles have been considerably modified. Formerly the presence of a submaxillary abscess was regarded as the most important diagnostic symptom in this disease, but we are now aware that in many instances this phenomenon is absent. A large number of cases of so-called 'infectious catarrh' are in reality strangles, and when they infect healthy horses may produce in them the familiar submaxillary abscess. Again, the abscess formation may be delayed, and not appear until the case is approaching convalescence. This knowledge has taught us to adopt preventive measures, such as isolation, in all cases of nasal catarrh, pharyngitis, etc.

The connection between strangles and influenza is not definitely determined. Clinical experience teaches us that it is not uncommon during an outbreak of influenza to find a number of cases manifesting the symptoms of strangles. Although strangles is regarded by many as a benign affection, the sequelæ very often prove serious, and there is abundant evidence to show that a large proportion of cases of whistling and roaring in young horses arises as the result of this disease. Some cases of strangles no doubt are of a mild type, and tend to recover spontaneously without sequelæ or complications. On the other hand, the disease may assume a serious character and run an irregular course, being associated with the formation of abscesses in various parts of the body. In mild cases, little treatment is required beyond simple saline in the drinking-water and attention to hygienic and dietetic details. If pharyngitis be a prominent symptom, the treatment suitable for that condition should be adopted (see p. 569). If the submaxillary abscess matures slowly, a cantharides blister should be applied to the part, and when the swelling pits on pressure it should be opened by means of a bistoury, the pus evacuated, and the cavity

carefully cleansed and treated according to ordinary surgical principles. In the irregular type of the disease the employment of vaccine-therapy is indicated (see p. 549).

We have observed good results from the administration of polyvalent antistreptococcic serum. The hypodermic injection of nuclein often acts in a beneficial manner. When abscesses form in internal organs, a fatal termination is inevitable. Mesenteric abscesses are often slow in development, and symptoms may not be manifested for some time after an apparent recovery.

When asphyxia is threatened owing to abscess formation in the vicinity of the larynx or œdema of this organ, tracheotomy should be performed. This operation ought not to be delayed when marked difficulty in breathing is manifested, more especially if the case is not convenient to the practitioner.

If pneumonia be associated with strangles, the outlook is very serious.

In the treatment of strangles, provided the weather be favourable, the patients are best left on pasture.

The Treatment of Purpura Hæmorrhagica.

This is a disease which is usually met with as a secondary condition to influenza, strangles, and other infective processes. It is characterized by the presence of petechiæ on the mucous membranes and other structures, and extensive œdematous cutaneous swellings on various regions. The affection is very probably a microbial one, although the bacteriology has not been definitely determined. The disease is by no means uncommon, yet its pathology has not been investigated in a satisfactory manner. As might be expected under such conditions, the treatment of the affection is empirical, and in many instances is far from successful.

At one time oil of turpentine was regarded as the routine treatment for purpura, and no doubt it not infrequently gave good results. But the risks incurred by drenching in this disease cannot be overlooked; moreover, in many cases it is

impossible to administer medicines in the fluid form. In addition to oil of turpentine, tincture of perchloride of iron was advised, also potassium chlorate given in the food.

The intratracheal injection of Lugol's solution of iodine was advised by Dieckerhoff. Opinions as to the value of this treatment are very variable. Bloye claims marked success from its employment, and advises 1½ ounces of the following solution: Iodine, 1 part; potassium iodide, 5 parts; boiled water, 100 parts. This dose is administered intratracheally twice daily for four or five days, but frequently during the latter of these a single daily dose is sufficient.

In large horses and in severe cases as much as 2½ ounces may be given for the first two or three doses, subsequent doses being gradually lessened. (For the technique of the operation, see p. 829.)

The intravenous injection of a solution of formalin—1 drachm of formalin (40 per cent.) to 8 ounces of boiled water—has been found to give good results by some practitioners. A warm solution of iodine and potassium iodide injected intravenously is also advised.

Adrenalin, administered subcutaneously, gives excellent results in some cases, but fails in others. Two drachms of the solution (1 to 1,000) may be given once daily. Nuclein has also been tried in the treatment of this disease, and the results are encouraging.

Antistreptococcic serum (polyvalent) has also been employed, with a fair degree of success.

In cases where cardiac weakness is present, the intravenous or subcutaneous injection of normal saline solution is indicated.

When extreme dyspnœa is present owing to occlusion of the nostrils and nasal passages, or to œdema of the larynx, tracheotomy must be performed. Rigid antiseptic precautions are necessary in connection with the operation, as there is a marked tendency for the wound to become septic.

Scarification of the swellings must be condemned, as it leads to secondary infection and gangrene. When, however, there is extensive œdema of the sheath, which interferes

with micturition, or in cases of paraphimosis, scarification, carried out under strictly antiseptic precautions, is indicated.

Sloughing of the skin, and the presence of deep fissures, require surgical treatment, such as the application of a solution of iodine or peroxide of hydrogen, followed by dry dressings composed of iodoform and boric acid.

Halters or surcingles should not be worn by horses suffering from purpura, as the slightest pressure on the skin is liable to produce sloughing.

In some instances the disease is very fatal, and death may occur rather suddenly. Again, it is not uncommon to find that a case apparently progressing favourably (the swellings having disappeared and the patient feeding well), succumbs unexpectedly, after manifesting abdominal pain. The autopsy shows enteritis and hæmorrhage into the intestines. Pulmonary œdema may also occur. The sudden disappearance of the swellings is usually regarded as an unfavourable sign.

In the treatment of the disease, careful nursing and hygienic surroundings are of great importance. Oatmeal gruel, linseed-tea, barley-water, hay-tea, and milk, *ad lib.*, should be allowed. Special attention should be devoted to ventilation, also to the cleansing and disinfection of the stall.

During convalescence careful dieting is also necessary, and the horse should not be put to work too soon, otherwise a relapse may occur. A course of tonics is generally indicated.

The complications in purpura are various, and treatment must be adopted as they arise.

Horses suffering from the disease should be promptly isolated, in order to avoid any risk of infection to other horses. It has sometimes been found that one case of the disease in a stable has been followed by other cases.

CHAPTER XV

THE TREATMENT OF RED-WATER, DIABETES INSIPIDUS, AND DIABETES MELLITUS

The Treatment of Red-Water in Cattle.

OUR remarks apply to this disease as it occurs in the British Isles (British red-water). It is now generally accepted that the affection is due to the presence in the blood of an intracorpuscular parasite—the *Piroplasma bovis*—and that the disease is spread through the agency of ticks. At one time dietetic errors were regarded as the causal agents, and two forms of the disease were recognized, viz.—(1) **Parturient,** occurring in dairy cows about eight to fifteen days after calving; (2) **Non-Parturient**, occurring in dry stock. Beyond the fact that the former is usually more virulent, the pathology and symptoms of both types are similar. It is probable that dietetic errors, by weakening the natural powers of resistance, render the animals more liable to infection.

On considering the pathology of the affection, one would imagine that the administration of quinine should prove beneficial. In some cases it does prove of value; in others it fails. Clinical experience teaches the value of sodium chloride if administered sufficiently early. From 10 to 12 ounces should be given, dissolved in 4 pints of linseed-tea to which 2 pounds of treacle have been added. This causes thirst and also acts as a purgative. A liberal amount of drinking-water, hay-tea, etc., should be allowed. The purgative action

should be assisted by the administration of 2 pints of raw linseed-oil.

Not infrequently diarrhœa is observed in the early stages, but this does not contra-indicate the above treatment. The obstinate constipation which follows the diarrhœa is a leading feature in the disease, and must be overcome, but not by drastic purgatives. The raw linseed-oil should be repeated if necessary, but drenching ought to be avoided as far as possible, and we have seen good results from administering small repeated doses of sodium chloride, with nux vomica, in the form of electuary. If deemed advisable, 2-drachm doses of quinine sulphate may be added to the electuary.

Unfortunately, the practitioner very often does not get a chance of treating the case in the early stages, as the owner administers large and repeated doses of Epsom salt before seeking professional aid. A large number of animals succumb from this cause, while not infrequently pneumonia is added to the original disease, owing to careless drenching. When the latter complication sets in, the case is generally hopeless. In cases where the animal is suffering from the results of excessive doses of Epsom salt, and the gastro-intestinal canal is in a paralyzed condition, it becomes necessary to administer agents calculated to restore nervous tone even at the risk of accidents occurring from drenching. For this purpose a combination of carbonate of ammonia, nux vomica, and gentian, may be given in ale and treacle three times daily. When gastritis is present, extract of belladonna and bicarbonate of soda should be prescribed. Occasional doses of raw linseed-oil should be given as required.

It is of supreme importance to get the patient to take food of its own accord. The pernicious custom of forcing large amounts of fluid food on the animal cannot be too strongly condemned. Good nursing is a *sine quâ non* in the successful treatment of the disease.

A search for ticks on the animal should be made, and these should be removed. The usual locations are the under-aspects of the body, between the thighs and between the

forearms, under the neck, on the dewlap, and the inferior aspects of the thorax and abdomen, also on the udder and perineum.

As regards the prevention of red-water, we know that certain pastures are notorious for the number of cases of the disease which appear in cattle placed thereon. Such pastures should receive a liberal dressing of rock-salt, and then should be tilled.

The prophylactic effect of placing rock-salt on pastures is well known; in fact, this agent should always be within reach of cattle.

In order to prevent the inoculation of susceptible animals by ticks in infected districts, and also to destroy the ticks, spraying the cattle with an arsenical dip is advised. This must be carried out every fourth or fifth day, at periods of the year when the disease is prevalent. The following (advised by Watkins-Pitchford) is a useful formula:

Arsenite of soda	1 pound.
Soft soap	¾ pound.
Paraffin-oil	2 pints.
Water	100 gallons.

Dissolve the soap in 5 gallons of hot water; while still hot add this soap solution in small quantities to the paraffin-oil, and stir to a creamy lather. Dissolve the arsenite of soda in sufficient hot water (1 gallon), and when completely cold add cold water up to 20 gallons; add this gradually to the soap and oil emulsion, stirring well, and add water to make 100 gallons.

The Treatment of Diabetes Insipidus.

This is a disease of comparatively common occurrence in the horse, but is not so frequently observed in the dog. It is characterized by well-marked thirst, profuse urination, rapid loss of condition, and unfitness for exertion. The urine is pale in colour, of low specific gravity, and contains neither albumin nor sugar. This affection must be distinguished from polyuria (profuse diuresis), which is a symptom occurring in certain forms of chronic nephritis, diabetes mellitus,

tuberculosis, glanders, also as the result of large doses of diuretics, and during recovery from pneumonia or pleurisy when exudates are absorbed and excreted by the kidneys. In the horse diabetes insipidus is generally due to damaged fodder, such as musty oats, badly-saved, mow-burnt, or musty hay, and bran of inferior quality. In the dog it may depend on certain lesions of the central nervous system.

In the **Treatment** of the disease, attention should be directed to the food, and if this be of inferior quality it should be immediately changed.

As regards medicinal treatment, an aperient dose of Epsom salt is advisable; this can be given one-half in the food, and one-half in the drinking-water. The most effectual agents to check the inordinate thirst and the profuse urination are iodine and its preparations. Iodine may be given in the form of bolus in doses of 1 to 2 drachms twice daily. Or, Lugol's solution (see p. 266) in doses of ½ ounce may be administered in the drinking-water three times daily. A combination of potassium iodide, 1 drachm, with an equal amount of sulphate of iron, given in the food twice a day, is also useful.

In some cases we have found full doses of bicarbonate of soda (½ to 1 ounce), given twice daily in the food, to prove effectual when the iodine treatment did not succeed. In obstinate cases arsenic in the form of Fowler's solution may be tried. The supply of water should not be curtailed. Linseed-tea and oatmeal gruel should be allowed *ad lib.*

In the dog, a diet of raw meat and milk should be ordered. Barley-water to which is added infusion of triticum relieves the thirst. Bromide of soda may also be tried. Sewell advises small doses of liquor arsenicalis three times daily before feeding, and if this fails he prescribes powdered opium in pill form.

The Treatment of Diabetes Mellitus.

This is a condition due to disturbance in the carbohydrate metabolism, depending on various causes and characterized by the presence of grape-sugar in the urine, a voracious

appetite, marked thirst, polyuria, and emaciation. The term 'glycosuria' is applied to a temporary form of the disease.

Diabetes mellitus is of rare occurrence in the horse, but a number of cases have been recorded in the dog, especially in aged animals.

The tests for determining the presence of sugar in the urine will be found on p. 62.

With reference to **Treatment**, it is clear that on economical grounds it would not be advisable to attempt therapeutical measures in the horse, as the disease is incurable.

But in the dog, especially in the case of a favourite animal, treatment will be demanded. Attention to diet is of first importance. A diet of raw meat is indicated, and carbohydrates should be withheld. As regards drugs, various agents have been tried, but have proved unsatisfactory. Codeine appears to have the effect of temporarily diminishing the glycosuria, and may be administered in the form of syrupus codeinæ twice daily, the dose being from 20 minims to 1 drachm, according to the size of the dog.

Gray advises the following to prevent the intense craving for food and water which is present in the disease:

℞	Pulv. Opii	...	...	...	gr. ¼.
	Pulv. Ipecac.	...	...	...	gr. ss.
	Cretæ Prep.	...	...	...	gr. iii.
	Fe ri Carb.	...	...	...	gr. i.
	Excipient.	...	...	...	q.s.

Ft. pil. i. Mitte xii. Sig.: Give from one to four pills two or three times daily.

Various complications may arise, and will require appropriate treatment.

Diabetic coma (due to acidosis) is occasionally observed, and usually proves fatal.

CHAPTER XVI

THE TREATMENT OF AZOTURIA, LYMPHANGITIS, URTICARIA, AND RHEUMATISM

The Treatment of Azoturia.

ALTHOUGH the affection in horses known as azoturia, hæmoglobinuria, and various other terms, has been familiar to clinicians from early times, yet little definite is known as regards its etiology and pathology, and much has yet to be learned in connection with its successful treatment. Even the terms applied to the disease do not convey an accurate idea of its nature; for example, 'azoturia' would lead one to suppose that the urine contained an abnormal amount of urea, but several authorities hold that such is not the case.

Idleness and high feeding have an important influence in the production of the disease. In typical cases we find that, after a period of enforced idleness, the horse leaves the stable, in good spirits, and after proceeding a short distance shows stiffness in progression, especially in the hind-limbs; he gradually comes to a standstill, sweats profusely, and may show colicky symptoms. If removed to the nearest stable, these symptoms may disappear, and a variable amount of dark-coloured urine may be passed. On the other hand, if the animal be forced to move he soon becomes unable to maintain the standing posture, and goes down; the gluteal muscles become rigid, tense, and appear swollen, and nervous phenomena are manifested. Renal, muscular, and nervous symptoms are the characteristic features of the disease, and

considerable differences of opinion exist as to the manner in which these are produced, and also with reference to the organs which are primarily attacked. The urine is coffee-coloured or resembles porter, and, according to some authors, it contains pigment derived from the hæmoglobin, which, owing to morbid alterations in the blood, circulates in solution in the blood-plasma. It also contains albumin.

For full details of the various views held with reference to the pathology of the disease, the reader is referred to our article on the subject in ' A System of Veterinary Medicine,' vol. ii.

Here we are concerned with the therapeutic aspect of the disease, and in this connection the nervous phenomena are of chief importance, as not infrequently either convulsions, or paralysis of the triceps cruralis muscles, render the case hopeless. Unfortunately, in our present state of knowledge, we are not aware of any means by which we can prevent the occurrence of these undesirable complications, and we must admit the inefficiency of medicinal agents, in the majority of cases, when such phenomena set in.

In mild cases, if the horse be immediately kept at rest on the first appearance of symptoms, recovery tends to occur with simple treatment, or even spontaneously. The animal should be placed in the nearest stable, clothed warmly, and as soon as available a full dose of sweet spirit of nitre should be administered. It is also well to draw off the urine as soon as a catheter can be obtained; in the mare this can be accomplished by gently dilating the opening of the urethra with the fingers.

In more severe cases an active cathartic should be given. A full dose of aloes in solution acts more promptly than when the drug is administered in the form of bolus. Chloral hydrate (1 ounce in solution) may be given with the aloes, and in our experience this agent exerts a marked beneficial effect on the disease, although we are unable to explain its *modus operandi*. Some practitioners, in order to insure a free and rapid action of the bowels, prefer eserine to aloes.

Local applications to the affected muscles prove useful.

The most effectual is a cataplasm composed of kaolin and glycerin, applied thick and hot, and covered with a layer of cotton-wool and a rug. Irritant applications are harmful.

When the animal goes down and is unable to rise, a large bed of straw should be provided. He must be turned from side to side every three or four hours, and the urine ought to be drawn off by means of a catheter at proper intervals. Adrenalin gives excellent results in some instances, and may be administered in a dose of 2 drachms of the 1 in 1,000 solution, by hypodermic injection, twice daily. On the second or third day, if the animal be unable to rise and if convulsions be absent, an attempt ought to be made to assist him to his feet by means of slings. Inability to rise, in this disease, is in very many cases due to a paralyzed condition of the anterior crural nerves (crural paralysis); this may be unilateral or bilateral. If no weight can be borne by the hind-limbs, slings are useless. Strychnine may be given hypodermically along with the adrenalin.

When convulsions develop, the case is generally hopeless, and all that can be done is to administer full doses of chloral hydrate.

In cases where inability to rise persists beyond the third or fourth day, the outlook is serious; the animal may feed well, but complications are likely to occur, and ultimately destruction has to be carried out. At the same time a guarded prognosis is advisable, as some apparently hopeless cases have recovered. We have met with instances in which the loss of power was confined to one hind-limb, and a dose of adrenalin seemed to produce a speedy recovery.

To recapitulate, the conditions which usually render a case beyond the aid of treatment are (1) convulsions, (2) crural paralysis. Digalen (see p. 418) has been found useful by some American practitioners in the treatment of azoturia. In severe cases a dose of pantopon (see p. 374) is first given (10 c.c. of a 4 per cent. solution of the drug) hypodermically, and in twenty minutes afterwards 15 c.c. of digalen is administered in a similar manner. The digalen is repeated at intervals of six hours until the horse is able to rise.

Braund claims to bring about 95 per cent. of recoveries by giving 3½ to 6 drachms of potassium iodide on the first day, and, if necessary, adding 2 drachms extra on the second day; a hypodermic injection of eserine is also administered.

Brunschwik observed good results from subcutaneous injections of either air or oxygen gas.

It will thus be seen that various lines of treatment have been adopted in connection with the disease. But up to the present time the mortality in severe cases is very high, and until the pathology of the affection is determined treatment can only be empirical.

As regards preventive measures, horses out of work should be exercised daily, and nitrogenous food ought to be restricted in amount. Animals recovering from diseases which entail a long period of rest should not be fed too highly.

It is well known that certain horses are predisposed to azoturia, and in such instances special precautions are necessary when, from any cause, they are kept idle in the stable. These precautions include soft diet, the administration of salines such as Epsom salt and bicarbonate of soda at suitable intervals, and avoidance of chills when first taken out of the stable.

The Treatment of Lymphangitis.

This condition is also known as 'Inflammatory Œdema,' 'Weed,' and 'Monday Morning Disease.' It is a constitutional affection of equines, chiefly occurring in heavy draught-horses, and characterized by the presence of fever of a sthenic type, and an acute inflammation of the lymphatic vessels and glands of one hind-limb, associated with marked lameness and extensive œdema of the affected extremity. The constitutional disturbance appears prior to or immediately before the development of the local manifestation. Generally speaking, it may be described as a disease succeeding a period of idleness and full feeding. Heavy horses, well fed and accustomed to full work, furnish many cases of the disease, when from any cause they are left idle for a varying period of time. But it is also met with

in horses out of condition when they are suddenly changed in their surroundings, and put on high feeding to which they are unaccustomed.

The circumstances under which the disease is likely to occur are well known, but the actual etiological factor has not been determined.

Idleness and high feeding predispose to colic, to azoturia, and to lymphangitis, but we cannot explain in a satisfactory manner how these various affections are brought about. Moreover, we are aware that in many instances unlimited idleness and high feeding may not be followed by any disease.

The symptoms usually observed are—In the early stages, well-marked rigors; fever; a full, rapid pulse; and accelerated respirations. These phenomena are followed by severe lameness in one hind-limb, and marked abduction during movement. On palpation of the inguinal region and inside of the thigh, the lymphatic glands are found hot, swollen, and acutely painful, and on pressure the limb will be sharply abducted to such a degree that the animal threatens to fall over on the sound side. The swelling soon extends downwards over the greater part of the limb and reaches the foot. Pain and lameness persist until the local symptoms have reached their full development, when an improvement is observed. Occasionally both hind-limbs are involved, and in rare instances the disease is located in one of the fore-limbs. The affection tends to recur, and after two or more attacks a permanent enlargement of the limb is likely to result (elephantiasis).

The indications for treatment are to administer a purgative and to adopt local therapeutic measures.

If the case be seen in the early stages, and if rigors be present, a diffusible stimulant, such as sweet spirit of nitre, may be given, and suitable clothing applied. Provided the animal be plethoric and the pulse strong, a cathartic bolus composed of aloes and calomel should be administered. Under opposite conditions, a dose of raw linseed-oil should be given instead of the above.

As regards local treatment, hot fomentations to the limb are indicated, succeeded by the application of a soft hay band as high up as possible; this should not be applied too tightly. Exercise ought not to be given until the animal is able to use the limb; it then proves beneficial by promoting absorption of the exudate. In cases where the pain is very acute, glycerin of belladonna may be applied to the limb. When acute symptoms have abated, gentle massage applied to the part is of advantage. In order to promote absorption of the exudate, potassium iodide should be given in the food twice daily. The diet ought to be light and easy of digestion. In chronic cases associated with permanent thickening of the limb, treatment has very little effect. The injudicious and excessive employment of hot fomentations leads to sloughing of the skin and subcutaneous tissues.

In the prophylaxis of lymphangitis, attention should be directed to proper exercise and to dieting. Horses unavoidably left idle should be fed on a soft, laxative diet. Such precautions are especially necessary in the case of horses which are known to have suffered from an attack of the disease.

The Treatment of Urticaria.

Although urticaria ('nettle-rash') is generally regarded as an affection of the skin, yet occasionally it is associated with such extensive œdema of the conjunctiva, nostrils, lips, sheath, etc., that the case may readily be mistaken for one of purpura hæmorrhagica.

The characteristic of the disease is the sudden appearance of an eruption on the skin in the form of prominent swellings of the size of a pea to an almond; these are hard, flat or half round, and the hair assumes a ruffled appearance. The swelling of the lips and nostrils in some instances may be so extensive as to partly occlude the nasal orifices, and the eyelids may be completely closed owing to tumefaction. The swelling, like the eruption, appears very suddenly, and may disappear spontaneously in a short space of time. No irritation of the skin is present such as occurs in the urticaria of man.

Nothing is definitely known with reference to the etiology of the affection. As regards treatment, in the simple cases, showing only an eruption, therapeutic measures are not necessary. When, however, swellings of the nostrils, eyes, etc., are manifested, hot fomentations prove useful, and bicarbonate of soda may be given in the food or drinking-water. Inhalations of steam are indicated when the nostrils become partially occluded as the result of the swelling.

The Treatment of Rheumatism.

The characteristics of rheumatism are—(1) A tendency to attack the limbs and to produce lameness of various degrees, the lesions being located in joints, muscles, tendons, fasciæ, and fibrous tissues, and depending on inflammation arising in these structures from causes which are still obscure. (2) A tendency for the inflammation to subside in one region and to reappear in another (metastasis). (3) In acute articular rheumatism, lesions of the heart and serous membranes frequently occur. (4) In influenza, rheumatic complications are not uncommon.

Acute Articular Rheumatism in the Horse (Rheumatic Fever).—This is not a common affection in the horse as compared with its incidence in cattle.

It is an acute febrile disease, probably depending on an infectious agent whose nature is as yet unknown. The local manifestations consist of an acute inflammation of certain joints, which is metastatic in character, and there is a marked tendency to cardiac complications. The joints usually affected are the fetlock, hock, knee, stifle, elbow, and hip.

As regards treatment, probably the most useful agent is salicylate of soda. It should be given in full doses at first —viz., 4 to 6 drachms every four hours; and when the pain and fever have abated the drug is prescribed in smaller amounts. It is usually given in the food, but, if refused by the animal, it can be administered in the form of electuary. Sodium bicarbonate may be given in the drinking-water at the same time. In the later stages potassium iodide proves useful.

Local treatment consists of hot fomentations followed by belladonna or chloroform liniment, and cotton-wool applied with bandages. When acute pain is relieved, stimulating applications are serviceable. Later on, when the disease becomes located in certain joints, a cantharides blister should be applied.

In the treatment of cardiac complications, similar lines to those advised for pericarditis or endocarditis may be adopted (see pp. 725, 729).

Acute Articular Rheumatism in the Dog.—This is not so common as muscular rheumatism. The stifle-joints are often attacked. Not infrequently the acute form merges into the chronic type. Aceto-salicylic acid (aspirin) gives the best results, and may be given in doses of from 5 to 10 grains three times daily. An ointment containing oil of wintergreen and menthol, applied with friction to the affected joints, relieves pain. When pericarditis or endocarditis is present, suitable treatment for these conditions must be prescribed (see pp. 734, 736).

Chronic Articular Rheumatism.—Owing to the nature of the lesions, treatment is seldom successful. Potassium iodide should be given internally in full doses, and continued for a length of time. Stimulating liniments and, if necessary, counter-irritants constitute the local treatment.

In the Dog, aceto-salicylic acid followed by potassium iodide is indicated. Not infrequently the affection is associated with muscular rheumatism.

Muscular Rheumatism in the Horse.—In many instances this type and articular rheumatism are combined. Many cases of obscure lameness are attributed to rheumatism, without sufficient grounds for such a diagnosis. Nevertheless, the disease is very common in the horse. The parts attacked are the muscles, the fasciæ, and the periosteum to which the tendons of the muscles are attached. Any group of muscles may be involved, but the disease has a predilection for certain groups or regions, such as the lumbar, gluteal, cervical, scapulo-humeral, and intercostal. Cardiac complications are by no means so common as in the articular form.

Treatment.—Laxatives such as Epsom salt should be given

in the food or drinking-water. Salicylate of soda in large doses gives good results. In chronic cases, potassium iodide with full doses of sodium bicarbonate should be prescribed twice daily.

Local treatment consists in applying stimulating liniments to the affected parts. When the disease is located in the muscles of the shoulder or hip, counter-irritation by means of cantharides ointment should be carried out. In chronic rheumatism of the shoulder, Continental authors recommend the hypodermic injection of veratrine; from $\frac{3}{4}$ to $1\frac{1}{2}$ grains of this drug, dissolved in 15 to 30 minims of alcohol, are injected beneath the skin of the affected region.

Muscular Rheumatism in the Dog.—This affection is of frequent occurrence in the dog. The muscles of the back and loins, and those of the neck, are generally involved, and metastasis is well marked. Occasionally the disease may be generalized. In many instances the abdominal muscles are attacked. Acute pain is manifested when the animal is lightly handled, or on any sudden movement. Constipation is a frequent symptom, and depends on the pain induced by defæcation, so that the animal avoids the act as much as possible; hence the fæces accumulate in the colon and rectum. When the cervical region is involved, the headand neck are held in a stiff manner, and the muscles give the appearance of being swollen. The muscles of the jaws may be affected, and prehension and mastication are interfered with. If the practitioner makes an attempt to open the mouth, the animal utters sharp cries. When the lumbar muscles are involved, the dog walks in a stiff manner on the hind-limbs. In severe cases, paralysis of the hind-limbs occurs, especially in the case of fat pampered dogs. When the abdominal muscles are attacked, the abdomen appears to be distended, and simulates its appearance in cases of intestinal obstruction.

It will thus be seen that the affection closely resembles chronic pachymeningitis in its clinical characters, and it is probable that rheumatism plays an important part in the etiology of the disease mentioned (see p. 747).

Treatment is to be conducted on similar lines to those advised for pachymeningitis (see p. 748).

CHAPTER XVII

THE TREATMENT OF TETANUS

We may preface our remarks on this subject by stating that up to the present time there is no drug which is capable of exerting a favourable influence on the course of tetanus. Formerly it was the custom to adopt many varieties of heroic measures, but these only had the effect of hastening the fatal termination. Any success which can be claimed in the treatment of this disease in the present day must be attributed to the attention devoted to the care and nursing of the patient, and the avoidance of undue interference. A consideration of the pathology of tetanus indicates that, when the toxins in large amounts have entered the central nervous system, the therapeutic measures likely to prove of benefit are very limited. We are well aware that subacute cases of the disease tend to recover spontaneously, while peracute cases which develop in a comparatively short space of time after the infliction of a wound, and in which trismus occurs early, frequently succumb in spite of treatment.

Of late years marked success has been claimed by American practitioners from the employment of antitetanic serum administered in far larger doses than usual. Cases have been recorded by British practitioners in which serum treatment proved successful, although from the symptoms manifested one would have regarded the patients as hopeless.

Although we are by no means convinced of the value of serum treatment, yet we consider that in the case of

valuable horses it ought to be employed, as it may assist the natural powers of recovery. In our experience, antitetanic serum has no therapeutic effect on the peracute cases of the disease, at any rate when given in the usual doses.

The principles of treatment in tetanus are as follows: Early cessation from work; perfectly quiet surroundings; having a good nurse who will not subject the patient to rough handling; attention to diet, soft, sloppy, easily digested food being allowed, and milk *ad lib.*; the feeding utensils, manger, etc., should be kept scrupulously clean. Calomel may be given in the food until the bowels are acted on. Extract of belladonna given in the form of electuary is a favourite remedy with many practitioners, but, beyond exerting a sedative effect, we are not aware of any specific action on the disease which the drug possesses. Similar remarks apply to other nerve sedatives. On no account should drenches be administered. In giving a prognosis with reference to tetanus, caution is necessary. Apparently hopeless cases have been known to recover. No doubt if the spasms be very acute and generalized, and if trismus be extreme and swallowing impossible, a fatal termination may be expected. When the animal assumes the recumbent position and violent struggling occurs, destruction should be carried out.

The employment of slings is a question on which opinion is divided. If the patient takes to them quietly, they are of advantage, as they obviate the danger of the animal going down from exhaustion. But in many instances slings produce such a degree of excitement that they are likely to do more harm than good.

Captain Dawson, A.V.C., recorded two cases of tetanus successfully treated by hypodermic injections of magnesium sulphate. One of the cases was very severe, and the jaws were firmly locked. A saturated solution of the drug was employed; and the dose given was 40 c.c., of which 20 c.c. was injected on each side of the body, just behind the shoulder. This was repeated in three hours, and then twice daily until the twelfth day, when the dose was reduced to 20 c.c. once daily, and continued to the eighteenth day.

Three doses of antitetanic serum were also given—viz., one on the first day, one on the third day, and one on the sixth day. After the third day the symptoms were greatly modified, and on the twelfth day the horse could eat grass off the ground. The animal was convalescent on the twenty-second day. This method is deserving of further trial. Abscess formation is likely to occur at the sites of injection.

Recoveries have been recorded after the hypodermic injection of Lugol's solution of iodine. Injections of carbolic acid have also been tried, but with indifferent success.

In the treatment of tetanus, surgical attention to the wound (when it can be discovered) is believed by some practitioners to be desirable. In the early stages, excision of the tissues in the vicinity of the wound is said to prevent the formation of fresh supplies of toxin, by removal of the bacilli and their spores. This procedure can be carried out in a painless manner by injecting a local anæsthetic into the part. After excision, the resulting wound should be dressed with a strong solution of carbolic acid. Similar remarks apply to cases occurring after the operation of 'docking'; a fresh portion of the dock may be amputated, and the hæmorrhage checked by applying a pledget of tow soaked in compound tincture of benzoin, and kept in place by a bandage.

Prophylaxis.—The value of antitetanic serum as a preventive agent is now universally recognized. In valuable horses it is advisable to inject the serum in all cases of accidental wounds, but more especially in the case of punctured wounds of the limbs and feet, as these are likely to be contaminated by manure, which is well known to be a favourite habitat of the tetanus bacillus. In certain operations, such as those for scrotal or umbilical herniæ, tetanus is not uncommon as a sequel, and the serum should be injected as a preventive. The usual dose is 1 ounce, and this should be administered at the first attendance on the patient, or in the case of an operation the serum may be given just prior to the surgical procedure, or immediately afterwards. As immunization only lasts for about three weeks, a second injection is advisable in two weeks after the first.

In carrying out surgical operations, and in dressing wounds, every care should be taken to avoid infection from the tetanus bacillus. Surgical cleanliness, the sterilization of instruments and surgical dressings, ligatures, and suture materials, are matters of importance. In the infirmary, cases of tetanus should be isolated, and anyone who dresses a wound in a case of the disease should not handle wounds in other horses.

CHAPTER XVIII

THE TREATMENT OF MILK FEVER

Owing to the great success attending the method of treatment discovered for this disease by Schmidt in 1897, our remarks on the subject will be brief. Nothing is known with reference to the etiology or pathology of the affection, and we need not occupy space with a description of the various theories which have been advanced from time to time. The important matter to point out is that by the simple method of inflating the udder with air we can succeed in restoring an affected animal to health in the large majority of cases. Prior to Schmidt's discovery, the mortality from the disease was high, and not infrequently the heroic and irrational methods of treatment adopted only hastened the fatal termination. The modern treatment for the disease is no doubt empirical, but it is eminently successful, and Schmidt deserves the highest honour that could be accorded to him by practitioners, and also by owners of cattle. The losses incidental to milk fever were enormous, and, as is well known, the chief victims were valuable deep-milking animals often in high condition. So hopeless was the disease regarded by cattle-owners in many districts, that on its appearance the usual course adopted was to send for the butcher, instead of obtaining the services of the practitioner. In the present day this state of affairs is completely altered, and the veterinary surgeon is often called in during the early stages of the disease as well as in clearly defined cases; moreover, the owners of cattle appreciate the fact that the administration of drenches is harmful, and often inimical to recovery. The ultimate result is an

enormous saving of valuable animals, and indirectly a well-marked increase in the practice of the veterinary surgeon. Schmidt's original treatment consisted of the injection of a 1 per cent. solution of potassium iodide into the udder. Further experience showed that other agents could be employed with similar results, until finally it was demonstrated that by simply insufflating the udder with air, recoveries occurred quite as readily, while the risks of mammitis were greatly reduced. The 'air treatment' is employed by a large number of veterinary surgeons in the present day, and the results are eminently satisfactory. In severe cases oxygen gas is substituted for air by some practitioners, and more rapid and successful results are claimed. However this may be, we are satisfied that, in the absence of serious complications, the air treatment will succeed, and that if the former are present (which only happens in a minority of cases) a fatal termination may be expected, in spite of any form of treatment. Simplicity, economy, and efficiency, are important matters in therapeutics, and we fail to see the necessity for complicated methods when simple measures will suffice.

Even in connection with the injection of air, various forms of apparatus, more or less complicated, are on the market, their chief features being, in our experience, the tendency to go out of order or to break at a critical moment. Much importance also has been ascribed to the so-called 'air-filter' attached to the rubber tube of the apparatus, but this contrivance is quite unnecessary. In our experience, the simplest, most durable, and most efficient apparatus is the air-pump known as Hauptner's. It resembles in make and in appearance the air-pump used to inflate the tyres of a motor. With this instrument the udder can be firmly and rapidly inflated, with little exertion on the part of the operator. All that is required is the pump, with a piece of rubber tubing attached thereto, and to the other end of the tubing a teat-syphon is fixed. The technique is very simple: Milk the udder dry; place a clean towel beneath it; sterilize the teat-syphon before use, and insert it carefully into the duct of one of the teats; work the

pump until the quarter is firmly inflated.* Remove the teat-syphon, and place a rubber ring on the teat a short distance from its lower end, so as to prevent the air from escaping. Repeat the procedure with the other teats. The rubber rings should be removed within an hour. Steffen condemns the use of rubber rings or tape to prevent the escape of air, and advises to push the end of the teat repeatedly into itself, until the distension of the teat proper has decreased to a certain extent, and no more air will then escape. When the udder is fully inflated, gentle massage should be applied, and a clean towel should be arranged so that the gland will not come into contact with the ground. The cow is next supported by means of bags firmly filled with straw, so that she will lie in a normal position on the sternum. She should be turned from side to side every three or four hours, if she has not sufficiently regained consciousness to accomplish this herself. Care should be taken that the lower hind-limb is in a proper position (*i.e.*, the foot visible in front of the udder), so as to avoid undue pressure on the limb and on the inflated udder. The animal ought to be covered with a rug, so as to promote cutaneous circulation and maintain the normal temperature of the body, which in this disease is usually subnormal. The beneficial effects of the treatment may be apparent in four or five hours in some cases; in others twelve hours or longer may elapse before the animal gets on her feet.

If the cow does not rise after an interval of twelve hours, the inflation of the udder should be repeated. The udder should not be interfered with for twelve or fifteen hours after the animal has risen, and then 'milking dry' must be avoided. It is best to remove small amounts of milk at intervals on the following day. Food should be restricted in amount, and in hot weather it is best to keep the patient indoors for a few days, so as to avoid a relapse. In cases that do not respond quickly to the air treatment, auxiliaries, such as the hypodermic injection of adrenalin or atropine, are advised by some practitioners. In such instances we have observed

* For further important information on this point, see note on p. 911.

good results from adrenalin administered in a dose of 2 drachms. Steffen advises ¼ to ½ grain of atropine sulphate, and adopts this treatment in every case, in addition to inflation of the udder. He claims as a result a quicker response to the treatment, and a more prompt and complete recovery.

The above treatment proves successful in the large majority of cases, not excluding those which in former times we should have regarded as hopeless.

The most unfortunate sequel to milk fever is the occurrence of paraplegia. Consciousness returns, and the patient feeds and ruminates, but is unable to bear any weight on the hind-limbs. In some instances a condition similar to that of crural paralysis in azoturia of the horse is observed. Such sequelæ very often prove resistant to treatment, and destruction has to be carried out. In some cases hypodermic injections of strychnine, counter-irritation to the spine, and attempts to assist the animal on her feet by means of mechanical support, prove successful. A guarded prognosis is advisable, as occasionally an apparently hopeless case will recover. We observed one instance in which the cow was unable to rise for eight days, but got up at the end of that period.

Pneumonia may occur as a complication; this may result from the animal being left for a long period stretched on her side, so that fluid regurgitates from the rumen and enters the trachea and bronchi. Not infrequently it depends on attempts made by the owner to administer drenches. This complication generally proves fatal.

Cases of sudden death during the course of milk fever are sometimes encountered, and nothing is known with reference to the causation.

It will thus be seen that we do not claim universal success from the air treatment, but we are quite confident that any other therapeutic measures adopted as auxiliaries, with the exception of those mentioned, will not prevent the occurrence of occasional fatalities from the disease. The pernicious practice of administering drenches cannot be too highly condemned, and we cannot understand how any practitioner in the present day could advise the ubiquitous dose of Epsom

salt in an affection of the kind. Yet we occasionally hear that such treatment is carried out; and we can only regard it as the perpetuation of a 'fetish' in therapeutics.

Prophylaxis.—Many measures have been suggested for the prevention of milk fever, but it is not uncommon to find that cases occur in spite of these precautions. Owing to the success of the modern treatment of the disease, preventive measures do not receive much attention in some districts at present. We are quite aware that in some parts of the country no means of prevention are adopted, and yet the disease is seldom seen. Two measures seem worthy of adoption—viz., avoidance of high feeding prior to parturition, and not milking dry for some days afterwards, but withdrawing the milk in small amounts at intervals, in imitation of the newly-born calf. Some owners of cattle leave the calf with the cow for a few days, and claim this as a preventive measure; but cases occur even with this precaution. Moreover, it has the disadvantage of rendering the calf unwilling to take milk in the ordinary way when removed from the cow, while the latter is inclined to 'hold her milk' in some instances for some time after the calf has been taken away. Some owners advise that when the udder is full of milk prior to parturition a certain amount should be withdrawn; others condemn any interference with the udder at this stage.

In our opinion the gradual milking of the cow after parturition is an important preventive measure, as we have frequently seen the first symptoms of the disease manifested after the first milking subsequent to calving.

Finally, we may remark that owners of cattle should watch carefully for the premonitory symptoms of the disease, so that treatment can be adopted as early as possible, even before the cow goes down. The earlier the treatment, the shorter is the course of the disease, and the less likely is the secretion of milk to be interfered with—a matter of great importance to the cowkeeper and dairyman. We have not observed that subsequent attacks of the disease are modified either in severity or otherwise, so that no great risk follows the keeping of a cow which has suffered from the affection.

CHAPTER XIX*

THE TREATMENT OF CANINE DISTEMPER AND CANINE TYPHUS

SECTION I.

THE TREATMENT OF DISTEMPER IN THE DOG.

CANINE distemper is a contagious and inoculable disease peculiar to the dog and other members of the family Canidæ.

It is characterized by an initial rise of temperature, dulness, loss of appetite, and languor, and, after a variable period from the appearance of these preliminary symptoms, by a catarrhal discharge from the eyelids and nostrils; often by a varioloid skin eruption, catarrh of the lower air-passages, such as the larynx, trachea, and bronchial tubes; and perhaps diarrhœa. Frequently it is accompanied by bronchopneumonia, and often, towards the fourth week or later, epileptiform convulsions, choreic movements, and other nervous phenomena, supervene.

It is due to a filtrable virus. Up to the present this virus has not been cultivated in artificial culture media.

In very many respects canine distemper is a disease analogous to equine influenza, swine fever, rabbit and guinea-pig distempers, and also to fowl plague.

This filtrable virus is mostly associated with or accompanied by superadded or secondary infections which are set up by various microbes inhabiting the animal system or its surroundings. The chief microbes involved in these secondary infections, which account for the majority of

* This chapter has been written by H. Gray, M.R.C.V.S., Kensington.

localizations or complications, are micrococci, staphylococci, the *Pasteurella canis*, the *Bacillus coli communis*, etc.

The affection attacks dogs of all ages, from birth up to extreme old age. As a general rule, however, it is in the majority of instances witnessed in animals aged between six and twelve months, this being the period at which they are most likely to come in contact for the first time with dogs suffering from the disease.

It usually takes from four to six weeks to run its **course**, but when complicated with localizations set up by secondary infections this period is not rarely extended to two, three, or more months. Occasionally its course is short and the symptoms are mild, but generally such cases of short duration are apparent and by no means real, for unless great care is taken **relapses** are very common, and often terminate in incurable sequelæ or in death.

One attack, and especially a severe one, mostly gives **immunity** to an ulterior exposure to infection. It, however, by no means gives absolute immunity, because second and even third attacks, sometimes terminating in death, are encountered.

As distemper is a true infectious disease, it will run its course in spite of all treatment. Much may, however, be done to mitigate its severity, and perhaps to prevent complications, which are so often followed by imperfect recovery, if not by death.

The practitioner as well as the owner must have patience, and not expect a recovery for at least five or six weeks, which is the course the malady usually runs. What want of skill or care brings about, therapeutic treatment cannot undo. More benefit will be derived from skilful management and rational dietary than from the irrational therapy so commonly carried out.

For the successful treatment of distemper one must understand the natural history of the disease, and also be able to recognize the malady in its earliest stage. This latter is also important with reference to prophylactic measures.

Certain facts ought to be impressed on the mind of the

student, in order that he may have a clear idea as to what he is likely to encounter in the beginning of his acquaintance with this malady.

First of all he should remember that distemper is often insidious in its invasion and mild in its manifestation, without any of the so-called classical characteristics; also that, unless the true nature of such cases be early suspected, the disease is likely to become widely spread, or serious complications may appear.

Secondly, that infection from cases complicated with certain secondary affections, especially of the pulmonary system, are frequently transmitted with great virulence to the mild or uncomplicated cases.

Thirdly, that cases mild in appearance often end fatally, or at least with incurable sequelæ, especially if carelessly managed. Therefore they should be given the same careful attention as those cases which are grave in their manifestation, and which, from the greater care they receive in consequence of their severity, frequently end in absolute recovery.

Fourthly, that no prognosis, or at best only a very guarded one, should be given at any stage of the malady, as slight cases often end disastrously, while severe cases may recover. The acute pulmonary and the nervous manifestations are very grave, because they account for the greatest mortality or form the bulk of the incurable cases. Sequelæ often appear after an apparent recovery.

Fifthly, the most critical period is between the end of the third and the beginning of the fifth week, when grave complications or sequelæ are likely to appear.

Sixthly, too much reliance must not be placed on the readings of the clinical thermometer in the diagnosis, prognosis, or treatment, of this malady.

Seventhly, the aphorism of Hippocrates, although more than 2,000 years old, is still true, and should be remembered —viz., ' Experience is fallacious, and judgment difficult.'

Isolation of the sick from the apparently healthy, and the mild or non-complicated cases from the complicated, should be rigidly carried out.

The sick animals should be confined in a small space or room which is dry, well lighted, and well ventilated, but free from draughts. A southern aspect is the best situation for the room. On no account should exercise or exposure in the open be allowed, especially during inclement weather, as such are liable to fatigue or chill the system, and thus to open the defences of the body to secondary infections.

In the cold or chilly months of the year short-haired dogs should have the body covered with a woollen jacket, so made that it will cover not only the back and loins, but also the under-surface of the chest and abdomen.

The diet should be highly nutritious and also easily assimilable, and during the earlier stages of the malady nothing equals fresh milk. Perhaps at first the animal will not take to it readily, but after a few days' coaxing a fondness for it is created. As far back as the eighteenth century, Dr. Erasmus Darwin, the grandfather of Charles Darwin, advocated this dietary for dogs badly affected with distemper, and in the writer's experience no other form of diet equals it.

Improper dieting with meat and other solid material is injurious, and often accounts for serious complications. Loss of appetite during the early stage, especially when there is an elevation of the internal temperature, is an indication to give only what the patient will take voluntarily in the form of milk. Forced feeding is injurious; it still further nauseates the animal, and often induces vomition. Nature prompts the animal not to ingest food which would be likely to prove injurious.

Forcing raw meat and other such-like foods on the patient when there is a total abeyance of appetite is not only irrational, but decidedly cruel. Should, however, total loss of appetite remain for several days, a few spoonfuls of milk, or perhaps liquid meat extracts, should be given every three or four hours. As a general rule a continuous and prolonged loss of appetite is likely to be followed by a sudden craving for solid food, such as meat, which if given will be followed by convulsions and other nervous phenomena, which ultimately prove fatal.

When the temperature has dropped to the normal, and the animal has a good appetite, boiled bread and milk or boiled milk and rice should be offered.

It should not be forgotten that meat extracts, which are generally of poor nutrient value, often set up irritation of the intestinal mucous membrane, and in consequence diarrhœa, which further debilitates the already weakened system.

When it is deemed advisable to allow the animal solid diet, it is wise to commence by giving small and repeated quantities. On no account should such nauseous or irritating agents as cod-liver oil, iron compounds, etc., be administered where there is loss of appetite, elevation of temperature, or a catarrhal state of the digestive system, as such agents increase these conditions and torture the animal for no good purpose. Many of the conditions, such as vomiting, diarrhœa, loss of appetite, and emaciation, are often produced by indiscriminate and improper dieting and dosing. Over-nursing not infrequently distresses the patient and renders his condition critical. Sick animals require rest, and should not be submitted to meddlesome interference.

As to the **elevation of temperature** at the beginning of the disease, this frequently abates after a short period of existence; but should it be prolonged and of a high degree, it may be moderated with morning and night dosages of aceto-salicylic acid, sodium salicylate, salicin, or salicylic acid, the dose being in the proportion of ½ grain to every pound of the body-weight. Warm milk and warm clothing assist in lowering the temperature, and may have some influence in the prevention of complications such as broncho-pneumonia or bronchitis, which is often evidenced by the manifestation of a husky cough followed by expectoration into the mouth.

The following is a suitable powder for a fox-terrier of 10 to 15 pounds weight:

Aceto-salicylic acid	grs. x.
Quinine salicylate	gr. ½.

This should be dropped into the buccal pouch, and the head kept raised until it is swallowed.

During the early stage of distemper there is often **catarrh of the stomach,** which shows itself in the form of repeated vomiting of a glairy mucus or fluid, often mingled with air-bubbles, and ultimately with greenish bile. To remedy such a condition equal parts of milk and soda-water should be offered, and bismuth carbonate or subnitrate in 5 to 10 grain doses, alone or along with bicarbonate of soda, and perhaps opium, may be prescribed. Pure ice, in pieces of the size of a filbert, pushed down the throat, or aerated soda-water, is useful in allaying gastric irritation.

There is not infrequently diarrhœa, which may result from catarrh of the intestine. It is mostly profuse, and persistent when accompanied by an elevation of temperature. It is not a critical or vicarious diarrhœa, and should be checked, as it is likely to produce rapid emaciation, which is a very grave sign. The bismuth salts, such as the carbonate, salicylate, or subnitrate, also β-naphthol, benzo-naphthol, cyllin, salol, or lactophenin, act very beneficially in this condition. Besides the agents just mentioned, sodium hyposulphite and calomel in small and repeated doses are useful as intestinal antiseptics.

Moderate diarrhœa without much loss of condition does not call for any special treatment.

The principles for treating vomiting or diarrhœa are to soothe the mucous membrane of the stomach or intestine, check peristalsis, abstain from exercise or excitement, avoid laxative or irritating nourishment, such as meat or its extracts, create alimentary antisepsis by rendering the gastric and intestinal secretions untenable for the development of deleterious bacteria, and, finally, keep the body warm.

The **dysenteric diarrhœa,** containing blood, mucus, and epithelium, indicating an intense congestion, and even a slight abrasion of the mucous membrane of the posterior or so-called large intestine, which is accompanied by straining, should promptly be checked, in order to prevent prolapse of the bowel, rapid emaciation, or great exhaustion. For this purpose large doses of bismuth salts and hypodermic injections of morphine should be given. When improvement

occurs, sodium citrate may be given in small and repeated doses, either in the milk or in the form of a mixture. Lactic acid may be used as an alternative.

After convalescence seems fairly established, and if there still remains a persistent or obstinate diarrhœa, tincture of coto or of krameria in small and repeated doses may be tried. Should this fail, the following will control and ultimately check the evil :

Concentrated infusion of cloves Concentrated infusion of logwood Aromatic sulphuric acid	of each 4 drachms.
Syrup of ginger	2 ounces.
Chloroform-water	to 6 ounces.

The dose of this is a tea, dessert, or a table spoonful, according to the size of the dog, given three times a day.

Constipation is rarely observed in distemper. What is generally mistaken for it is the inaction of the bowels during the early stage, especially when the appetite is in abeyance, or when the animal is living on a liquid diet such as milk or meat extracts. This inertia of the bowel occurs in consequence of the lack of solid ingesta, as the presence of fæces acts as a normal stimulus to the intestine. The greater part of the excrementitious material derived from liquid nourishment is removed by the kidneys instead of by the bowels. This absence of defæcation is also usually encountered when there is repeated vomition, as in gastric catarrh, when any nourishment partaken of is expelled.

Under these circumstances, no alarm should be taken if there is no action of the bowels for several days, and on no account should the animal be tortured with sundry doses of castor-oil, buckthorn, and other aperients, which not rarely set up a catarrhal condition of the intestine and an obstinate diarrhœa, often difficult to check and frequently producing great prostration, and also prolapsus of the rectum or intussusception.

Should no fæces be passed for several days, simple warm-water enemata may be administered just to remove the small quantity of fæcal material, or perhaps fæcal mucus

from the rectum, and to appease the mind of the owner, should he or she be obsessed with the evil of the bowels not acting.

Before proceeding farther, let us say that, should worms in the intestines be suspected, they usually come away spontaneously during the course of this disease, as they cannot as a rule thrive in an unhealthy body. Should the animal during the early stage vomit these parasites from the stomach or pass them by the anus, it is a sign that the parasites are being got rid of spontaneously, and on no account should areca nut or other powerful vermifuges be administered, as such are likely to make the animal seriously ill, even if they do not cause death, more especially in the early stage of the disease. When an animal manifests an unaccountable dulness, with loss of appetite and condition, and evidences of worms, the practitioner may conclude that the parasites are not the cause of the illness, but the illness is the cause of the parasites shifting, and that on no account should he treat the animal for worms. To the writer's knowledge, many practitioners have had painful experience of the evil or disastrous effects of mistaking the effect for the cause, and treating the animal for worms when in reality it was sickening for distemper. Thousands of young dogs are sacrificed every year by treating them for worms when in reality they are suffering from unsuspected distemper. Worms (ascarides and tæniæ) do not, in the writer's experience, cause any harm to dogs, unless in puppies during the weaning period, and in them only when the parasites are in such prodigious quantities as to set up mechanical obstruction. No healthy animal in nature is free from them.

The **gangrenous ulcerations of the mouth**, including the lips, cheeks, and gums, especially those portions surrounding the necks of the teeth, and the resulting necrosis of the adjoining bone, require constant attention. To mitigate or even prevent these complications, the mouth should periodically be inspected; and if the teeth be dirty, or covered with a greyish or brownish scum, they should be brushed two or three times a day with peroxide of hydrogen, Sanitas, or a solution of permanganate of potassium.

The shedding of the temporary teeth should be assisted by removing all the loosened ones, in order to prevent gangrene of the gum, necrosis of the alveolar processes, and ulceration of the cheeks, which are liable to cause death by septicæmia. Should the animal recover from the disease, and be left with necrosis of the alveolar processes and gangrene of the cheeks (noma), the dead bone is generally exfoliated, and the breach remaining, both in the jaw and the cheek, becomes filled up with granulations. To assist this process, the parts should be painted with tincture of iodine, compound tincture of benzoin, or the following:

Quinine sulphate	24 grains.
Dilute hydrochloric acid	2 drachms.
Honey	2 „
Camphor-water	to 8 ounces.

This procedure should be carried out several times daily. (The hydrochloric acid does not act on living bone.) The medicament also acts as an excellent mouth-wash and, when swallowed, as a tonic.

Hypochlorite of soda in solution, chlorine solution, or a solution of chlorinated lime, is also an excellent mouth-wash in gangrenous stomatitis.

The troublesome harsh and paroxysmal **cough** due to laryngitis or laryngo-tracheitis may be cut short by keeping the animal in a warm place, giving warm liquid food, and painting the outside of the throat in the region of the larynx and trachea with strong tincture of iodine or oil of mustard two or three times a day until soreness of the skin is produced. Expectoration should be promoted at first by the administration (if the animal be not too feeble) of a hypodermic injection of apomorphine, the dose varying according to the size of the dog—from $\frac{1}{50}$ to $\frac{1}{10}$ grain. If too large a dose of this drug be given, instead of producing an emetic or expectorant action, cerebral excitement, evidenced by whining and restlessness, is set up.

If there should be pharyngitis accompanying the laryngitis, painting the fauces, naso-pharynx, and the pharynx,

with glycerin of iodine containing a small quantity of pure carbolic acid may give beneficial results.

This treatment may be succeeded by the administration of the following mixture:

Pure carbolic acid ...	...	24 minims.
Spirit of chloroform Ipecacuanha wine Syrup of squills Syrup of tolu ... Syrup of codeine	...	of each 2 drachms.
Aniseed-water ...	...	to 3 ounces.

Of this, a tea, dessert, or a table spoonful, according to the size of the dog, should be given three times a day. Codeine, unlike morphine, does not check the secretions.

In old dogs with disturbance of the valves of the heart, tincture of nux vomica and tincture of digitalis ($\frac{1}{10}$ minim of the former and $\frac{1}{5}$ minim of the latter to every pound the dog weighs) may be added to the mixture. (Note: The cumulative effect of these two agents should be watched. In order to prevent it, they should be discontinued on the third day and renewed after a three-days interval.)

The **broncho-pneumonia** which so frequently complicates distemper—especially during wet weather, when it causes a very high percentage of mortalities—is evidenced by paroxysms of a short, hacking cough which distresses the animal very much. The broncho-pneumonic patches are very liable to coalesce and give rise to extensive areas of consolidation, even to one-half or occasionally to two-thirds of the lower part of both lungs. When this occurs, the cough generally becomes suppressed.

During the early stage, when there is a high temperature and loss of appetite, the following may be tried:

Compound tincture of cinchona	...	1 drachm.
Salicylate of sodium	...	2 drachms.
Syrup of ginger	...	$\frac{1}{2}$ ounce.
Chloroform-water	...	to 3 ounces.

Of this, a tea, dessert, or a table spoonful (according to the size of the dog) should be given every four hours.

The hair over the sides of the chest should be clipped off, and the following poultice applied:

Kaolin	3 ounces.
Boric acid	3 drachms.
Iodine	1 drachm.
Oil of turpentine or oil of wintergreen	3 drachms.
Glycerin	1 ounce.

This should be taken off and a fresh dressing applied morning and evening. It should be made according to art, enveloped in gauze, and have on its outer surface oiled silk, jaconet, or mackintosh, to keep in the moisture of the poultice as well as the heat radiating from that part of the animal's body to which it is applied.

In case the owner objects to having the hair clipped, strong tincture of iodine or equal parts of turpentine liniment and camphor liniment should be applied to the skin of the breast and sides, twice a day, until soreness is set up.

On no account is the **short hacking cough** to be checked, as it is an effort of nature to relieve the bronchioles of mucus and irritation. Its purpose may, however, be assisted by inhalations of steam containing oil of eucalyptus and cresol in equal quantities. The proportion should be one teaspoonful of this mixture to a pint of water, in a tin or iron vessel placed on an oil or gas stove. The compound tincture of benzoin may be substituted for this mixture.

In a great number of instances the writer has had recourse to rapid counter-irritation by means of injecting a few drops of sterilized terebene or oil of turpentine under the skin in front of the breast. But although this promptly gives the desired results, it often produces an abscess with necrosis of the overlying skin (**fixation abscess**). The cough is, however, lessened, but returns after the effects of the counter-irritation have passed off.

Expectoration should be promoted, and when the animal is robust an occasional emetic in the form of a hypodermic injection of apomorphine hydrochloride will give temporary relief.

Antimonial powder or wine of antimony is a much better

emetic for the dog than squill or ipecacuanha, which have rather a false value in veterinary medicine. These latter, however, may be used as mild expectorants during the course of broncho-pneumonia, as in the following prescription:

Pure carbolic acid	... ...	24 minims.
Syrup of squill Syrup of ipecacuanha Syrup of chloral	...	of each 3 drachms.
Aniseed-water ...	... ...	to 3 ounces.

Of this, a tea, dessert, or a table spoonful, according to the size of the dog, should be given every three hours.

When there is great prostration, small and repeated doses of brandy should be administered.

The **acute congestive** or **hyperæmic stage of pneumonia,** encountered in many acute malignant outbreaks of distemper, runs a very rapid course, and mostly ends in death. It is probably set up by an infection of the lungs through the circulation. It seems to produce death by cardiac failure or cerebral intoxication. There is frequently hæmorrhage, which issues from the nostrils or mouth. The prostration is profound. Often a critical bloody acneiform eruption appears, and this seems to bring about an improvement of the pulmonary condition.

Powerful stimulation, whether internal or external, should be adopted. For internal administration the following is advised:

Tincture of digitalis	... ...	1 drachm.
Tincture of nux vomica	... ...	24 minims.
Best brandy	... .	½ ounce.
Solution of acetate of ammonia	...	½ ,,
Syrup of ginger	... ...	1 ,,
Chloroform-water	... ...	to 3 ounces.

Of this a tea, dessert, or a table spoonful should be given every three hours. Should there be evidence of the nux vomica producing physiological effects, this drug should be omitted.

The kaolin poultice should be applied to the sides In

lieu of this, oil of mustard acts very promptly and effectually. Repeated injections of ½ grain of camphor in 17 minims of ether should be made under the skin when the prostration is profound and the heart is weak. Citrate of caffeine in hypodermic injections of ½ to 2 grains, according to the size of the dog, may also be used as a cardiac and as a nerve stimulant.

In case of a subnormal temperature and a semi-comatose or dazed condition, the injection of several ounces of normal saline solution (7 in 1,000, or 49 grains of sodium chloride in 16 ounces of boiled water), raised to the normal temperature of the body or a few degrees above it, may be made under the skin. This is carried out by means of a serum syringe or a douche-like apparatus fitted with a long rubber tube and a serum needle, raised several feet above the animal, so that by its own weight the fluid is drawn under the skin and is rapidly absorbed by the circulation (see p. 214). *There is no need to fear an abscess*, but the needle should not be inserted in the same place when the injection is repeated.

In all forms of pneumonia inhalations of oxygen, although of doubtful value, may be tried in the case of valuable dogs.

The **croupous pneumonia** which occasionally complicates distemper should be treated on similar lines. There is generally little or no cough, but panting, restlessness, and a high temperature, are present. It runs an insidious course, and may occur in young as well as in adult animals. The consolidation is generally extensive in area. Sometimes when the lung is enlarged there is moaning, as in pleurisy, which is not a common complication in canine distemper.

The **nervous complications**, or what are usually but erroneously termed **nervous sequelæ**, arising during the course, especially at the later or even in the convalescent stage of distemper, are very difficult to treat with success. Indeed, the majority of such cases, even if they do not succumb, are left incurable or maimed. They are more prevalent during some seasons than others, and are generally secondary or superadded to pulmonary or intestinal lesions.

As to the **epileptiform convulsions** arising from an infec-

tion of the central nervous system, although they may be checked by the inhalation of chloroform or by the administration of chloral hydrate via the mouth, rectum, vein, or peritoneum, they end as a rule in death from coma, or pass away, to be followed sooner or later by chorea, paraplegia, ataxia, or a progressive general paralysis, etc.

The bromides in a great number of instances seem to aggravate the condition, but in a few cases bromide of potassium and iodide of potassium given in the drinking-milk twice a day for a long period have been followed by success. Whether the favourable results are due to the drugs or to the *vis medicatrix naturæ* is doubtful. The bromide and iodide when given in milk (which is taken voluntarily by the animal) may be administered in large doses for a long period without doing any appreciable injury. No doubt this is due to their being largely diluted.

Apomorphine, codeine, morphine, veronal, sulphonal, chloretone, chloralose, scopolamine, urethane, and other similar hypnotics, although temporarily giving benefit, seem of no real value.

When there is **meningitis**, evidenced by delirium, restlessness, and excitement, especially at night-time, very little, if any, hope of a recovery, partial or complete, should be entertained, and it is the duty of the practitioner to inform his client of the fact, in order to obtain consent for the destruction of the animal. Many of these cases, if allowed to live, gradually become affected with general paralysis, and die in a state of coma.

The **chorea**, or twitching convulsions, is evidence of anterior poliomyelitis, and may appear without the precedence or accompaniment of epileptiform convulsions. It is not rarely succeeded by various forms of paralysis, such as paralysis of the lower jaw, paraplegia, or progressive general paralysis. These clonic convulsions may occur in any of the systemic muscles or in one or more groups of muscles, including those of the head, neck, abdomen, or limbs. They are the effect of an infective or toxi-infective action upon the nerve cells of the motor tracts, especially

the inferior cornua, which after a time undergo degeneration, and ultimately become replaced by fibrous or connective-tissue elements (sclerosis). The damage is done to the nerve cells before they show it in the form of clonic convulsions, known in this case as 'canine chorea,' which does not pathologically correspond to chorea in man.

From these facts one may gather the reason why chorea in the dog is practically an incurable malady. It is, however, quite true that a great number of cases improve as soon as the nervous and muscular systems regain their tone, and that in a few instances, out of many hundreds, the convulsions may disappear altogether.

During the early stage of chorea, on no account should nerve stimulants or tonics, such as strychnine, nux vomica, arsenic, or phosphorus, be administered, or electricity be employed, as they would add fuel to the fire by stimulating the already overstimulated nerve-centres and probably increasing their degeneration.

These agents, if they do any good at all, which is very doubtful, should, however, be only used when such active phenomena as an elevation of internal temperature, diarrhœa, pneumonic lesions, and catarrhal discharge, have disappeared, and convalescence is well established. For this purpose the following formula is suggested:

Strychnine arsenate	...	1 part.
Distilled water	...	1,000 parts.

Of this solution 5 minims ($\frac{1}{200}$ grain) to 30 minims ($\frac{1}{33}$ grain), according to the size of the dog, should be injected under the skin once daily for three days, when the cumulative effect is likely to be noticed. After allowing a few days' interval, repeat the process. Great circumspection is required in adopting this treatment.

During the early or acute stage the administration of bromide and iodide of soda in milk is followed in many instances by satisfactory results. Salicylate of sodium, aceto-salicylic acid, antipyrin, salol, scopolamine, chloretone, chloralose, sulphonal, and such-like agents, are sometimes useful.

When the disease seems quiescent—that is, does not progressively get worse after two or three weeks—the following prescription is suggested:

Iodide of potassium Bromide of potassium	...	of each 1½ drachms.
Fowler's solution of arsenic (without tincture of lavender)		½ drachm.
Water		to 6 ounces.

Of this, a tea, dessert, or a table spoonful, according to the size of the dog, should be administered in the milk three times a day.

In spite of the fact that a few dogs may recover—that is, the twitchings may cease in consequence of the counterbalancing centres also becoming degenerated—there is no remedy yet discovered that will restore a degenerated part, and in consequence its function, to its normal state. However, a great amount of medical treatment is still speculative.

As regards the **paresis, paraplegia**, or various forms of **monoplegia**, such as paralysis of the tongue, paralysis of the optic nerve (amaurosis), paralysis of the auditory nerve (deafness), paralysis of the olfactory nerve (loss of smell), scapular and femoral paralysis, and paralysis of the detrusor urinæ (incontinence of urine), the remarks on chorea are here applicable.

Sometimes these forms of paralysis are quite ephemeral, passing away almost as quickly as they appear.

Other nervous phenomena that appear occasionally during the course of distemper, or perhaps some time after an apparent recovery, are 'going in a circle,' often with a high-stepping action of the limbs during progression, an irresistible desire to wander in an aimless manner, vertigo, loss of space instinct, loss of memory, difficulty in avoiding obstacles, lateral curvature of the body or neck, etc. They are generally the result of some lesion of the brain, and are mostly grave signs. They may be treated on similar principles to those outlined for the treatment of nervous complications.

Ocular Lesions.—The discharge from the eyes (con-

junctivitis) may be moderated with mild astringent collyria. The following are useful formulæ :

1.	Sulphate of zinc	1 part.
	Distilled, or rose water ...	500 parts.
2.	Sulphate of copper	1 part.
	Cherry-laurel water	1,000 parts.
3.	Boric acid	1 part.
	Elder-flower water	50 parts.
4.	Silver nitrate	1 part.
	Sweet spirit of nitre	0·5 part.
	Distilled water ...	1,000 to 200 parts.
5.	Biniodide of mercury ...	1 part.
	Distilled water ...	4,000 to 2,000 parts.
6.	Perchloride of mercury ...	1 part.
	Distilled water ...	4,000 to 2,000 parts.
7.	Chinosol	1 part.
	Distilled water ...	1,000 to 500 parts.

Whichever of these is selected should be applied by means of a piece of lint saturated with the lotion, or dropped from a MacNaughton-Jones eye-dropping bottle. The eyelids should be drawn apart and outwards, so that a pocket is formed to receive the collyrium, which is squeezed out of the lint or dropped out of the bottle, held an inch or two from the eyelids. By this means the collyrium gravitates all over the mucous membrane ; the latter is thereby freed from muco-purulent material, which floats upon the fluid. The collyrium should be used two or more times a day, according to circumstances.

After this has been thoroughly applied, the outer surface of the eyelids should be smeared with a weak boric ointment, to prevent excoriation of the skin, and also the eyelids from adhering together.

Should there be any pain, expressed by the dread of light and the continual closure of the eyelids, whether accompanied by ulceration or other morbid conditions of the cornea or iris (ulcerative and vascular keratitis, irido-cyclitis), this should be relieved, so as to allow the eyelids to

keep open and thus permit the outflow of the muco-purulent discharge, and remove the pressure on the eyeballs caused by their swollen condition. For this purpose the following formula is advised :

Cocaine hydrochloride	10 grains.
Atropine sulphate	½ grain.
Distilled water	4 drachms.

Two or three drops should be allowed to fall from an eye-dropping bottle between the eyelids two or three times a day.

In case of there being an ulcer at the circumference of the cornea, the above prescription should be replaced by the following :

Eserine sulphate	2 grains.
Cocaine hydrochloride	10 „
Distilled water	4 drachms.

A few drops to be instilled between the eyelids every four hours in order to contract the pupil, and thus draw away the pupillary margin of the iris from the vicinity of the peripheral ulcer.

Should the ulcer be of the wide sloughing kind, it is advisable to puncture the floor of it after it has been disinfected with pure carbolic acid, applied with a small camel-hair pencil. This lets out some of the aqueous humour, and at the same time prevents a wide perforation of the cornea, with a resulting prolapse of the iris and a consequent staphyloma. On no account should solution of subacetate of lead be used in an **infraction** of the cornea, as there is danger of a lead deposit being left in the breach, and the formation of a well-defined, dense white opacity in the depth of the cornea.

For the resulting granulations filling up the ulcers, the mild astringent and antiseptic collyria already mentioned are sufficient. Or, instead of these, calomel, iodoform, or zinc oxide, may be dusted on the ulcers.

When the ulcers or granulations are sluggish, a mild stimulating ointment should be gently rubbed between the

eyelids once a day. For this purpose Pagenstecher's ointment is recommended:

Yellow oxide of mercury	...	1 part.
White vaseline	... ...	100 parts.

This should be made according to art, so as to avoid any grittiness in it.

It should not be used when any vascularity of the cornea is present, or in iritis, or when iodide of potassium is being given internally, or iodine is being applied elsewhere on the surface of the body. In certain cases of sluggish ulcers, repair rapidly takes place after puncturing the cornea with a needle and allowing escape of some of the aqueous humour.*

The **exanthematous eruption** characteristic of distemper, although it may mostly be present during the initial stage, may not appear until late in the course of the malady. In some cases there is a recurrence of crops of the eruption extending even up to the end of the convalescent stage, and also after an apparent recovery. In a great number of instances, however, it is suppressed, other localizations taking its place. Nevertheless, distemper is a true eruptive disease, just like smallpox, measles, and scarlet fever, in man, in whom the characteristic eruptions do not always appear in every outbreak, so much so that the true nature of these complaints is sometimes overlooked until the outbreaks have become widespread.

This eruption should be encouraged by warmth and stimulants, as it, especially during the initial stage, relieves the system of a great deal of disturbance. In many instances, when it becomes generalized, it gives off a yellowish serous exudate which dries into a yellowish resinous-looking material, and appearing as if yolk of egg had been smeared on the animal's skin and allowed to dry on it. This is mostly seen in young pups, and, as it is accompanied by itching, it is often mistaken for sarcoptic mange.

* For a fuller account of the treatment of eye complaints and of the actions and uses of medicaments on the eye, consult Henry Gray's translation and edition of Dr. Nicolas's 'Veterinary and Comparative Ophthalmology, which will shortly be published.

To allay the irritation, the body should be carefully smeared with a weak liniment of sulphurated potash, which should be made with a bland non-irritating oil, such as olive or castor oil. It should be applied over small areas at a time in order to avoid interference with the cutaneous functions.

In some of the very grave pulmonary complications a critical or vicarious eruption appears in the form of small bloody abscesses involving the dermis and subdermis, attacking chiefly the under-surface of the jaws and limbs, and not infrequently the whole body. This is not rarely mistaken for follicular mange.

These small abscesses should, as soon as 'ripe,' be opened, their contents squeezed out, and the skin sponged with a 5 per cent. solution of creolin or sprinkled with a powder composed of chlorinated lime, kaolin, and boric acid.

In other cases skin disease appears in which the hair is rapidly shed, the skin becomes dry, pigmented, thickened, and encrusted with scales. There is no itchiness, nor do the sebaceous follicles contain the *Demodex folliculorum*. It is not contagious, but all the pups in a litter may be affected. It is liable to recur, and is often mistaken, by those who have not made a close study of skin diseases in the dog, for follicular scabies.

It requires a continuous persevering treatment with the following ointment:

Zinc oxide	2 ounces.
Strong mercurial ointment ...	1 ounce.
Beech creosote	2 drachms.
Sublimed sulphur	1 ounce.
Lanolin, Vaseline, Lard ...	equal parts up to 12 ounces.

Warm creolin or sulphurated potash baths should be given after the body has been dressed over in small areas at a time with the above ointment. These should be repeated weekly.

Follicular mange often takes its start from distemper, no doubt from the system being lowered, and does not seem to be a contagious skin disease in the strict sense of the word.

It cannot be conveyed experimentally, and the dam which gave birth to the affected pups may remain perfectly free from it. Sarcoptic mange, ringworm, and other skin diseases, may also complicate distemper.

The **vesiculo-pustular or herpetic eruption on the under-surface of the flap of the external ear and the internal lining of the middle ear,** causing what is generally termed canker (a generic term which includes every disease of the ear to which the dog is subject), is moderated by dusting the affected surface with dry oxide of zinc; this forms a scab, which ultimately becomes detached, leaving a healthy dry surface. Kaolin, starch powder, and boric acid, also form a good dusting-powder for this purpose. As a rule no other treatment is necessary.

The growth of the *Symbiotes auriculorum* in the internal ear becomes very prolific, causing great irritation, and often leading to otorrhœa during the course of distemper, when the vitality of the tissues is greatly lowered.

In conclusion it should be repeated, for the benefit of the senior student or junior practitioner, that during the course of distemper, and especially in the convalescent stage, exposure to cold, exercise, and improper diet, should be specially avoided. A guarded prognosis should always be given at all stages of this disease, no matter how favourable or unfavourable it may appear to the observer. In the early stage diagnosis is often difficult in this multiform malady, which usually takes five to six weeks to run its course. Sometimes the so-called sequels may appear months after an apparent recovery.

For information on **jaundice** in connection with distemper, see p. 670.

Sero-Therapy and Vaccination in Connection with Distemper.

Although there are very many sera and vaccines on the market, there is not yet one that will give any benefit, at least not to such a high degree as that claimed by their inventors, manufacturers, or exploiters.

Ferry claims that the active culture of his micro-organism is not capable of producing the disease, but states that it is necessary to use vaccines of graduated virulence to give immunity. Even when his vaccine is used early, it will only save 60 to 70 per cent. of those attacked, surely a percentage no higher than that obtained by the ordinary rough and ready methods of treatment.

Why is it necessary to use doses of graduated virulence, when everybody knows that a mild attack of the disease, contracted naturally, gives great, if not absolute, immunity from future attacks?

How can any of the highly-lauded vaccines and sera give the immunity claimed, when they are prepared from visible micro-organisms which are generally normal inhabitants of the dog's system? The true *contagium* of distemper is an invisible or filtrable element which has not been cultivated in artificial media. In this category it resembles many of the other true contagious diseases, such as foot-and-mouth disease, sheep-pox, swine-fever, and equine influenza.

No doubt the simultaneous method of inoculation with hyperimmunized serum and virulent blood, as adopted in cattle-plague, swine-erysipelas, swine-fever, and other contagious diseases of animals, may give favourable results.

In the opinion of the writer, none of the vaccines or sera on the market have been of any value in practice.

Section II.

THE TREATMENT OF DISTEMPER IN THE CAT.

This is an analogous but not an identical disease to distemper of the dog. It is neither communicable by natural infection or contagion to the dog, nor *vice versa*.

The **catarrhal** form resembles, in its clinical aspect, influenza of the horse. Frequently there is chemosis and conjunctivitis affecting only one eye. Pharyngitis and laryngitis are common accompaniments.

The **pharyngeal** form is very fatal, and so is the **gastro-enteric** form. In some outbreaks pleuro-pneumonia with pleural effusion is a prominent feature. On the other hand, broncho-pneumonia and eruptions are relatively rare. The same may be said of nervous phenomena such as convulsions, chorea, and paralysis. Still, ataxia is not rarely noticed. Ulceration of the cornea is occasionally encountered, and in the kitten the eye is frequently affected with a purulent conjunctivitis, and destruction of the eyeball often results. Persistent protrusion of the membrana nictitans with or without conjunctivitis is often pronounced in adult cats. Stomatitis, even associated with shedding of the epithelium of the tongue, is a common complication.

The mortality from the disease is sometimes very great, especially during inclement weather.

The cat should be kept in a warm, draughtless, and darkened place. Milk should be offered, but if there be absolute loss of appetite, or, rather, an inability to lap, as is often the case when the tongue is affected with catarrhal inflammation, the animal should be spoon-fed.

Gentleness is a necessary requisite in dealing with feline patients. Coarse handling promptly causes resistance.

Medicaments are best administered in the form of small pills, capsules, tablets, or powders dropped at the back of the open mouth when the head is elevated.

In the local treatment of pharyngeal affections, etc., agents in the form of powder placed at the back of the mouth are preferable to fluid medicaments intended to act on the pharynx.

The table on p. 803 gives a simple list of medicaments, and the forms or localizations of feline distemper for which they are suitable.

For a fuller account of this disease refer to the article on 'Distemper of the Cat' in Hoare's 'System of Veterinary Medicine,' vol. i.

Let it be noted that the coal-tar series, chloral hydrate, chloretone, belladonna, henbane, and similar agents, are

Form or Localization.	Agent.	Dose.	Form of Administration.
Catarrhal	Quinine sulphate	½ to 1 grain	Pill.
Catarrhal	Sodium citrate	2½ to 5 grains	Tablet or powder.
Pharyngeal	Borax	2½ to 5 grains	Powder, used as a local application.
Pharyngeal	Tincture of iodine	Ad lib.	Painted on pharyngeal region.
Stomatitis	Quinine sulphate	½ grain	Combined and used as a powder.
	Borax	3 grains	
Gastritis and gastro-enteritis	Bismuth carbonate	3 to 5 grains	As a powder two or three times a day.
Diarrhœa	Bismuth carbonate	3 to 5 grains	As a powder two or three times a day.
Constipation	Calomel	½ to 1 grain	In pill form.
Debility with nervous prostration	Quinine sulphate	½ grain	One pill morning and night.
	Extract of nux vomica	$\frac{1}{30}$ grain	
	Excipient	A sufficient quantity to make pill, as small as possible	

relatively dangerous to the cat. On the other hand, emetic agents can be well tolerated—that is to say, they do not act so promptly or effectually on the cat as they do on the dog.

Section III.

DISTEMPER IN OTHER (SMALL) ANIMALS.

The **ferret**, **guinea-pig**, and **rabbit**, have distempers peculiar to their species. They are manifested in similar forms to those of the dog and cat, and should be treated on similar principles, taking into consideration the different habits and natures of the various species. The rodents may have salines and sodium salicylate sprinkled on oats and bran. The medicaments for the ferret may be sprinkled on rabbit flesh or given in the milk.

The **fowl** is also subject to distemper in the form of

catarrh, or catarrh with false membranes on the various mucosæ. This affection is commonly termed **contagious catarrh, roup, diphtheritic roup**, etc.

As regards treatment, medicaments may be given in pill form, in the water, or mixed with soft food. Milk, into which bran, bread, boiled potato, or table refuse, is placed, is a very good diet for the sick bird. Birds can withstand relatively very much higher doses than mammals. For instance, a farm-yard fowl can tolerate double the dose of strychnine for man. Nevertheless, the dose for adult poultry should be generally approximated according to the dose for man or for a dog of 50 pounds weight. The pigeon should have its doses approximated according to the doses for the cat.

In the treatment of a large number of sick fowls together, sulphate of iron, sulphocarbolate of sodium, citrate of sodium, sulphate of sodium, or salicylate of sodium, are given in the drinking-water or in milk, or are dissolved in boiling water or milk, and then mixed with barley-meal, bran, or bread. Valuable stock birds may receive pills containing quinine, capsicum, camphor, and nux vomica. The catarrhal mucous membranes may be washed with a weak solution of permanganate of potassium, acetate of aluminium, or copper sulphate. False or cheesy membranes should be removed, and the denuded mucous surfaces painted with tincture of iodine, pure carbolic acid, or a strong solution of chloride of zinc.

Diarrhœa may be treated with chalk sprinkled on the wet food, or by a small amount of powdered catechu in the drinking-water (about 10 grains to the half-gallon of water).

Sick birds should be kept in warm and dry surroundings. The oculo-maxillary sinus may require to be evacuated of its cheesy contents.

Bread steeped in stout and sprinkled with powdered capsicum may be given as a stimulant to birds in a prostrate condition.

Section IV.

THE TREATMENT OF CANINE TYPHUS.

Canine typhus—also known in this country as contagious or epizoötic gastro-enteritis, canine influenza, and by the Germans, abdominal typhus, or *Stuttgarter Hundeseuche*, and by the French, *Gastro-entérite Hémorragique*, or *Pasteurellose Canine* — is a disease that occurs periodically, especially during wet, chilly, or changeable weather, but seems to disappear as soon as dry or frosty weather sets in.

Although it is seen chiefly during the autumn, winter, and spring months, it may be encountered at any time of the year if the weather is favourable for its development.

Notwithstanding the fact of several dogs in a house, or two dogs belonging to different owners living next door to one another, becoming affected at the same time, there is very little, if any, evidence from the general history of the disease that it is conveyed by direct contagion. As a rule, when the affection makes its appearance in a district, the cases encountered are scattered about in different parts of it.

It may occur in dogs of any age, but is generally seen in adult or aged animals.

Its mortality is very great. Some have placed it as high as 80 or even 90 per cent. However, one is not inclined to accept this estimate of its death-rate. It would, no doubt, be correct if those cases showing intense gastritis, with gangrenous lesions of the mucous membrane of the cheeks, gums, or occasionally the tongue, were only included under this disease. On the other hand, there are a great number of mild or atypical cases, not always recognized as belonging to this disease, that recover, and which should be taken into account when preparing statistics.

Relapses are common, and **second attacks** within a year or after several years, even in dogs that have lost a portion of the tongue at the first seizure, are not rare.

The **course of typhus** varies from a few days to a month, or more. Its invasion in chronic cases is frequently insidious and deceptive.

It is generally considered to be a different disease from canine distemper (Fr. *Maladie des Chiens*, Ger. *Hundestaupe*), both etiologically and clinically. This is apparently true if only some of the clinical types or isolated outbreaks of the latter disease are compared with typical cases of typhus. But in some outbreaks of canine distemper in large kennels of young dogs, we may find the majority of the cases showing the typical symptoms of distemper, while the remainder present many of the features of typhus. Moreover, one witnesses sometimes a newly-purchased puppy developing the characteristic erupto-catarrhal form of distemper, which transmits to the adult or perhaps aged canine inmate in the same house a disease having all the clinical characters of typhus and indistinguishable from it.

In many of its later developments typhus also somewhat resembles malignant jaundice and uræmia.

It may be mild, chronic, acute, or peracute in form.

Mild Form.—In this form the following symptoms are observed: The dog may be somewhat dull; he has shivering fits and little or no appetite, and perhaps an increased thirst. After a time he vomits everything he takes, and also any food or medicine which is forced upon him. In a few days a slight gangrenous ulceration of the buccal mucous membrane appears, especially over those parts which come in contact with the canine, carnassial, and perhaps the upper and lower incisor teeth. Frequently, however, this latter change is absent. In some cases the only symptoms present are an increased thirst, and perhaps frequent passage of urine. In most instances there is at first a slight diarrhœa. Under rational treatment recovery takes place in two or three days.

Chronic Form.—Although canine typhus is said to be always an acute and rapidly fatal disease, close observations made upon a large number of cases seem somewhat to negative this assertion. The writer has often encountered dogs that have manifested rheumatic symptoms which, under appropriate treatment, have passed away, to be soon followed by increased desire for water, diminished appetite,

and gradual wasting for some time; and, in spite of this, the animals did not appear to be much distressed, nor had they a sad facial expression. Rather the opposite was noticed—brightness of countenance. After a time they began to show lassitude, a desire for warmth, and were observed to micturate frequently. This would go on for two or three weeks, when vomiting began, and the emaciation and weakness progressed rapidly. Two or three days from the commencement of these latter symptoms the mouth almost suddenly gave off a very offensive odour, resembling somewhat that of a cesspool or bad ensilage. (This odour is also encountered in the oral complications of canine distemper.) The suddenness of this symptom was so well marked that on inspection of the mouth the day before the appearance of lesions, beyond, perhaps, a little dirty greyish or brownish slime on the buccal mucous membrane and teeth, no lesions were noticed.

In this type of the disease one finds on inspection of the mouth that the buccal and oral mucous membrane—especially those portions coming in contact with the carnassial, canine, and incisor teeth, upper and lower—and sometimes the anterior portion or tip of the tongue, are blackish or greenish in appearance, cold and insensitive to the touch, and giving off the nauseating odour mentioned above. After a few hours this blackish or greenish appearance changes to a greyish-green or straw colour, and a gangrenous slough appears that seems attempting to separate itself from the healthy or living membrane. Complete separation of the necrotic parts take place in a day or two, and if the animal survive, there is left a reddish or greyish-red granular surface. Very often this process when attacking the gums round the neck of the teeth also extends to the alveolar processes and a portion of bone surrounding them, which, with the neck of the teeth, are left exposed.

If the vomiting continue and the rejected material be of a coffee-coloured or brownish-red appearance, and give off a putrid odour; and if, also, there be a convulsive action of the temporal and masseter muscles (simulating that seen in

strychnine-poisoning), sometimes causing a short, sharp convulsive opening and shutting of the jaws, death will certainly take place in a very short time.

Acute Form.—In this form, which rages in certain districts or at certain periods, there are fits of shivering, and in some instances a great desire for warmth; loss of appetite, which quickly becomes absolute; dulness; no desire to move, but when made to walk there is a short tottering gait, with a slight arching of the loins; the whole of the body seems stiff, the expression becomes anxious, and after a time there is great depression. The action of the bowels at first remains in abeyance, but after a few days there is a frequent passage of a gelatinous material containing blood, accompanied with much straining.

After two or three days, vomiting sets in and is continued at short intervals, especially if water be frequently taken or nourishment forced upon the animal. At first the vomit contains particles of food mingled with mucus, and as emesis continues it soon becomes of a glairy, ropy, clear-looking material, streaked here and there with air-bubbles, giving it a frothy appearance. After a time this is replaced by a thin, greenish, watery liquid, and ultimately a dirty prune-juice or brownish coffee-coloured material, which gives off a putrid, nauseating odour. If the vomiting be severe there is a great desire for water; this is rejected almost as soon as swallowed.

In some instances the conjunctival mucous membrane is of a dirty purplish colour; in others it has a dirty pale yellow tint, or a bright red appearance, with the sclero-conjunctival bloodvessels standing out prominently.

On inspection of the mouth we may find a stringy mucus tinged with blood, or a brownish material hanging from its angles, and the muzzle may present a swollen appearance; there may be a thick layer of dirty or brownish mucus adhering to the buccal and labial membrane, gums, teeth, tongue, soft palate, and pharynx, or the teeth only may be covered with a reddish- or brownish-coloured material towards the later stage of the complaint. Those portions

of mucous membrane of the cheeks and lips that come in contact with the surface of the teeth, and in many instances (especially during certain seasons) the tip of the tongue, also become affected, as in the later stage of the chronic form.

The base of the tongue, tonsils, pillar of the fauces, soft palate and pharynx have often a dark, turgescent appearance due to congestion or dilation of the minute bloodvessels, and are not rarely covered with a gangrenous or purulent diphtheroid material. In this state, if food be forced upon the animal, or if the pharyngeal region be pressed, spasm of the œsophagus may be sometimes observed. In many of these cases, and more especially where the mouth and pharynx are not cleansed and dressed with an antiseptic, a rapidly fatal pneumonia supervenes.

In slighter cases, where the thirst, vomiting and diarrhœa are not severe, an improvement may take place as soon as the necrotic patches in the mouth have separated themselves from the living tissues, which may occur in two or three days. However, not infrequently such early recoveries as these are liable to be followed by an almost sudden relapse, ending in death in a few hours.

Many of the cases that recover do so after having suffered a total loss of appetite for weeks.

Peracute Form.—This is the most fatal of all forms of this disease. The animal is suddenly seized with an unaccountable vomiting, or perhaps has passed an amount of almost pure blood *per anum*, although an hour or two before this food was eagerly taken, or he was playing about or hunting as usual. Many cases have occurred where the dog was all right at bed-time, but during the night the owner has been disturbed by the animal vomiting or crying or passing a bloody diarrhœic material, or, where it has not slept in the owner's room, it has been found in the morning in a drowsy, cold, and miserable state. Usually such a state of affairs is attributed by the owner to either malicious or accidental poisoning.

There is great depression; the animal appears in a dazed state, and does not care to move; the ears, mouth, and feet,

are icy cold; there is a dirty saliva issuing from the mouth, and the skin is not very contractile when the grip has become loosened. When he gets up for water he loses the dazed appearance, and laps up the fluid with avidity, but rejects it immediately. The stools are often bloody and fœtid. The abdomen, as in all other forms, is tucked up, and in a good many instances the animal moans when it is manipulated, especially over the region of the stomach, and this not rarely brings on vomiting.

After twelve to twenty-four hours have elapsed from the onset of the illness, symptoms of coma, preceded or not by peculiar clonic convulsions, set in, and death takes place without a struggle. In other cases the animal dies during an attack of vomiting or retching.

If the animal lingers two or three days longer, conditions of the mouth similar to those seen in the preceding forms are observed.

Internal Temperature.—There is no doubt, if one could observe every case of typhus from the commencement of its initial stage, one would find the thermometer raised to 1°, 2°, or 3° above the normal.* Indeed, when the animal is brought for inspection during the early stage, one often observes the temperature elevated to 103° to 105° F. However, as soon as general intoxication sets in, it goes down to the normal, and even the subnormal—98° to 95° F., which is maintained until death or a reaction (followed by recovery) takes place.

The Urine.—Although in some of the mild cases, and also in the earlier stage of the chronic form (when vomiting is absent or has not yet occurred), the urinary secretion does not appear to be diminished in amount, yet it is the case that very little urine is secreted, or rather filtered, through the kidneys during typhus. In many instances it seems as if this function

* The normal temperature of the dog ranges between 100° F. and 102·6° F., and averages in a large number of cases about 101·5° F. I have seen it stated that 103° F. is a normal temperature when the dog is submitted to excitement. This has not been my experience.

remains in abeyance. What little is passed or drawn off by the catheter has a clear yellowish or golden-reddish tint, or it may be quite turbid in appearance. It generally contains albumin, and often bile salts, epithelial cells, urinary casts, white corpuscles, and blood-cells. It is acid in reaction.

An important fact should not be overlooked—viz., this disease (typhus) often occurs in aged dogs which are very commonly and unsuspectingly affected with senile or chronic interstitial nephritis independent of typhus, so that it does not necessarily follow that, because albumin, casts, etc., appear in the urine, they are due to typhus. However, like distemper and other infective processes, it frequently gives rise to catarrhal or even parenchymatous nephritis.

The diminution or seeming suppression of urine is to be chiefly accounted for by the immediate vomiting of all fluids as soon as ingested.

It may be well to mention that many of the later features of uræmic poisoning, brought about by obstruction to the exit of urine from the bladder in consequence of urethral calculi, are common to those seen in the later stage of typhus.

Muscular and Nervous Phenomena.—The muscular and nervous phenomena as seen sometimes in typhus are not peculiar to that disease, as they may be observed in ptomaine-poisoning, in many septic conditions following enteritis, or gastritis due to foreign bodies, and in the typhoid state occurring late in distemper, etc. They may consist of vertigo, tetanic convulsions resembling those of strychnine, or the eclamptic fits of suckling bitches. The muscular twitchings may be confined to the head, jaws, shoulders, hind-quarters, or diaphragm, or they may extend all over the body. When the muscles of the jaws are affected, the temples throb, the jaws are opened and shut suddenly in a snatching, jerky manner, and there is chattering of the teeth. When the limbs are affected there is a rigidity, alternating with a jerky relaxation. These convulsions, like those of strychnine-poisoning, are increased by touching the body. At times there are writhings or tremors of certain muscles. Some-

times there is a general weakness of the hind-quarters simulating paraplegia.

Gastric and Cutaneous Phenomena.—The **gangrenous condition** is not always confined to the mouth; it may occur on the skin where there is pressure, or in the rectum or around the anus.

Intense gastritis may be present, with very little vomiting and thirst; or conversely intense vomiting and great thirst may have existed in cases wherein no well-marked gastric lesions were discernible to the naked eye on post-mortem examination. The gastric secretion in this disease is always alkaline.

As in distemper, long-coated dogs after convalescence from typhus very often have shedding of the hairy covering of the body.

The **Prognosis** is always grave. When the vomit is putrid, or when the gangrenous state of the mouth sets in late, or when there is rapid wasting, coma, prolonged subnormal temperature, and twitchings of any of the various groups of muscles, death is certain to follow. Typhus generally runs its course in a few hours to a fortnight. The longer the animal lives, the better the chances of its recovery become. Recovery is anticipated when the vomiting has ceased, and the stomach can bear liquid nourishment, and also when the bowels regain their natural function. As a rule, in these cases the buccal lesions, if occurring early in the disease, throw off their necrosed portions, and commence to heal very rapidly.

Treatment.—As soon as typhus is suspected from the dulness, stiffened gait, tired appearance, and perhaps vomiting, with or without other appreciable symptoms, and from the fact that similar cases have been encountered in the same district, the practitioner should at once enjoin abstinence from exercise and from exposure to the open air. The affected animals should be kept warm and quiet.

If fortunate enough to get the cases brought for treatment in their early stage, a great deal may be done to lessen the virulence of the virus when circulating in the blood, and before the secondary infections arising from the mouth and

intestine take place, and which give rise to the oral, gastric, and intestinal lesions.

To obtain a mitigating effect I have used quinine *subcutaneously* with very good results. The following formula is very suitable:

Acid hydrochloride of quinine ...	8 grains.
Distilled water	96 minims.

Of this, 6 to 24 minims are to be injected three times a day.

The only drawback to the injection of quinine in the dog is its liability to cause an abscess, especially if the material be not aseptic or not injected sufficiently deep. It is preferably administered by intramuscular injection.

If it is deemed advisable to administer the drug in the form of mixture, the following may be substituted:

Sulphate of quinine	24 grains.
Dilute hydrochloric acid	24 minims.
Chloroform-water	to 6 ounces.

Mix.

Of this, a tea, dessert, or table spoonful should be given every four hours.

When there are acute rheumatic pains, instead of either of the above, the following powder may be dropped on the tongue three times a day:

Salicylate of quinine	2 grains.
Salicylate of soda	8 „

However, as a rule attention is not called to animals when suffering from this disease until their owners have become alarmed by the symptoms manifested, such as repeated vomiting, absolute loss of appetite, and great thirst. Gastritis or enteritis, or both combined, may then have to be dealt with.

When there is repeated vomiting—which may not necessarily be due to gastritis, but sometimes to cerebral intoxication—the bismuth salts and other gastric sedatives so valuable in simple gastritis or gastro-enteric catarrh are worthless here. I know they are highly recommended by various

writers, who seem to have reasoned from analogy rather than from the actual facts on this subject; but nevertheless in my hands they have proved of no value.

As pointed out in the symptomatology, the gastric secretion, as indicated by the vomit in this disease, is alkaline, whereas in the healthy dog it is strongly acid—a condition unfavourable for the majority of pathogenic and saprophytic micro-organisms.

It is a well-known fact that many animals under natural conditions are refractory to certain infections; but when the normal acid condition of their stomachs is overcome by neutralizing it with alkalies, infection readily takes place.

Therefore, in this disease, as the normal acid gastric juice has become replaced by an alkaline secretion, is it not reasonable to suppose that the normal saprophytic microbes of the alimentary canal, having the opportunity, take it to invade the deeper layers of the gastric mucous membrane, and set up inflammatory, and very often ultimately gangrenous, changes and general septic intoxication?

To acidify the gastric secretion with the object of destroying, or at least modifying, the injurious action of the micro-organisms contained in that viscus, I have utilized hydrochloric acid, ½ drachm to 8 ounces of water, given in tea, dessert or table spoonful doses every four hours; and when this treatment has been adopted before any structural changes in the alimentary canal have taken place, I have had very favourable results.*

I was induced to try this treatment in consequence of the success I had with it in cleansing dogs' teeth and mouths when suffering from 'foul breath.' Although tartar on the teeth is often, but not always, associated with 'foul breath,' I noticed, in using water acidulated with hydrochloric acid as a mouth-wash to assist in removing the tartar, that it not only did away with the offensive odour, but that the animals improved in appetite and in condition. I could not attribute these results to the removal of tartar, as many dogs have

* *Vide Veterinary Record*, pp. 539, 540, vol. xi., 1898-99.

tartar and no 'foul breath,' while, on the other hand, many dogs have 'foul breath' and no tartar on the teeth.

However, when structural changes of the gastric mucous membrane, or, for that matter, any part of the alimentary canal, have taken place, slight stimulating antiseptics or disinfectants are of use in modifying the diseased tissues and their products.

The mouth and teeth may be washed out a few times with a ½ to 1 per cent. solution of permanganate of potassium, a 7 per 1,000 solution of sodium chloride, or a 2 per cent. solution of hydrogen peroxide. The portions swallowed during the procedure act beneficially on the stomach and intestines.

If there be much gastric pain, cocaine hydrochloride (¼ to ½ grain), or chloretone (5 to 10 grains) in tabloids or tablets given by the mouth, or morphine hydrochloride (⅛ to ¼ grain) subcutaneously, or a mustard-plaster or leeches applied over the region of the stomach every four hours, may prove of service, not only in alleviating the pain, but also the distressing vomiting.

Stimulants, although injurious in simple gastritis, are very useful here. They may be given in the form of pure and mature brandy (Martell's or Hennessy's * * * brands are the best for this purpose), either injected under the skin or administered by the mouth in ½ to 2 drachm doses every four hours. Or the British Pharmacopœia compound tincture of cinchona in similar doses may be used for a like purpose.

Where the shock, evidenced by the dazed appearance, cold extremities, subnormal temperature, infrequent and slow pulse, is profound, subcutaneous transfusions or rectal injections of normal saline solution (sodium chloride, 7; water, 1,000), raised to a temperature of 105° or 106° F., may be tried, as also the hot-water bottle and hypodermic injection of strychnine, ether, caffein, digitalin, etc.

If such bland and easily digested nutrients as Brand's Essence of Beef (jelly), Plasmon, barley-water, etc., cannot be supported by the stomach, peptonized milk, containing common salt (7 to 1,000), meat suppositories, etc., injected or

inserted up the rectum, may be tried. Boas recommends the following nutrient enema where the stomach cannot support any nourishment :

Yolk of two eggs.	
Milk	8 ounces.
Common salt	1 teaspoonful.
Red wine	1 tablespoonful.

Even if these means of giving nourishment fail, the subcutaneous method of administering normal saline solution, sterilized milk diluted with an equal amount of water (the whole containing 1 drachm of common salt to the pint), or defibrinated blood obtained from a healthy dog, should be adopted in the case of valuable animals or very great pets.

Whatever is administered in the shape of food should be in the smallest quantity, and repeated as often as is deemed advisable. If too large a quantity be given at one time, it is likely to be rejected at once, whereas a small quantity will probably be retained.

If the thirst be great, ice broken into small pieces and pushed down the back of the mouth, citrated water, lemon-juice, aerated soda-water in small and repeated quantities, or the subcutaneous transfusion of boiled water, may appease the animal's craving.

After the acute symptoms have abated—*e.g.*, no vomiting for at least thirty-six hours—and the animal begins to wander about as if seeking for food, a tea, dessert, or table spoonful (according to the size of dog) of *scraped* raw beef should be offered, and if taken and retained a similar quantity should be allowed every four hours for at least twenty-four hours, and then, if well supported, increased from day to day. The compound solution of bismuth, containing nux vomica and pepsin, is useful in this stage of the complaint.

When there are any gangrenous ulcers inside the cheeks, lips, or on the gum surrounding the teeth, or gangrene of the tip of the tongue, the sloughing process should be encouraged by painting the surrounding living tissues with the glycerin or tincture of iodine, nitrate of silver, chloride of zinc, etc.

As soon as the dead parts become loose they should be removed, and the remaining ulcerated surface dressed with tincture of iodine, peroxide of hydrogen, etc.

When there are any loosened teeth they should be removed, and if the bone surrounding the alveoli be exposed and necrotic, it should be mopped with dilute hydrochloric acid, and allowed to exfoliate. It is not advisable to remove it surgically, as general infection is likely to ensue, causing great suffering, if not death. If the animal survives, the necrotic bone will soon exfoliate itself.

Hygienic and dietetic precautions should be observed for some time after the dog has apparently recovered from typhus, as a too speedy return to his normal diet, too much food given at one time, or exposure to chill, fatiguing exercise, etc., are far too common causes in bringing about fatal relapses in animals apparently recovering from a mild attack of this malignant disease.

CHAPTER XX

ON SOME MINOR OPERATIVE MEASURES AND PROCEDURES ASSOCIATED WITH THERAPEUTICS

ALTHOUGH, properly speaking, the measures which we intend to notice briefly in this section are more or less of a surgical character, yet they are so closely associated with therapeutics that a work on the subject would not be complete without a description of their technique. The therapeutist may at any time during the treatment of a case be called on to carry out these procedures, hence it is essential for the student to be familiar with their technique as well as the indications for their employment.

The former is an art, and requires manipulative dexterity in addition to a knowledge of surgical anatomy. Being an art, it must be acquired by actual practice, and proficiency cannot be attained by reading descriptions in textbooks. This art should be taught to the student in a practical manner, so that he may be able to carry out the various procedures with confidence and dexterity, and not be compelled to obtain the necessary knowledge by making first attempts on his clients' animals when he starts in practice. In the present day, stock owners have many opportunities of obtaining a knowledge of veterinary matters, and, however superficial this may be, it enables them to observe and to criticize the manner in which the practitioner deals with simple manipulative measures, while, on the other hand, they

are incapable of drawing conclusions with reference to the scientific aspect of professional work. Hence the necessity for manipulative dexterity on the part of the junior practitioner, and a practical acquaintance with what might appear to be commonplace duties. Not infrequently it happens that the recent graduate, while fully equipped as regards scientific knowledge, is hopelessly 'at sea' when he is called on to carry out some simple measure requiring the exercise of 'art,' and he often suffers severely in reputation as a result.

Passing the Probang.

This is resorted to for the relief of 'choking' when simple measures fail. In all animals it requires a considerable degree of skill and dexterity in order to avoid serious damage to the œsophagus. It should not be resorted to in a hasty or indiscriminate manner, and simple measures should always be given a trial before the probang is used.

In the Horse, the safest form of probang is one composed of gum-elastic. In many instances the instrument can be passed with the animal in the standing posture. Nervous, excitable horses require to be cast before the procedure can be attempted with safety. Instruct the assistant to keep the horse's head in such a position that the mouth and pharynx may be in as straight a direction as possible. Smear the probang with lard. Insert a reliable mouth-gag in the animal's mouth. Leave the tongue free. Pass the probang very slowly and carefully over the base of the tongue and epiglottis. The horse usually makes a movement of deglutition, and the instrument then passes readily into the œsophagus. When it reaches the foreign body, apply a gentle, intermittent pressure. Do not employ force, as rupture of the gullet is likely to be produced. Make sure that the instrument does not enter the trachea instead of the gullet—an accident that may very readily happen. If the probang enters the trachea, it passes downwards very easily, and the presence of air passing in and out can be detected if the operator applies his ear to the proximal end of the

instrument, while coughing and dyspnœa will occur in some cases. The most reliable test is to palpate the region of the left jugular furrow, and if the probang be in the gullet it can readily be felt.

Remember not to employ the probang in cases of choking with dry food, as this would convert the obstruction into a hard mass, and very likely bring about rupture of the gullet when pressure is applied to the instrument. In cases of choking with dry food, adopt massage; try the effect of a hypodermic injection of ¾ grain of apomorphine hydrochloride, and, if these fail, pass a Knisely's double stomach-tube (see p. 824) as far as the obstruction, and carry out irrigation of the gullet.

In the Ox, the procedure of passing the probang is much easier. Fix a wooden perforated gag in the animal's mouth, and secure it by a strap round the base of the horns. Get two assistants to steady the head by holding the arms of the gag. Proceed as in the horse. When the obstruction is reached, use judicious pressure or gentle tapping, and exercise patience. Sometimes the probang will slip past the foreign body and enter the rumen, so it is advisable, when the instrument passes downwards in too easy a manner, to retract it a few inches and again push it gently until it enters the stomach. The latter event is evidenced by the passage of gas from the proximal end of the tube. If the animal attempts to rear up during the procedure, desist; and if this performance be repeated, abandon the use of the probang and try other measures.

Remember that 'tubing' is an operation very frequently attempted by owners of cattle and empirics, and rupture of the gullet is not uncommon as the result. In such instances it is not unusual for the services of the practitioner to be requisitioned without informing him of the operative attempts which have been made. If the practitioner knows or suspects that the case has been tampered with, he should first express his suspicions to the owner, and then pass the probang very carefully down to the obstruction and immediately withdraw it; and if the instrument be found smeared with blood, it is

an indication of injury or rupture of the gullet, and the owner should be so informed.

Remember, also, if a swollen and emphysematous condition of the neck be observed in a case of choking, it is clear evidence that an empiric has been at work, and the practitioner should refuse to pass the probang, otherwise he will very likely be blamed for causing the lesion.

Finally, remember that a foreign body may be in the region of the pharynx, or at the commencement of the gullet and within reach of the operator's hand. In such a case do not employ the probang.

In the Dog various patterns of probangs are employed. In the case of needles, pins, fish-bones, etc., in the gullet, an instrument composed of horsehair at its extremity is useful, as during its withdrawal the above-mentioned bodies may be removed. Another useful probang is one made of flexible steel wire, on the distal extremity of which a smooth conical metal top is screwed. These metal tops are of various sizes to suit small, medium, or large dogs. Lubricate the instrument with lard. Insert a speculum in the dog's mouth. Pass the instrument carefully along the palate in the median line (the tongue being depressed by the fingers of the left hand), over the epiglottis and into the gullet, taking care that it does not enter the trachea. When the foreign body is reached, apply gentle pressure. Avoid force, as rupture of the gullet may be produced. If gentle pressure fails to dislodge the foreign body, œsophagotomy must be performed.

Passing the Stomach-Tube.

In the Horse this instrument is employed in the treatment of gastric impaction and gastric tympany, and also in the treatment of obstruction of the œsophagus by dry food, or in the case of a foreign body lodged in the thoracic portion of this organ.

Opinion is divided as regards the best form of tube for these purposes. Some practitioners prefer a double tube, others a single tube. It is also a matter of opinion as to

whether the tube should be passed by way of the nostril or by the mouth. If the former be selected, a single tube is necessary, as the double one would be too bulky. We prefer the route by the mouth, and hence shall describe that method first. The object of the tube in the case of the gastric affections mentioned is—(1) To give exit to the gases present. (2) To withdraw ingesta by means of gastric lavage. (3) To introduce gastric disinfectants into the stomach.

D. O. Knisely, of Topeka, Kansas, is the inventor of the double stomach-tube. This pattern is favoured by many American practitioners. We may remark that considerable practice is necessary in order to become expert in passing any pattern of tube, more especially when the horse is restive, as is often the case in gastric diseases.

Knisely's tube is made of soft rubber. It is 10 feet in length, is double for 7 feet, and has the balance in two separate tubes. Where the tube is double the parts are vulcanized together. The separate tubes consist of—(1) One with a small opening ($\frac{1}{4}$ inch in diameter) through which water is pumped into the stomach by means of a continuous-flow injection pump. (2) The other tube is larger ($\frac{1}{2}$ inch in diameter), and is the outlet through which food and gases will escape from the stomach.

The technique is as follows:

1. Pour 2 ounces of oil into the large opening, so that the stilette can be withdrawn easily when the tube enters the stomach; insert the stilette to within $1\frac{1}{2}$ inches of the end of the tube. Lubricate the outside of the tube with a decoction of slippery elm-bark (oil should not be used for this purpose, as it damages the rubber).

2. Fix a speculum in the horse's mouth. Place the left hand over the tongue and pass in the tube slowly and gently; when it enters the pharynx, the horse will make a 'swallowing movement,' and thus assist the passage of the instrument into the gullet. After it has been passed for about 1 foot, draw the stilette back about 6 inches and pass the tube into the stomach. Withdraw the stilette and fix the pump connection to the larger of the two tubes, and pump in enough

water to form a syphon. When that is started, change the pump connection to the smaller of the two tubes; then pump slowly, so as to keep a small stream of water running. When the large tube ceases running, change the pump connection back to it, and pump rapidly about half to two-thirds of a pail of water into the stomach.

If the tube be passed too far into the stomach, the pump will not work freely. In that case, withdraw the tube about ½ to 1 inch.

If relief be not obtained in from thirty minutes to one hour, repeat the procedure.

3. Care should be taken that the tube does not enter the trachea. This accident occurs very easily, and it is remarkable how little respiratory distress it occasions at the time.

In order to detect this occurrence, palpate the left jugular furrow while the stilette is in the tube, and feel for the presence of the instrument in the gullet. On no account commence the pumping until you are certain the tube is in the right place.

Treman advises that, in passing the double tube, a small strap should be drawn tightly round the nose, just high enough to avoid interfering with respiration. The tube is then passed through the interdental space of one side, and down the gullet as usual. By this means the animal breathes much easier than when a mouth-gag is used, and hence does not resist so strenuously; moreover, the tube is less liable to enter the trachea when so used than it is when the mouth is held open.

Treman, however, prefers a single tube, and adopts the nasal route. An assistant holds the horse's head firmly, and the operator passes the tube (without the stilette) along the floor of the nasal passage into the pharynx. When the tube reaches the latter region, the patient will involuntarily make a 'swallowing movement'; the operator then rapidly shoves in about 4 inches of the tube, which generally enters the gullet. In case the tube happens to 'stop' just before entering the stomach, a stilette is necessary, and Treman

recommends the insertion into the tube of a thin wire used in a double fashion.

The single tube acts as a syphon, and it is said that, when of proper calibre, it will permit the passage outwards of whole grains of corn.

Merilatt also favours the single tube and the nasal route, but employs a stilette, and states that when this is used the instrument very seldom enters the trachea. Moreover, a tube containing a stilette can readily be felt in the œsophageal region.

This author also states (and we can confirm its accuracy), that the only real warning that the tube has entered the trachea is the ease with which it passes into this organ as compared with the force required to push it down the œsophagus.

As regards the employment of the double tube in cases of 'choking' with dry food, Knisely advises as follows:

Pass the tube down to the obstruction. Pump in water through the large opening. When the tube is full, change the syringe quickly to the small opening, and pump in water. A continuous stream of water is thus produced, which issues from the large opening, bringing with it a large amount of ingesta from the gullet; the remainder passes down to the stomach. If the obstruction has been in existence for some days, this method will fail. Then make an incision in the gullet just above the seat of the obstruction, insert the tube into the opening made, and pump in water.

When the obstruction is situated in the thoracic portion of the gullet, and ordinary measures fail, pass the tube down to the obstruction, expose the œsophagus in the neck, but do not make an incision into it. Pass a soft tape round the organ, and carefully tie it so that the œsophageal wall is in firm apposition to the tube passing through the gullet.

Pump in a full stream of water through the large end of the tube. This gradually distends the gullet below where the ligature is placed, and may have the effect of displacing the obstruction and enabling it to reach the stomach; or an opening may be made in the œsophagus as far down as

possible in the neck, and the tube is then inserted through this opening and water pumped in as already described.

In the Ox the stomach-tube can be passed in the same manner as the probang. It is a very simple procedure.

In impaction of the rumen, irrigation gives excellent results, and, in fact, for all diseases of the stomach the introduction of large amounts of hot water proves beneficial.

Puncture of the Intestine.

This is performed for the relief of acute intestinal tympany (flatulent colic) in the horse (see p. 627). It is a very simple procedure. The instrument employed is a trocar and cannula from 6 to 8 inches in length, the calibre of the cannula being from $\frac{1}{8}$ to $\frac{1}{5}$ inch in diameter. The side of the body selected is that on which the distension is most marked. The **site** of operation is at a point equidistant from the last rib, the anterior angle of the haunch, and the transverse processes of the lumbar vertebræ. The instrument is introduced at this point and the trocar withdrawn, leaving the cannula *in sitû* until all the gas has escaped. It sometimes happens that after the withdrawal of the trocar no gas escapes; this may depend on the cannula being blocked by ingesta, or the instrument may not have entered the portion of bowel containing the gas. In the former case pass a long whalebone probe up the cannula in order to remove the obstruction. In the latter instance, withdraw the instrument and reinsert it at a point 1 or 2 inches removed from the seat of the first puncture, or at the opposite side of the body if the distension occurs on both sides. The only undesirable sequel to the operation is the occurrence of an abscess at the seat of the puncture. This depends on contamination of the wound in the muscles by material from the bowel during the withdrawal of the cannula. The abscess is formed outside of the peritoneum. and the pus tends to find its way towards the skin. As a preventive measure it is advised to reinsert the trocar before withdrawing the cannula, and to exert firm pressure on the abdominal wall

around the instrument while withdrawing it. Even this precaution fails in some cases. Sterilization of the instrument will not prevent abscess formation, but obviously it is advisable to insure that it is surgically clean, so as not to introduce infection from outside the body.

The treatment of the abscess consists in carefully locating the pus cavity by means of an exploring needle, and making a free incision so as to afford efficient drainage. Care should be taken to avoid puncturing the peritoneum. In some cases the development of the abscess is very slow, and we have met with instances in which no evidences of its presence were apparent until two weeks subsequent to the operation.

Puncture of the Rumen.

This operative measure is carried out on the ox for the relief of tympany of the rumen (hoven); see p. 594. It is a very simple procedure, and is often performed by cattle owners. A large trocar and cannula is necessary. The site of puncture is at the most prominent part of the distension on the left side—*i.e.*, at a point equidistant from the last rib, the external angle of the ilium, and the transverse lumbar processes. Considerable force is necessary in order to penetrate the skin in cattle. During the procedure the operator should stand as close to the fore part of the animal as possible, so as to be out of reach of the kick which not infrequently follows the puncture of the skin. On withdrawal of the trocar, it is advisable to exert firm pressure on the shield of the cannula, so as to prevent its displacement sideways, which is apt to occur as soon as the swelling is somewhat relieved. It is generally necessary to permit the cannula to remain *in sitû* for some time after the gas has been evacuated, in order to prevent a recurrence. If, when the instrument is introduced into the rumen and the trocar withdrawn, only a small amount of free gas escapes, followed by a bubbling of semi-fluid material, this method of treatment will fail (see p. 594).

Paracentesis Abdominis ('Tapping' for Abdominal Dropsy).

In the Horse this operation is seldom called for, as ascites is not common in equines, and when present is usually associated with an incurable disease, so that operative measures can only be palliative. The **site** for operation is close to the linea alba, and midway between the xiphoid cartilage and the pubis. Möller advises that the side of the abdominal wall should be selected as more convenient, the horse being operated on in the standing position. The instrument employed is similar to that advised for puncture of the intestine. It should be sterilized by boiling. The hair is shaved from the site of operation, and the latter disinfected with tincture of iodine. The instrument is held with the handle in the palm of the operator's hand. With the fore-finger on the cannula, he limits the distance to which the instrument can penetrate (Möller advises from 1¼ to 2 inches). As soon as the cannula has entered the abdominal cavity, the trocar is withdrawn and the fluid is allowed to escape. The cannula is then withdrawn, and the seat of puncture is again painted with iodine.

In the Dog the operation is frequently demanded, as ascites is a comparatively common condition in this animal. The treatment can only be palliative, but, nevertheless, by adopting it a favourite animal's life can often be prolonged. Either a small trocar and cannula or an aspirator may be employed; the latter is preferable, for the reason given farther on.

The site of operation selected is a point midway between the umbilicus and the pubis, close to the linea alba. The animal may be placed on its side or on its back. When in doubtful cases an exploratory puncture is made, the latter position is preferable, as the intestines are not then in contact with the inferior abdominal wall. After the instrument is inserted and the trocar withdrawn, the animal can be laid on the side. We think that it is best not to operate with the dog in the standing posture, as in this position there is more risk of syncope occurring. Strict aseptic precautions

should be observed. The fluid should be withdrawn slowly, so as to avoid the danger of collapse owing to a sudden fall in blood-pressure consequent on removal of the pressure from the abdominal vessels. If there be no evidences of cardiac weakness, the fluid may be allowed to flow until it ceases spontaneously. The cannula is then withdrawn and the site of operation disinfected with iodine. A pad of antiseptic wool and a broad bandage are then applied to the abdomen. Not infrequently it happens that, although a large amount of fluid is present, it cannot be withdrawn by means of the trocar and cannula. The reason suggested is that the opening of the cannula becomes blocked by the omentum. In such cases the aspirator should be employed.

A word of caution is necessary in performing *paracentesis abdominis* in cases of cardiac disease, more especially if accompanied by asthma. The owner of the dog should be informed that sudden collapse may occur, followed by death, just as the operation is completed. In order to prevent such a calamity, the state of the heart should be carefully watched, and the necessary equipment to overcome a sudden fall in blood-pressure should be at hand. A hypodermic injection of brandy, ether, and adrenalin, should be given on the first signs of cardiac weakness. The inhalation of the fumes of strong liquor of ammonia is useful as a stimulant.

Paracentesis Thoracis ('Tapping the Chest').

The indications for this operation will be found on p. 707. It is a very simple procedure, and if performed early, and with a due regard to aseptic precautions, it exerts very beneficial effects in cases of pleuro-pneumonia and pleurisy in the horse.

The **site** of operation selected by some practitioners is the intercostal space on the right side, about 4 inches behind the point of the elbow (when the horse is standing with both fore-legs level). W. Williams advised the fifth or sixth intercostal space, as near as possible to the anterior margin of the rib (so as to avoid wounding the intercostal artery).

When there is obstruction in the communication between both pleural cavities, it may be necessary to select the left side instead of the right, in which instance care should be taken to avoid injury to the heart. The operation is carried out by means of a trocar and cannula of fine dimensions, as follows: Sterilize the instrument by boiling. Disinfect the site of operation with tincture of iodine. Insert the instrument in the intercostal space at the point mentioned for a distance of $1\frac{1}{2}$ to $2\frac{1}{4}$ inches. Withdraw the trocar and let the fluid come away, keeping the cannala *in sitû* until the entire amount is drawn off. Then withdraw the cannula and again apply iodine to the site of operation.

Precautions with reference to not permitting the entrance of air, and not withdrawing all the fluid at one time, are quite unnecessary. The important matter is to adopt aseptic precautions and to carry out the operation early. The utility of the operation has been adversely criticized, and unfortunate sequelæ ascribed to its employment, but these are in reality due to delaying the procedure until too late. Clinical experience has amply demonstrated its utility and its safety.

Paracentesis Pericardii ('Tapping the Pericardium').

This is employed in cases of extensive pericardial effusion. The site of operation selected is the fifth or sixth intercostal space of the left side. A fine trocar and cannula is employed. The instrument should be directed upwards and inwards so as to avoid wounding the heart. Strict aseptic precautions should be observed.

Intratracheal Injection.

Administration of medicinal agents by way of the trachea is occasionally resorted to where rapidity of action is desired. But this mode of administration is chiefly confined to the injection of a solution of iodine in the treatment of purpura hæmorrhagica (see p. 755), and of an emulsion containing oil of turpentine and other vermicides in the treatment of parasitic bronchitis in calves.

Intratracheal Injection in Purpura.—A special intratracheal syringe having a curved cannula is best. Rigid aseptic precautions are necessary. Instruct the attendant to support the horse's head on his shoulder. Insert the cannula between two rings of the trachea in the upper third of the organ. Fill the syringe with the solution and attach it to the cannula. Inject *very slowly*. Take care to prevent the larynx from sinking below the level of the cannula, by instructing the attendant to keep the head sufficiently raised. If the larynx be permitted to sink below the operation point, or if the fluid be injected too rapidly, a portion of the latter, aided by the expired air, gravitates towards the larynx and induces a violent fit of coughing.

The syringe is refilled and the process is repeated. When the operation is concluded, disinfect the skin with tincture of iodine.

Intratracheal Injection in Cases of Parasitic Bronchitis (Hoose) in Calves.—This is a simple procedure when the operator becomes adept at it. The best instrument is a syringe fitted with a strong curved, pointed cannula. An assistant should hold the animal's head upwards so as to keep the neck in a straight line and render the trachea tense. Make a small incision in the skin so as to expose the trachea in the upper third. Insert the cannula between two rings of the trachea, so that the point of the instrument is directed downwards. Attach the syringe containing the dose (see p. 443) to the cannula, and inject slowly. A fit of coughing is an indication that the medicament has entered the bronchi, and not the surrounding tissues.

In small calves considerable difficulty is often experienced in inserting the cannula, and the beginner not infrequently injects the medicine into the surrounding tissues. It is of advantage to have a metal handle to plug into the cannula when inserting the instrument.

Here we may point out that, in far-advanced cases of hoose, intratracheal injections are liable to accelerate death, and it is wiser not to attempt the operation in such instances.

Artificial Respiration.

This procedure is employed during chloroform anæsthesia, when the respirations become short, spasmodic, jerky, or shallow, or when respiration ceases.

In the Horse the tongue should be drawn well forward, and the animal's head held for a moment in such a position that any fluid which has accumulated in the pharyngeal region can escape. In carrying out artificial respiration, Hobday advises that the ribs over the thorax should be compressed in a rhythmical manner by the operator, who, by placing the palms of both hands on the ribs and throwing the weight of his body thereon, brings about the movements of respiration in the animal. Or, in the case of a heavy horse, the operator (with his boots off) stands on the thorax and raises his legs and body upwards and downwards, being supported in his position by a colleague ('Anæsthesia and Narcosis of Animals').

Merillat (paper on 'Respiratory Anæsthesia in Animals,' Tenth International Veterinary Congress) recommends the following as the best method of restoring the respiratory function: The operator should press his foot into the horse's abdomen firmly and deeply, but not roughly, at first three times per second, and then more frequently if no success be obtained. Care must be taken not to obstruct a spontaneous inspiration that might be taken while the procedure is being carried out. Simultaneously the assistants should extend the head, allow fresh air, draw out the tongue, remove the hobbles, and as soon as possible the patient should be turned to the opposite side so as to prevent blood-stasis. A hypodermic injection of strychnine is then given. 'When these means fail in the horse, little else can be done—the patient is dead.'

This is in accordance with our experience, but, in some of the fatalities we have observed during chloroform anæsthesia in the horse, death has occurred very rapidly, suggesting a cardiac implication (see p. 305).

In the Dog, provided the action of the heart does not

cease, we have found that more success is likely to attend the employment of artificial respiration than in the horse. Even in cases that are apparently hopeless, artificial respiration should be kept up, for so long as the heart beats there is hope. The procedure is as follows: Place the animal on its right side, and arrange so that the head is at a lower level than the body. With the hand or fingers compress the ribs sharply and let them suddenly expand. Keep up this action in a diligent manner until there are evidences that the respiratory movements are returning. Once breathing starts we may hope for success, but the case must be carefully watched. We have no faith in drugs as an adjunct to artificial respiration.

Catheterization (Passing the Catheter).

In the Horse the chief difficulty often consists in drawing the penis out of the sheath, as in many instances the animal retracts the organ just as it is being grasped by the operator. Considerable patience is required, and in some cases the application of a twitch to the animal's upper lip succeeds in distracting his attention so that the organ can be exposed. No force should be employed, gentle traction being all that is necessary. Lubricate the catheter with lard, and pass the instrument carefully into the urethra, using slow, steady pressure. No obstruction to the passage of the catheter is felt until the instrument enters the bend of the urethra at the ischial arch. An assistant should then insert his finger in the rectum, and direct the distal end of the catheter forwards towards the bladder, while the operator, with gentle pressure, pushes the instrument onwards and retracts the stilette for a few inches. When the catheter enters the bladder, the stilette is fully withdrawn, and the urine then escapes.

In the Mare the procedure is a very simple one. The catheter employed is a short gum-elastic one. The operator inserts his left hand into the vagina and locates the opening of the urethra in the vaginal floor, and places his index finger therein. The catheter is introduced with the right hand,

and guided into the urethral opening by means of the index finger of the left hand. The urethra of the mare is so dilatable that, in cases of emergency, two fingers can be introduced therein, and this manipulation is often sufficient to produce urination.

In the Bull or Ox, owing to the **S**-shaped curve in the urethra, the catheter cannot be introduced farther than this point. Hence, in cases of retention of urine, it is necessary to make a longitudinal incision in the urethra above the curve, and insert the catheter by this means.

In the Cow the procedure is similar to that advised for the mare ; but considerable difficulty is often experienced by the beginner, owing to the presence of a thin membranous valve which guards the urethral opening. In passing the catheter, this valve should be lifted upwards by the index finger of the left hand, and the point of the instrument introduced beneath it.

In the Ram the urethra possesses an **S**-shaped curve similar to that in the bull; hence ordinary catheterization is not possible. Moreover, owing to the free portion of the urethra (vermiform appendix), which extends beyond the penis, it is difficult to introduce a catheter. Because of the difficulty in performing urethrotomy (making an incision in the urethra) in this animal, many authors advise amputation of the vermiform appendix when retention of urine is due to the presence of a calculus close behind the free end of the urethra (which is the usual location for a calculus of the kind). In such a case, when the vermiform appendix is removed, the urine is passed freely. If, however, retention of urine depends on obstruction farther back, or on other causes, it is necessary to carry out urethrotomy at the ischial arch. (See works on veterinary surgery.)

In the Dog the technique of catheterization is very simple. The instrument employed is a gum-elastic catheter. The length and diameter must be selected according to the size of the dog. The instrument should be well lubricated. Place the dog on his left side, and instruct the assistant to draw the right hind-leg well forward. Expose the glans

penis by pressing back the prepuce. Introduce the catheter carefully into the urethra, and pass it gently. As it enters the portion of urethra passing through the groove in the os penis, a slight obstruction will be encountered, which is easily overcome. When the ischial arch is reached another slight obstruction is met with, and the stilette should be withdrawn for a short distance. The instrument can now be passed into the bladder without difficulty; the stilette is then fully withdrawn, and the urine escapes.

In the Bitch.—In small bitches considerable difficulty is often experienced in passing the catheter, especially by beginners. Some practitioners employ a vaginal speculum, but this procedure is generally resisted by the animal. Jakob (*Münchener Tier. Woch.*) advises the operator to place his thumb and fore-finger on the external vulvar region, drawing the vulva backwards to a moderate degree, and then to introduce the catheter by way of the upper vulvar commissure. By exerting a moderate degree of pressure with the fingers externally on the vulvo-vaginal region (which in small bitches is not more than $1\frac{3}{5}$ inches distant from the vulvar lips), the catheter is generally prevented from missing the opening of the urethra. In the larger breeds, the procedure can be carried out with the animal in the standing posture, and the catheter can be guided by the fore-finger of the left hand into the orifice of the urethra, which is located as a small opening on the floor of the vagina.

Jakob (*ibid.*) advises that the animal be placed on her side, and that the operator should introduce his fore-finger, slightly bent, and draw the entire vulva slightly backwards, while the thumb and middle finger, placed respectively on the upper and lower vulvar regions, exercise a moderate pressure upon them. By this means the catheter, when introduced, is prevented from slipping past the opening of the urethra. The drawing backwards of the vulva brings the urethral opening nearer to the vulvar lips, and the opening can be best reached by introducing the catheter in a direction level with the axis of the body. As regards the instrument, one made of gum-elastic is preferable.

In the Male Cat, owing to the large number which succumb as the result of urethral obstruction, due in most cases to a collection of sabulous material in the urethra, and occasionally to calculi, we deem it necessary to describe the technique of catheterization in this animal. Complete urethral obstruction leads to retention of urine in the bladder, and, unless relieved, causes death from uræmia. In the diagnosis and treatment of this condition, the catheter must be employed.

H. Gray, who has devoted special attention to the subject, and invented a catheter suitable for use in the cat, describes the procedure of catheterization as follows:*

'Gum-elastic catheters are useless for the cat. The instrument required is a fine, straight, metal catheter, about 5 or 6 inches in length. Three different sized catheters should be kept in stock, as the lumen of the urethra varies according to the size or age of the cat.

'Place the animal on the left side. Instruct an assistant to hold the two fore-legs with his left hand, and the right hind-leg with his right hand, the left or under hind-leg being free. Press the penis out of its sheath with the left hand. With the right hand pass the catheter gently into the urethra in a perpendicular direction until it reaches the floor of the pelvis, where it meets with some resistance. Direct the instrument gently in a backward direction until it is in a straight line with the pelvic floor, carefully pass it into the bladder, and withdraw the stilette. The urine will then escape.

'In the case of obstruction due to sabulous matter, no cutting operation is necessary. When the obstruction is situated low down, it can be extruded by pressing the end of the penis between the thumb and index finger. When located higher up, it can be pushed into the bladder by means of the catheter. If it is deemed necessary to wash out the bladder, this can be accomplished by attaching a rubber douche or syringe to the catheter.'

In carrying out catheterization in all animals, it is important

* For full details *vide* 'A System of Veterinary Medicine,' vol. ii., pp. 784, 786.

to remember that the instrument employed should be thoroughly cleansed in an antiseptic solution prior to use. This is especially necessary when the procedure has to be repeated.

Uterine Irrigation in the Mare and Cow.

This is employed in the local treatment of metritis, and its value, when properly performed, is undoubted.

The best instrument for the purpose is the double stomach-tube described on p. 822. By its use a thorough irrigation can be carried out, and the uterus can be completely drained of fluid. A continuous-flow injection pump is attached to the small end of the tube, and the technique is somewhat similar to that described for lavage of the stomach. The antiseptic solution employed should not be too strong. In our experience a 1 per cent. solution of Cook's Klondol Fluid is most efficient. After this has been syphoned off, a uterine pessary composed of iodoform, boric acid, and chinosol, should be inserted into the uterus and left *in sitû*. The irrigation should be repeated at suitable intervals. When the fœtor of the discharges has been overcome, the injection should be changed to a 5 per cent. solution of sodium chloride.

Bier's Hyperæmic Treatment.

This is a therapeutic measure introduced by Bier for the treatment of various suppurative and inflammatory processes. It consists in inducing a condition of passive hyperæmia by the application of an elastic bandage applied above the diseased part for a certain period daily. The effects produced depend on the bactericidal, resorbent, and anodyne action of the procedure, which also favours the regeneration of tissue.

Passive hyperæmia—*i.e.*, venous congestion—can be induced in the extremities either by means of an elastic bandage or a rubber ring. In the horse the elastic bandage is preferable. It should be applied as far above the diseased area as possible, and drawn sufficiently tight to partially obstruct the venous circulation without interfering with the arterial flow.

C. Hartley,* who has given this treatment a fair trial, and obtained excellent results, advises the following technique:

1. The bandage should not be applied so tightly as to cause pain, or to interfere with the voluntary movement of the limb. The limb should remain as warm as, or even warmer than, the corresponding one of the opposite side, and the pulse (if it can be palpated) below the bandage should be clearly perceptible.

2. The bandage should always be padded underneath with plenty of cotton-wool.

3. In the fore-limb the bandage should be applied around the fore-arm, and in the hind-limb around the tibia as high as possible, to avoid undue pressure on the tendo Achillis. To prevent slipping, fasten a layer of cotton-wool to the hair by means of some adhesive application.

4. The length of time which the bandage should be left on varies from four hours twice daily to twelve hours on and twelve hours off, alternately.

5. The procedure lessens pain, checks infection, has an attenuating affect on bacteria, and favours absorption and regeneration. The diminution of pain is one of the most notable effects of the treatment. The result of the compression is to cause a great slowing and widening of the blood-current in the parts below where the bandage is applied; there is an outpouring of serum into the tissues and an emigration of leucocytes. Probably it is owing to the serous infiltration of the tissues, which diminishes the sensitiveness of the nerves (similar to the infiltration anæsthesia of Schleich), that pain is relieved.

Sheather found the treatment useful in the following conditions: Suppurative wounds of the coronet, quittor, infected bursæ (capped hock), and laminitis. He points out that surgical attention in the case of suppurative conditions is essential as an adjunct to the treatment, such as the evacuation of pus and providing efficient drainage.

In small animals (dogs and cats) a rubber ring well padded with cotton-wool is employed, and is applied either

* *Veterinary Journal*, 1914, vol. lxx., p. 215.

above the elbow or the hock, for four hours on and four hours off, alternately, and after a week this is increased to twelve hours on and twelve hours off, alternately.

Bichot records a case of apparently hopeless penetrating wound of the foot in a colt (due to puncture by a nail) in which recovery resulted from the application of an india-rubber bandage to the middle of the cannon bone, for an hour, morning and evening. The period of treatment was thirty-seven days. Surgical measures were also adopted.*

Cases have also been recorded by Sampson, Pillers, and Irving.

From the evidence before us, it is quite clear that the hyperæmic treatment is well worthy of a trial as an adjunct to surgical measures, in conditions such as those mentioned.

Firing.

In former times the operation of 'firing,' or, as it is technically termed, the 'application of the actual cautery,' was carried out in an indiscriminate manner. Not only was it adopted as a curative measure for various forms of lameness in the horse, but it was employed as a so-called preventive. The latter idea was so prevalent that it was not uncommon to find, in certificates of soundness, remarks such as, 'The horse is fired on both hocks.' To us in the present day such a state of affairs is justly regarded as barbarous in the extreme, and we should not draw attention to it here if it were not for the fact that some horse owners in the present day request the operation to be performed when they imagine that a horse is 'starting to grow a spavin' or to 'spring a curb.' Needless to remark, no conscientious practitioner would be guilty of such cruel or dishonest conduct as to carry out an operation for which there is no necessity or utility. It is obvious that, although we can perform the operation in a painless manner by the use of a local or general anæsthetic, it is not possible to prevent the pain which must follow the high degree of irritation of the skin

* *Veterinary Journal*, vol. lxx., p. 514.

set up by the cautery. Hence the operation should not be carried out without due consideration of the benefits to the animal and its owner which are likely to be derived from it. Firing 'for prevention' ought to be made an offence under the Protection of Animals Act. Further, it should be made illegal for farriers and empirics to attempt the operation. At present much cruelty is perpetrated by unqualified persons who apply the actual cautery in an ignorant and barbarous manner to the limbs of horses.

Lack of space will not permit us to discuss the various theories set forth with reference to the manner in which the application of the actual cautery produces beneficial results in diseases of tendons and joints. We must point out that not infrequently the apparent beneficial results are due to the period of rest which is essential after the operation.

There are conditions in which firing is not only useless, but harmful. For example, during the acute stage of a strain of the flexor tendons counter-irritation is harmful; also, in cases where a contracted condition of the flexor tendons is present, firing tends to increase the contraction, and should not be employed. We fail to see what benefit can result from 'firing' in cases of 'sidebones,' more especially when we have no clear evidence that such a condition *per se* is ever a cause of lameness. We admit the value of the operation in cases of strains of the flexor tendons, or of the suspensory ligament (when the acute stage has passed), in sesamoiditis, in bone-spavin, in curb, and in splints. We are very sceptical of its value in cases of ringbone lameness.

It is a popular idea that 'firing' is able to reduce bony enlargements, such as spavin, ringbone, splints, etc. Clients, however, should be informed that our object in applying the actual cautery is to enable the horse to go sound—in popular language, to 'cure the lameness.' The practitioner who leads his clients to the belief that he can reduce or remove bony enlargements by this means has not long to wait until his assumed skill is appreciated at its proper value.

In preparing a case for the operation of firing, it is

advisable to lay the horse off work for a reasonable time, and to apply cold water by means of a hose-pipe until any existing inflammation is reduced. As already remarked, the operation should not be performed on recent cases of strained tendons, etc., while heat and pain are present in the parts.

In preparing the seat of operation, clip off the hair as close as possible, and wash the skin thoroughly with antiseptic soap and warm water. This should be carried out some time before the operation, so as to have the skin dry prior to applying the cautery.

The following points are of importance:

1. As regards the **instrument.** The thermo-cautery possesses such advantages over the old-time 'firing-iron' that it is now largely employed. The advantages are—(*a*) Convenience, no fire being required. (*b*) An even temperature can be maintained. (*c*) The operation can be more neatly carried out and far less blemish results.

In the present day we do not observe many cases of blemished limbs in horses as the result of firing. But sufficient are met with to indicate that some practitioners lack technical skill, and the result of their handiwork, so far as crooked and uneven lines and permanent loss of hair are concerned, constitute a living reproach to the operators. Firing is one of the procedures which illustrates the fact that art and manual dexterity are essential attributes in the practitioner.

In our experience, the best instrument is Dechery's 'autocautery.' It is worked with facility and is not likely to go out of order, provided ordinary care is adopted. For heating the instrument, methylated ether (specific gravity 0·720) may be employed. We have found that the instrument supplied by Messrs. Sharp and Smith, of Chicago, is more satisfactory than others we have tried; moreover, the attachment for line firing is a great improvement on the Continental pattern. The most important matter in connection with the heating of the instrument is to make sure that the minute aperture in the head is free from grease or other obstruction. This opening can be kept free by means of a very fine wire, and

before starting to heat the cautery it is well to see that, when the regulator is turned towards the left, a fine stream of ether issues from the aperture.

2. As regards **technique**, either firing in lines or in the form of pyropuncture may be chosen. For thickened tendons, curbs, etc., **line** firing is preferable. The lines should be drawn with a proper distance between them (about ½ inch), and they should be even and on no account penetrate the skin. The depth must depend on the nature of the case; if severe effects be desirable, deep firing is required. When the latter is carried out, a larger space should be left between the lines. The cautery is applied first at a dull red heat, so as to trace the pattern on the skin. It is then applied to the same lines at a greater heat, being drawn lightly, evenly, and carefully, along the skin a sufficient number of times, until the desired depth is obtained. No pressure should be used, the weight of the instrument being quite sufficient. The colour of the lines is a guide: in superficial firing the tint is a deep yellow; as we go deeper a light yellow is obtained. In thoroughbred horses the skin is much thinner than in the heavy breeds, and previous blistering has the effect of thickening the integument. On no account should the cautery be applied to the flexures of joints.

For **pyropuncture**, points of various degrees of thickness are supplied with the instrument. This mode of firing is indicated in bone-spavin and in splints. The depth required will depend on the nature of the case. In every instance the skin is penetrated, and the deeper the punctures the more space should be allowed between them.

(In deep firing, about ¾ inch to 1 inch should be left between each puncture.)

In cases of obstinate lameness from bone-spavin, success often attends the practice of puncturing very deeply, so that the point of the cautery penetrates between the small bones of the hock, in the region of the exostosis.

In using the pyropuncture point great care is necessary so as to avoid entering the true hock joint or penetrating blood-vessels. The instrument, when applied at a great heat, wil

penetrate very rapidly and deeply. In the treatment of splints, all that is neceesary is to puncture the periosteum over the exostosis.

Care should be taken in applying blisters subsequent to deep firing; except in obstinate cases of lameness, it is best to defer blistering until two or three weeks after the operation. In the after-treatment of the fired part, dressings composed of oil alone should be avoided. A good dressing is an emulsion of carbonate of potassium, olive oil, and water, to which may be added a little oil of eucalyptus. The horse must be kept in clean surroundings, so as to avoid the risks of septic infection of the fired parts. It is generally advisable to fasten the horse's head to the manger for twelve hours, so as to prevent him from biting the parts. Some practitioners, however, let the animal on grass immediately after operation, and state that they have never observed any evil effects to follow.

3. As the operation of firing is very painful, an **anæsthetic** should always be given. In the majority of instances local anæsthesia will suffice (see p. 381). Aseptic precautions are essential so as to avoid sloughing of the skin, and it is very desirable not to use too strong solutions of adrenalin.

As regards the necessity of casting horses for the operation, this will depend on circumstances. In our experience, when deep pyropuncture has to be carried out on the hock, it is safer to cast the animal. In untrained horses and in thoroughbreds it is generally impossible to inject a local anæsthetic while the animal is on its feet. Our opinion is that the safety of the operator should receive first consideration. Considering the few accidents to the horse that occur as the result of casting, when ordinary care is exercised, we hold that it is not prudent to attempt either local anæsthesia or firing of the hind-limbs in the case of unhandled, restive, or vicious animals. Moreover, the operation can be performed more efficiently, safely, and neatly, with the horse in the recumbent position.

CHAPTER XXI

THE TREATMENT OF WOUNDS

PROBABLY this subject will be regarded by many readers as more properly pertaining to surgery. Yet the principles of wound treatment are in a great measure allied to surgical therapeutics, and we consider that a brief reference to the subject will not be out of place in the present work. The treatment of wounds forms a considerable part of the daily duties of the practitioner, and it cannot be said that, in veterinary literature or in the discussions at meetings of veterinary associations, the subject is by any means a hackneyed one. On the contrary, it would seem that, in consequence of the familiarity with wound cases and their frequent occurrence, interest in the subject has become dulled, and routine methods of treatment and technique have more or less obstructed the line of progress. Some practitioners are satisfied with existing knowledge and technique, and fail to see the necessity for improving their methods. Others recognize that the usual modes of treatment leave much to be desired, and they set themselves out to discover if there be a possibility of applying the methods which have proved so successful in the treatment of wounds in human surgery.

It is necessary at the outset to point out that the conditions under which wounds, both accidental and surgical, are treated in human surgery are vastly different in veterinary practice.

Except in cases treated from the outset in a well-equipped veterinary infirmary, it is difficult, if not impossible, to get the ordinary owner or attendant to carry out the necessary dressing of wounds in accordance with cleanliness, or to recognize the importance of sanitary surroundings. Again, 'healing by first intention' is the exception in veterinary surgery, unless in operations on the dog or cat when special precautions are observed and asepsis is secured. In the horse it is easy to recognize why asepsis is so seldom obtained, even when every effort is made in the case of surgical wounds. No doubt we can render the skin sterile by applying tincture of iodine, but the operation is usually carried out with the patient cast on a bed of straw, the operator in many instances has to take part in the casting, assistants possessing a knowledge of surgical cleanliness are seldom to be obtained, it is impossible to render even the best form of stall aseptic, and, last but not least, in the after-treatment of the case micro-organisms are certain to be introduced into the wound.

As regards accidental wounds, it is quite apparent that in every instance infection to a greater or less extent has gained entrance before the case comes under the care of the veterinary surgeon. As almost every owner of animals imagines he knows something about wounds, it is usual to find that amateur treatment has been adopted prior to seeking professional attendance, and in many instances this is responsible for some, at least, of the wound contamination.

We think it will be generally admitted that in equine surgery the aseptic method as practised by human surgeons cannot be carried out successfully in ordinary practice. This method aims at preventing the access of pathogenic bacteria to wounds, and embraces all measures adopted to keep the wound aseptic (germ-free), and also free from the ill-effects of septic organisms, throughout its entire course. Antiseptics are not permitted to come into contact with operation wounds, nor do the ligatures, sutures, or dressings, contain these agents. All such materials are sterilized by heat, and the instruments are sterilized by boiling and are placed in

boiled water containing no antiseptic. This method can only be applied to operation wounds made through unbroken skin into non-infected tissues, and it implies sterilization of the patient's skin at the site of operation, and also of the surgeon's hands. As already remarked, it can be carried out in canine surgery in a properly equipped hospital. But we may remark that many eminent human surgeons practise modifications of the aseptic method, and adopt the judicious use of antiseptics.

It is held by surgeons of the aseptic school that antiseptics, by causing irritation, interfere with the normal powers of resistance of the tissues, and thus retard healing. Also that the weakening of the resisting power of the tissues may even enable micro-organisms to enter and take effect in cases where surgical cleanliness is neglected, although antiseptics are employed.

As we shall point out later on, antiseptics must be used with discretion, and it is not rational to lay down dogmatic rules—at any rate so far as veterinary practice is concerned. Although we agree that strict aseptic surgery is not possible in ordinary equine practice, we must emphasize the point that every attempt should be made to insure surgical cleanliness and to prevent the entrance of micro-organisms into wounds. Such efforts, combined with the judicious employment of antiseptics and attention to important details, such as the efficient drainage of wounds, exert a far-reaching influence on the results obtained.

In considering the general principles of the treatment of wounds, it is well to inquire with reference to the favourable influences which we can exert on the process of repair and healing.

Obviously, we must recognize the influence of the *vis medicatrix naturæ* and respect it. The natural powers of resistance to the development and effects of micro-organisms have an important bearing on the subject. When we consider the filthy conditions under which many cases of wounds are treated, especially in country districts, we cannot but express surprise that more cases of septicæmia and allied sequelæ to

wound infection do not occur. The apparent immunity to such infection can only be explained by the vital resistance possessed by the animals.

The student of surgical therapeutics will naturally desire to know how he can best assist Nature in her efforts to combat infection from wounds. In former days the custom was to treat wounds with irritant dressings of various kinds. The natural powers of recovery were not recognized, and, just as in the case of diseases, the practitioner imagined that by applying heroic remedies he could accelerate, if not produce, healing in a wound Nothing was known of micro-organisms or their effects, and crude notions prevailed as regards the manner in which healing occurred.

The discoveries of Lister exerted a revolution in the old ideas of wound treatment, and the employment of antiseptics and surgical cleanliness marked a new era in the surgical world.

Like all other innovations, there was a tendency to overdo the use of antiseptics, by employing too strong solutions or dressing wounds too frequently. Both of these errors interfered with the natural mode of recovery, and in the present day much importance is very properly attached to the avoidance of strong antiseptic solutions in dressing wounds that are progressing in a favourable manner, and also to the question of meddlesome interference—*i.e.*, dressing wounds too often.

We readily admit that if the patient be healthy, the wound free from virulent micro-organisms, the surroundings and the attendant's hands clean, and if efficient drainage be provided in the wound, irrigation with boiled water containing a little common salt will suffice as a dressing.

But under opposite conditions we are equally certain that the judicious employment of antiseptics is necessary and essential, and, unfortunately, many of these conditions are the very ones which obtain in ordinary practice, especially in the country.

This leads us to the consideration of the term 'septic' wounds, and also to the varieties of wound infection.

In former times the term 'septic' was applied to wounds of an offensive character, which not infrequently were associated with septicæmia or allied conditions. But at the present time the term is applied in a general way to all suppurating wounds.

We must point out, however, that in practice it is usual to distinguish wounds that are healing by granulation, and suppurating, from those of a putrid character. In the former the pus is not offensive and is of a thick, creamy nature. In the latter the discharge from the wound is stinking, infiltrates the surrounding tissues, and is thin and of a reddish tinge.

Although technically we should term all wounds in which pus is present as septic, yet we know that a vast difference exists between those exhibiting the so-called 'laudable' pus and those in which there is a putrid fœtid discharge. Take, for example, a castration wound which, although suppurating, is free from putridity, and not accompanied by constitutional disturbance. Compare this with a similar wound in which the discharge is thin, red-coloured, and stinking, and the patient suffering from severe constitutional disturbance. In the latter instance we know that the life of the patient is in serious danger, as the infection is likely to extend to the peritoneum and induce septic peritonitis, which is invariably fatal.

The difference between these wounds depends on the nature of the pathogenic micro-organisms which have gained entrance. When the latter are virulent, a putrid, unhealthy condition of the wound results.

A variety of micro-organisms are responsible for infection in wounds. Some produce only ordinary suppuration; others bring about a serious condition not infrequently associated with general septicæmia. The most serious consequences arising from wound infection are malignant œdema, erysipelas, and tetanus, because a fatal termination so often results. Other infections give trouble by reason of delaying the process of healing, and tending to induce the formation of sinuses and fistulæ.

A consideration of these points will impress the reader with the importance of preventing the entrance of micro-organisms into wounds, and, when such have gained an entrance, of the necessity of inhibiting their development or multiplication in the depths of the wound. We have already pointed out that in equine surgery it is difficult, if not impossible, to prevent the entrance of micro-organisms under the ordinary conditions of practice—*i.e.*, to practise **asepsis.** But this is no reason why we should not adopt every means in our power to *limit* the number of micro-organisms entering the wound, and to adopt steps to inhibit or destroy those which have already gained entrance.

Obviously, our first concern is with the virulent micro-organisms, as these are likely to bring about serious, if not fatal, consequences. One of the most important duties of the veterinary surgeon, in dealing either with surgical or accidental wounds, is to fight against virulent micro-organisms. As such micro-organisms are often widely distributed, it follows that they may be introduced in many ways; hence the precautions should never be relaxed, even though the surrounding circumstances may seem favourable to the case. In fact, it may be said that the more thorough precautions we take to exclude *all* forms of micro-organisms, the more likely we are to succeed in preventing the entrance of the virulent types.

The measures at our command in cases treated in a veterinary infirmary are ample so far as the prevention of virulent micro-organisms gaining entrance to surgical wounds is concerned. But in the case of accidental wounds which are infected prior to coming under our care, or which have been tampered with by the owner, considerable difficulty is often experienced in combating virulent micro-organisms.

It seems hardly necessary to point out that a large number of wound cases have to be treated at the owners' stables, and, except in valuable horses, it is not possible for the veterinary surgeon to attend daily in order to carry out the surgical dressing personally, more especially in a country practice. Under such conditions it is not surprising to find that the

healing of wounds is so often unsatisfactory, especially when we consider the ignorance and carelessness of owners and attendants as regards the elements of surgical cleanliness. Yet, in spite of such drawbacks, we must admit a large number of recoveries, and can only ascribe some at least of the results to the vital resistance of the patients and the wonderful powers of the *vis medicatrix naturæ*. As we shall point out later on, it is necessary to adopt special precautions in the way of antiseptics when dealing with cases in which unskilled attendants have to be entrusted with the dressing of wounds.

In a work on therapeutics it cannot be expected that we should deal with the question of aseptic surgery as applied to surgical wounds. As already remarked, 'healing by first intention' is not common in equine surgery, except in certain operations carried out under specially favourable conditions in an infirmary. We have also pointed out that 'healing by first intention' can be secured in canine surgery in the case of surgical wounds. For full details of the technique the reader should consult works on veterinary surgery.

Here we are chiefly concerned with the treatment of wounds under the conditions usually met with in general practice. Obviously, we should aim at bringing about the healing of wounds in as short a time as possible; also we should take all available steps to prevent a blemish from resulting. Further, in the case of wounds already infected with virulent micro-organisms, we must adopt treatment so as to prevent the occurrence of septicæmia or other constitutional sequelæ of microbial infection.

Dealing first with general principles, we must point out the necessity for cleanliness in connection with every detail of wound treatment. There is no excuse for slovenly methods, and utensils, instruments, dressings, ligatures, and, last but not least, the hands of the practitioner, can be rendered at least clean, even though aseptic measures may be impossible under existing conditions. In most places boiling water can be obtained without much difficulty, and

by the exercise of a little tact it is easy to avoid the introduction of virulent micro-organisms from the surroundings.

As regards the procedure to be adopted in wounds known or suspected to be seriously infected, thorough irrigation with antiseptic solutions is essential. But without efficient drainage this measure will fail. Hence the first duty of the practitioner is to provide drainage so as to permit the discharges to escape, and also to enlarge the wound in such a manner that the antiseptic can be brought into contact with the deep parts and recesses.

The researches of Sir Almroth Wright* on the treatment of infected wounds should be carefully studied, and there seems little doubt but that his conclusions will exert an important influence on the technique of the dressing of wounds. At present his methods have not been sufficiently tested in veterinary practice to enable us to speak definitely on their superiority over the orthodox measures adopted This authority has shown that, by increasing the lymph flow from wounds and rendering it incoagulable, the infecting microbes will be washed out of the walls of the wound, and other important effects will follow. This is accomplished by irrigation with a solution of common salt (sodium chloride). The above authority states that when such a solution is introduced into a wound the sodium chloride, being highly diffusible, will radiate out by diffusion through all the fluids of the wound. It will act as a lymphagogue (*i.e.*, increase the flow of lymph), and its action will extend to the deep parts of the wound. Wright holds that a 2 per cent. solution of sodium chloride applied to an infected wound will begin to inhibit, and a 5 per cent solution will completely arrest, the growth of pyogenic microbes. Further, a 5 per cent. solution will prevent any growth of microbes in the wound. In a sloughing or indurated wound the application of the solution will '. . . set free trypsin, favour autodigestion, and, coming into operation at the same time on the walls of the wound, it will promote an outflow of fluid. The

* *Vide* 'Wound Infections and their Treatment,' *Lancet*, November 6 and 13, 1915.

effect will be to loosen and separate the sloughs, to disperse the induration . . . and finally the muscles and connective tissues are found free from pus.'

The strength of the salt solution advised is 5 per cent., and with this is combined 0·5 per cent. of sodium citrate. The purpose of the sodium citrate is to prevent the lymph and blood from coagulating on the walls of the wound.

This solution is boiled, and kept at a temperature of 98·6° F. to 104° F. Irrigation should be continued daily until desired results are obtained. When the tissues are restored to a natural condition, and only a mere surface infection is present, irrigation is carried out with physiological salt solution until the surface infection is extinguished, or nearly so. Secondary suture of the wound is then undertaken.

This treatment is well deserving of a full trial in veterinary practice, with the exception of the suturing of the wound, which we do not think would be advisable. If the saline solution accomplishes all that is claimed for it, the method will prove of marked value in the case of suppurating wounds treated under the supervision of the practitioner. But we are doubtful of the results if the treatment had to be carried out by ordinary attendants in country districts, and must point out the risks of fresh infection being superadded to the existing infection, if we omit the reliable germicides.

As regards the most suitable agents to be employed, we are of opinion that, provided proper drainage be given, the selection is largely a matter of choice, as so many reliable germicides are now on the market. The important point is not to employ too strong solutions, and to insure that, as far as possible, the germicide gains access to the deep parts of the wound. The question of drainage should receive serious consideration in the treatment of all wounds. A large number of cases of septicæmia result from extensive wounds in which, owing to their situation, efficient drainage is difficult to obtain.

Experience teaches us that, in dealing with wounds when it is impossible to secure even ordinary cleanliness, either in

the attendants or surroundings, it is necessary to employ stronger antiseptic dressings than are desirable when cases are treated in an infirmary under our supervision. Some may argue that the results obtained do not depend on the antiseptics we employ. But the fact remains that, if under unfavourable circumstances we attempt treatment and omit efficient germicides, cases of septicæmia and other virulent infections are not uncommon. It is a question of adapting our methods to circumstances. Even at the risk of being accused of advising agents which may cause a varying degree of irritation to the tissues, we recommend for country practice the application of a liniment composed of creosote, 2 drachms; terebene, 8 ounces; and olive oil, 1 pint. This is applied after proper drainage has been provided, and the wound cleansed with an antiseptic solution. The results obtained are, in our opinion, reliable evidence of the value of this treatment, and of greater value than suggestions based on practice carried out under distinctly favourable conditions.

The employment of sodium hypochlorite combined with boric acid, as a dressing for wounds, is worthy of consideration here, as the agent is comparatively cheap and easily applied.

H. D. Dakin (*British Medical Journal*, August 28, 1915) states that sodium hypochlorite has high germicidal action, but as ordinarily prepared is of extremely variable composition, contains free alkali, and sometimes free chlorine, and is consequently irritating when applied to wounds. In order to overcome these undesirable properties, Dakin prepares this agent as follows: 'Chloride of lime (bleaching-powder) is decomposed with a solution of sodium carbonate, and the filtered solution containing sodium hypochlorite, together with a slight excess of alkali, is mixed with boric acid in such quantity that the solution is acid to phenolphthalein suspended in water, but still alkaline to litmus. The resultant solution contains a balanced mixture of hypochlorite and polyborates of sodium with small amounts of free hypochlorous acid and boric acid. Thus the irritating action of free caustic alkali is avoided. The solution

employed contains 0·5 to 0·6 per cent. of sodium hypochlorite, and is prepared as follows:

Dry Sodium Carbonate ... ... 140 grammes.

Or:

Crystallized Sodium Carbonate (Washing Soda) ... 400 grammes.

Dissolve in 10 litres of ordinary water.

Add to this:

Chloride of Lime ... ... 200 grammes.

Shake well, and after an hour syphon off the clear liquid and filter through a plug of cotton.

Add:

Boric Acid ... ... 40 grammes.

The solution is now ready for use. It should not be kept longer than one week.

A **concentrated** solution, which contains about 4 per cent. of sodium hypochlorite, and can be kept for a month without serious decomposition occurring, is prepared as follows:

Sodium Carbonate ... ... 105 grammes.

Dissolve in 1 litre of water.

Add to this:

Chloride of Lime ... ... 150 grammes.

Filter the mixture. Titrate rapidly 20 c.c. of the filtered mixture with a solution of boric acid of known strength (31 grammes to the litre), using phenolphthalein suspended in water as indicator, in order to determine the amount of solid boric acid to be added to the rest of the filtrate. An excess of boric acid should be avoided, so that it is best to add slightly less than the calculated amount.

This solution should be diluted with 6 parts of water before use.

The solution is employed in the form of irrigation. It does not produce any visible irritation, and assists in the rapid dissolution of necrosed tissue, 'this action being doubtless due to the ability of hypochlorites to attack the (NH) groups present in proteins, with formation of soluble products.'

The germicidal properties of the solution, as pointed out

by Dakin, are very convincing. It should not be used in conjunction with other antiseptics.

A few words here on the employment of **sutures** are necessary. They should not be employed in the case of punctured wounds, or in any instances in which they might interfere with free drainage from a wound. In our experience, wounds in the vicinity of the orbit or forehead are best left without sutures, as we have observed in the horse that this region appears to be a seat of predilection for the infection of erysipelas or malignant œdema. Thorough cleansing of the deep parts of such wounds, efficient drainage, and the use of germicides, are of vital importance in the treatment of wounds in this part of the body.

Finally, we may remark that up to the present time a successful treatment has not been discovered for generalized septicæmia, or malignant œdema. Researches in vaccine treatment for these conditions are urgently needed, as it is quite apparent that success can only be achieved on these lines.

It is probable that the investigations which are now being carried out in human surgery, with a view to the prevention and treatment of virulent infections from wounds, will result in important discoveries which can also be applied in veterinary practice. There are many instances in which we fail to trace the source of these virulent infections, and hence are unable to suggest preventive measures. Take, for example, septic peritonitis resulting from so simple an operation as castration, or malignant œdema occurring in connection with a trivial wound.

There is at least one encouraging factor—viz., that, since the adoption of surgical cleanliness and antiseptics in the treatment of wounds, serious or fatal cases resulting from virulent infections are not frequent, as compared with former times, when such precautions were not employed.

But the available methods are yet far from ideal, and until we are able to prevent the development of micro-organisms in wounds, and overcome their ravages, we cannot remain satisfied with our present technique or treatment.

CHAPTER XXII

THE CARE, MANAGEMENT, AND NURSING OF SICK SHEEP

By G. MAYALL, M.R.C.V.S.

WHETHER sheep be lame, ill, or injured, they must be taken to a quiet place and separated from the rest of the flock. Being pastoral animals, shelter in the open in fine weather may be improvised for them, but in wet weather they must be put under cover in an airy abode. The signs of health are liveliness, good appetite, and normal rumination. When approached they get up, are on the watch, and move quickly; they bleat at feeding-time; when the shepherd distributes food, they follow him about and hustle and rush eagerly towards the feeding-crates.

The best time to detect an ailing animal, however, is when the flock is let out to feed or admitted to fresh pasture; there is a general rush towards the entrance to the feeding-ground, and any laggards or indifferent animals which are then observed are generally not in perfect health. It is difficult, on account of the number in the flock, to pick out single ailing sheep, but an impression of them as a whole will assist the observer to recognize the animals which are not healthy. Really good shepherds with excellent memories are able to distinguish and recognize any single animal, and note any weakness or ailment that may be present. In healthy sheep the pulse, taken at the radial artery, is from 70 to 80 in adults, 85 to 95 in young sheep,

and 55 to 60 in old sheep. The respirations vary from 13 to 16 per minute, but thick wool and heat may increase this average. The temperature is 102·4° F. to 104° F. It must be remembered that sheep have often to be manœuvred quickly in order to separate an ailing member from the rest of the flock; and when it is caught and held, the temperature, respirations, and pulse, may all be increased. We may point out that dampness is bad for sheep, although they stand cold well; whilst hot weather, especially if they have not been shorn, causes them some discomfort. A good shepherd will observe at feeding-time those sheep which sulk at their repast, and at each 'going-out,' those which are lame or lag behind, and 'at rest,' those which do not ruminate.

Medicine is prescribed for sheep in various forms—viz., as draughts or drinks, electuaries, and tabloids. Great care must be taken in the administration of drenches, and any irritant remedies given—*e.g.*, oil of turpentine—must be mixed in a mucilaginous or oily fluid and administered slowly. The orthodox way to give medicine is to sit the sheep up on its hind-quarters, hold it between the legs, control the mouth with the left hand, and administer the draught with the right hand. The total quantity of liquid given averages about 4 ounces, or 2 wineglassfuls. Not a few good observers consider that it is safer to drench the sheep with the animal in the standing posture. An assistant must prevent the patient from running backwards, the head is then raised and the dose administered. Electuaries made up with treacle, glycerin, or honey, are always safe if too much acrid medicine does not enter into their composition. Tabloids, used chiefly for worms, are dropped on the back of the tongue, and so swallowed, and small bullets of medicine made up in ball form are occasionally given in the same way. The sheep is perhaps the most easily choked of any animal. Linseed mucilage, milk, or oil, are common vehicles used for the administration of medicine in liquid form.

Purgatives for Sheep.—A dose of 6 to 12 drachms of sodium sulphate forms a good purgative for sheep. A laxa-

tive which is very useful is 4 to 6 ounces of linseed-oil. A moderate cathartic for large sheep is composed of magnesium sulphate, 4 ounces; powdered gentian and ginger, of each ½ ounce; sublimed sulphur, ½ ounce. Mix and give in ½ pint of linseed mucilage. If 5 drops of croton-oil be added to 4 ounces of Epsom salt, and if ½ ounce each of powdered gentian and ginger be combined with the above, and the whole administered well stirred up in ½ pint of linseed mucilage, it will form an active purgative for large and strong sheep suffering from constipation.

The Surroundings of the Patient.—These should always comprise a liberal supply of fresh air, cleanliness of utensils for feeding and administration of medicines, dry litter, and a clean abode. In the case of ewes at lambing-time, the ground or litter must be untainted and unsoiled for each individual ewe as she lambs. The shepherd must wash his hands in germicidal solutions frequently, anoint them with reliable antiseptic oils, and be cleanly in his person and attire.

Diet.—A cooling diet is advisable in most cases of illness where there is a rise of temperature. Grass, green rye, sloppy bran, oatmeal-gruel, linseed mucilage, or scalded hay, are suitable nutrients. Roots must be discarded in cases of digestive trouble, but a concentrated diet of oats, oilcake, and peameal, is indicated where there is poverty of blood and parasitic invasion is suspected. The sheep is not a great drinker, and any diet given which is entirely liquid will probably be refused. A noticeable stiffness at times occurs in the joints of lambs, which is ascribed to a disproportionate amount of solids in the ewe's milk. There is an enlargement of the joints, and this occurs chiefly in years when large quantities of rich hay are fed to the ewes. It is considered that this causes a too high percentage of the calcium contents of the milk of the dam, and consequently the ends of the young animals' bones (epiphyses) grow excessively, and bring about stiffness in the joints, which cannot be extended and flexed in a normal manner.

CHAPTER XXIII

THE CARE, MANAGEMENT, AND NURSING, OF SICK SWINE

By G. MAYALL, M.R.C.V.S.

Not a few of the illnesses of swine would be avoided altogether if sties and feeding-troughs were kept clean, suitable food given at regular hours, a sufficiency of exercise allowed, and comfortable, dry, airy quarters provided. Often the abode of pigs is some obscure, damp quarter, where they are left much to themselves to lie about in their own excreta. Swine are naturally clean animals, and their general health suffers by neglect; besides which, the quality of their flesh and their growth are both injuriously affected by careless management. If attention be paid to the skin, and an occasional brushing and washing given, many skin ailments to which swine are somewhat prone will be prevented, and the functions of transpiration and perspiration, which purify the blood, will have free play. Good feeding causes quick fattening, an increase of waste to be expelled from the body, and a large secretion of urine. The purifying of the blood by the kidneys will be aided by a good functional activity of the skin. Swine are fond of an occasional bath, and if they can be conducted to clean water, or have a bath placed in the sty, they will enjoy a dip. Muddy pools and dirty 'wallows,' although they may be patronized, are not beneficial. Quick drying in a sunny atmosphere is always advisable after the bath, and exercise is advantageous.

It needs an observant man to tell when swine are sick and ailing. If he knows the appearances of health in porcines, he will be in a better position to judge of illness. Healthy pigs are robust, have remarkably good appetites, grunt impatiently before a meal, and contentedly afterwards. They come up eagerly to the trough when food is put down. They move about freely with head declined and tail curled; are lively in gait before becoming fat; later on they assume a slower pace, but can move rather quickly for a short distance if pressed to do so. Rather small, watchful eyes, partly hidden by folds of skin or by large pendant ears, are in some races a characteristic. The skin is firm and clear, and the surface of the body of an equal temperature all over. The normal fæces of swine are cylindrical or pulpy, and greyish-yellow in colour. The urine is passed frequently and plentifully. The mucous membranes are rosy red. The respirations of healthy swine are from 13 to 18 per minute; the pulse is 60 to 80 in adult swine, and 100 to 110 in piglings; and the temperature taken at the rectum 102·6° F., or 103° F. in quite young pigs.

It is a matter of first importance to separate at once a sick pig from its companions. The reason for this is twofold—(1) If this duty be neglected the cure of the ailing animal is delayed or hindered; and (2) the health of the other pigs may be endangered, because it will not be positively known at the start that the oncoming ailment is not highly infectious. The sick pig wants rest and quiet, and the diet that the other hogs are receiving will not be suitable for the invalid. An airy and not too warm abode is best. In some instances the irrational custom of putting the pig in the warmest place possible, with doors and windows tightly closed or stopped, is carried out. A draught on an ailing animal is not desirable, but pure air is as vital for the sick as it is for healthy subjects, and an impure atmosphere in the stall or stable has an injurious influence. The attendant may give marked help, where skilled advice is sought, by observing the sick animal closely as soon as he notices illness, and relating what he sees to the expert adviser. The amount and condition of the

fæces and urine are important points; moreover, the character of the latter will frequently be difficult for the practitioner to observe.

The Administration of Medicine.—The pig is perhaps one of the most difficult of animals to give medicine to by hand. His control often necessitates upsetting him, and the dose is not satisfactorily taken when under restraint; besides which, there is a risk of choking the patient. Wherever possible, the remedy, made as tasty or tasteless as may be, should be given in the food, which may be liquid or sloppy. A quiet attendant who knows the animal may succeed in giving medicine when the patient is lying down. By scratching the skin and speaking to the patient, it is wonderful sometimes how easily a palatable dose may be given, especially if the snout is raised and the medicine cautiously and slowly introduced into the mouth in a small and frequently interrupted stream. If it can be carried out, we think manual giving of remedies is always best performed on the recumbent pig. To struggle hard with a patient, force the mouth open, and pour large quantities of medicine therein, is only risking an early dissolution. Forced giving of remedies is only warranted in very urgent cases. The time-honoured 'old boot with the toe cut off,' and a noosed rope slipped over the upper jaw behind the tusks, are methods of administration and control that need only be resorted to occasionally.

Quite an effective and handy way of giving drugs to porcines is to make them up with honey, treacle, or glycerin, in the form of electuaries, and to smear them on the lips and teeth.

Purgatives for Swine.—Sodium sulphate may be given as a purgative to swine in doses of 6 to 12 drachms. If mixed with sloppy food most animals will take it. Senna, in doses of 2½ to 6 drachms; gamboge, ½ to 1 drachm; and jalap, 1 to 3 drachms, are other purgatives used; but these must be given as electuaries, and will not be taken readily in the food. Calomel, 15 grains to 1 drachm, may be given mixed with the food. Where drenching is done carefully, a dose of 4 ounces of linseed-oil to which 3 to 5 drops of croton-oil have been added,

and well shaken up, will make a full purge for an adult pig. Sulphur is readily taken by swine in the food, and the dose is 2½ to 6 drachms; it may be advantageously mixed with magnesium sulphate, in which case 3 drachms of flowers of sulphur and 8 to 10 drachms of magnesium sulphate would be a full dose for an adult pig. To get the best effect from purgatives, solid food should be withheld for twenty-four hours, and sloppy diet or wash given in its place.

Hypodermic or Subcutaneous Injections.—These are quite handy in pigs, and frequently overlooked. A piece of skin at the back of the elbow or inside the fore-leg may be painted with iodine, a loose fold raised, and with a sterilized needle and syringe a hypodermic dose of medicine be given.

It will be useful here to indicate the method of administering **serum in hog cholera outbreaks.** It is a therapeutic measure which is gaining ground in all civilized countries. Mr. A. T. Kinsley, M.Sc., D.V.S., of Kansas City, gives the following instructions for its employment: 'The operator must always provide clean and sterile instruments. It is true that the instruments become contaminated as soon as used, but at least two needles should be provided, in order that one may be placed in a disinfecting solution while the other is in use. The syringe should be sterilized by boiling after being used for a few hours, or after a herd has been immunized, before using it on another herd. The serum and virus should be injected deeply into the muscle in order to insure rapid absorption. Bad results frequently are the result of failure of absorption of the serum or virus that has been injected just beneath the skin into the subcutaneous fat. Swine that are in filthy, muddy pens should not be injected because of the probability of infection in the needle wounds, and swine that have quantities of mud or filth upon their bodies should not be injected. All swine that are injected should be reasonably clean, the point of injection should be painted with tincture of iodine, and the skin should be pinched after withdrawing the needle, to prevent leakage.' The simultaneous method (injection of serum and virulent

blood) is used more extensively than the serum alone, because it produces a longer immunity. George R. White, M.D., D.V.S., of the Terre Haute Veterinary College, who has had a large experience of sero-therapy in hogs, considers that the double injection of serum and virulent blood creates a permanent protection against hog cholera. Serum is injected on the inner side of the thighs, or inside the fore-leg or back of the ears. Where serum and virus are used, the virus is injected in the opposite side to that where the serum was injected. For instance, if the serum be injected into the muscles of the right hind-leg, the virus should be given in the muscle of the left leg; while if the serum be given behind the left ear, place the virus under the skin behind the right ear.

Diet.—Nothing is so useful as milk as a diet for sick pigs. A little oatmeal, middlings, or barleymeal, may be added thereto. Wholesome brothy wash without any solids or condiments in it may be used where milk is unobtainable. One or two eggs beaten up in milk are sustaining and nourishing. Where there is throat or lung trouble, a quarter of a pint of linseed mucilage may be added two or three times daily to the liquid diet. A fresh clean root, uncooked and pulped or sliced, is useful when convalescence sets in, and some cut greenstuff like lucerne, red clover, or vetches, is often relished. All troughs or vessels should be kept scrupulously clean, and no remains of old repasts mixed with new.

Attendants.—The attendant should go quietly and gently about feeding and administering medicine. A sick pig is not well looked after if left lying on a hard, cold, dirty, or damp floor. Too much attention and interference is as bad as too little. Quietness and repose are appreciated by sick swine.

Clothing.—It perhaps seems out of place to write about this item in connection with the pig. In cases of pneumonia and bronchitis, however, the writer has seen benefit result from the use of a flannel or old blanket jacket for the patient. Holes are cut in the material, through which the fore-legs of the pig are placed, and the thoracic region of the

body is enveloped by fastening the ends of the covering by stitching or 'safety-pinning' along the back.

Litter. — Farrowing sows need plenty of clean straw litter. Straw cut in lengths of 8 inches makes excellent bedding. Wooden floors are less likely to cause lameness among pigs than concrete ones, but the latter are more hygienic.

Exercise.—To keep the bodies of young pigs in health, and to obtain bone and muscle growth, exercise is of paramount importance. Pregnant sows also require a sufficiency of it in order to do well. There is a convalescent stage in rickets and rheumatism when exercise is advantageous. To stir pigs up at night when they lose some use in their hindquarters is good procedure, as thereby the elimination of waste products through urination is procured. To an animal so much 'be-stied' as the pig, a grass paddock is always valuable. At almost all periods of its life it needs some exercise.

No. 2. ℞ Acidi Arseniosi ... ... gr. $\frac{1}{50}$.
Ferri Sulph. Exsicc. ... gr. i.
Calcii Sulphidi ... ... gr. $\frac{1}{4}$.
Ext. Gentianæ ... ... q.s.
M. Ft. pil. i. Mitte xii. Sig.: Give from one to two pills three times daily.

No. 3. (*Useful in Chronic Rheumatism.*)
℞ Guaiaci Resinæ ... ... grs. iii.
Sulphuris Præcip. ... ... grs. iii.
Ext. Gentianæ ... ... q.s.
M. Ft. pil. i. Mitte xii. Sig.: Give from one to four pills three times daily.

Alterative Powders.

No 1. ℞ Acidi Arseniosi ... ... gr. $\frac{1}{50}$ to gr. $\frac{1}{20}$.
Magnesii Sulph. ... ... grs. x. to grs. xx.
Sodii Bicarb. ... ... grs. v. to grs. x.
M. Ft. pulv. i. Mitte xii. Sig.: Give one twice daily in the food.

No. 2. ℞ Sulphuris Præcip. ... ... grs. v. to grs. x.
Sodii Bicarb. ... ... grs. v. to grs. x.
Magnesii Sulph. ... ... grs. x. to grs. xx.
M. Ft. pulv. i. Mitte xii. Sig.: Give one twice daily in the food.

No. 3. ℞ Sulphuris Præcip. ... ... grs. v. to grs. x.
Potassii Tartratis Acidi ... gr. i. to grs. iii.
M. Ft. pulv. i. Mitte xii. Sig.: Give one twice daily in the food.

ANODYNES.

For Horses.

Anodyne Drenches or Draughts.

No. 1. ℞ Chloral Hyd. ... ... ℥i.
Spts. Camphoræ ... ... ℥ii.
Mucilaginis ... ... ℥iv.
Aquæ ... ... ad O.i.
M. Ft. haust. Sig.: Give at once. Repeat in two hours if necessary.

No. 2. ℞ Chlorodyni ... ... ℥i. to ℥ii.
Ol. Menth. Pip. ... ... ℥i.
Ol. Lini ... ... O.i.
M. Ft. haust. Sig.: Give at once.

For Enteritis, Peritonitis, etc.

No. 1. ℞ Chloral Hyd. ... ... ℥i.
Morphinæ Hydrochlor. ... grs. iv.
Mucilaginis ... ... ℥iv.
Aquæ... ... ... ad O.i.

M. Ft. haust. Sig.: Give at once. Repeat in two hours, or as required.

Or:

No. 2. ℞ Ext. Cannabis Indicæ Fl. ... ℥ss. to ℥i.
Glycerini ... ... ℥ii.
Aquæ .. .. ad O.i.

M. Ft. haust. Sig.: Give at once.

Or:

No. 3. ℞ Chloral Hyd. ... ... ℥ss.
Ext. Cannabis Indicæ Fl. ... ℥ss.
Mucilaginis ... ... ℥iv.
Aquæ .. .. ad O.i.

M. Ft. haust. Sig.: Give at once.

ANODYNE BALLS.

No. 1. ℞ Chloral Hyd. ... ... ℥i.
Excipient. ... ... q.s.

Ft. bol. i. Sig.: Give at once. Repeat in two hours if necessary.

For Enteritis.

No. 2. ℞ Pulv. Opii ... ... ℥i. to ℥ii.
Pulv. Camphoræ ... ... ℥i.
Ext. Belladonnæ Vir. ... ℥ii. to ℥iv.
Excipient. ... ... q.s.

Ft. bol. i. Sig.: Give at once. Repeat in four or six hours as required.

No. 3. ℞ Ext. Cannabis Indicæ ... ℥ss. to ℥i.
Excipient. ... ... q.s.

Ft. bol. i. Sig.: Give at once. Repeat in four to six hours if necessary.

Anodynes for Cattle are similar to those advised in the form of draughts for the horse.

For Dogs.

ANODYNE MIXTURES.

No. 1. ℞ Chlorodyni ... ... ℥ii.
Aquæ... ... ... ad ℥iii.

Ft. M. Sig.: Give from a teaspoonful to a tablespoonful, according to the size of the dog.

APPENDIX

FORMULÆ

ALTERATIVES.

For Horses.

ALTERATIVE MIXTURES.

No. 1. ℞ Hydrarg. Biniod. ... ... ℥i.
Potassii Iod. ... ... ℥i.
Aquæ ... ... ad ℥xii.

Ft. M. Sig.: Give half a wineglassful three times daily in the food.

No. 2. ℞ Liq. Arsenicalis ... ... ℥℥x.
Ferri Carb. Sacch. ... ... ℥℥iv.
Tinct. Gent. Co. ... ... ℥v.
Aquæ ... ... ad O.i.

Ft. M. Sig.: Give a wineglassful twice daily in the food.

POWDERS.

No. 1. ℞ Sulphuris Sub. ... ... ℥℥iii.
Antim. Potass. Tart. ... ℥℥i.ss.
Sodii Bicarb. ... ... ℥℥iv.
Pulv. Anisi ... ... ℥iii.

M. Div. in pulv. xii. Sig.: Give one twice daily in the food.

No. 2. ℞ Acidi Arseniosi ... ... ℥i
Ferri Sulph. Exsicc. ... ℥℥i.ss.
Sodii Bicarb. ... ... ℥℥iv.
Pulv. Carui Sem. ... ... ℥℥iii.

M. Div. in pulv. xii. Sig.: Give one twice daily in the food.

No. 3. ℞ Magnesii Sulph. ... ... ℥vi.
Sulphuris Sub. ... ... ℥ii.
Sodii Bicarb. ... ... ℥ii.
M. Div. in pulv. vi. Sig.: Give one twice daily in the food.

ALTERATIVE BALLS.

℞ Acidi Arseniosi ... ... ℥i.
Ferri Sulph. Exsicc. ... ℥i.ss.
Pulv. Gentianæ ... ... ℥iii.
Sodii Bicarb. ... ... ℥iii.
Saponis Mollis ... ... q.s.
M. Div. in bol. xii. Sig.: Give one twice daily.

For Cattle.

ALTERATIVE POWDERS.

℞ Magnesii Sulph. ... ... ℥vi.
Sulphuris Sub. ... ... ℥iii.
Sodii Bicarb. ... ... ℥iii.
Ferri Sulph. Exsicc. ... ℥i.ss.
Pulv. Carui Sem. ... ... ℥iii.
M. Div. in pulv. vi. Sig.: Give one twice daily in the food.

For Dogs.

ALTERATIVE MIXTURES.

No. 1. ℞ Liq. Arsenicalis ... ... ℥i.
Syr. Simpl. ... ... ℥i.ss.
Aquæ... ... ... ad ℥vi.
Ft. M. Sig.: Give from a teaspoonful to a tablespoonful (according to the size of dog) three times daily after feeding.

No. 2. ℞ Liq. Arsenii et Hydrargyri Iodidi ... ... ℥ii.
Syr. Aurantii ... ... ℥ii.
Aquæ... ... ... ad ℥vi.
Ft. M. Sig.: Give from a teaspoonful to a tablespoonful twice daily after feeding.

ALTERATIVE PILLS.

No. 1. ℞ Acidi Arseniosi ... ... gr. $\frac{1}{60}$ to gr. $\frac{1}{20}$.
Sulphuris Præcip. ... ... grs. v. to grs. x.
Sodii Bicarb. ... ... grs. v. to grs. x.
Ext. Gentianæ ... ... q.s.
M. Ft. pil. i. Mitte xii. Sig.: Give one twice daily.

No. 2. ℞ Chloroformi ... ... ℥ii.
Morphinæ Acet. ... ... grs. iii.
Ol. Anisi .. .. ♏ xvi.
Ol. Menth. Pip. ... ... ♏xvi.
Mucilaginis ... ... ℨss.
Aq. Camphoræ ... ... ad ℥iv.

Ft. M. Sig.: Give from 20 minims to 1 drachm, and repeat in three or four hours if required.

No. 3. ℞ Liq. Opii Sed. (Battley) ... ♏v. to ♏x.
Ol. Menthæ Pip. ... ... ♏ss.
Spts. Chloroformi ... ... ♏x. to ♏xx.
Ol. Ricini ... ... ℥ii. to ℨss.

M. Ft. haust. Sig.: Give at once.

No. 4. ℞ Tinct. Belladonnæ ... ... ℥ss.
Tinct. Cardamomi Co. ... ℥vi.
Spts. Ammon. Aromat. ... ℥ii.
Spts. Chloroformi ... ... ℥ii.
Aq. Menth. Pip. ... ... ad ℨvi.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every hour until pain is relieved.

ANTIPYRETICS AND FEBRIFUGES.

For Horses.

Antipyretic Electuaries.

No. 1. ℞ Quininæ Sulph. ... ... ℨi.
Mellis ... ... ℨii.
Theriacæ ... ... ℨii.

M. Ft. electuar. Sig.: Give a tablespoonful every four hours on the tongue.

No. 2. ℞ Sodii Salicyl. ... ... ℨii.
Mellis ... ... ℨii.
Theriacæ ... ... ℨii.

M. Ft. electuar. Sig.: Give a tablespoonful every four hours on the tongue.

Febrifuge Powders.

℞ Magnesii Sulph. ... ... ℨxii.
Potassii Nit.... ... ... ℨii.

M. Div. in pulv. vi. Sig.: Give one twice a day dissolved in the drinking-water.

ANTIPYRETIC BALLS.

℞ Quininæ Sulph. ... ... ℥i. to ℥i.ss.
Ammonii Carb. ... ... ℥ii.
Excipient. ... ... q.s.

Ft. bol. i. Mitte vi. Sig.: Give one three times a day.

For Dogs.

ANTIPYRETIC MIXTURES.

No. 1. ℞ Phenacetini ... ... grs. viii.
Quininæ Hydrobrom. ... grs. viii.
Syr. Simpl. ... ... ℨss.
Aquæ... ... ... ad ℨiv.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every two hours.

No. 2. ℞ Sodii Salicylatis ... ... ℥i.
Syr. Simpl. ... ... ℨss.
Aquæ... ... ... ad ℨiv.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every two hours.

No. 3. ℞ Spts. Æth. Nit. ... ... ℥vi.
Liq. Ammon. Acet. ... ℨiii.
Syr. Simpl. ... ... ℨss.
Aquæ... ... ... ad ℨvi.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every three hours.

No. 4. ℞ Quininæ Sulph. ... ... grs. xl.
Ac. Sulph. Dil. ... ... q.s.
Syr. Simpl. ... ... ℨi.ss.
Aquæ... ... ... ad ℨvi.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every three or four hours.

ANTHELMINTICS.

For Horses.

WORM DRENCH.

No. 1. ℞ Ol. Terebinth. ... ... ℨii.
Spts. Æth. Nit. ... ... ℨii.
Ol. Lini ... ... O.i.

Ft. haust. Sig.: Give at one dose. The horse should be prepared by feeding him on soft food for two days previously.

No. 2 ℞ Ext. Chenopodii Fl. ... ℥ii.
Ol. Terebinth. ... ... ℥ii.
Ol. Lini ... ... O.i.
Ft. haust. Sig.: Give at one dose.

WORM POWDERS.

℞ Antim. Potass. Tart. ... ℥i.ss.
Ferri Sulph. Exsicc. ... ℥i.ss.
Pulv. Gentianæ ... ... ℥ii.
Pulv. Anisi ... ... ℥ii.
M. Div. in pulv. xii. Sig.: Give one twice daily in the food. When all have been taken, administer a worm drench.

For Strongylosis in Foals.

℞ Thymol ... ... ℥x.
Salol ... ... ℥ii.
Terebeni ... ... ℥iii.
Glycerini ... ... ℥iv.
Spts. Rectif. ... ... ℥ii.
Mucilaginis ... ... ℥vi.
Aquæ ... ... ad O.i.
Ft. M. Sig.: Give a wineglassful once daily in two wineglassfuls of linseed-tea.

For Sheep.

For Parasitic Gastritis in Sheep.

℞ Acidi Arseniosi ... ... ℥i.
Ferri Sulph. Exsicc. ... ℥v.
Pulv. Nucis Vom. ... ... ℥ii.
Pulv. Arecæ ... ... ℥ii.
Sodii Chlorid. ... ... ℥iv.
M. Div. in pulv. xxx. Sig.: Give one daily in the food.

For Dogs.

WORM MIXTURES.

For puppies up to eight weeks old:

No. 1. ℞ Ol. Chenopodii ... ... ℥ss.
Ol. Terebinth. ... ... ℥ss.
Ol. Anisi ... ... ℥ss.
Spts. Æth. Nit. ... ... ℥ss.
Ol. Ricini ... ... ℥v.ss.
Ol. Olivæ ... ... ℥v.ss.
Ft. M. Sig.: For a large or medium-sized puppy *under six weeks* give ½ drachm in an equal amount of milk; *at the sixth or eighth week* give 1 drachm; *after eight weeks* give 1 drachm, to be repeated in an hour. If

the bowels do not act in an hour or so, give 1 drachm of castor-oil in a little milk. If no worms are passed, repeat the medicine in two days. In the case of very small breeds of dogs, a quarter of the above doses should be given.

For puppies over eight weeks old:

No. 2. ℞ Ol. Chenopodii ... ... ℥v.
Santonini ... ... ℥i.
Chloroformi ... ... ℥ii.
Spts. Æth. Nit. ... ... ℥ss.
Ol. Terebinth. ... ... ♏xlv.
Ol. Anisi ... ... ℥ss.
Ol. Ricini ... ... ℥x.
Ol. Olivæ ... ... ℥iii.

Ft. M. Sig.: Give 1 drachm in 1 drachm of castor-oil. If no action of bowels in four hours after first dose, give 2 drachms of castor-oil. If no worms are passed, repeat the dose in two hours. *At fourth month* give 1½ drachms; *at tenth month* give 2 drachms; *at thirteenth month* give 3 drachms. Increase the dose by one-half for every three months. For Yorkshire and toy breeds give a quarter of the above doses.

For either Tape or Round Worms.

For adult dogs:

No. 3. ℞ Ol. Chenopodii ... ... ℥v.
Thymol ... ... ℥ii.
Æther. Sulph. ... ... ℥v.
Chloroformi ... ... ℥ii.
Ol. Ricini ... ... ad ℥viii.ss.

Ft. M. Sig.: Give from ½ drachm to 2 drachms in an equal amount of castor-oil.

Or:

No. 4. ℞ Ol. Chenopodii ... ... ℥i.
Ol. Terebinth. ... ... ℥i.
Chloroformi ... ... ℥ii.
Ol. Ricini ... ... ℥xiv.

Ft. M. Sig.: Give from ½ drachm to 2 drachms in an equal amount of castor-oil.

For large dogs:

No. 5. ℞ Chloroformi ... ... ℥i.
Ol. Terebinth. ... ... ℥ss.
Spts. Æth. Nit. ... ... ℥ss.
Glycerini ... ... ℥ss.
Ol. Ricini ... ... ℥iii.

Ft. M. Sig.: Give from 1 to 2 drachms in ½ ounce of castor-oil.

ANTITYMPANITICS.

For Horses.

DRENCHES OR DRAUGHTS FOR CASES OF INTESTINAL TYMPANY.

No. 1. ℞ Ol. Terebinth. ... ... ℥ii. to ℥iv.
Spts. Ammon. Aromat. ... ℥iv.
Ol. Menthæ Pip. ... ... ℥i.
Ol. Lini ... ... O.i.ss.
Ft. haust. Sig.: Give at once.

No. 2. ℞ Creosoti ... ... ℥ss.
Terebeni ... ... ℥iv.
Ol. Lini ... . O.i.ss.
Ft. haust. Sig.: Give at once.

No. 3. ℞ Acidi Carbolici ... ... ℥i.
Ol. Terebinth. ... ... ℥ii.
Spts. Ammon. Aromat. ... ℥iv.
Ol. Lini ... ... O.i.ss.
Ft. haust. Sig.: Give at once.

For Acute Gastric Tympany.

℞ Terebeni ... ... ℥iv.
Acidi Carbolici ... ... ℥i.
Ol. Menth. Pip. ... ... ℥i.
Ol. Lini ... ... O.i.ss.
Ft. haust. Sig.: Give at one dose.

Capsules for Acute Gastric Tympany.

℞ Acidi Salicylici ... .. ℥ss.
Ext. Nucis Vom. Fl. ... ℥ii.
Pulv. Zingib. ... ... ℥ii.
M. Place in two capsules and administer both. Repeat in one hour if necessary.

For Cattle.

DRENCHES FOR TYMPANITES.

No. 1. ℞ Liq. Ammoniæ ... ... ℥i.
Ol. Terebinth. ... ... ℥iv.
Ol. Lini ... ... O.ii.
Ft. haust. Sig.: Give at once.

No. 2. ℞ Acidi Carbolici ... ... ℥ii.
Terebeni ... ... ℥iv.
Liq. Ammoniæ ... ... ℥i.
Ol. Lini ... ... O.ii.
Ft. haust. Sig.: Give at once.

No. 3. ℞ Creosoti ... ... ℥ii.
Ol. Terebinth. ... ... ℥iv.
Liq. Ammoniæ ... ... ℥i.
Tinct. Nucis Vom. ... ... ℥ii.
Ol. Lini ... ... O.ii.
Ft. haust. Sig.: Give at once.

For Dogs.

Mixtures for Flatulence.

For Cases of Acid Flatulent Dyspepsia.

No. 1. ℞ Liq. Bismuthi ... ... ℥i.ss.
Sodii Bicarb. ... ... ℥ii.
Spts. Chloroformi ... ... ℥ss.
Tinct. Calumbæ ... ... ℥vi.
Aq. Menth. Pip. ... ... ad ℥vi.
Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every four hours as required.

Or:

No. 2. ℞ Tinct. Rhei ... ... ℥i.ss.
Sodii Bicarb. ... ... ℥iii.
Magnesii Carb. ... ... ℥ii.
Spts. Ammon. Aromat. ... ℥vi.
Aq. Menth. Pip. ... ... ad ℥vi.
Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every four hours as required.

Pills.

No. 1. ℞ Thymol ... ... gr. ss. to gr. i.
Pulv. Saponis ... ... q.s.
Ft. pil. i. Sig.: To be given at once.

Or:

No. 2. ℞ Creosoti ... ... ℥iv.
Pulv. Saponis ... ... q.s.
M. Div. in pil. viii. Sig.: Give from one to two pills. Repeat every four hours if necessary.

ASTRINGENTS.

For Horses.

Astringent Mixtures.

No. 1. ℞ Tinct. Chloroformi et Morphinæ Co. ... ... ℥x.
Cretæ Præp. ... ... ℥ii.ss.
Tinct. Gentianæ Co. ... ℥v.
Aquæ ... ... ad O.i.
Ft. M. Sig.: Give two wineglassfuls every four hours in a pint of flour-gruel.

No. 2. ℞ Tinct. Camph. Co. ... ... ℥v.
Tinct. Catechu ... ... ℥v.
Spts. Chloroformi ... ... ℥v.
Cretæ Præp. ... ... ℥ii.ss.
Aquæ ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls every four hours in a pint of flour-gruel.

No. 3. ℞ Acidi Carbolici ... ... ℥ii.ss.
Tinct. Opii ... ... ℥ii.ss.
Spts. Chloroformi ... ... ℥v.
Aq. Menth. Pip. ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls every four hours in a pint of flour-gruel.

In Cases of Dysentery.

No. 4. ℞ Creosoti ... ... ℥v.
Vini Ipecac. ... ... ℥v.
Tinct. Opii ... ... ℥ii.ss.
Spts. Chloroformi ... ... ℥v.
Tinct. Camph. Co. ... ... ℥v.
Aquæ ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls every four hours in a pint of flour-gruel.

For Diarrhœa in Foals.

Commence treatment with a laxative, as follows:

No. 1. ℞ Ol. Ricini ... ... ℥i.
Liq. Potassæ ... ... ℥ss.
Ol. Menth. Pip. ... ... ♏v.
Aquæ ... ... ad ℥ii.

M. Ft. haust. Sig.: Give at once. For foals over a week old the above doses may be doubled. If the animal be weak, add 1 ounce of brandy to the draught.

ASTRINGENT MIXTURES FOR FOALS.

No. 2. ℞ Pulv. Catechu ... ... ℥iii.
Cretæ Præp. ... ... ℥iii.
Spts. Ammon. Aromat. ... ℥ii.
Tinct. Opii ... ... ℥i.
Aquæ ... ... ad ℥xii.

Ft. M. Sig.: Give from half a wineglassful to a wineglassful, with two wineglassfuls of the mare's milk, every four or six hours as required.

Or:

No. 3. ℞ Tinct. Chloroformi et Morphinæ Co. ... ... ℥ss.
Cretæ Præp. ... ... ℥i.
Tinct. Camph. Co. ... ... ℥ii.
Aq. Menth. Pip. ... ... ad ℥viii.

Ft. M. Sig.: Give from half a wineglassful to a wineglassful in ½ pint of flour-gruel every four hours as required.

Should constipation ensue after the above mixtures, give—

℞ Ol. Ricini ... ... ℥i.
Glycerini ... ... ℥ss.
Ol. Menth. Pip. ... ... ♏x.
Aquæ ... ... ad ℥ii.

Ft. M. Sig.: Give as directed.

For Cattle.

Astringent Mixture.

℞ Cretæ Præp. ... ... ℥iv.
Tinct. Opii ... ... ℥v.
Tinct. Catechu ... ... ℥v.
Spts. Chloroformi ... ... ℥v.
Aquæ ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls three times a day in a pint of flour-gruel.

Astringent Drench.

℞ Ext. Hæmatoxyli Liq. ... ℥i.
Cretæ Præp. ... ... ℥i.
Spts. Chloroformi ... ... ℥ii.
Aquæ ... ... ad O.i.

M. Ft. haust. Sig.: Give at once in a pint of flour-gruel. Repeat in six hours if necessary.

Mixture for Diarrhœa in Calves.

℞ Pulv. Catechu ... ... ℥ii.
Cretæ Præp. ... ... ℥ii.
Tinct. Opii ... ... ℥v.
Tinct. Zingib. ... ... ℥ii.ss.
Aq. Menth. Pip. ... ... ad O.i.

Ft. M. Sig.: Give from two to four tablespoonfuls in ½ pint of starch-gruel every four hours as required.

For Dogs.

Astringent Mixtures.

No. 1. ℞ Tinct. Catechu ... ... ℥vi.
Tinct. Opii ... ... ℥i.
Cretæ Præp. ... ... ℥ss.
Aq. Menth. Pip. ... ... ad ℥vi.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every four hours as required.

No. 2. ℞ Sodii Bicarb. ... ... ℥ii.
Spts. Ammon. Aromat. ... ℥vi.
Tinct. Cardamomi Co. ... ℥i.
Aq. Menth. Pip. ... ... ad ℥vi.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every three hours as required.

No. 3. ℞ Bismuthi Carb. ... ... ℥ss.
Tinct. Camph. Co. ... ... ℥ss.
Cretæ Præp. ... ... ℥ss.
Mucilaginis ... ... ℥i.
Aq. Menth. Pip. ... ... ad ℥vi.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every four hours as required.

No. 4. ℞ Bismuthi Carb. ... ... ℥ii.
Cretæ Præp.... ... ... ℥ss.
Sodii Bicarb. ... ... ℥i.
Liq. Opii Sed. ... ... ℥i.
Spts. Ammon. Aromat. ... ℥vi.
Spts. Chloroformi ... ... ℥ss.
Mucilaginis ... ... ℥ii.
Aq. Menth. Pip. ... ... ad ℥vi.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every three or four hours.

For Obstinate Cases of Diarrhœa in the Dog.

No. 5. ℞ Acidi Sulph. Dil. ... ... ℥iii.
Decocti Hæmatoxyli ... ℥iv.
Infusi Caryophylli ... ... ℥iv.
Aq. Menth. Pip. ... ... ad ℥x.

Ft. M. Sig.: Give from two teaspoonfuls to two tablespoonfuls three times a day as required.

Or :

℞ Decocti Hæmatoxyli ... ℥iv.
Infusi Caryophylli ... ... ℥iv.
Acidi Sulph. Aromat. ... ℥iv.
Syr. Zingib. ... ... ℥ii.
Aquæ Chloroformi ... ... ad ℥vi.

Ft. M. Sig.: Give from a teaspoonful to a tablespoonful three times daily.

Astringent Pills.

No. 1. ℞ β-Naphthol ... ... gr. ss.
Carbonis Ligni ... ... grs. ii.
Ol. Menth. Pip. ... ... ♏ss.
Excipient. ... ... q.s.

Ft. pil. i. Mitte xii. Sig.: Give from one to four pills every four or six hours. (*Useful for diarrhœa depending on a microbial origin.*)

No. 2. ℞ Bismuthi Subnit. ... ... grs. ii.ss.
Pulv. Ipecac. Co. ... ... grs. ii.ss.
Excipient. ... ... q.s.

Ft. pil. i. Mitte xii. Sig.: Give from one to four pills three or four times daily.

No. 3. ℞ Plumbi Acet. ... ... gr. ss. to grs. ii.
Pulv. Opii ... ... gr. ¼ to gr. ss.
Excipient. ... ... q.s.

Ft. pil. i. Mitte vi. Sig.: Give from one to two pills every four or six hours as required.

CATHARTICS.

For Horses.

Purgative Balls.

No. 1. ℞ Aloes Barb. ... ... ℥v.
Ext. Belladonnæ ... ... grs. xx.
Pulv. Gentianæ ... ... ℥i.
Ol. Menth. Pip. ... ... ♏xx.
Excipient. ... ... q.s.

Ft. bol. i.

Or :

No. 2. ℞ Aloes Barb. ... ... ℥iv.
Hydrarg. Subchloridi ... ℥ss.
Pulv. Gentianæ ... ... ℥i.ss.
Ol. Menth. Pip. ... ... ♏xx.
Excipient. ... ... q.s.

Ft. bol. i.

Strong Cathartic Ball.

No. 3. ℞ Aloes Barb. ... ... ℥v. to ℥vi.
Hydrarg. Subchloridi ... ℥ii.
Ext. Belladonnæ ... ... grs. xx.
Ol. Menth. Pip. ... ... ♏xx.
Excipient. ... ... q.s.
Ft. bol. i.

PURGATIVE DRAUGHT.

℞ Aloes Barb. ... ... ℥vi.
Aquæ Ferv. ... ... O.i.

Dissolve by means of a pestle and mortar, and add—

Ext. Zingib. Fl. ... ... ℥i.
Ft. haust.

For Cattle.

PURGATIVE DRENCHES.

No. 1. ℞ Magnesii Sulph. ... ... lb. i.
Pulv. Zingib. ... ... ℥ii.
Pulv. Anisi ... ... ℥ii.
Theriacæ ... ... lb. i.
Aquæ... ... ... O.iii.
Ft. haust. Sig.: Give at once.

No. 2. ℞ Magnesii Sulph. ... ... lb. ss.
Sodii Chlor. ... ... lb. ss.
Pulv. Zingib. ... ... ℥ii.
Theriacæ ... ... lb. i.
Aquæ... ... ... O.iii.
Ft. haust.

Or:

No. 3. ℞ Magnesii Sulph. ... ... lb. ss.
Aloes Barb. ... ... ℥i.
Pulv. Zingib. ... ... ℥ii.
Pulv. Anisi ... ... ℥ii.
Theriacæ ... ... lb. i.
Aquæ Ferv. ... ... O.ii.
Ft. haust.

For Sheep.

PURGATIVES.

No. 1. ℞ Sodii Sulph. ... ... ℥vi. to ℥xii.
Ft. pulv. i. Sig.: Dissolve in ½ pint of linseed mucilage, and give as a drench.

For Large Sheep.

No. 2. ℞ Magnesii Sulph. ... ... ℥iv.
Pulv. Gentianæ ... ... ℥ss.
Pulv. Zingib. ... ... ℥ss.

Ft. pulv. i. Sig.: Dissolve in ½ pint of linseed mucilage, and give as a drench.

Powerful Cathartic for Large and Strong Sheep.

℞ Ol. Crotonis ... ... ♏v.
Magnesii Sulph. ... ... ℥iv.
Pulv. Gentianæ ... ... ℥ss.
Pulv. Zingib. ... ... ℥ss.

M. Sig.: Give in ½ pint of linseed mucilage as a drench.

For Swine.

PURGATIVES.

No. 1. ℞ Sodii Sulph. ... ... ℥vi. to ℥xii.

Ft. pulv. i. Sig.: Give in sloppy food.

No. 2. ℞ Pulv. Jalapæ ... ... ℥i. to ℥iii.
Hyd. Subchlorid. ... ... gr. xv. to gr. xxx.
Theriacæ ... ... q.s.

Ft. electuar. Sig.: Administer on the tongue with a spoon.

No. 3. ℞ Sulphuris Sub. ... ... ℥iii. to ℥vi.
Magnesii Sulph. ... ... ℥viii. to ℥x.

Ft. pulv. i. Sig.: Give in the food or in the form of electuary.

Powerful Cathartic for Adult Swine.

℞ Ol. Crotonis ... ... ♏iii. to ♏v.
Ol. Lini ... ... ℥iv.

M. Ft. haust. Sig.: Give in one dose.

For Dogs.

PURGATIVE DRAUGHT.

℞ Ol. Ricini ... ... ℥ii. to ℥i.
Mucilaginis Acaciæ ... ℥ii. to ℥i.
Spts. Æth. Nit. ... ... ♏x. to ♏xx
Syr. Rhamni ... ... ℥ii. to ℥i.
Aquæ Menth. Pip. ... ... ℥ii. to ℥i.

M. Ft. haust.

Or:

PURGATIVE MIXTURE.

℞ Ol. Ricini ... ... ℥iii.
Mucilaginis Acaciæ ... ℥i.ss.
Syr. Aurantii ... ... ℥i.
Aq. Menth. Pip. ... ... ℥ii.ss.

Ft. M. Sig.: Give from a dessertspoonful to a wine-glassful.

PURGATIVE PILLS.

No. 1. ℞ Pil. Hydrargyri ... ... grs. ii.
Pil. Colocynthidis et Hyoscyami ... ... grs. iv.

M. Ft. pil. i. Mitte ii. Sig.: Give from one to two pills, according to the size of the dog.

Or:

No. 2. ℞ Hydrarg. Subchloridi ... grs. ii.
Pil. Colocynthidis et Hyoscyami ... ... grs. iv.

M. Ft. pil. i. Mitte ii. Sig.: Give from one to two pills.

Or:

No. 3. ℞ Ext. Colocynth. Co. ... gr. i.
Ext. Jalapæ ... ... gr. ss.
Podophylli Resinæ ... ... gr. $\frac{1}{8}$.
Ext. Hyoscyami ... ... gr. $\frac{1}{4}$.
Ol. Menth. Pip. ... ... gr. $\frac{1}{8}$.

Ft. pil. i. Mitte ii. Sig.: Give from one to two pills.

Cholagogue Cathartic Pills for the Dog.

No. 1. ℞ Podophylli Resinæ ... ... gr. $\frac{1}{4}$.
Pil. Hydrargyri ... ... gr. $\frac{1}{4}$.
Ext. Nucis Vom. ... ... gr. $\frac{1}{20}$.
Ext. Hyoscyami ... ... gr. $\frac{1}{8}$.
Oleo-resinæ Capsici ... gr. $\frac{1}{8}$.

M. Ft. pil. i. Mitte ii. Sig.: Give from one to two pills.

Or:

No. 2. ℞ Hydrarg. Subchloridi ... gr. i.
Ext. Rhei ... ... grs. ii.
Ext. Colocynth Co. ... grs. ii.
Ext. Hyoscyami ... ... gr. $\frac{1}{6}$.

Ft. pil. i. Mitte ii. Sig.: Give from one to two pills.

Laxatives for the Dog.

No. 1. ℞ Ext. Cascaræ Sagradæ ... grs. ii.
Ext. Nucis Vom. ... ... gr. $\frac{1}{20}$.
Ext. Gentianæ ... ... q.s.

M. Ft. pil. i. Mitte xii. Sig.: Give from one to two pills every day as required.

Or:

No. 2. ℞ Ext. Cascaræ Sagradæ ... grs. ii.
Ext. Nucis Vom. ... ... gr. $\frac{1}{20}$.
Ext. Belladonnæ ... ... gr. $\frac{1}{16}$.
Ext. Gentianæ ... ... q.s.

M. Ft. pil. i. Mitte xii. Sig.: Give from one to two pills once a day as required.

Laxative Mixture (Mistura Alba).

No. 1. ℞ Magnesii Sulph. ... ... ℥vi.
Magnesii Carb. ... ... ℥i.
Aq. Menth. Pip. ... ... ad ℥vi.

Ft. M. Sig.: Give from two teaspoonfuls to two tablespoonfuls as required.

Laxative Mixture.

No. 2. ℞ Paraffini Liq. ... ... ℥iv.

Sig.: Give from a teaspoonful to a tablespoonful, according to the size of the dog. Repeat as required.

Liver Pills for the Dog.

℞ Aloini ... ... gr. $\frac{1}{40}$.
Resinæ Podophylli ... ... gr. $\frac{1}{10}$.
Jalapin ... ... gr. $\frac{1}{40}$.
Ext. Nucis Vom. ... ... gr. $\frac{1}{80}$.
Ext. Hyoscyami ... ... gr. $\frac{1}{50}$.
Oleo-resinæ Capsici ... gr. $\frac{1}{80}$.

Ft. pil. i. Mitte xii. Sig.: Give from one to four pills twice daily.

Tonic Laxative Pills.

℞ Ferri Carb. Sacch. ... ... grs. v. to grs. x.
Aloini ... . gr. $\frac{1}{20}$.
Ext. Gentianæ ... ... q.s.

M. Ft. pil. i. Mitte xii. Sig.: Give from one to two pills twice daily.

DIURETICS.

For Horses.

DIURETIC MIXTURES.

No. 1. ℞ Potassii Acet. ... ... ℥ii.ss.
Tinct. Digitalis ... ... ℥x.
Spts. Æth. Nit. ... ... ℥v.
Aquæ... ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls every four hours in a pint of linseed-tea.

Or:

No. 2. ℞ Potassii Acet. ... ... ℥ii.ss.
Spts. Æth. Nit. ... ... ℥v.
Liq. Ammonii Acet. (Concent.) ℥x.
Aquæ... ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls every four hours in a pint of linseed-tea.

DIURETIC POWDERS.

℞ Pulv. Resinæ ... ... ℥ii.
Potassii Nit.... ... ... ℥ii.

M. Div. in pulv. vi. Sig.: Give one twice a day in the food.

For Dogs.

DIURETIC MIXTURES.

No. 1. ℞ Potassii Acet. ... ... ℥iii.
Liq. Ammonii Acet. ... ℥iv.
Spts. Æth. Nit. ... ... ℥vi.
Aquæ Camphoræ ... ... ad ℥vi.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every four hours.

No. 2. ℞ Potassii Acet. ... ... ℥ss.
Tinct. Digitalis ... . ℥ii.
Tinct. Scillæ ... ... ℥ss.
Spts. Æth. Nit. ... ... ℥vi.
Aquæ Camphoræ ... ... ad ℥vi.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every four hours.

EXPECTORANTS AND RESPIRATORY SEDATIVES.

For Horses.

Cough Mixtures.

No. 1. ℞ Glyco-heroin ... ... ℥v.
Aquæ... ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls every four hours in the food or in the drinking-water.

For Asthma and Chronic Cough.

No. 2. ℞ Glyco-heroin ... ... ℥v.
Potassii Iod.... ... ... ʒv.
Aquæ... ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls three times a day in the food.

For Chronic Cough and 'Broken Wind.'

No. 1. ℞ Liq. Arsenicalis ... ... ℥v.
Ext. Belladonnæ Fl. ... ʒv.
Glyco-heroin ... ... ℥v.
Aquæ... ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls in the food three times a day.

Or:

No. 2. ℞ Liq. Arsenicalis ... ... ℥v.
Ext. Belladonnæ Fl. ... ʒiii.
Tinct. Camphoræ Co. ... ℥v.
Aquæ... ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls three times a day in the food.

Cough Powders.

For Simple Cough.

℞ Pulv. Camphoræ ... ... ʒiii.
Pulv. Fol. Belladonnæ ... ʒi.ss.
Potassii Chlorat. ... ... ʒi.ss.
Pulv. Anisi ... ... ʒii.

M. Div. in pulv. vi. Sig.: Give one twice a day in the food.

For Chronic Cough.

No. 1. ℞ Pulv. Ext. Aconiti ... ... ℥ss.
Acidi Arseniosi ... ... ℥ss.
Antim. Potass. Tart. ... ℥vi.
Pulv. Anisi ... ... ℥ii.

M. Div. in pulv. vi. Sig.: Give one every night in the food.

No. 2. ℞ Veratrinæ ... ... gr. vi.
Pulv. Ext. Aconiti ... ... ℥ss.
Strychninæ Hydrochlor. ... gr. iii.
Acidi Arseniosi ... ... ℥ss.
Sodii Bicarb. ... ... ℥iii.

M. Div. in pulv. vi. Sig.: Give one every night in the food.

For Dogs.

COUGH MIXTURES.

No. 1. ℞ Glyco-heroin ... ... ℥i.ss.
Aquæ... ... ... ad ℥vi.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every four hours.

No. 2. ℞ Potassii Chlorat. ... ... ℥i.
Liq. Ammonii Acet. ... ℥iii.
Vini Ipecac. ... ... ℥ii.
Tinct. Camph. Co. ... ... ℥ss.
Aquæ Chloroformi ... ... ad ℥vi.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times daily.

No. 3. ℞ Syr. Cocillanæ Co. ... ... ℥ii.
Aquæ... ... ... ad ℥iv.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every four hours.

MEDICATED INHALATION FOR BRONCHITIS, COUGHS, ETC.

No. 1. ℞ Terebeni ... ... ℥ss.
Magnesii Carb. Levis ... ℥ii.
Aquæ... ... ... ad ℥vi.

M. Sig.: Use two tablespoonfuls in ½ pint of hot water as an inhalation.

Or :

No. 2. ℞ Ol. Eucalypti ... ... ℥ii.
Magnesii Carb. Levis ... ℥i.
Aquæ... .. .. ad ℥vi.

M. Sig.: Mix a teaspoonful in a pint of water at 140° F. for each inhalation.

GASTRIC SEDATIVES.

For Horses.

GASTRIC SEDATIVE MIXTURES.

No. 1. ℞ Ext. Belladonnæ Fl. ... ℥v.
Sodii Bicarb. ... ... ℥ii.ss.
Acidi Hydrocyanici (B.P.) ℥iii.
Bismuthi Carb. ... ... ℥ii.ss.
Mucilaginis ... ... ℥iv.
Aquæ... ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls every four hours in a pint of linseed-tea or in the drinking-water.

If Pain be a Prominent Symptom.

No. 2. ℞ Tinct. Camph. Co. ... ... ℥iv.
Ext. Belladonnæ Fl. ... ℥v.
Spts. Chloroformi ... ... ℥v.
Bismuthi Carb. ... ... ℥ii.ss.
Mucilaginis ... ... ℥iv.
Aquæ... ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls every four hours in a pint of linseed-tea or in the drinking-water.

For Cattle.

GASTRIC SEDATIVE MIXTURES.

No. 1. ℞ Ext. Belladonnæ Fl. ... ℥x.
Sodii Bicarb. .. ... ℥v.
Spts. Chloroformi ... ... ℥v.
Aquæ... ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls every four hours in a pint of linseed-tea.

Useful for Gastritis when Pain is a Prominent Symptom.

No. 2. ℞ Ext. Belladonnæ Fl. ... ℥x.
Chlorodyni ... ... ℥x.
Sodii Bicarb. ... ... ℥v.
Spts. Chloroformi ... ... ℥v.
Aquæ... ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls every four hours in a pint of linseed-tea until pain is relieved.

For Dogs.

Gastric Sedative Mixtures.

No. 1. ℞ Sodii Bicarb. ... ... ʒii.
Magnesii Carb. ... ... ʒii.
Bismuthi Carb. ... ... ʒiii.
Mucilaginis ... ... ʒi.
Aq. Menth. Pip. ... ... ad ʒvi.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful three or four times daily.

No. 2. ℞ Sodii Bicarb. ... ... ʒii.
Magnesii Carb. ... ... ʒii.
Bismuthi Carb. ... ... ʒiii.
Acidi Hydrocyanici (B.P.)... ʒi.
Mucilaginis ... ... ʒi.
Aq. Menth. Pip. ... ... ad ʒvi.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every three or four hours.

When Pain is a Prominent Symptom.

No. 3. ℞ Bismuthi Carb. ... ... ʒii.
Acidi Hydrocyanici (B.P.)... ʒi.
Liq. Opii Sed. ... ... ʒi.
Mucilaginis ... ... ʒi.
Aq. Menth. Pip. ... ... ad ʒvi.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every three or four hours.

Or:

No. 4. ℞ Liq. Bismuthi (B.P.) ... ʒvi.
Liq. Opii Sed. ... ... ʒi.
Spts. Chloroformi ... ... ʒiii.
Aq. Menth. Pip. ... ... ad ʒvi.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful every three or four hours.

Powders.

No. 1. ℞ Bismuthi Carb. ... ... ʒi.
Sodii Bicarb. ... ... ʒi.
Magnesii Carb. ... ... ʒi.

M. Div. in pulv. xii. Sig.: Give from one to two powders, on the tongue, every four hours.

When Persistent Vomiting is a Prominent Symptom.

No. 2. ℞ Chloretone ... ... ℥ss.

Div. in pulv. vi. Sig.: Give from one to two powders, on the tongue, every three or four hours until relief is obtained.

NOTE.—In toy dogs and in cats the dose of chloretone should not exceed 2 to 3 grains.

GASTRIC TONICS.

For Horses.

GASTRIC TONIC MIXTURES.

No. 1. ℞ Tinct. Nucis Vom. ... ... ℥ii.ss.
Acidi Hydrochlorici Dil. ... ℥x.
Tinct. Capsici ... ... ℥i.
Tinct. Gentianæ Co. ... ℥v.
Aquæ... ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls three times a day in a pint of ale.

No. 2. ℞ Liq. Strychninæ ... ... ℥v.
Acidi Nitro-hydrochlorici ... ℥x.
Tinct. Gentianæ Co. ... ℥v.
Aquæ... ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls three times a day in a pint of ale.

For Cattle.

GASTRIC TONIC MIXTURE.

℞ Ammonii Carb. ... ... ℥vi.
Tinct. Nucis Vom. ... ... ℥v.
Ext. Zingib. Fl. ... ... ℥v.
Aquæ... ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls three times a day in 2 pints of ale.

GASTRIC TONIC POWDERS.

℞ Pulv. Sinapis ... ... ℥vi.
Ammonii Carb. ... ... ℥vi.
Pulv. Nucis Vom. ... ... ℥i.ss.
Pulv. Gentianæ ... ... ℥vi.
Pulv. Zingib. ... ... ℥vi.

M. Div. in pulv. vi. Sig.: Give one three times a day in 1 pound of treacle and 2 pints of ale.

For Dogs.

Gastric Tonic Mixtures.

No. 1. ℞ Liq. Strychninæ ... ... ℥xx.
Acidi Hydrochlorici Dil. ... ʒi.ss.
Tinct. Calumbæ ... ... ʒiv.
Syr. Aurantii ... ... ℥i.
Aquæ... ... ... ad ℥iv.
Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times a day.

No. 2. ℞ Pepsini Glycerini ... ... ℥i.ss.
Tinct. Nucis Vom. ... ... ʒi.
Tinct. Capsici ... ... ℥xl.
Tinct. Calumbæ ... ... ʒvi.
Syr. Aurantii ... ... ℥i.ss.
Aquæ... ... ... ad ℥vi.
Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times a day.

No. 3. ℞ Ferri et Ammonii Cit. ... ʒi.
Liq. Strychninæ ... ... ℥xxxvi.
Acidi Hydrochlorici Dil. ... ʒii.
Syr. Aurantii ... .. ℥i.ss.
Aquæ... ... ... ad ℥vi.
Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times a day.

HÆMATINIC TONICS.

For Horses.

Tonic Mixtures.

No. 1. ℞ Ferri et Ammonii Cit. ... ʒx.
Tinct. Nucis Vom. ... ... ʒx.
Tinct. Calumbæ ... ... ℥v.
Glycerini ... ... ℥iii.
Aquæ... ... ... ad O.i.
Ft. M. Sig.: Give two wineglassfuls three times a day in a pint of ale.

No. 2. ℞ Quininæ Sulph. ... ... ʒii.ss.
Ac. Sulph. Dil. ... ... q.s.
Tinct. Ferri Perchloridi ... ʒx.
Tinct. Calumbæ ... ... ℥v.
Glycerini ... ... ℥iii.
Aquæ... ... ... ad O.i.
Ft. M. Sig.: Give two wineglassfuls three times a day in a pint of ale.

TONIC BALL.

℞ Quininæ Sulph. ... ... ℥ss.
Ferri Sulph. Exsicc. ... ℥i.
Ext. Nucis Vom. Sicc. ... gr. x.
Pulv. Gentianæ ... ... ℥ii.
Theriacæ ... ... q.s.

Ft. bol. i. Mitte xii. Sig.: Give one twice a day.

TONIC POWDERS.

℞ Ferri Sulph. Exsicc. ... ℥vi.
Sodii Bicarb. ... ... ℥ii.
Pulv. Nucis Vom. ... ... ℥iii.
Pulv. Gentianæ ... ... ℥i.ss.
Pulv. Anisi ... ... ℥ii.

M. Div. in pulv. vi. Sig.: Give one twice a day in the food.

For Cattle.

TONIC MIXTURE.

℞ Tinct. Ferri Perchloridi ... ℥ii.
Ext. Nucis Vom. Fl. ... ℥v.
Ext. Gentianæ Fl. ... ... ℥v.
Ext. Zingib. Fl. ... ... ℥ii.ss.
Aquæ... ... ... ad O.i.

Ft. M. Sig.: Give two wineglassfuls three times a day in 2 pints of ale and ½ pound of treacle.

TONIC POWDERS.

℞ Ferri Sulph. Exsicc. ... ℥i.ss.
Magnesii Sulph. ... ... ℥xii.
Pulv. Nucis Vom. ... ... ℥i.ss.
Pulv. Gentianæ ... ... ℥vi.
Pulv. Carui ... ... ℥iv.

M. Div. in pulv. vi. Sig.: Give one twice a day dissolved in 2 pints of ale and ½ pound of treacle, or give in the form of electuary.

For Dogs.

TONIC MIXTURES.

No. 1. ℞ Ferri Carb. Sacch. ... ... ℥ss.
Tinct. Nucis Vom. ... ... ℥i.
Tinct. Quininæ ... ... ℥vi.
Tinct. Calumbæ ... ... ℥vi.
Syr. Aurantii ... ... ℥ii.
Aquæ... ... ... ad ℥vi.

Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times a day.

No. 2. ℞ Ferri et Quininæ Cit. ... ℥ii.
Syr. Aurantii ... ... ℥ii.
Aquæ... ... ... ad ℥vi.
Ft. M. Sig.: Give from two teaspoonfuls to a tablespoonful three times a day.

Tonic Pills.

No. 1. ℞ Ferri Redacti ... ... gr. ss.
Quininæ Sulph. ... ... gr. ss.
Strychninæ Sulph. ... ... gr. $\frac{1}{120}$.
Ext. Gentianæ ... ... q.s.
Ft. pil. i. Mitte xii. Sig.: Give from one to two pills twice a day.

No. 2. ℞ Pil. Ferri ... ... grs. v.
Acidi Arseniosi ... ... gr. $\frac{1}{100}$.
Strychninæ Sulph. ... ... gr. $\frac{1}{100}$.
Excipient. ... ... q.s.
Ft. pil. i. Mitte xii. Sig.: Give from one to two pills twice a day.

No. 3. ℞ Ferri Hypophosphitis ... grs. ii.
Quininæ Sulph. ... ... gr. i.
Acidi Arseniosi ... ... gr. $\frac{1}{50}$.
Strychninæ Sulph. ... ... gr. $\frac{1}{100}$.
Excipient. ... ... q.s.
Ft. pil. i. Mitte xii. Sig.: Give from one to two pills three times daily.

No. 4. ℞ Ferri Sulph. Exsicc. ... grs. xxxvi.
Potassii Carb. ... ... grs. vi.
Pulv. Nucis Vom. ... ... grs. xii.
Saponis Dur. ... ... q.s.
M. Div. in pil. xii. Sig.: Give from one to two pills three times a day.

CEREBRAL SEDATIVES.

For Horses and Cattle.

Sedative Mixture.

℞ Chloral Hyd. ... ... ℥ii.ss.
Potassii Bromidi ... ... ℥iii.
Mucilaginis ... ... ℥iv.
Aquæ... ... ... ad O.i.
Ft. M. Sig.: Give two wineglassfuls every four hours in a pint of linseed-tea as required.

For Dogs.

Sedative Mixture.

No. 1. ℞ Chloral Hyd. ... ... ℥ii.
Potassii Bromidi ... ... ℥ii.
Liq. Opii Sed. ... ... ℿxl.
Syr. Aurantii ... ... ℥ss.
Aquæ... ... ... ad ℥iv.

Ft. M. Sig.: Give from a teaspoonful to a tablespoonful every four hours as required.

No. 2. ℞ Chloral Hyd. ... ... ℥ii.
Potassii Bromidi ... ... ℥ii.
Ext. Cannabis Ind. ... ... gr. i.
Ext. Hyoscyami ... ... gr. i.
Syr. Simpl. ... ... q.s.
Aquæ... ... ... ad ℥i.

Ft. M. Sig.: Give from 15 drops to a teaspoonful in a little water every four hours.

Sedative Pills.

No. 1. ℞ Chloral Hyd. ... ... grs. v.
Potassii Bromidi ... ... grs. v.
Excipient. ... ... q.s.

Ft. pil. i. Mitte xii. Sig.: Give from one to three pills every four hours as required.

No. 2. ℞ Potassii Bromidi ... ... grs. v.
Sodii Bromidi ... ... grs. v.
Ammonii Bromidi ... ... grs. iii.
Excipient. ... ... q.s.

Ft. pil. i. Mitte xii. Sig.: Give from one to three pills three times a day.

ELECTUARIES.

For Horses.

For Laryngitis, Pharyngitis, etc.

No. 1. ℞ Pulv. Camphoræ ... ... ℥ss.
Pulv. Myrrhæ ... ... ℥i.
Potassii Chlorat. ... ... ℥ii.
Ext. Belladonnæ Vir. ... ℥i.
Mellis ... ... ℥i.
Glycerini ... ... ad ℥viii.

M. Ft. electuarinum. Sig.: Give from ½ ounce to 1 ounce three times a day on the tongue.

No. 2. ℞ Pulv. Camphoræ ... ... ℥iv.
Pulv. Myrrhæ ... ... ℥viii.
Potassii Chlorat. ... ... ℥iv.
Ext. Belladonnæ Vir. ... ℥ii.
Pulv. Glycyrrh. Rad. ... ℥viii.
Theriacæ ... ... q.s.

M. Ft. electuarinum. Sig.: Give from ½ ounce to 1 ounce four times daily.

Sedative Electuary for Tetanus in the Horse.

℞ Ext. Belladonnæ Vir. ... ℥ii.
Potassii Bromidi ... ... ℥iv.
Acidi Hydrocyanici Dil. ... ℥i.
Theriacæ ... ... ad. ℥viii.

M. Ft. electuarinum. Sig.: Give 1 ounce four times daily on the tongue.

CLEANSING DRENCH FOR COWS.

℞ Pulv. Ergotæ ... ... ℥i.
Ammonii Carb. ... ... ℥i.
Magnesii Sulph. ... ... ℥xii.
Pulv. Zingib. ... ... ℥i.
Pulv. Anisi ... ... ℥ii.

M. Sig.: To be given in 2 pints of warm ale, together with 1 pound of treacle and four raw eggs.

COUNTER-IRRITANTS.

Cantharides Blister.

No. 1. ℞ Pulv. Cantharidis ... ... ℥viii.
Ol. Olivæ ... ... ℥viii.
Adipis Præp. ... ... ℥viii.

Heat for ten hours in a steam-bath, and then add:

Ceræ Flavæ ... ... ℥iv.
Ol. Terebinth. ... ... ℥viii.

M. Ft. ung.

Or:

No. 2. ℞ Pulv. Cantharidis ... ... ℥x.
Ol. Terebinth. ... ... ℥vi.
Acidi Acetici ... ... ℥iv.ss.

Mix and heat to 200° F. for a short time; then melt 2½ pounds of lard and mix the above constituents therewith.

Red Iodide Blister.

No. 3. ℞ Hydrarg. Biniod. ... ... ℥ii.
Paraffini Liq. ... ... ℥iv.

Mix well together in a mortar, then melt ½ pound of lanolin and ½ pound of vaseline, and mix the above therewith, blending them together in a mortar until thoroughly incorporated.

For Active Counter-Irritation.

No. 4. ℞ Ung. Cantharidis ... ... ℥i.
Ung. Hydrarg. Biniod. ... ℥i.
M. Ft. ung.

No. 5. ℞ Pulv. Cantharidis ... ... ℥ii.ss.
Ol. Terebinth. ... ... O.i.
Ol. Olivæ ... ... O.i.ss.

Digest for fourteen days, and shake well daily. After letting it stand until it becomes clear, decant the clear portion. It is employed as a counter-irritant in the case of chronic enlargements, and is directed to be applied at intervals of three weeks. This is known in France as 'Feu Français.'

LINIMENTS.

Absorbent Liniments.

No. 1. ℞ Iodi ... ... ℥i.
Potassii Iodidi ... ... ℥ii.
Glycerini ... ... ℥xvi.
M. Ft. lin.

No. 2. ℞ Saponis Animalis ... ... ℥ii.
Potassii Iodidi ... ... ℥i.ss.
Glycerini ... ... ℥i.
Ol. Limonis ... ... ℥i.
Aquæ Destillatæ ... ... ℥x.

Reduce the curd soap to fine shreds; mix it with the distilled water and glycerin in a porcelain dish on a water-bath. When the soap is dissolved, pour the liquid into a mortar in which the potassium iodide has previously been powdered, mix by trituration, and continue the latter until the mixture is cold; set aside for an hour, then rub the oil of lemon into the cream-like product. This liniment neither stains nor irritates the skin.

Absorbent Liniment for reducing Capped Hocks, Thoroughpins, etc.

No. 3. ℞ Ol. Picis Rectificati ... ℥iv.
Ol. Lini ... ... ℥iv.

M. Ft. lin. Sig.: Apply to the part with a brush once daily.

Absorbent Liniment used in reducing Chronic Enlargements, etc.

No. 4. ℞ Pulv. Cantharidis ... ... ℥viii.
Pulv. Euphorbii ... ... ℥vi.
Spts. Vini Rectif. ... ... O.ii.
Liq. Ammon. Fort. ... ... ℥ii.

Macerate for seven days, then strain and filter. Sig.: Apply with a nail-brush, and repeat in three days.

STIMULATING LINIMENT.

℞ Saponis Mollis ... ... ℥ii.
Pulv. Camphoræ ... ... ℥iv.
Ol. Terebinth. ... ... ℥xvi.

Digest in a large wide-mouthed bottle for a week, and shake frequently. Then add very gradually (2 ounces at a time) 24 ounces of water, and shake the bottle vigorously during the process. Add 6 ounces of ammonium chloride dissolved in a pint of warm water, and shake well together. Then add gradually 3 pints of water and shake, and add 6 ounces of Liq. Ammon. Fort. After again shaking well together, add 2 pints of water. The above makes 1 gallon of liniment, the constituents of which do not separate. If a stronger liniment be required, add more oil of turpentine and ammonia.

Strong Stimulating Liniment suitable for Cattle.

℞ Liq. Ammon. Fort. ... ... ℥ii.
Ol. Terebinth. ... ... ℥ii.
Ol. Lini ... ... ℥vi.

M. Ft. lin.

Liniments for Mud Fever.

No. 1. ℞ Liq. Plumbi Subacet. Fortis ℥ii.
Glycerini ... ... ℥xvi.

M. Ft. lin.

Or:

No. 2. ℞ Liq. Plumbi Subacet. Fortis ℥ii.
Ol. Olivæ ... ... ℥viii.
M. Ft. lin.

White Liniment for applying after Counter-Irritation.

℞ Potassii Carb. ... ... ℥ss. or ℥ii.
Ol. Olivæ ... ... ℥x. or O.ii.
Ol. Eucalypti . ... ℥i. or ℥ss.
Aquæ... .. .. ℥x. or O.ii.
M. Ft. lin.

Garget Liniment (Useful in the Treatment of Mammitis).

℞ Ext. Belladonnæ Vir. ... ℥ss. or ℥ii.
Glycerini ... ... ℥iv. or ℥xvi.
Lin. Saponis ... ... ℥vi. or ℥xxiv.

Linimentum Saponis (Soap Liniment).

℞ Pulv. Camphoræ ... ... ℥i.
Saponis Mollis ... ... ℥ii.
Ol. Rosmarini ... ... ℥iii.
Spts. Rectificati ... ... ℥xvi.
Aquæ... ... . ℥iv.

Dissolve the soap in the water, and mix it with the camphor and oil of rosemary dissolved in the alcohol. After a week filter.

Carron-Oil for applying in the Treatment of Burns, etc.

℞ Liq. Calcis ... ... ℥x.
Ol. Lini ... ... ℥x.
M. Ft. lin.

For Dogs.

Liniment for Acute Eczema.

No. 1. ℞ Zinci Oxidi ... ... ℥iii.ss.
Adipis Lanæ Hyd. ... ... ℥ss.
Liq. Calcis ... ... ℥iv.
Ol. Olivæ ... ... ℥iv.
M. Ft. lin. Sig.: Apply twice daily.

Or:

No. 2. ℞ Calaminæ Præp. ... ... ℥iii.
Zinci Oxidi .. .. ℥ii.
Liq. Calcis ... ... ℥iv.
Ol. Olivæ ... ... ℥iv.
M. Ft. lin. Sig.: Apply twice daily.

Skin Liniment for Eczema in Long-coated Dogs.

No. 3. ℞ Sulphuris Præcip. ... ... ℥i.
Zinci Oxidi ... ... ℥i.
Paraffini Liq. (white vaseline oil) ... ... ℥viii.

M. Ft. lin. Perfume with Ol. Rosæ. Sig.: Apply twice daily.

Skin Liniment for Eczema, etc., in Cats.

No. 4. ℞ Sulphuris Præcip. ... ... ℥i.
Calaminæ Præp. ... ... ℥i.
Glycerini ... ... ℥ii.
Liq. Calcis ... ... ℥iv.
Aquæ Rosæ ... ... ℥iv.

M. Ft. lin. Sig.: Apply twice daily.

Liniment for Eczema of the Scrotum in the Dog.

No. 5. ℞ Liq. Plumbi Subacet. Dil. ... ℥ii.
Tinct. Opii ... ... ℥ii.
Glycerini ... ... ℥ss.
Aquæ ... ... ad ℥viii.

M. Ft. lin. Sig.: Apply two or three times daily.

Liniment for Chronic or Neglected Cases of Canker in the Dog.

No. 6. ℞ Iodi ... ... ℥i.
Glycerini ... ... ℥vi.

M. Ft. lin. May be diluted with an equal amount of rose-water, or used undiluted. Apply every third day.

Parasiticide Liniments.

For Parasitic Mange in the Horse.

℞ Sulphuris Sub. ... ... ℥viii.
Potassii Carb. ... ... ℥ii.
Ol. Picis ... ... ℥iv.
Ol. Lini ... ... ad O.ii.

M. Ft. lin. Sig.: Apply all over affected parts. Wash off on the third day and reapply.

For Sarcoptic Mange in the Horse, as approved by the Army Veterinary Department, 1915.

℞ Sulphuris Sub. ... ... ℥x.
Ol. Cetacei (sperm-oil) ... O.ii.

M. Ft. lin.

Directions:

1st day : (*a*) Clip, singe, and wash with hard soap and warm water.

(*b*) Dress. Rub in dressing thoroughly with an old body-brush. A body-brush cut in half makes two convenient appliances.

2nd day : Reapply dressing to spots that appear to be irritable, or from which the dressing has been removed by contact.

3rd day : Reapply dressing as directed for second day.

10th day : Cleanse thoroughly with hard soap and warm water.

11th day : Dress as on first day.

12th day : Reapply dressing as directed for second day.

13th day : Reapply dressing as directed for second day.

21st day : Cleanse thoroughly with hard soap and warm water.

22nd day : Dress as on first day.

23rd day : Reapply dressing as directed for second day.

24th day : Reapply dressing as directed for second day.

30th day : Wash off finally, sweat, and groom daily for a week.

If still irritable after a week, proceed again with treatment for a second month on the assumption that the case is one of sarcoptic mange.

Dressing for Psoroptic Mange; also useful for dressing 'In-Contacts' and for Disinfection of Fittings, etc.

Paraffin (Kerosene) Oil	...	1 pint.
Solution of Hard Soap	...	1 gallon.

Directions.—Prepare the soap solution by cutting in small pieces 1 pound of hard soap; add this to 1 gallon of warm water in a pot. Simmer it over a slow fire until the soap is dissolved. Remove from the fire and (while hot) add the kerosene oil, and stir thoroughly until the dressing becomes of a creamy consistence. Apply the dressing with a brush, and wash it off on the fourth day, and if necessary reapply. As the oil tends to float to the surface of the dressing, it is necessary to stir it frequently while carrying out the application; otherwise the kerosene will be taken up by the brush, and will set up dermatitis of the surface to which it is applied.

Dressing for Generalized Ringworm in the Horse.

Kerosene-Oil	... ...	2 pints.
Raw Linseed-Oil	... ...	1 pint.
Solution of Soft Soap	...	2 pints.

Directions.—Mix the two oils, and then add the solution of soap. (The soap solution is prepared by dissolving ½ pound of soft soap in 1 gallon of hot water.) Clip the horse all over, and apply the dressing with a brush. Two dressings are usually sufficient.

Liniment for Localized Ringworm in the Horse.

℞ Iodi ... ... ℥i.
Ol. Picis Rect. ... ... ℥iv.

Mix carefully, applying heat if necessary. Shake the bottle before use. Apply with a stiff brush. Usually two dressings are sufficient.

Liniments for Symbiotic Ear Mange or Parasitic Ear Canker in the Dog.

No. 1. ℞ Balsami Peruviani ... ...
Glycerini ... ... } āā ℥i.
M. Ft. lin.

No. 2. ℞ Ol. Staphisagriæ ... ... ℥i.
Ol. Olivæ ... ... ℥iv.
M. Ft. lin.

No. 3. ℞ Ung. Hydrarg. Nit. Dil. ... ℥i.
Balsami Peruviani ... ... ℥iii.
Ol. Olivæ ... ... ℥v.
M. Ft. lin.

No. 4. ℞ Ol. Staphisagriæ ... ... ℥ii.
Ac. Carbolici ... ... ℥ss.
Ol. Olivæ ... ... ℥v.
M. Ft. lin.

Directions.—After cleansing the ears, pour in a little of any of the above liniments.

Liniment for Generalized Mange in the Dog.

℞ Sulphuris Sub. ... ... lb. ii.
Ol. Picis ... ... ℥iv.
Paraffini Liq. (white vaseline oil) ... ... O.iv.

M. Ft. lin. Sig.: Dress one-third of the body each day. Do not repeat the dressings until a week has elapsed.

Liniment for Follicular Mange in the Dog.

℞ Creosoti ... ... ℥iv.
Liq. Potassæ ... ... ℥i.
Ol. Olivæ ... ... ℥viii.

M. Ft. lin. Sig.: First shave the affected parts, then apply the liniment; repeat twice weekly, and then at longer intervals when the skin becomes tender. (Hunting.)

Liniment for Open Joint.

℞ Hydrarg. Perchloridi ... ℥ii.
Tinct. Myrrhæ ... ... ℨxvi.
Aquæ... ... ... ℨii.

M. Ft. lin. Sig.: Apply with a camel hair brush once a day.

Or:

℞ Hydrarg. Biniod. ... ... ℥iv.
Paraffini Liq. (white vaseline oil) ... ... ℨvi.

Ft. lin. Sig.: Inject into the cavity of the joint, after the part has been thoroughly cleansed by irrigation with saline solution.

Liniment for Erysipelas, Lymphangitis, etc.

℞ Ext. Belladonnæ Vir. ... ℨii.
Liq. Plumbi Subacet. Fortis ℨiv.
Glycerini ... ... ℨiv.
Aquæ... ... ... ad O.ii.

M. Ft. lin. Sig.: Apply four times daily.

Antiseptic Liniment for Wounds.

℞ Creosoti ... ... ℥ii.
Terebeni ... ... ℨviii.
Ol. Olivæ ... ... ad O.i.

Ft. lin.

LIQUID SOAP.

For Washing Dogs, etc.

℞ Saponis Mollis (Knight's) ... lb. i.
Spts. Methylati ... ... ℨxvi.
Ol. Eucalypti ... ... ℨi.

M.

The above also forms a useful basis for skin liniments, and agents such as sulphur, cyllin, etc., may be added thereto.

LOTIONS.

Absorbent Lotion for Capped Hock.

℞ Hydrarg. Biniod. ... ... ℥i.
Potassii Iod. ... ... ℥ss.
Aquæ... ... ... ℨxii.

M. Ft. lotio. Sig.: Apply once or twice daily until the part becomes scaly and tender, then discontinue and reapply.

Lotion for Fœtid Grease and Chronic Cracked Heels.

℞ Plumbi Acet. ... ... ℥i.
Zinci Sulph. ... ... ℥i.
Cupri Sulph. ... ... ℥i.
Aquæ Camphoræ ... ... O.i.

M. Ft. lotio. Sig.: Soak a bandage in this lotion, and apply by drawing it backwards and forwards on the part until the latter is thoroughly cleaned. Repeat twice daily. Use no ointments until all discharge has ceased.

White Lotion.

℞ Plumbi Acet. ... ... ℥i. or ℥iv.
Zinci Sulph. ... ... ℥vi. or ℥iii.
Aquæ ... ... O.i. or O.iv.

M. Ft. lotio.

Cooling Lotion for Strained Tendons, etc.

No. 1. ℞ Liq. Plumbi Subacet. Fortis ℥iv.
Spts. Rectificati ... ... ℥i.
Aquæ ... ... ad O.i.

M. Ft. lotio. Sig.: Soak bandages in this lotion, and apply to affected limbs.

No. 2. ℞ Ammon. Chlor. ... ... ℥i.
Plumbi Acet. .. ... ℥i.
Alumenis ... ... ℥i.
Aceti (vinegar) ... ... O.ii.
Aquæ ... . O.i.

M. Ft. lotio. Sig.: Apply as directed for No. 1.

EYE LOTIONS.

No. 1. ℞ Ext. Belladonnæ Vir. ... ℥ii.
Ac. Borici ... ... ℥i.
Aquæ Laurocer. ... ... ℥vi.
Aquæ Rosæ ... ... ad O.i.

M. Ft. lotio.

No. 2. ℞ Ac. Borici ... ... grs. lxxx
Aquæ Laurocer. ... ... ℥viii.
Aquæ Rosæ ... ... ad O.i.

M. Ft. lotio.

For Opacity of Cornea.

No. 3. ℞ Argenti Nit.... ... ... grs. ii. to grs. iv.
Aquæ Destil. ... ... ℥i.

M. Ft. lotio. Sig.: Apply with a camel-hair brush once a day.

Eye-Drops for Keratitis, Iritis, etc.

No. 4. ℞ Cocainæ Hydrochlor. ... grs. ii.
Atropinæ Sulph. ... ... grs. ii.
Ac. Borici ... ... grs. iv.
Aquæ Rosæ ... ... ℥i.

M. Ft. lotio. Sig.: Instil a few drops by means of an eye-dropper three times daily.

Astringent Lotion for Chronic Ophthalmia, Purulent and Catarrha Ophthalmia, Catarrhal Conjunctivitis, etc.

No. 5. ℞ Zinci Sulph.... ... ... gr. i. to grs. ii.
Aquæ Rosæ ... ... ℥i.

M. Ft. lotio. Sig.: May be instilled into the eye four or five times daily.

No. 6. ℞ Hydrogenii Peroxidi ... ℥i.
Aquæ Destil. ... ... ad ℥iv.

M. Ft. lotio.

No. 7. ℞ Sol. Adrenalini (1 to 1,000) ℥xlviii.
Cocaine Hydrochlor. ... grs. ii.
Atropinæ Sulph. ... ... grs. ii.
Ac. Borici ... ... grs. iv.
Aquæ Destil. ... ... ℥i.

M. Ft. lotio. Sig.: Instil a few drops into the eye twice daily.

INJECTIONS.

Intratracheal Injection for Parasitic Bronchitis in Calves.

℞ Ac. Carbolici ... ... ℥iv.
Ol. Terebinth. ... ... ℥x.
Potassii Carb. ... ... ℥i.ss.
Ol. Olivæ ... ... ℥v.
Aquæ... ... ... ad ℥xx.

M. Sig.: Administer ½ ounce by intratracheal injection once daily for three consecutive days.

Dean's Injection for the Treatment of Bog-Spavin.

No 1 ℞ Hydrarg. Perchlorid. ... grs. xx.
Spts. Methylati ... ... ℥i.

M.

No. 2. ℞ Tinct. Iodi Decoloratæ ... ℥i.

Sig.: Mix together 1 drachm of each of the above, and inject this amount after withdrawing the synovia. For successful results, Dean's combined aspirator and injector should be employed. No air should be admitted into the part, and aseptic precautions should be observed. One injection is usually sufficient.

Injection for the Production of Local Anæsthesia.

℞ β-Eucaine ... ... grs. ix.
Sol. Adrenalini Chlor. (1 to 1,000) ... ... ℥xvi.
Aquæ Destil. ... ... ℥i.

M. Sig.: Inject hypodermically from 10 to 20 minims at different points in the region to be rendered anæsthetic.

Cocaine Injection for the Diagnosis of Lameness in the Horse.

℞ Cocainæ Hydrochlor. ... grs. iv.
Aquæ Destil. ... ... ℥i.

Ft. injectio. Sig.: Inject half into the region of the plantar nerves at each side of the limb, just above the fetlock.

Saline Solution for Irrigating Wounds.

℞ Sodii Chlor. ... ... ℥vii.
Sodii Citratis ... ... grs. xlv.
Aquæ... ... ... O.i.

Ft. lotio.

Normal Saline Solution for injecting either Subcutaneously or by Intravenous Injection.

Prepared by dissolving 1 drachm of sodium chloride in 1 pint of boiled water. Some authorities advise 75 to 78 grains to the pint.

OINTMENTS.

Antiseptic.

℞ Iodoformi ... ... ℥ii.
Ac. Borici ... ... ℥ii.
Ol. Eucalypti ... ... ℥i.
Adipis Lanæ Hyd. ... ... lb. ss.
Vaselini ... ... lb. ss.

M. Ft. ung.

Ointment for Cracked Heels and Slight Grease.

No. 1. ℞ Plumbi Acet. ... ... ℥iv.
Plumbi Carb. ... ... ℥iv.
Pulv. Camphoræ ... ... ℥ii.
Ol. Eucalypti ... ... ℥ii.
Adipis Lanæ Hyd. ... ... lb. i.
Vaselini ... ... lb. i.

M. Ft. ung. Melt the lanolin and vaseline, then add the two salts of lead, and heat so as to combine the constituents; add the camphor and the oil of eucalyptus, and blend thoroughly in a mortar. Colour with Armen. bole.

No. 2. ℞ Zinci Oxidi ... ... ℥iv.
Calaminæ Præp. ... ... ℥ii.
Sulphuris Sub. ... ... ℥ii.
Ac. Borici ... ... ℥ii.
Ol. Eucalypti ... ... ℥i.
Adipis Lanæ Hyd. ... ... lb. ss.
Vaselini ... ... lb. ss.

M. Ft. ung. Melt the lanolin and vaseline, add the eucalyptus-oil, mix the zinc salts, sulphur, and boric acid together, and blend thoroughly the entire constituents in a mortar. Colour with Armen. bole.

Absorbent Ointments.

No. 1. ℞ Potassii Iod. ... ... ℥ii.
Adipis Lanæ Hyd. ... ... lb. ss.
Vaselini ... ... lb. ss.

M. Ft. ung. Powder the potassium iodide finely; melt the basis, and thoroughly incorporate both in a mortar. Colour with Armen. bole.

No. 2. ℞ Iodi ... ... ℥ii.
Potassii Iod. ... ... ℥ii.
Adipis Lanæ Hyd. ... ... lb. ss.
Vaselini ... ... lb. ss.

M. Ft. ung. Mix as directed above.

For reducing Bursal Enlargements, etc.

No 3. ℞ Iodi ... ... ℥vi.
Potass. Iod. ... ... ℥iii.
Spts. Methyl. ... ... q.s.
Picis Liquidæ } ... ... āā lb. i.ss.
Sapo. Moll. }

Melt together. Sig.: Apply once daily until the part gets tender and scaly.

Ointment for the Treatment of Mallenders and Sallenders.

℞ Cyllin ... ... ℥ii.
Ung. Hydrarg. Ammoniati (B.P.) ... ... ℥iv.

M. Ft. ung. Sig.: Apply twice a day.

Hoof Ointment, for the Treatment of Brittle Feet, etc.

℞ Picis Liquidæ ... ... lb. i.
Ceræ Flavæ ... . lb. i.
Mellis ... ... lb. i.
Glycerini ... . ℥xii.
Adipis Lanæ Hyd. ... ... lb. iii.
Vaselini ... ... lb. iii.

M. Ft. ung. Melt the lanolin, vaseline, and beeswax together, then stir in the other ingredients, and blend thoroughly.

For Dogs.

Ointment for Acute Eczema in the Dog.

℞ Zinci Oxidi ... ... ℥ii.
Calaminæ Præp. ... ... ℥ii.
Sulphuris Præcip. ... ... ℥ii.
Adipis Lanæ Hyd. ... ... ℥viii.
Vaselini ... ... ℥viii.

M. Ft. ung. Sift the zinc salts thoroughly; melt the basis, and blend in a mortar. Scent with Ol. Rosæ, and colour with carmine. Sig.: Apply twice daily.

Ointment for Eczema, Mange, etc., in Small Pet Dogs.

℞ Zinci Oxidi ... ... ℥i.
Sulphuris Præcip. ... ... ℥i.
Balsami Peruviani ... ... ℥ss.
Ol. Staphisagriæ ... ... ℥ss.
Adipis Lanæ Hyd. ... ... ℥iv.
Vaselini ... ... ℥iv.

M. Ft. ung. Melt the basis with the balsam of Peru, and stir in the other ingredients. Sig.: Apply once daily.

Ointment for Follicular Mange, Chronic Eczema, Sarcoptic Mange.

℞ Zinci Oxidi ... ... ℥ii.
Sulphuris Sub. ... ... ℥ii.
Ac. Salicylici ... ... ℥ii.
Styrax Præp. ... ... ℥ii.
Adipis Lanæ Hyd. ... ... ℥viii.
Vaselini ... ... ℥viii.

M. Ft. ung. Sift the zinc and sulphur finely; melt the styrax, vaseline, and lanolin together, and add the other ingredients; stir until set. Afterwards rub well up in a mortar to thoroughly incorporate the ingredients, and to give the whole mass a homogeneous appearance.

Sig.: Clip the dog, and apply the ointment to one-third of the body one day, another third another day, and the other third the day following. Use friction when applying. Continue the treatment daily until the disease disappears. Do not wash. Keep the dog warm, especially during cold, wet, or damp weather. Feed well on stimulating food, such as meat. Give from $\frac{1}{40}$ to $\frac{1}{20}$ grains of arsenious acid in the food every morning and evening. The above ointment is perfectly safe and most effectual.

Ointment for Chronic Eczema.

℞ Ol. Betulæ ... ... ℥i.
Zinci Oxid. ... ... ℥i.
Adipis Lanæ Hyd. ... ... ℥iv.
Paraffini Moll. Flav. ... ℥iv.

M. Ft. ung. Sig.: Apply once a day.

Ointment for Eczema Dorsi (frequently met with in Aberdeen Terriers).

℞ Zinci Oxidi ... ... ℥i.
Picis Liquidæ ... ... ℥i.
Ung. Hydrarg. ... ... ℥i.

M. Ft. ung. Sig.: Apply every third or fourth day.

Ointment for Ophthalmia Tarsi, Corneal Ulceration, and Chronic Conjunctival Inflammation; also for Eczema affecting the Eyelids.

℞ Hydrarg. Oxidi Flav. ... ℈ss.
Paraffini Moll. Flav. ... ℥iii.

M. Ft. ung. Sig.: Insert a portion of ointment about the size of a hemp-seed within the lower eyelid every night.

Stainless Iodine Ointment.

R	Iodi	℥iv.
	Acidi Oleic.	lb. i.

Place in an earthenware pot, and heat by placing the pot in a tin of water over a gas fire. When dissolved, add

Adipis Lanæ Hyd.	lb. ss.
Vaselini	lb. ss.

and mix well together. This ointment can be made stronger by reducing the amount of lanolin and vaseline.

VILLATE'S INJECTION FOR QUITTOR.

R	Liq. Plumbi Subacetatis Fort.	℥ii.
	Cupri Sulph.	℥i.
	Zinci Sulph....	℥i.
	Ac ti	℥viii.

M. Ft. injectio.

FORMULA FOR ALOETIC MASS.

R	Aloes Barb.	lb. i.ss.
	Ol. Lini	℥iii.

Powder the aloes coarsely, put into a pan, add the linseed oil, and place the pan in a hot-water bath. When the ingredients are melted, stir well, add 8 ounces of treacle, and mix thoroughly. In weighing out for physic balls, allow 1½ drachms of this mass for each 1 drachm of aloes.

ADDENDUM TO MATERIA MEDICA SECTION

Camphora Monobromata (Monobromated Camphor) is a combination of Camphor and Bromine. It is occasionally prescribed in canine practice as a sedative in cases of chorea, epilepsy, etc., and is advised by some authors in the treatment of cystitis. The dose for dogs is grs. ii. to grs. viii., given either in the form of pills or as an elixir.

Cardamomi Semina (Cardamom Seeds), *Tinctura Cardamomi Composita* (Compound Tincture of Cardamoms).—Cardamoms possess a carminative action, and the compound tincture is sometimes employed as an adjunct to colic draughts, the dose being ℥i. to ℥ii.

Cuprol (P., D. and Co.).—This is a preparation containing 6 per cent. of copper in combination with nucleinic acid. Solutions of the agent (5 per cent. in water) prove useful as a local application in the treatment of chronic conjunctivitis in the dog. It also forms a valuable astringent in cases of chronic cracked heels in horses, and is prescribed as a lotion (1 to 40 of water). As an alterative and tonic, it is sometimes given to horses, the dose being ℥i.

Guaiaci Resinæ (Guaiacum Resin) is sometimes prescribed in cases of chronic rheumatism in the dog, and for this purpose is combined with sulphur, and administered in the form of capsules. Its value is doubtful. The dose for dogs is grs. v. to grs. viii.

Kaolin is a native aluminium silicate possessing desiccant, astringent, and protective actions. Combined with boric acid

and zinc oxide, it forms a useful application for the treatment of canker of the ear in dogs.

A combination of kaolin, glycerin, and antiseptic agents, is frequently employed as a substitute for the old-fashioned linseed-meal poultice, and it possesses many advantages for this purpose (see p. 189).

Piperazin (Diethylene-Diamine) is employed in human medicine in order to overcome the uric acid diathesis in cases of gout, and to break up cystic concretions; but its value is doubtful, according to some authorities.

Potassa Sulphurata (Sulphurated Potash, 'Liver of Sulphur') is occasionally employed in the treatment of parasitic skin diseases in the dog, in the form of medicated baths. A 2 per cent. solution of the drug is advised by some authors for this purpose.

Sodii Citras (Citrate of Soda).—For the uses of this salt see pp. 285, 851.

Sodii Hypochloris (Hypochlorite of Soda).—In the treatment of septic wounds in the present war, a solution of hypochlorite of soda has given excellent results in the hands of many surgeons. This agent has not as yet been used extensively in veterinary surgery, but the results obtained so far are very encouraging. The most convenient preparation is Dakin's Concentrated Borated Hypochlorite Solution, which can be diluted for use by adding 6 parts of sterilized water. This solution is prepared by decomposing chlorinated lime with a solution of sodium carbonate, and then adding to the filtered solution a sufficient quantity of boric acid to render it acid to phenolphthalein, but still alkaline to litmus. For full details of the preparation see p. 853. The solution actually contains a mixture of hypochlorite and polyborates of sodium, with small amounts of free hypochlorous and boric acids.

Strychninæ Arsenas (Strychnine Arsenate).—This salt may be prescribed in cases where the actions of strychnine and arsenic are desirable—*e.g.*, in pulmonary emphysema (broken wind), and in certain nervous diseases. The doses are similar to those of strychnine hydrochloride (see p. 407).

Strychninæ Phosphas Acidus (Strychnine Phosphate).—This salt of strychnine, combined with codeine phosphate, has been found useful in cases of chronic bronchitis in the dog (see p. 718). The dose is similar to that of strychnine hydrochloride (see p. 407).

Sambuci Flores (Elderberry Flowers).—*Aqua Sambuci* is prepared from the above. It is sometimes employed as an adjunct to lotions for the eyes, and is believed to exert a slight sedative action which lessens irritation in various ophthalmic conditions.

Zinci Oleas (Oleate of Zinc).—This agent, combined with boric acid and oxide of zinc, forms an excellent application for canker of the ear in the dog.

Codeinæ Phosphas (Codeine Phosphate).—Dose for dogs, gr. $\frac{1}{4}$ to gr. i. (See p. 718 for uses.)

Syrupus Codeinæ (Syrup of Codeine).—Two drachms of this contain about $\frac{1}{2}$ grain of Codeine Phosphate. Dose for dogs, ℥xx. to ʒi. (For uses see p. 761.)

Syrupus Apomorphinæ Hydrochloridi (Syrup of Apomorphine).—Apomorphine Hydrochloride, 0·05; Diluted Hydrochloric Acid, 0·25; Alcohol (90 per cent.), 4·5; Distilled Water, 4·5; Syrup, to 100. Dose for dogs, ʒss. to ʒi. (See p. 718 for uses.)

Syrupus Ipecacuanhæ Acetatis (U.S.P.).—Fluid Extract of Ipecacuanha, 7; Acetic Acid, 1; Glycerin, 10; Sugar, 70; Water, to 100. Dose for dogs, ʒss. to ʒi. (For uses see p. 718.)

NOTE ON THE INTRAVENOUS INJECTION OF FORMALIN SOLUTION IN THE TREATMENT OF PNEUMONIA IN THE HORSE

In the treatment of pneumonia, the intravenous injection of a solution of formalin is advised by Mr. D. Imrie, M.R.C.V.S., under the following conditions: When the disease is bilateral, the patient debilitated, the pulse quick and weak, the case 'hanging fire,' and there is reason to fear that pulmonary gangrene may set in. Generally speaking, these indications occur about the seventh day of the illness, but the treatment may be adopted earlier if deemed necessary, or, in fact, at any time during the course of the disease. The solution is prepared by diluting 2 drachms of formalin (40 per cent.) with 12 ounces of warm (sterilized) water. A small trocar and cannula is first introduced into the jugular vein, the trocar is withdrawn, and a piece of small-bore pliable rubber tubing is attached to the cannula. The solution is then slowly injected through the rubber tubing by means of a glass syringe having a capacity of 4 ounces. Strict aseptic precautions should be observed.

Other observers recommend a ½ per cent. solution of formalin, 1 pint of which is injected daily into the jugular vein, and continued until the temperature falls. The treatment is commenced immediately the case comes under observation. The daily injections are carried out on the left jugular and right jugular veins alternately. This measure has proved very successful in the treatment of pneumonia in army horses, and the mortality from the disease, according to the reports issued, was reduced to 7·6 per cent. as the result of its employment.

NOTE ON THE PREVENTION OF MAMMITIS IN CONNECTION WITH MILK FEVER

In order to minimize, as far as possible, the risks of mammitis, the practitioner should make a careful examination of the quarters, and of the milk therefrom, prior to inflating the organ. If any quarter is suspected of disease or actually affected, it should not be inflated until the sound quarters have first been subjected to the procedure. If the teat syphon has been used on a diseased quarter, it should be sterilized by boiling before being employed on another case. Neglect of this precaution has not infrequently been the means of infecting a healthy udder and inducing mammitis.

It is advisable to ask the owner of the cow if, to his knowledge, the animal had suffered from an attack of mammitis, as it is not uncommon for the disease to occur during the dry period. Precautions can then be adopted prior to inflating the udder, in order to prevent the spread of infection.

NOTE ON ELECTROTHERAPY IN VETERINARY PRACTICE

In veterinary practice the application of electrotherapy is limited to the use of Faradism or Galvanism. Although theoretically there are various conditions which ought to be benefited by this treatment, yet in practice it is seldom employed, except in cases of paraplegia in the dog, and even here the results are not often satisfactory.

In **Galvanism** the continuous galvanic current is employed, while in **Faradism** an interrupted or induced (faradic) current is used.

In cases of paraplegia, Faradism is employed by means of an induction apparatus of a similar pattern to that used in human medicine. A suitable apparatus can be obtained at a moderate price. Owing to the fact that the hairy skin of animals is a poor conductor of electricity, it is necessary to moisten the electrodes with a saline solution. In cases of paraplegia in the dog, the solar surface of both hind-feet should be moistened with saline solution, and an electrode is then applied to each foot. If only one limb be affected, one electrode is applied to the solar aspect of the foot, and the other to the lumbar region of the spine. A weak current should be employed at the commencement, and gradually increased in strength until twitching of the limb occurs. The application should be continued for ten or fifteen minutes two or three times daily. Improvement in the case is evidenced when a weaker current induces twitching of the muscles.

INDEX

A

Abbreviations used in prescriptions, 175
A.B.C. liniment, 351
Abdomen, auscultation of the, 45
— palpation of, 44
— percussion of, 44
— physical examination of, 44
Abdominal breathing, 27
— dropsy, 679, 827
— — tapping for, 827
— sounds, 33
'Abdominal typhus,' 805
Abomasitis, treatment of, 598
Absolute alcohol, 291
— ether, 313
Absorbent applications, 447, 448
— — formulæ for, 893, 894, 899, 903, 904
Acaciæ gummi, 498
A.C.E. mixture, 298
Acetanilide, 327
Acetate of lead, 231
— of potash, 209
Acetic acid, 284
— — antidotes to, 285
— — toxic actions of, 285
Acetozone, 330
Acetum, 284
Acetyl-salicylic acid, 490
Acid hydrochloride of quinine, 487
— — — use of, in canine typhus, 813
Acids, 277
— general actions of, 277
Acidum aceticum, 284
— — dilutum, 284
— — glaciale, 284
— arseniosum, 255
— benzoicum, 452
— boricum, 282
— carbolicum, 332
— chromicum, 282
— chrysophanicum, 482
— citricum, 285
— gallicum, 478
Acidum glycerophosphoricum, 286
— hydrochloricum, 280
— — dilutum, 280
— hydrocyanicum dilutum, 347
— nitricum, 279
— — dilutum, 279
— nitro-hydrochloricum dilutum, 281
— pyrogallicum, 479
— salicylicum, 490
— sulphuricum, 278
— — aromaticum, 278
— — dilutum, 278
— tannicum, 478
— tartaricum, 285
Acoine, 383
Aconite, 351
— antidotes to, 354
— extract of (dry), 351
— extract of (liquid), 351
— liniment of, 351
— tincture of, 351
— — Fleming's, 351
Aconitina, 352
Aconitine, 352
— ointment, 352
Actinomycosis, treatment of, 254, 269
Action of drugs, physiological, 126
Actions and uses of drugs, 120
— of drugs, circumstances modifying, 122
Actual cautery, uses of, 162, 830 (see also 'Firing')
Adeps benzoatus, 452, 501
— lanæ, 501
— lanæ hydrosus, 501
— præparatus, 501
Administration of medicines, 180
— — to birds, 191
— — to cats, 115
— — to cattle, 181, 182
— — to dogs, 182, 183
— — to horses, 181
— — to pigs, 860
— — to sheep, 856
Adrenalin, 513

Adrenalin chloride, solution of, 513
— — contra-indications of, 515
— — toxic action of, 514
— — uses of, in azoturia, 516, 764
— — — in detection of broken wind, 517
— — — in diseases of the eye, 516
— — — in epistaxis, 516
— — — in laminitis, 516
— — — in milk fever, 517, 777
— — — in purpura hæmorrhagica, 517, 755
— — — in red water, 517
— — — in surgical shock, 517
Æther, 313
— purificatus, 313
Agglutinins, 543
— immune, 543
— normal, 543
Agropyrum, 485
— liquid extract of, 485
Air, fresh, importance of, in treatment of respiratory diseases, 563, 702, 706
— treatment of milk fever, 776
Airoform, 264
Airol, 264
Albumin, tests for, 58
Albuminuria, 55
— spurious, 56
Alcohol, 291
— actions of, 292
— antidotes to, 295
— contra-indications of, 296
— toxic actions of, 295
— uses of, 295
Ale, 292
Alembroth, sal, 250
Alexins, 542
Alkalies and alkaline earths, 205
Alkaline stomachics, 130
Alkaloids, 203
Aloes, 459
— actions of, 459
— Barbadensis, 459
— contra-indications of, 462
— in treatment of colic, 625
— precautions in the employment of, 461
— superpurgation from, 461, 639
— uses of, 460, 625
Aloinum, 459
Aloin, 459, 463
Alteratives, 158
— formulæ for, 864
Althææ radix, 500
Alum, 228
— ammonia, 228
— in the treatment of laminitis, 228
— potash, 228
Alumen, 228
Aluminium, 228
Alypin, 383
American wormseed, oil of, 474
Aminoform, 325
Ammonia, antidotes to, 217
— aromatic spirit of, 219
— carbonate of, 218
— solution of, 217
— — strong, 216
— toxic actions of, 217
Ammoniacum, 455
Ammoniated camphor liniment, 449
— mercury, 251
— quinine, 487
— tincture of ergot, 427
— tincture of quinine, 487
Ammonii acetatis, liquor, 220
— benzoas, 452
— bromidum, 272
— carbonas, 218
— chloridum, 220
Ammonium and its medicinal compounds, 216
— sulpho-ichthyolate, 343
Amyl nitris, 322
— nitrite, 322
Amylene hydrate, 322
Amyloform, 326
Amylum, 500
Anæsthesia, general, 154, 299
— local, 155, 378, 381, 515
— spinal, 187
Anæsthetics, 154, 297
— general, 154
— local, 155, 378, 381, 515
— — formulæ for, 902
— remarks on the action of, 297
Anal glands, catarrh of, 656
— — diseases of, 656
— — impaction of, 657
Analgesics, 153
Anaphrodisiacs, 143
Anaphylaxis, 554
Anhydrotics, 161
Anise fruit, 438
— oil of, 438
Aniseed, 438
Anisi fructus, 438
Anodynes, 153
— formulæ for, 866
Antacids, 131
Anthelmintics, 138
Anti-anthrax vaccine and serum, 528, 554
Anti-distemper vaccines, 527, 537
Antidotes to acetic acid, 285
— to aconite, 354
— to alcohol, 295
— to ammonia, 254

Antidotes to antimony, 217
— to arsenic, 258
— to atropine, 388
— to barium, 226
— to belladonna, 388
— to cantharides, 509
— to carbolic acid, 215, 334
— to chloral hydrate, 317
— to chloroform, 309, 312
— to cocaine, 379
— to colchicum, 359
— to copper salts, 235
— to corrosive sublimate, 249
— to creolin, 339
— to creosote, 337
— to digitalis, 421
— to ergot, 430
— to eserine, 401
— to hemlock, 397
— to hydrochloric acid, 280
— to hydrocyanic acid, 349
— to iodine, 268
— to lead salts, 231
— to mercury salts, 244
— to morphine, 368
— to nitrate of silver, 237
— to nitre, 207
— to nitric acid, 280
— to nux vomica, 411
— to opium, 368
— to paraffin oil, 346
— to phosphorus, 262
— to physostigmine, 401
— to pilocarpine, 405
— to prussic acid, 349
— to strychnine, 411
— to sulphuric acid, 278
— to tartar emetic, 254
— to tobacco, 395
— to turpentine, oil of, 442
Anti-emetics, 132
Antifebrin, 327
Antimastitis vaccine, 551
Antimonial wine, 254
Antimonium tartaratum, 253
Antimony, 253
Antipyretics, 158
Antipyrin, 327
Antiseptics, 166
— intestinal, 137
— in treatment of wounds, 845
— urinary, 142
Antisialics, 129
Antispasmodics, 153
Anti-strangles serum, 533
Anti-streptococcic serum, 554
Anti-swine-erysipelas vaccine and serum, 529
Anti-swine-fever serum, 555, 861
Anti-tetanus serum, 535, 555
Anti-toxin, influenza, 532
Anti-toxins, 542
Anuria, 54
Aphrodine, 493
Aphrodisiacs, 143
Apocynum, 377
Apomorphinæ hydrochloridum, 363
Apomorphine hydrochloride, 363
Appearance, general, of animal, symptoms in connection with, 71
Appetite, abnormal, 40
— depraved, 40
— loss of, 40
Applications, cold, 164, 288
— hot, 190, 288
Aqua, 287
— camphoræ, 449
— chloroformi, 298
— destillata, 289
— fortis, 279
— lauro-cerasi, 485
— menthæ piperitæ, 436
— picis, 447
— regia, 281
— rosæ, 451
— sambuci, 909
Aquæ, 201
Araroba, 482
Areca, 475
Areca-nut, 475
— contra-indications of, 476
— precautions in prescribing, 476
— toxic actions of, 476
Arecoline hydrobromide, 476
— — actions of, 476
— — uses of, 476
Argenti nitras, 236
— — antidotes to, 237
— — induratus, 236
— — toxic actions of, 237
Argentum, 236
— colloidale, 237
Argyrol, 238
Aristol, 343
Arnica, 454
— tincture of, 454
Aromatic spirit of ammonia, 219
— sulphuric acid, 278
— volatile oils, 435
Arsenate of iron, 242
— of strychnine, 908
Arsenic, 255
— actions of, 255
— antidotes to, 258
— Fowler's solution of, 255
— hydrochloric solution of, 255
— toxic actions of, 256
— uses of, 259
— white, 255

Arsenical dip for destruction of ticks in cattle, 759
— sheep dip, 260
Arsenicalis, liquor, 255
Arsenicum album, 255
Arsenious acid, 255
Arsenium, 255
Artificial respiration in the dog, 831
— — in the horse, 831
Asafetida, 455
Ascites, treatment of, 679
Aspidin, 472
Aspirin, 490, 492
Assumed skill, 12
Asthma, bronchial or spasmodic, treatment of, in the dog, 718
— — — in the horse, 699
Astringents, 165
— formulæ for, 873, 875
— gastric, 130
— intestinal, 136
Atoxyl, 255, 260
Atropina, 385
Atropinæ sulphas, 385
Atropine sulphate, 385
— — actions of, 386
— — antidotes to, 388
— toxic actions of, 388
— uses of, 389
Attendant, the, 86, 104, 862
Attitudes and postures, symptoms furnished by, 48
Atypical cases, 11
Auramin, 328
Aurantium, 458
Auscultation of abdomen, 45
— of chest, 32
— of heart, 24
Auto-cautery, Dechery's, 840
Azoturia, treatment of, 763
— — adrenalin in, 764
— — digalen in, 764
— — pantopon in, 764
— — potassium iodide in, 765

B

Bacteria, agents acting on, 166
— aggressivity of, 540
— remarks on, 539
Bacterial infection, 539
— invasion, 539
Bacteriolysins, 544
Bacteriolysis, 544
Balls, 196
— administration of, 180
Balsam of Peru, 453
— of Tolu, 453
Barii chloridum, 226
Barium chloride, 226
— — actions of, 226
— — antidotes to, 226
— — toxic actions of, 226
— — uses of, 227
Barley water, 499
Baths, 190
— luminous heat, 191
Battley's liquor opii sedativus, 361
Bedding for sick dogs, 113
— — swine, 863
Beeswax, 504
Begg, H., on the care, management, and nursing of sick cattle, 90
— on treatment of impaction of rumen, 591
Belladonna, 384
— actions of, 386
— antidotes to, 388
— extract, dry, of, 384
— — green, of, 384
— — liquid, of, 384
— glycerin of, 385
— liniment of, 385
— ointment of, 385
— tincture of, 385
— toxic actions of, 388
— uses of, 389
Benzene, 326
Benzine, petroleum, 345
Benzoate of ammonium, 452
— of soda, 452
Benzoated lard, 452, 501
Benzoic acid, 452
— — toxic actions of, 453
Benzoin, 451
— compound tincture of, 451
Benzoinum, 451
Benzol, 326
Benzoline, 345
Benzoyl-acetyl-peroxide, 330
Berberine, 435
Beta-eucaine, 380
Betulæ, oleum, 448
Biborate of soda, 282
Bicarbonate of potash, 206
— of soda, 211
Bichloride of mercury, 249
Bichromate of potash, 282
Bier's hyperæmic treatment, 836
Bile-duct, acute catarrh of, in the dog, 672
— — in the horse, 667
Bile pigments in urine, tests for, 61
Biniodide of mercury, 251
Birch tar, oil of, 448
Birds, administration of medicines to, 191
— bronchitis in, 721

Birds, diet for sick, 117
— diseases of crop in, 615
— — of intestines in, 660
— — of stomach in, 618
— nasal catarrh in, 721
— nursing of sick, 116
— pneumonia in, 722
— surroundings of sick, 118
Bismuth, 263
— paste, 264
Bismuthi benzoas, 264
— carbonas, 263
— oxy-iodogallas, 264
— salicylas, 264
— subgallas, 264
— subnitras, 263
Bismuthum, 263
Bitartrate of potash, 210
'Blacklegoids,' 526
Black quarter vaccine, 524
— — — directions for use, 524
Black wash, 246
Bladder, drugs acting on, 141
— inflammation, acute, of, in the dog, 692
— — — in the horse, 690
— inflammation of, chronic, in the dog, 692
— — — in the horse, 692
— irrigation of the, 691
Blaud's pill, 239
Bleaching powder, 222
Blister, cantharidin, 507
— 'green,' 507
Blistering liquid (B.P.), 508
— hints on, 510
Blisters, formulæ for, 892
— precautions necessary in applying, 510
Blood-letting, 159
Bloodvessels, drugs acting on, 148
Blue ointment, 246
— pill, 245
— stone, 235
— vitriol, 235
Bog-spavin, Deans' injection for, 270
Boracic acid, 282
Borated hypochlorite of soda solution, 852
Borax, 282
— glycerin of, 283
Boric acid, 282
— gauze, 282
— lint, 282
— ointment, 282
— poultice, 283
— wool, 282
Boro-chloretone, 321
Brain, diseases of the, in the dog, 746
— — of the, in the horse, 740
— drugs acting on, 152
Brandy, 292
Breathing, abdominal, 27
— irregular, 27
— thoracic, 27
Broken wind, 710
— — contra-indications of eserine and arecoline in, 402, 713
— — detection of, by adrenalin, 517
— — treatment of, 712
Bromide of ammonium, 272
— of potassium, 272
— of sodium, 272
Bromine, 272
— toxic actions of, 272
Bromism, 272
Bromum, 272
Bronchi, drugs acting on, 151
Bronchial asthma in the dog, 718
— — in the horse, 699
Bronchitis, acute, treatment of, in the dog, 717
— — in the horse, 697
— chronic, in the dog, 717
— — in the horse, 698
— parasitic, in calves, 443, 830
Broom, 397
Brucine, 408
Buccal membrane and hard palate, congestion of, 566
— mucosæ, alterations in character of, 41
Buchu, 484
— infusion of, 484
— tincture of, 484
Buckthorn, syrup of, 464
Bulimia, 40
Burgundy pitch, 448
Burnett's disinfecting fluid, 235
Bursal enlargements, absorbent applications for, 894, 904
Butter of antimony, 253
Butyl-chloral hydrate, 320

C

Cactin, 425
Cactoid, 425
Cade, oil of, 436
Caffeinæ citras, 415
Caffeine, 415
— citrate, 415
Calabar bean, 399
Calamina præparata, 234
Calamine, prepared, 234
Calcii chloridum, 222
— hydras, 221

Calcii hypophosphis, 261
— phosphas, 223
— sulphas, 223
Calcined gypsum, 223
— magnesia, 223
Calcium and its medicinal salts, 221
— lactate, 222
— oxide, 221
Calculi, intestinal, 634
Calomel, 247
Calumba, 433
Calyx, 221
— chlorinata, 222
— sulphurata, 261
Campbell, on the use of alum in laminitis, 228
Camphor, 449
— Compound liniment of, 449
— — tincture of, 449
— liniment of, 449
— spirit of, 449
— subcutaneous or intramuscular injection of, 451
— tincture of, 449
— water, 449
Camphora, 449
— monobromata, 907
Camphorated oil, 449
Canadian hemp, 377
Canine distemper, treatment of, 780 (see also Distemper, canine)
— — vaccines, 527, 551
'Canine influenza,' 752, 805
— typhus, treatment of, 805, 812
— — types of, 806
— — use of acid hydrochloride of quinine in, 813
— — use of dilute hydrochloric acid in, 814
— — use of normal saline solution in, 815
Canker, ear, formulæ for, 233, 896, 898
Cannabis indica, 375
— — actions of, 376
— — extract of, 375
— — toxic actions of, 376
— — uses of, 376
Cantharides, 507
— actions of, 508
— antidotes to, 509
— precautions in use of, 510
— toxic actions of, 508
Cantharidin, 507
— ointment, 507
Cantharidinum, 507
Cantharis, 507
Capsicum, 455
Capsules, gelatin, 197
Caraway, 438
Carbo animalis, 275
— ligni, 275
Carbolic acid, 332
— — actions of, 333
— — antidotes to, 334
— — glycerin of, 332
— — toxic actions of, 333
— — uses of, 335
— antiseptic dressings, 332
— disinfecting powder, 333
— oil, 335
— ointment, 332
— soap, 332
Carbon disulphide, 502
Carbonate of ammonia, 218
— of bismuth, 263
— of iron, 239
— of lead, 231
— of magnesia, 223
— of potash, 206
— of zinc, 234
Cardamoms, 438, 907
Cardiac action, intermittent, 727
— — irregular, 727
— depressants, 148
— diseases, 727
— impulse, 23
— murmurs, 25, 731
— stimulants, 145
— tonics, 147
— valvular diseases in the dog, 736
— — — in the horse, 728, 730
Care and management of sick animals, 76
Carlsbad salt, artificial, 215
Carminatives, 137
Carron oil, 222
Caryophyllum, 436
Cascara evacuant, 464
— sagrada, 464
— — dry extract of, 464
— — liquid extract of, 464
Cascarilla, 435
Case, history of, 12
Cases, atypical, 11
— typical, 11
Castor oil, 468
Castration, peritonitis following, 678
— — prevention of, 678
Casts, organized, in urine, 63
— clinical significance of, 64
Cat, distemper in the, 801
— passing the catheter in the, 835
Catarrh, gastric, acute, treatment of, in dog, 609
— — — — in horse, 582
— — chronic, in dog, 611
— — — in horse, 583
— ingluvial, 616

Catarrh, nasal, acute, in the dog, 716
— — — in the horse, 694
— — chronic, in the horse, 695
— of anal glands, 656
— of bile-duct in dog, 672
— — — in horse, 667
— of crop, 616
Catarrhal enteritis, acute, in dog, 652
— jaundice in dog, 672
— — in horse, 667
— stomatitis, 565
Catechu, 480
— compound powder of, 480
— tincture of, 480
Cathartics, 132 (see also Purgatives)
Catheter, special, for cats, 835
Catheterization in the bitch, 834
— in the cat, 835
— in the cow, 833
— in the dog, 833
— in the horse, 832
— in the mare, 832
— in the ox, 833
— in the ram, 833
Cats, sick, nursing of, 115
— vermicide for, 476, 477
Cattle, sick, nursing of, 90
Caustic, lunar, 236
— potash, 205
Caustics, 164
Cautery, actual, use of, 162, 838
— auto-, Dechery's, 840
Cera alba, 504
— flava, 504
Cerebral diseases in the dog, 746
— — in the horse, 740
— sedatives, 152
— — formulæ for, 890
— stimulants, 152
Cetacei oleum, 502
Cetaceum, 502
Chalk, prepared, 222
Charcoal, 275
Chaulmoogra oil, 500
Chemotaxis, negative, 541
— positive, 541
Chenopodium, oil of, 474
Cherry-laurel water, 485
Chest, auscultation of, 32
— palpation of, 37
— percussion of, 31
— physical examination of, 30
Chillies, 455
Chinaseptol, 331
Chinese blistering fly, 512
Chinosol, 331
Chinosol, toxic actions of, 331
Chiretta, 435
Chloral hydrate, 316
— — actions of, 316
— — antidotes to, 317
— — as an anæsthetic, 318
— syrup of, 319
— toxic actions of, 317
— uses of, 317
Chloralamide, 320
Chloralose, 319
— as an anæsthetic, 320
Chlorate of potash, 208
Chloretone, 320
Chloric ether, 298
Chloride of ammonium, 220
— of barium, 226
— of calcium, 222
— of lime, 222
— of sodium, 211
— of zinc, 235
Chlorinated lime, 222
— soda, solution of, 216
Chlorine, 265
Chlorodyne, 364
Chloroform, 298
— action on respiration and circulation, 301
— antidotes to, in dog, 312
— — in horse, 309
— as a general anæsthetic, 302
— danger-signals during administration, 309, 310
— methods of administration to dog, 311
— — — to horse, 307
— — — — in standing posture, 308
— methylated, 298
— anæsthesia, effect of surgical shock on, 306
— — stages of, 299
— remarks on administration of, 303
— risks of, 303, 305
— spirit of, 298
— water, 298
Chloroformum, 298
Chlorum, 265
Cholagogues, 138
Chorea, treatment of, 793
Chromic acid, 282
Chrysarobin, 482
Chrysophanic acid, 482
Cinchona, 486
— compound tincture of, 486
Cinnamon, oil of, 481
Circulation, drugs acting on, 144
Circulatory organs, diseases of, treatment of, 724

Circumstances modifying the action of medicines, 122
' Circus mode of progression,' 48
Cirrhosis of the liver in the dog, 673
— — in the horse, 668
Citrate of potash, 210
— of soda, 285, 908
Citric acid, 285
Citrine ointment, 253
Cleansing drench, 892
Clinical experience, importance of, in therapeutics, 562
— study, importance of, 11
Clothing for sick animals, 79, 102, 113, 862
Cloves, infusion of, 436
— oil of, 436
Coal-tar, solution of, 341
Cocainæ hydrochloridum, 377
Cocaine hydrochloride, 377
— — actions of, 378
— — antidotes to, 379
— — as a local anæsthetic, 379
— — in the diagnosis of lameness, 380
— — toxic actions of, 378
— — uses of, 379
Cocillana, 493
Codeina, 363
Codeine, 363
— actions of, 369
— phosphate, 909
— uses of, 363
Cod-liver oil, 503
Cofectant fluid, 341
Colchicina, 358
Colchicine, 358
Colchicum, 358
— antidotes to, 359
— tincture of, 358
— toxic actions of, 358
'Colchi-Sal,' 359
Cold applications, 164, 288
Colic, flatulent, in cattle, 646
— — in the horse, 626
— formulæ for, 866, 872
— obstructive, in foals, 633
— — in the horse, 628
— simple, or spasmodic, in cattle, 646
— — — in the dog, 651
— — — in the horse, 626
— treatment of, in the horse, 623
Collargol, 237
Collinsonia, 485
Collodion, 315
Collodium, 315
— cum iodoformo, 342
Colloid silver, 237
Colocynth, 465
Colocynth, compound pill of, 465
Colocynthis, 465
Colon, impaction of, in cattle, 647
— — in foals, 633
— double, subacute obstruction of, in horse, 628
— — — — of pelvic flexure of, 632
— single, impaction of, in horse, 632
Common salt, 212
— — in treatment of wounds, 850
Condy's fluid, 210
Conine, 396
Conium, 396
— antidotes to, 397
Constipation, 49, 641
Contagious gastro-enteritis in dog, 805
— pneumonia in horse, 703
Contra-indications of drugs, 170
Convallaria, 424
— tincture of, 424
Copaiba, 456
Copeman's anti-distemper vaccine, 527
Copper, salts of, 235
— — antidotes to, 235
— — toxic actions of, 235
Copperas, 240
Coriander, 438
Corrosive sublimate, 249
— — antidotes to, 249
— — toxic actions of, 249
Coryza, acute, 694
Coster's paste, 266
Couch grass, 485
— — liquid extract of, 485
Cough, as a symptom, 27
— character of, in broken wind, 711
— formulæ for, 803
— ' stomach,' 211
— varieties of, 28
Counter-irritants, 161
— — in respiratory diseases, 708
— — uses of, 162
' Cracked ' heels, formulæ for, 894, 903
Cream of tartar, 210
Creolin, 337
— antidotes to, 339
— toxic actions of, 338
Creosote, 336
— antidotes to, 337
— toxic actions of, 337
Crepitation, 36
Creta præparata, 222
' Crop-bound,' 617
Crop, diseases of, treatment of, 616
— impaction of, 617
— pendulous, 616
' Crop-sick,' 616

Croton oil, 467
— — toxic actions of, 467
Croupous enteritis in cattle, 647
— — in the dog, 653
Cubebs, 456
Cumulative action, 127
— — drugs possessing, 127
Cupri sulphas, 235
Cupric sulphate, 235
Cuprol, 907
Cuprum, 235
Curare, 397
Cusparia, 435
Cusso, 477
Cyllin, 337
Cystamin, 325
Cystitis, acute, treatment of, in dog, 692
— — — in horse, 690
— chronic, in dog, 692
— — in horse, 692
Cytolysins, 544

D

Dairy cows, nursing and care of, 93
Dakin's formula for treatment of infected wounds, 852
Damiana, 494
Daturine, 393
Deans' injection for bog-spavin, 270
Dechery's auto-cautery, 840
Decoctions, 201
Decoctum hæmatoxyli, 481
— hordei, 499
— scoparii, 397
Decolorized tincture of iodine, 266
Demulcents, 130
Deodorants, 167
Depressants, cardiac, 148
— spinal, 156
Dermatol, 264
Diabetes insipidus, 759
— — treatment of, in dog, 760
— — — in horse, 760
— mellitus, 760
— — treatment of, 761
Diabetic coma, 761
Diacetyl-morphine, 373
— — hydrochloride, 373
Diagnosis and general symptoms of disease, 8
— correct, importance of, 9
— — foundations of a, 12
— difficulties in connection with, 10, 12
— doubts, and probabilities in connection with, 561
— method in, 12
Diagnosis, importance of clinical study in connection with, 11
Diagnostic symptoms, 11
Dialyzed iron, 239
Diaphoretics, 159, 160
Diaphragm, spasm of, 745
Diarrhœa as a symptom, 49
— chronic, in the dog, 654
— in calves, 649
— — formulæ for, 875
— in cattle, 648
— — formulæ for, 749, 875
— in foals, 640
— — formulæ for, 874
— in the horse, 638
— — formulæ for, 873
— obstinate, in canine distemper, 786
Diet for sick birds, 117
— — cats, 115
— — cattle, 99
— — dogs, 109
— — horses, 80
— — sheep, 857
— — swine, 862
Digalen, 418
— in the treatment of azoturia, 764
Digestive adjuvants, 136
— organs, diseases of, 564
— — — treatment of, in birds, 615
— — — — in cattle, 588
— — — — in the dog, 606
— — — — in the horse, 564
— — symptoms furnished by morbid conditions of, 38
Digipoten, 418
Digitalin, 417
Digitalis, 416
— action, cumulative, of, 420
— actions of, 418
— antidotes to, 421
— contra-indications of, 422
— fluid extract of, 417
— infusion of, 417
— leaves, 416
— medicinal uses of, 421
— tincture of, 417
— toxic actions of, 420
Digitonin, 417
Digitoxin, 418
Dilatation of the stomach in the dog, 608
Dionin, 374
Disinfectants, 166
— gastric, 131
— intestinal, 137
Dispensing, 193
Distemper, canine, 780
— — course of, 781
— — diarrhœa in, 785

Distemper, canine, diet in, 783
— — elevation of temperature in, 784
— — eruption in, 798
— — gastric phenomena in, 785
— — intestinal complications of, 785
— — nervous complications of, 792
— — ocular lesions of, 795
— — pulmonary complications of, 789
— — treatment of, 780
— in the cat, treatment of, 801
— in the ferret, guinea-pig, and rabbit, 803
— in the fowl, 803
Distilled water, 289
Diuretics, 139
— formulæ for, 882
— uses of, 140
Diuretin, 688
Dogmatism in therapeutics, 12, 561
Dogs, administration of medicines to, 180, 183
— average weight of various breeds of, 174
— sick, bedding for, 113
— — clothing for, 113
— — diet for, 109
— — nursing of, 105
— — surroundings of, 112
Donovan's solution, 252
Dosage, computation of, for various animals, 173
Dose, the, effect of, on the action of drugs, 126
Dover's powder, 361, 483
Draughts, 182, 197
Drenches, 182, 197
— administration of, 182
— dangers of, in respiratory affections, 182, 706
Dropsical swellings as a symptom, 71
Dropsy, abdominal, treatment of, 679
— — tapping for, 827
Drugs, actions and uses of, 127
— administration of, 122, 180
— circumstances modifying the action of, 132
— combining of, 171
— cumulative action, 127
— fallacies in connection with, 120
— idiosyncrasy, 127
— standardization of, 203
— toleration, 127
'Dry mouth,' 41
Duboisine, 393
Dysenteric enteritis, treatment of, in dog, 653
Dysentery, formulæ for, 643, 650, 874
— in horse, 638
— treatment of, in cattle, 648
Dyspepsia, chronic, treatment of, 583
— in calves, 602
— in cattle, 601
— in the dog, 611
— — formulæ for, 873
— post-parturient, in cattle, 325, 601
Dyspnœa, causes of, 27
Dysuria, 66

E

Easton's syrup, 243, 408
Ecbolics, 143
Eclampsia, treatment of, 749
Economical considerations in connection with therapeutics, 6
Eczema in the dog, formulæ for, 895, 904
Edwards on the uses of biniodide of mercury in actinomycosis and joint-ill, 251
Ehrlich's side-chain theory, 546
Elaterin, 467
— compound powder of, 467
Elaterium, 467
Electrotherapy, 912
Electuaries, 183, 197
— formulæ for, 891
— preparation of, 197
Elephantiasis, 766
Emetics, 131
— direct, 131
— indirect, 132
Emetine, 483
— use of, in hæmorrhage, 484
Emollients, 165
Empirical therapeutics, 5
Emplastrum picis, 448
— resinæ, 445
Empyema, treatment of, 715
Endocarditis, acute, in the dog, 735
— — in the horse, 728
— chronic, in the dog, 736
— — in the horse, 730
— diagnosis of, 731
— ulcerative or malignant, 729, 735
Enemata, 187
— administration of, 188
— nutrient, 189
— of glycerin, 188, 497
— uses of, 188
Enteritis, acute, treatment of, in cattle 647
— — — in dog, 652

Enteritis, acute, treatment of, in foals, 637
— — — in horse, 634
— catarrhal, in dog, 653
— chronic, in cattle, 648
— — in dog, 654
— croupous, in cattle, 647
— — in dog, 653
— dysenteric, in dog, 653
— treatment of, in birds, 600
Epilepsy in the dog, treatment of, 749
Epispastics, 162
Epispasticus, liquor, 508
Epistaxis, use of adrenalin in, 516
Epithelium in urine, significance of, 64
Epizoötic cellulitis, 752
— gastro-enteritis, 805
— pneumonia, 703
Epsom salt, 224
— — irrational use of, in cattle practice, 225
— — use of hypodermic injections of, in tetanus, 772
Ergamine, 429
Ergot, 426
— actions of, 429
— ammoniated tincture of, 427
— antidotes to, 430
— aseptic, 427
— contra-indications of, 429, 431
— dosage of, computed according to body-weight of dog, 431
— extract of, 426
— — liquid, 426
— hypodermic injection of, 426
— toxic actions of, 430
— uses of, 430
Ergotin, 426
Ergotism, 430
Ergotoxine, 427
Eructations as a symptom, 51
Escharotics, 164
Eserine, 399 (see also Physostigmine)
Ether, 313
— as an anæsthetic, 313
— methylated, 313
— nitrous, spirit of, 323
— purified, 313
— rectified, 313
— soap, 496
— spirit of, 313
Ethocaine, 382
Ethyl carbamate, 322
Ethyl-morphine hydrochloride, 374
Eucainæ hydrochloridum B, 380
Eucaine hydrochloride, 380
— — actions of, 381
Eucaine hydrochloride, uses of, as a local anæsthetic, 381
Eucalyptus, oil of, 439
— tincture of, 440
Eudrenine, 515
Euonymin, 470
Europhen, 343
Exalgin, 331
Examination of patient, 14
— — method of, 15
Exercise as a therapeutic agent, 85
Expectorants, 150
Extract, Goulard's, 232
Extracts, 201
— fluid standardized, 204
Extractum aconiti, 351
— agropyri, 485
— belladonnæ, 384
— cannabis indicæ, 375
— cascaræ sagradæ, 464
— conii, 396
— digitalis fl., 417
— ergotæ, 426
— filicis liquidum, 472
— hamamelidis, 482
— hyoscyami, 391
— nucis vomicæ, 406
— opii, 360
Eye, drugs acting on the, 157
— lotions, formulæ for, 796, 900
— ointment, Pagenstecher's, 905

F

Fæcal impaction of intestine in dog, treatment of, 345, 654
Faradism, 912
Farina tritici, 500
Febricula, 16
Febrifuges, 158
Feline distemper, 801
— — table, showing localizations, medicaments, and dosage for, 803
Fennel, 438
Fenugreek, 438
Ferri acetatis, liquor, 243
— arsenas, 242
— carbonas saccharatus, 239
— dialysatus, liquor, 239
— et ammonii citras, 243
— et quininæ citras, 243
— iodidum, 242
— perchloridi, liquor, 241
— — tinctura, 242
— peroxidum humidum, 240
— phosphas, 242
— pilula, 239
— sulphas, 240

Ferri sulphas exsiccatus, 240
Ferric acetate, solution of, 243
— chloride, solution of, 241
— — — strong, 241
— — tincture of, 241
Ferrous sulphate, 240
Ferrum, 238
Ferry's distemper vaccine, 527
' Feu Français,' formula for, 893
Fever, 15
— milk, 775
— simple, 16
— symptoms of, 16
Fibrolysin, 494
Filicic acid, 472
Filix mas, 472 (see Male fern)
' Firing,' 838
— contra-indications of, 839
— technique of, 840, 841
— uses of, 839
Flatulent colic, treatment of, 626
— — formulæ for, 872
Flax seed, 499
Flowers of sulphur, 273
Foals, diarrhœa in, 640
— — formulæ for, 874
— enteritis in, 637
— — formulæ for, 643
— obstructive colic due to impaction in, 633
' Fœtor oris,' 41, 814
— — treatment of, with hydrochloric acid, 814
Follicular mange, formulæ for, 898, 905
Fomentations, 190
Foods, invalid, for dogs, 111
Foreign bodies in rumen and reticulum, 595
— — in stomach of dog, 612
Formaldehyde, 324
— toxic actions of, 324
— use of, in pneumonia, 910
Formalin, 324
Formin, 325
Formulæ, 864
— for alteratives in cattle, 865
— — in dogs, 865
— — in horses, 864
— anodynes in dogs, 867
— — in horses, 866
— anthelmintics for dogs, 870
— — for foals, 870
— — for horses, 869
— antipyretics for dogs, 869
— — for horses, 868
— antitympanitics in cattle, 872
— — in dogs, 873
— — in horses, 872
— astringents in cattle, 875
Formulæ, astringents in dogs, 876
— — in horses, 873
— blisters, 892, 893
— broken wind, 883, 884
— canker of the ear, 896
— — parasitic, 898
— cathartics for cattle, 878
— — for dogs, 879
— — for horses, 877
— — for sheep, 878
— — for swine, 879
— chronic cough in horses, 883
— cleansing drenches, 892
— colic in dogs, 867, 868
— — in horses, 866, 867
— colic, flatulent, 872
— cough in dogs, 884
— — in horses, 883
— diarrhœa in calves, 875
— — in cattle, 749, 875
— — in dogs, 876
— — in foals, 874
— — in horses, 873
— diuretics, for dogs, 882
— — for horses, 882
— dysentery, 643, 650, 659, 874
— dyspepsia, flatulent, in dogs, 873
— electuaries, 891
— enteritis in horses, 867
— febrifuges, 868, 869
— fever in dogs, 869
— — in horses, 868
— gastric tympany in horses, 586, 872
— gastritis in cattle, 885
— — in dogs, 886, 887
— — in horses, 885
— hoose in calves, 901
— injection for hoose, 901
— — for local anæsthesia, 902
— — of normal saline solution, 902
— — Villate's, for quittor, 906
— laxatives for dogs, 881
— liniments, 893
— — absorbent, 893, 894
— — antiseptic, 899
— — eczema, 895
— — erysipelas, 899
— — garget, 895
— — mange, 896
— — mud fever, 894
— — soap, 895
— — stimulating, 894
— — white, for applying after blisters, 895
— liver pills for dogs, 881
— lotions, 899
— — for eyes, 900, 901
— — for grease and chronic cracked heels, 900

Formulæ, lotions, for strained tendons, 900
— lotion, white, 900
— mange in the dog, 898
— — follicular, 898, 905
— — in the horse, 896, 897
— — symbiotic, of the ear in the dog, 898
— ointments, 903
— — absorbent, 903, 904
— — antiseptic, 903
— — cracked heels, 903
— — eczema, acute, 904
— — — chronic, 905
— — follicular mange, 905
— — hoof, 904
— open joint, 899
— parasitic gastritis in sheep, 870
— physic balls, 906
— post-parturient dyspepsia in cows, 325, 602
— ringworm, 897, 898
— tonics, 887
— tympanites of rumen, 870
— — — chronic, 604
— vermicides for dogs, 870
— — for foals, 870
— — for horses, 869
— — for sheep, 870
— vomiting, persistent, in dogs, 887
— worm mixtures for dogs, 870
'Foul breath' in the dog, treatment of, 814
Fowl, distemper in the, treatment of, 803
Fowler's solution of arsenic, 255
Fremitus or thrill, 23
French oil of turpentine, 440
Friar's balsam, 451
Friction sounds, 36
Functional affections of the heart, treatment of, 727

G

Galactagogues, 144
Galbanum, 455
Galla, 478
Gall and opium ointment, 478
Gallic acid, 478
Galls, 478
Gamboge, 466
Garget liniment, formula for, 895
Gastric astringents, 130
— catarrh, acute, in the dog, 609
— — — in the horse, 582
— — chronic, in the dog, 611
— — — in the horse, 583
— disinfectants, 131
Gastric impaction in the horse, 575
— lavage, 581, 822
— sedatives, 130
— stimulants, 130
— tonics, 131, 157
— — formulæ for, 887
— tympany, acute, in the horse, 578
Gastritis, formulæ for, 885, 886
— in birds, 618
— acute, in cattle, 598
— — in the dog, 609
— — in the horse, 582
— chronic, in the dog, 611
— — in the horse, 583
Gastro-entérite hémorragique, 805
Gastro-enteritis, contagious, 805
— epizoötic, 805
Gaultheria, oil of, 492
Gelatin, 502
— capsules, 197
Gelatinum, 502
Gelsemin, 398
Gelseminine, 398
Gelsemium, 397
General appearance of patient, symptoms in connection with, 71
Generative organs, drugs acting on, 143
Gentian, 433
— compound tincture of, 434
Germicides, 166
Gin, 292
Ginger, 438
— tincture of, 438
Gingerin, 438
Glacial acetic acid, 284
Glauber's salt, 214
Glonoin, 323
Glossitis, treatment of, 567
Glutol, 326
Glycerin, 496
— enemata, 184, 497
— suppositories, 184, 497
Glycerina, 201, 497
Glycerinum, 496
— acidi borici, 282
— — carbolici, 332
— — tannici, 479
— belladonnæ, 385
— boracis, 283
— iodi, 266
— plumbi subacetatis, 233, 497
Glycerol of pepsin, 505
Glycerophosphates, 286
Glycerophosphoric acid, 286
Glyco-heroin, 374
Glycosuria, as a symptom, 58
Glycuronic acid, normal presence of, in dog's urine, 62
Glycyrrhiza, 498

Goitre, treatment of, 270
Goulard water, 232
Goulard's extract, 232
— lotion, 232
Granatum, 479
Gray, H., observations on areca-
— nut, 476
— — on arsenic, 126
— — on catheterization of the cat, 835
— — on chloralose as an anæsthetic, 320
— — on chronic nephritis in the dog, 686
— — on cystitis, 692
— — on dosage of apomorphine, 363
— — — of ergot, 431
— — on spinal pachymeningitis, 747
— — on strychnine, 408
— — on treatment of chronic bronchitis in the dog, 718
— — — of contagious venereal tumours in the bitch, 261
— — — of diabetes mellitus, 761
— — — of diseases of anal glands, 656
— — — of distemper in the dog, 780
— — — — in the cat, 801
— — — of follicular mange, 492, 905
— — — of typhus in the dog, 805
— uses of dilute hydrochloric acid in canine typhus, 814
— — — in 'fœtor oris,' 281, 814
— — — in oral lesions of distemper, 788
— — of kamala, as a vermicide for cats, 476, 477
— — of quinine hydrochloride in canine typhus, 813
— vaccines in the prevention and treatment of distemper, 800
'Green' blister, 507
Green vitriol, 240
Grey powder, 245
Grooming, 85, 103
Guaiacol, 337
Guaiacum, 337, 907
Gum acacia, 498
— benzoin, 451
— tragacanth, 498
Gynocardiæ oleum, 500
Gypsum, 223

H

Habit, effect of, on the action of drugs, 127
Hæmatic tonics, 157
Hæmatinics, 157
Hæmatoxyli lignum, 481
Hæmatoxylin, 481
Hæmatoxylon, 481
— decoction of, 481
Hæmaturia, as a symptom, 56
Hæmoglobin, tests for, 61
Hæmoglobinuria, as a symptom, 57
Hæmorrhage, pulmonary, 701
— treatment of, with adrenalin, 515
— — with atropine, 390
— — with emetine, 484
— — with ergot, 431
Hamamelis, 482
— liquid extract of, 482
Hard palate, congestion of, 566
— paraffin, 344
Hartshorn, spirits of, 216
Hazeline, 482
Heart, auscultation of, 24
— diseases of, in cattle, 733
— — in the dog, 735
— — in the horse, 727
— drugs acting on, 144
— functional affections of, 727
— palpitation of, 727
— percussion of, 23
— physical examination of, 21
— rhythm of, disturbance of, 727
— valvular disease of, 730
— — diagnosis of, 731
Heel ointment, formulæ for, 903
Helmitol, 326, 692
Hemlock, 396
— antidotes to, 397
— toxic actions of, 396
Henbane, 391 (see Hyoscyamus)
Hepatitis, acute, treatment of, in the dog, 673
— — in the horse, 667
— chronic, in the dog, 673
— — in the horse, 668
Heroin hydrochloride, 373
— actions of, 373
— toxic actions of, 373
— uses of, 374
History of case, in relation to diagnosis, 12
H.M.C., 372
Hog cholera serum, 530
Hollands, 292
Holocaine, 383
Homatropine hydrobromide, 385
Honey, 503
Hoof ointment, formula for, 904
'Hoose,' intratracheal injection for, 443, 830
Hordeum, 499
Horses, sick, nursing and care of, 77
Hot applications, 190, 288

Hoven, treatment of, 592
Huile de cade, 437
Hunting's observations on the use of mallein, 520
— treatment of follicular mange, 337
Hydragogue cathartics, 135
Hydrargyri bichloridum, 249
— iodidum rubrum, 251
— — viride, 252
— oleatum, 246
— oxidum flavum, 247
— — nigrum, 246
— — rubrum, 246
— perchloridum, 249
— pilula, 245
— subchloridum, 247
— suboxidum, 246
— unguentum, 246
Hydrargyrism, 244
Hydrargyrum, 244
— ammoniatum, 251
— cum creta, 245
Hydrastine, 435
Hydrastis, 435
Hydrochloric acid, 280
— — antidotes to, 280
— — toxic actions of, 280
— — use of, in canine typhus, 814
— — — in the oral lesions of distemper, 788
— — — in 'foul breath' in the dog, 814
Hydrocyanic acid, 347
— — actions of, 347
— — antidotes to, 349
— — Scheele's, 347
— — toxic actions of, 347
— — uses, 349
Hydrogen peroxide, 289
Hydrothorax, treatment of, 715
Hyoscine hydrobromide, 392
Hyoscyamine sulphate, 392
Hyoscyamus, 391
— actions of, 392
— extract of, 391
— tincture of, 392
— uses of, 392
Hypnone, 322
Hypnotics, 152
Hypochlorite of soda, 852, 908
— — in the treatment of wounds, 852
Hypodermic injections, 184
— — administration of, 185
— — preparation of, 198
— syringe, the, 185
Hypophosphite of lime, 261
— of soda, 261
Hyposulphite of soda, 215

I

Ice, 288
Ichthyol, 343
Idiosyncrasy, 127
Immunity, 545
— acquired, 545
— active, 545, 547
— and immunization, 538
— passive, 545, 553
— theories of, 545
Immunization, active, 549
— passive, 553
Impaction, fæcal, in the dog, 654
— of anal glands, 657
— of cæcum, 628
— of crop, 617
— of double colon, 628
— — — pelvic flexure of, 632
— of omasum, 598
— of rumen, 590
— of single colon, 632
— of stomach in dog, 607
— — in horse, 575
Imrie, D., on the use of formalin in treatment of pneumonia, 910
Incompatibles, 171
— chemical, 171
— pharmacological, 172
— physical, 172
Indian hemp, 375
— — actions of, 375
— — toxic actions of, 376
— — uses of, 376
— — American or black, 377
Indigestion, acute gastric, in the dog, 607
— — — in the horse, 575
— chronic, in the dog, 611
— — in the horse, 583
— in calves, 602
— in cattle, 601
— in parrots, 618
— post-parturient, in cattle, 325, 601
— traumatic, in cattle, 595
— with engorgement of stomach in the horse, 575
Inflammatory œdema, 765
Influenza, abdominal type of, 752
— antitoxin, 532
— 'bilious,' 752
— treatment of, 751
'Influenza' in the dog, 752, 805
Infusions, 201
Infusum buchu, 484
— caryophylli, 436
— digitalis, 417
— gentian, 434
— quassiæ, 434
— scoparii, 397

Ingluvial catarrh, 616
— indigestion, 617
Ingluvitis, 616
Inhalations, 184
— method of administration, 184
Injectio apomorphinæ hypodermica, 363
— ergotæ hypodermica, 426
— morphinæ hypodermica, 362
Injection of camphorated oil, as a cardiac stimulant, 451
— of normal saline solution, 213
— Villate's, for quittor, 906
Injections, hypodermic, 184, 198
— — mode of administration, 184
— intramammary, 186
— intramuscular, 185
— intraperitoneal, 186
— intraspinal, 187
— intratracheal, 186, 829
— intra-uterine, 187
— intravenous, 185
— rectal, 187, 189
— subcutaneous, 184
Inorganic acids, 278
Intestinal antiseptics, 137
— astringents, 136
— calculi, 634
— disinfectants, 137
— irrigation, 188, 631
— sedatives, 136
— stimulants, 136
— tonics, 158
Intestine, fæcal obstruction of, in the dog, 654
— puncture of, 825
Intestines, drugs acting on, 132
— treatment of diseases of, in birds, 660
— — — in cattle, 646
— — — in the dog, 650
— — — in the horse, 620
Intramammary injections, 186
Intraperitoneal injections, 186
Intraspinal injections, 187
Intratracheal injection of iodine in purpura, 266, 829
Intratracheal injections, 186, 829
— — for hoose, 830
— — — formula for, 901
Intra-uterine injections, 187
Intravenous injections, 185
Iodalbin, 267
Iodide of iron, 242
— of lead, 283
— of mercury, 251
— of potassium, 266
— of sodium, 267
— of sulphur, 271
Iodine, 265
Iodine, actions of, 268
— antidotes to, 268
— glycerin of, 266
— intratracheal injection of, 266
— liniment, 265
— Lugol's solution of, 266
— ointment of, 266
— — stainless, 906
— tincture of, decolorized, 266
— — strong, 265
— — weak, 266
— toxic actions of, 267
— uses of, 268
Iodism, 268
Iodoform, 341
— collodion, 342
— toxic actions of, 342
Iodoformal, 343
Iodoformin, 343
Iodum, 265
Ipecacuanha, 483
— compound powder of, 483
— wine, 483
Iridin, 471
Iron and its medicinal salts, 238
— — — general actions of, 238
— acetate, solution of, 243
— and ammonium citrate, 243
— and quinine citrate, 243
— arsenate, 242
— carbonate, saccharated, 239
— dialyzed, solution of, 239
— iodide, 242
— perchloride, 241
— peroxide, 240
— phosphate, 242
— pill, 239
— sesquioxide, 240
— sulphate, 240
Irrational treatment, 4, 561
Irrigation of bladder, 691
— of intestine, 188, 631
— of stomach, 581, 822
— of uterus, 836
Izal, 341

J

Jaborandi, 403
Jalap, 465
Jalapin, 465
Jaundice, as a symptom, 664, 669
— catarrhal, in the dog, 672
— — in the horse, 667
— enzoötic, in the dog, 670
— infectious, 670
— obstructive, 665
Jeyes' fluid, 338
— — antidotes to, 339
— — toxic actions of, 338

Juniper, 437
— oil of, 437
— tar oil, 437

K

Kamala, 477
Kaolin, 907
Keratin, 502
Kidneys, acute congestion of, in the horse, 683
— — inflammation of, in the dog, 688
— — — in the horse, 684
— chronic inflammation of, in the dog, 688
— — — in the horse, 686
— diseases of, in cattle, 687
— — in the dog, 687
— — in the horse, 681
— drugs acting on, 139
— passive congestion of, 684
Kino, 480
— compound powder of, 480
Klondol fluid, 340
Knisely on the use of the stomach-tube, 822
Kousso, 477
Krameria, 481

L

Labarraque's disinfecting fluid, 216
Lameness, diagnosis of, by means of cocaine, 380
Laminitis, treatment of, with adrenalin, 516
— — with alum, 228, 229
" Lampas," 566
Lanolin, 501
Lard, 501
— benzoated, 452, 501
Laryngitis, acute, treatment of, in the dog, 717
— — — in the horse, 696
— chronic, in the dog, 717
— — in the horse, 697
Laudanum, 360
Lavender, oil of, 437
Laxatives, 134
— formulæ for, in the dog, 881
Lead and its medicinal salts, 229
— — — antidotes to, 231
— — — general actions of, 229
— — — toxic actions of, 229
— acetate, 231
— carbonate, 231
— iodide, 233
— oxide, 231
— subacetate, solution of, 232
Leclainche's method of inoculation in swine erysipelas, 529
— polyvalent serum for wound treatment, 534
Lignières' anti-distemper vaccine, 527
Limbs, swollen, as a symptom, 71
Lime, 221
— chlorinated, 222
— saccharated solution of, 221
Lime-water, 221
Limits of treatment, 12
Lini farina, 499
Liniment, garget, 895
— skin, 896
— soap, 895
— stimulating, formula for, 894
— white, formula for, 895
Liniments, 202
— formulæ for, 893
Linimentum aconiti, 351
— — compositum, 351
— belladonnæ, 385
— calcis, 222
— camphoræ, 449
— — ammoniatum, 449
— crotonis, 467
— hydrargyri, 246
— iodi, 266
— potassii iodidi cum sapone, 267
— saponis, 495
— terebinthinæ, 440
— — aceticum, 440
Linseed, 499
— meal, 499
— oil, 470
— tea, 83
Linum, 499
— contusum, 499
Liquid paraffin, 345
Liquor acidi chromici, 282
— ammoniæ, 217
— — fortis, 216
— ammonii acetatis, 220
— antimonii chloridi, 253
— arsenicalis, 255
— arsenici hydrochloricus, 255
— arsenii et hydrargyri iodidi, 252
— atropinæ sulphatis, 385
— bismuthi et ammonii citratis, 263
— — et pepsinæ, 264
— calcis, 221
— carbonis detergens, 341
— chlori, 265
— epispasticus, 508
— ferri acetatis, 243
— — dialysatus, 239
— — perchloridi, 241
— formaldehydi, 324
— hydrargyri nitratis acidus, 253

Liquor hydrargyri perchloridi, 249
— hydrogenii peroxidi, 289
— iodi fortis, 266
— morphinæ hydrochloridi, 362
— opii sedativus, 361
— picis carbonis, 341
— plumbi subacetatis dilutus, 232
— — — fortis, 232
— potassæ, 205
— — arsenitis, 255
— potassii permanganatis, 210
— sodæ chlorinatæ, 216
— sodii ethylatis, 216
— strychninæ hydrochloridi, 407
— trinitrini, 323
Liquorice root, 498
Liquors, 202
Litharge, 231
Liver, active congestion of, in the dog, 672
— — — in the horse, 666
— acute inflammation of, in the dog, 673
— — — in the horse, 667
— chronic inflammation of, in the dog, 673
— — — in the horse, 668
— cirrhosis of, in the dog, 673
— — in the horse, 668
— diseases of, in cattle, treatment of, 669
— — in the dog, 669
— — in the horse, 662
— drugs acting on, 138
— passive congestion of, in the dog, 672
— — — in the horse, 668
Lobelia, 396
Lobeline, 396
Local anæsthetics, 155
Logwood, 481
— decoction of, 481
Loretin, 343
Losophan, 343
Lotio calcis sulphurata, 273
— hydrargyri flava, 247
— — nigra, 246
— sulphuris, 273
Lotion, Goulard's, 232
— white, 234
Lotions, 203
— formulæ for, 899
Lugol's solution of iodine, 266
Lunar caustic, 236
Lungs, acute congestion of, 700
— — inflammation of, 702
— chronic alveolar emphysema of, 710
Lymphagogue action of common salt, 285, 850
Lymphangitis, treatment of, 765
Lysoform, 325
Lysol, 340

M

Magnesia, calcined, 223
— levis, 223
— ponderosa, 223
Magnesii carbonas levis, 223
— — ponderosus, 223
— sulphas, 224
Magnesium and its medicinal salts, 223
— oxide, 223
Male fern, 472
— — liquid extract of, 472
— — precautions in prescribing, 472, 473
— — toxic actions of, 473
Mallein, 519
— directions for use of, 519
— Hunting's views on employment of, 520
— intra-dermal-palpebral method, 521
Malt, 503
Mammary gland, drugs acting on, 144
Mammitis, note on prevention of, in connection with milk fever, 911
Mange in the dog, formulæ for, 898
— follicular, formulæ for, 898, 905
— in the horse, formulæ for, 896, 897
Marmorek's antistreptococcic serum, 554
Marsh mallow ointment, 500
Martin, E. E., on early 'tapping' in the treatment of pneumonia and pleurisy, 707
Mastication, imperfect, as a symptom, 564
Materia medica, 200
'Mawbound,' 590
Mayall, G., on the care, management and nursing of sick sheep, 855
— — — — — swine, 858
— on the treatment of fæcal impaction in the dog, 655
— on the use of alum in laminitis, 229
Measures, domestic, 177
— pharmaceutical 176
Medicines, administration of, 115, 180, 182, 191, 856, 860
— circumstances modifying the action of, 122
Megrims, treatment of, 743

Mel, 503
— boracis, 283
Meningitis, acute, in the dog, treatment of, 746
— — in the horse, 740
— chronic, in the dog, 747
— spinal, acute, in the horse, 742
Menthæ piperitæ oleum, 436
Menthol, 436
Mercurial liniment, 246
— ointment, 246
— stomatitis, 566
Mercurialism, 244
Mercuro-zinc cyanide, 247
— — gauze, 247
Mercury and its preparations, 244
— — antidotes to, 244
— — general actions of, 244
— — toxic actions of, 245
— ammoniated, 251
— biniodide of, 251
— black oxide of, 246
— nitrate of, 253
— oleate of, 246
— perchloride of, 249
— red oxide of, 246
— subchloride of, 247
— with chalk, 245
— yellow oxide of, 247
Merillat, observations on artificial respiration, 831
— on the dangers of eserine in acute gastric impaction, 577
— on the use of the stomach-tube, 824
Methylated chloroform, 298
— ether, 313
— spirit, 291
Methylene blue, 329
Methyl salicylas, 492
— — ointment of, 492
— violet, 328
Metric system of weights and measures, 177
Micturition, disturbances of, symptoms in connection with, 66
Milk, agents checking secretion of, 144
— fever, air treatment of, 776
— — prevention of mammitis in connection with, 911
— — prophylaxis of, 779
— — sequelæ of, 778
— — treatment of, 775
— — — Schmidt's, 775, 776
— — use of adrenalin in, 517, 777
— — — of atropine in, 390, 777
— — — of strychnine in, 778
Milk of sulphur, 273
Mindererus spirit, 220
Mistura alba, 224, 881
Misturæ, 197, 202
Mixtures, 197, 202
Morphina, 361
Morphinæ acetas, 362
— hydrochloridi, liquor, 362
— hydrochloridum, 362
— sulphas, 362
— tartras, 362
Morphine, 361
— actions of, 368
— antidotes to, 368
— contra-indications of, 372
— hypodermic injection of (B.P.), 362
— toxic actions of, 367
Morrhuæ oleum, 503
Motor depressants, 156
Mouth, diseases of, treatment of, 564
— — — in the dog, 565
— — — in the horse, 564
— drugs acting on, 129
Mucilago acaciæ, 498
— tragacanthæ, 498
Mucous membranes, visible, alterations in, as symptoms, 37
'Mud' fever, formulæ for, 894
Mugwort, 432
Muriatic acid, 280 (see also Hydrochloric acid)
Murmurs, cardiac, 25
— — table of, 731
Mustard, 456
— as a counter-irritant, 457
— paste, 457
— volatile oil of, 457
Mydriatics, 157
Mylabris, 512
Myocarditis in the dog, 735
— in the horse, 728
Myotics, 157
Myrrh, 453
— tincture of, 453

N

Naphthalin, 329
Naphthol, 329
Narcotics, 153
Nasal catarrh, acute, treatment of, in the dog, 716
— — — — in the horse, 694
— — chronic, in the horse, 695
— discharge as a symptom, 28
— — varieties of, 28
Natural powers of recovery, 4
Nephritis, acute, in the dog, 688

Nephritis, acute, in the horse, 684
— chronic, in the dog, 688
— — in the horse, 686
Nerve tonics, 158
Nerves, drugs acting on, 156
Nervous system, diseases of, treatment of, 739
— — — — in cattle, 745
— — — — in the dog, 745
— — — — in the horse, 739
— — drugs acting on the, 152
— — symptoms in connection with the, 67, 739
'Nettle-rash,' 767
Neutral organic principles, 203
Nicotine, 394
— antidotes to, 395
— toxic actions of, 395
Nitrate of mercury, 253
— of potash, 207
— of silver, 236
Nitre, 207
— antidotes to, 207
— sweet spirit of, 323
— toxic actions of, 207
Nitric acid, 279
— — antidotes to, 280
— — toxic actions of, 279
Nitrite of amyl, 322
— of sodium, 215
Nitroglycerin, 323
Nitro-hydrochloric acid, 281
Nitro-muriatic acid, 281
Nitrous ether, spirit of, 323
— oxide, 315
Normal saline solution, 213
— — — administration of, 213, 214
Novocain, 382
Nuclein, 505
— preparations of, 505
— use of, in pneumonia, 707, 720
Nursing of sick birds, 116
— — cats, 115
— — cattle, 90
— — dogs, 105
— — horses, 77
— — pigs, 858
— — sheep, 855
Nutrient enemata, 189
— suppositories, 184
Nux vomica, 406
— — actions of, 408
— — antidotes, 411
— — extract of, 406
— — tincture of, 406
— — toxic actions of, 409
— — uses, 409, 410

O

Oatmeal gruel, 81
— porridge, 81
Obstruction, intestinal, in birds, 660
— subacute, of double colon, 628
Obstructive colic, due to impaction, in foals, 633
— — — in the horse, 628
Œsophagismus, 571
Œsophagitis, 571
Œsophagus, diseases of, treatment of, 571
— inflammation of, 571
— spasm of, 571
Oil, camphorated, 449
— carron, 222
— castor, 468
— chaulmoogra, 500
— cod-liver, 503
— croton, 467
— linseed, 470
— olive, 495
— paraffin, 345
— sandal-wood, 456
— sperm, 502
— white vaseline, 345
— of aniseed, 438
— of cade, 437
— of cinnamon, 481
— of cloves, 436
— of eucalyptus, 439
— of juniper, 437
— of mustard, 457
— of origanum, 437
— of peppermint, 436
— of spearmint, 437
— of tar, 447
— of turpentine, 440
— of vitriol, 278
— of wormseed, 474
Oils, 202
Ointment, boric, 282
— cantharidin, 507
— carbolic, 332
— citrine, 253
— iodide of sulphur, 272
— iodine, 266, 906
— mercurial, 246
— red iodide, 252
— sulphur, 273
— zinc, 233
Ointments, 198, 203
— formulæ for, 903
— — for eczema, 904
— — for follicular mange, 905
— — for ophthalmic affections, 905
Oleate of mercury, 246
— of zinc, 909

Oleatum hydrargyri, 246
Oleum anisi, 438
— betulæ, 448
— cadinum, 437
— caryophylli, 436
— cetacei, 502
— chenopodii, 474
— cinnamomi, 481
— crotonis, 467
— eucalypti, 439
— gaultheriæ, 492
— gynocardiæ, 500
— juniperi, 437
— lini, 470
— menthæ piperitæ, 436
— — viridis, 437
— morrhuæ, 503
— olivæ, 495
— origani, 437
— picis liquidæ, 447
— — rectificatus, 447
— pini sylvestris, 445
— ricini, 468
— santali, 456
— sinapis, 457
— staphisagriæ, 357
— terebinthinæ, 440
— — gallicum, 440
Oliguria, 54
Olive oil, 495
Omasum, impaction of, 596
Omnopon, 374
— in azoturia, 764
Open-air treatment, value of, 563, 706
Ophthalmia, periodic, Brusasco's treatment, 271
Opinion, guarded, necessity for, 561
Opinions, dogmatic, 12
— speculative, 12
Opium, 360
— actions of, 364
— antidotes to, 368
— circumstances modifying actions of, 369
— contra-indications of, 372
— extract of, 366
— tincture of, 360
— toxic actions of, 367
— uses of, 370
Opsonins, 541, 543
— immune, 544
— normal, 543
Oral lesions in distemper, 787
— — in typhus, 807
Orange, syrup of, 458
— tincture of, 458
Origanum, oil of, 437
Orthoform, 331
— toxic actions of, 331
Oxide of calcium, 221
— of iron, 240
— of lead, 231
— of magnesia, 223
— of mercury, 246, 247
— of zinc, 233
Oxygen, 289
— in the treatment of pneumonia, 289

P

Pachymeningitis, chronic ossifying, treatment of, in the dog, 747
Pain as a symptom, 42
— varieties of, 43
Palpation in diagnosis of abdominal affections, 44
— — in cardiac disease, 23
— — in respiratory diseases, 37
Palpitation of heart, 727
Pantopon, 374
— in azoturia, 764
Paracentesis abdominis, 827
— pericardii, 727, 829
— thoracis, 708, 828
Paraffina, 344
Paraffin oil, 345
— — antidotes to, 346
— — toxic actions of, 346
— hard, 344
— liquid, 345
— ointment, 345
— soft, 344
— wax, 344
Paraffins, 344
Paraffinum durum, 344
— liquidum, 345
— molle, 344
Paraldehyde, 321
Parasitic bronchitis, 423, 830
— gastritis, formula for, 870
— stomatitis, 566
Parasiticides, 138, 166
Paregoric, 361, 449
Pareira, 485
Parrish's syrup, 243
Parrots, indigestion in, 618
Parturient cattle, care of, 96
Passive immunization, 553
Pearl barley, 499
Peppermint, oil of, 436
— water, 436
Peppers, 455
Pepsin, 504
— glycerole of, 505
Perchloride of iron, 241
— of mercury, 249
Percussion in diagnosis of cardiac diseases, 23

Percussion in diagnosis of respiratory diseases, 31
Pericardial effusion, 726
Pericarditis, acute, treatment of, in the dog, 734
— — — in the horse, 725
— — paracentesis pericardii, 727, 829
— chronic, in the dog, 734
— — in the horse, 727
— tubercular, in the dog, 735
Pericardium, diseases of, 725
— ' tapping ' the, 829
Peritonitis, acute, treatment of, in the dog, 679
— — — in the horse, 676
— septic, following castration, 678
— — — prevention of, 678
Permanganate of potash, 210
Peroxide of hydrogen, 289
Peru, balsam of, 453
Pessaries, 187, 195
Petroleum benzine, 345
Phagocytes, varieties of, 541
Phagocytosis, theory of, 541
Pharmacy, veterinary, 193
Pharyngitis, acute, in the dog, 570
— — in the horse, 569
— chronic, in the dog, 570
— — in the horse, 570
Pharynx, acute inflammation of, in the dog, 570
— — — in the horse, 569
— chronic inflammation of, in the dog, 570
— — — in the horse, 570
— diseases of, treatment of, in the dog, 570
— — — in the horse, 569
Phenacetin, 328
Phenazone, 327
Phenol, 332
Phenolphthalein, 346
Phenyl salicylate, 328
Phisalix's anti-distemper vaccine, 527
Phlebotomy, 160
Phosphate of iron, 242
— of lime, 223
— of soda, 263
— of strychnine, 909
Phosphorus, 261
— antidotes to, 262
— toxic actions of, 261
Phylacogens, 531
Physostigminæ benzoas, 403
— salicylas, 399
— sulphas, 399
Physostigmine, 399
— actions of, 399
Physostigmine, antidotes to, 401
— contra-indications of, 402
— dangers of, in cases of ' broken wind,' 402
— toxic actions of, 401
— uses of, 401
Pigmentum iodi et olei picis, 266
Pigs, administration of medicines to, 860
— purgatives for, 860
— sick, care and nursing of, 858
Pill, Blaud's, 239
— blue, 245
— colocynth and hyoscyamus, 465
— compound colocynth, 465
Pills, 197, 202
— administration of, 180
Pilocarpinæ nitras, 403
Pilocarpine, 403
— actions of, 404
— antidotes to, 405
— toxic actions of, 404
— uses of, 405
Pilula colocynthidis composita, 465
— — et hyoscyami, 465
— ferri, 239
— hydrargyri, 245
' Pink-eye,' 752
Piorkowski's anti-distemper serum, 537
Piperazin, 908
Piper nigrum, 456
Pitch, 448
— Burgundy, 448
— plaster, 448
Pituitrin, 517
— in uterine inertia, 518
Pix burgundica, 448
— liquida, 447
— nigra, 448
Plaster of Paris, 223
' Plenalvia,' 590
Pleurisy, acute sero-fibrinous, 713, 714
— paracentesis thoracis in, 714, 828
— plastic or fibrinous, 713, 715
— purulent, 713, 715
— treatment of, in the dog, 720
— — in the horse, 714
— tubercular, 721
Plumbi acetas, 231
— carbonas, 231
— iodidum, 233
— oxidum, 231
Plumbism, 229
Plumbum, 229 (see Lead)
Pneumonia, causes of death in, 705
— counter-irritation in, 708
— formalin in the treatment of, 910

Pneumonia, importance of fresh air in treatment of, 706
— — of nursing in, 706
— indications for stimulants in, 707
— internal antiseptics in, 709
— treatment of, in the dog, 719
— — in the horse, 702
— value of paracentesis thoracis in, 708
— varieties of, in the horse, 703
Podophyllin, 466
Podophyllum, 466
Polyuria, 54, 759
Polyvalent antistreptococcic serum, 533
Pomegranate bark, 477
Porter, 292
Port wine, 292
Post-parturient dyspepsia in cows, 325, 601
Potash alum, 228
Potassa caustica, 205
— sulphurata, 908
Potassæ liquor, 205
Potassii acetas, 209
— bicarbonas, 206
— bichromas, 282
— bromidum, 272
— carbonas, 206
— chloras, 208
— citras, 210
— iodidum, 266
— nitras, 207
— permanganas, 210
— tartras acidus, 210
Potassio-tartrate of antimony, 253
Potassium and its medicinal salts, 205
— — — general actions of, 205
Poultices, 164, 189
Powder, Dover's, 361, 483
Powders, 202
— administration of, 183
Precipitins, 543
Prescribing, 168
— indiscriminate, 562
Prescription, the, 174
Prescriptions, abbreviations used in, 175
Pringle on puncturing the stomach of the horse, 581
— on the treatment of acute gastric tympany, 581
Probang, passing the, in the dog, 821
— — in the horse, 819
— — in the ox, 820
Prognosis, 73
Proof spirit, 291
Protargol, 238
Protective defences of the body, 540
Prussic acid, 347 (see also Hydrocyanic acid)
Pulmonary congestion, acute, treatment of, 700
— hæmorrhage, 701
Pulse, the, alterations in character of, 17
— Corrigan's, 20
— intermittent, 20
— irregular, 20
— jugular, 20
— strength and weakness of, 20
— varieties of, 18
— 'water-hammer,' 20
Puncture of the intestine, technique of, 825
— of the rumen, 826
— of the stomach in the horse, 581
Purgatives, 132
— cholagogue, 138
— drastic, 134
— formulæ for, 877
— for sheep, 856, 878
— for swine, 860, 879
— general effects of, 135
— hydragogue, 135
— saline, 133
— simple, 134
— uses of, 136
Purpura hæmorrhagica, treatment of, 754
— — — adrenalin in, 754
— — — formalin in, 754
— — — intratracheal injections of iodine in, 755, 829
Pustulants, 162
Pyoktanin, 328
Pyrogallic acid, 479
Pyuria, 58

Q

Quassia, 434
Quicklime, 221
Quicksilver, 244
Quininæ hydrochloridum acidum, 487
— sulphas, 486
Quinine, 486
— acid hydrochloride of, 487
— — — uses of, in canine typhus, 813
— — — — in oral lesions of distemper, 788
— ammoniated tincture of, 487
— and urea hydrochloride, 489
— sulphate of, 486
— — toxic actions of, 488
Quinoline, 331

Quitman on the dangers of eserine in 'broken wind,' 402
Quitman's treatment of acute gastric tympany, 580

R

Râles, 36
Rational therapeutics, 5
Recoveries, spontaneous, 4
Recovery, natural powers of, 4
Rectal exploration, evidences furnished by, 45
Rectified ether, 313
— spirit, 29
— spirit of tar, 447
Rectum tube, use of, 188
— — technique of employing, 188
Red iodide of mercury, 251
— precipitate, 246
'Red, scarlet,' 330
Red-water, treatment of, 757
Reeks' treatment of acute gastric tympany, 580, 586
— — of obstructive colic, 630
Regurgitations, 51
Remedies, selection of, 169
— specific, 6
Renal diseases, general symptoms of, 65
— — treatment of, in cattle, 687
— — — in the dog, 687
— — — in the horse, 681
Resin, 445
— ointment, 445
— plaster, 445
Resina, 445
Resorcin, 328
Respiration, artificial, 831
— types of, 27
Respirations, accelerated, as a symptom, 26
Respiratory functions, symptoms in connection with, 26
— organs, diseases of, treatment of, in cattle, 716
— — — — in the dog, 716
— — — — in the horse, 693
— — drugs acting on, 150
— sedatives, 151
— sounds, abnormal, 34
— — adventitious, 35
— stimulants, 151
Rest as a therapeutic agent, 562
Rhamni, syrupus, 464
Rhatany, 481
Rheum, 463
Rheumatic fever, treatment of, in the dog, 769
Rheumatic fever, treatment of, in the horse, 768
Rheumatism, acute articular, in the dog, 769
— — — in the horse, 768
— chronic articular, in the dog, 769
— — — in the horse, 769
— muscular, in the dog, 770
— — in the horse, 769
Rhonchi, 36
— varieties of, 36
Rhubarb, 463
— compound tincture of, 463
Ricini oleum, 468
Rigors, significance of, 70
Ringworm, formulæ for, 897, 898
Rock-salt, 212
— uses of, 212
Rosemary, oil of, 437
Rose water, 451
Rubefacients, 161
Rumen, foreign bodies in, 595
— impaction of, 590
— puncture of, 594, 826
— tympanites of, 592
— — formulæ for, 872
Rye, ergot of, 426

S

Saccharated carbonate of iron, 239
— solution of lime, 221
Sal alembroth, 250
— — wool, 250
— ammoniac, 220
— volatile, 219
Salicin, 490, 492
Salicylate of bismuth, 264
— of soda, 490
Salicylic acid, 490
— — toxic actions of, 491
— — use of, in acute gastric tympany, 491
Saline diuretics, 140
— purgatives, 133
— solution, normal, uses of, 213
— — technique of administration, 213
Salivation as a symptom, 40
Salol, 328
Salt, common, 211
— — solution of, in treatment of wounds, 285, 850
— Epsom, 224
— Glauber's, 214
— rock, 212
Saltpetre, 207 (see also Nitre)
Sandal-wood, oil of, 456

Sanitas, 445
Santonin, 473
— antidotes, 474
— precautions in prescribing, 474
— toxic actions of, 474
Sapo animalis, 495
— durus, 495
— mollis, 495
Scammony, 465
'Scarlet red,' 330
Schmidt's treatment of milk fever, 775
Scilla, 424
Scoparium, 397
Scopolamine hydrobromide, 392
Scott, W. M., on vaccine therapy and sero-therapy, 538
Sedatives, cardiac, 148
— cerebral, 152
— gastric, 130
— intestinal, 136
— respiratory, 151
— vesical, 141
Selection of remedy, 169
Senega, 455
— tincture of, 455
Senna, 464
Sensitized vaccines, 556
Sero-therapy, 538
Serpentary, 435
Serum, anti-anthrax, 529, 554
— anti-distemper, Piorkowski's, 537
— anti-strangles, 533
— anti-streptococcic, 533, 544
— anti-swine erysipelas, 529
— — fever, 530, 555, 861
— anti-tetanus, 535, 555, 773
— polyvalent, for treatment of wounds, 534
Sesquioxide of iron, 240
Sheep, administration of medicines to, 856
— dip, arsenical, 260
— purgatives for, 856
— sick, care, management, and nursing of, 855
Sherry, 292
'Shivering fits,' 70
Sialagogues, 129
— specific, 129
Silver and its medicinal preparations, 236
— colloid, 237
— nitrate of, 236
— protein, 238
Simple treatment, advantages of, 170
Simultaneous method of inoculation in anthrax, 529
— — — in swine fever, 555
Sinapis, 456
Skin, agents acting on, 160
Smith, F., observations on the functions of the liver, 663
— — on Indian hemp, 376
— — on pilocarpine, 464
Snake-bite, treatment by potassium permanganate, 210
Soap, ether, 496
— curd, 495
— hard, 495
— liniment, 495
— liquid, 496, 899
— soft, 495
Soaps, 495
Sobernheim's anti-anthrax vaccine and serum, 529
Sodii benzoas, 452
— biboras, 282
— bicarbonas, 211
— bromidum, 272
— carbonas, 211
— chloridum, 211
— citras, 285, 908
— hypochloris, 852, 908
— hypophosphis, 261
— hyposulphis, 216
— iodidum, 267
— nitris, 215, 322
— phosphas, 263
— salicylas, 490
— sulphas, 214
— sulpho-carbolas, 333, 336
— valerianas, 455
Sodium and its medicinal salts, 210
— general actions of, 210
Solutions, table for computing various percentages of, 179
Soporifics, 152
'Sore throat,' 569
Spanish fly, 507 (see Cantharides)
Sparteine sulphate, 397
Spasm of the diaphragm, treatment of, 745
Spasmodic asthma in the dog, 718
— — in the horse, 699
— colic, treatment of, in cattle, 646
— — — in the dog, 651
— — — in the horse, 623
Spearmint, oil of, 437
Specific remedies, 6
Spermaceti, 502
Spigelia, 477
Spinal anæsthesia, 187
— cord, concussion of, 742
— — diseases of, in the dog, treatment of, 747
— — — in the horse, 742
— — drugs acting on, 155
— depressants, 156

Spinal meninges, inflammation of, 742
— pachymeningitis in the dog, 747
— stimulants, 155
Spirit of ammonia, aromatic, 219
— of camphor, 449
— of chloroform, 298
— of ether, 313
— of hartshorn, 216
— of nitrous ether, 323
— of tar, 447
— methylated, 291
— rectified, 291
Spiritus ætheris, 313
— — nitrosi, 323
— ammoniæ aromaticus, 219
— camphoræ, 449
— chloroformi, 298
— frumenti, 292
— methylatus, 291
— rectificatus, 291
— tenuior, 291
— vini gallici, 292
Squill, 424
— syrup of, 424
— tincture of, 424
Standardization of drugs, 203
— — physiological, 203
Standardized fluid extracts, 204
Starch, 500
Stavesacre, 357
— ointment of, 357
— toxic actions of, 357
Steel, tincture of, 242
Steffen on the use of atropine in the treatment of milk fever, 390
— — of emetine in the treatment of hæmorrhage, 484
— — of sparteine in the treatment of pneumonia, 398
Stethoscope, use of, 22
Stimulants, alcoholic, irrational use of, 295
— cardiac, 145
— cerebral, 152
— gastric, 130
— respiratory, 151
— spinal, 155
Stomach, dilatation of, in the dog, 608
— diseases of, treatment of, in birds, 618
— — — in cattle, 588
— — — in the dog, 606
— — — in the horse, 573
— drugs acting on the, 130
— engorgement of, in the dog, 606
— — in the horse, 575
— foreign bodies in, in the dog, 612
Stomach, inflammation of, in cattle, 598
— — in the dog, 609
— — in the horse, 582
— tympany, acute, of, in the dog, 607
— — — in the horse, 578
— — — use of salicylic acid in, 491
Stomach-tube, Knisely's, 822
— technique of employment in the horse, 822
— — — in the ox, 825
— use of, in cases of choking, 824
Stomachic tonics, 131, 157
Stomachics, alkaline, 130
Stomatitis, treatment of, 565
— — catarrhal, 565
— — mercurial, 566
— — parasitic, 566
— — ulcerative, 565
Storax, prepared, 454
Stovaine, 383
Stramonium, 393
Strangles, treatment of, 753
— vaccine, 549
Strangury, 66
Strophanthin, 423
Strophanthus, 423
— tincture of, 423
Strychninæ arsenas, 908
— hydrochloridi, liquor, 407
— hydrochloridum, 407
— phosphas, 909
— sulphas, 408
Strychnine, 407
— actions of, 408
— antidotes to, 372, 411
— arsenate of, 908
— hydrochloride of, 407
— phosphate of, 909
— sulphate of, 408
— toxic actions of, 410
— uses of, 412
'Stuttgart disease,' 805
Styptics, 165
Styrax præparatus, 454
Subchloride of mercury, 247
Subcutaneous injections, 123, 184, 198
— — of camphor, 451
— — of normal saline solution, 213
Sublimed sulphur, 273
Subnitrate of bismuth, 263
Sudorifics, 160
Sugar in the urine, tests for, 62
— of lead, 231
Sulphate of copper, 235
— of iron, 240
— of lime, 223
— of magnesia, 224

Sulphate of quinine, 486
— of soda, 214
— of zinc, 234
Sulphocarbolate of soda, 333, 336
— of zinc, 333, 336
Sulphonal, 321
Sulphur, 273
— iodide of, 271
— precipitated, 273
— sublimed, 273
— toxic actions of, 274
Sulphuric acid, 278
— — antidotes to, 278
— — toxic actions of, 278
— ether, 313
Superpurgation, treatment of, 461, 639
— from aloes, 639
— from linseed oil, 470, 631
Suppositories, administration of, 184
— glycerin, 184, 497
— nutrient, 184
Suppurants, 162
Surface of body, drugs acting on, 161
— — symptoms in connection with, 70
Surgical shock, 306
— — prevention of, 310
— — treatment of, with adrenalin, 517
— — — with camphor, 451
— — — with ergot, 431
— — — with normal saline injections, 212
— — — with strychnine, 413
Surroundings of patients, 77, 97, 112
Sweating, profuse, as a symptom, 70
Sweet spirit of nitre, 323
Swellings, dropsical, significance of, 71
Swine, administration of medicines to, 860
— erysipelas, serum and vaccine for, 529
— fever, serum for, 530, 555, 861
— purgatives for, 860
— sick, care and nursing of, 855
Swollen limbs as a symptom, 71
Symptomatic treatment, 9
Symptoms, diagnostic, 11
— general, of disease, 8
— objective, 10
— subjective, 10
— typical, 11
Syrup, Easton's, 243
— Parrish's, 243
Syrup of apomorphine, 909
— of buckthorn, 404
— of chloral, 319
— of codeine, 761, 909
— of ipecacuanha, 909
— of orange, 458
— of squill, 424
— of tolu, 453
Syrups, 202
Syrupus apomorphinæ hydrochloridi, 909
— aurantii, 458
— chloral, 319
— codeinæ, 761, 909
— ferri iodidi, 242
— — phosphatis cum quinina et strychnina, 243, 408
— ipecacuanhæ acetatis, 909
— rhamni, 464
— scillæ, 424
— tolutanus, 453

T

Table of medicaments and dosage in feline distemper, 803
— of percentage dilutions, 179
— showing cardiac murmurs, 731
— showing characters of normal urine in various animals, 53
Tables of weights and measures, 176
— — — imperial, 176
— — — metric, 177
Tablets, 197
Tallianine, 449
Tannalbin, 479
Tannic acid, 478
Tannigen, 479
Tannin, 478
Tannoform, 326
'Tapping' the abdomen, 827
— the chest, 708, 828
— the intestine, 825
— the pericardium, 727, 829
— the rumen, 594, 826
— the stomach in the horse, 581
Tar, birch, oil of, 448
— coal, 341
— — solution of, 341
— oil of, 447
— — light, 447
— ointment, 447
— spirit of, 447
— water, 447
— wood, 447
Tartar, cream of, 210
— emetic, 253
— — antidotes to, 254
— — toxic actions of, 253

Tartarated antimony, 253
Tartaric acid, 285
Tartrate of potash, 210
Temperature, the, as an aid to diagnosis, 16
— average normal, of various animals, 17
— registering the, 17
— subnormal, 17
Tenaline, 477
Terebene, 444
Terebenum, 444
Terebinthinæ oleum, 440
— veneta, 446
Terpene hydrate, 444
Terpinol, 445
Test, mallein, 519
— tuberculin, 521
Tests for albumin, 58
— for bile-pigments, 58
— for hæmoglobin, 61
— for sugar, 62
Tetanus antitoxin, 535, 555, 773
— prevention of, 535, 555, 773, 775
— treatment of, 771
— use of anti-tetanus serum in, 535, 555, 771
— — of hypodermic injections of magnesium sulphate in, 772
Thalline, 331
Thebaine, 363
Theobromine, 416
Therapeutics, empirical, 5
— rational, 5
Theriaca, 497
Thermometer, clinical, use of, 17
Thioform, 492
Thiol, 344
Thiosinamine, 494
Thirst as a symptom, 40
Thrill or fremitus, 23
'Throat, sore,' 569
Thymol, 446
Ticks, arsenical dip for destruction of, 759
Time, with reference to prescribing, 174
Tinctura aconiti, 351
— arnicæ, 454
— asafetidæ, 455
— aurantii, 458
— belladonnæ, 385
— benzoini composita, 451
— buchu, 484
— calumbæ, 433
— camphoræ composita, 449
— cannabis indicæ, 375
— cantharidini, 507
Tinctura capsici, 455
— cardamomi composita, 907
— catechu, 480
— chloroformi et morphinæ composita, 364
— cinchonæ, 486
— — composita, 486
— cinnamomi, 481
— colchici, 358
— convallariæ, 424
— digitalis, 417
— ergotæ ammoniata, 427
— eucalypti, 440
— ferri perchloridi, 242
— gelsemii, 398
— gentianæ composita, 434
— hydrastis, 435
— hyoscyami, 392
— iodi decolorata, 266
— — fortis, 265
— — mitis, 266
— jaborandi, 403
— lobeliæ, 396
— myrrhæ, 453
— nucis vomicæ, 406
— opii, 360
— podophylli, 466
— quassiæ, 434
— quininæ ammoniata, 487
— rhei composita, 463
— scillæ, 424
— senegæ, 455
— stramonii, 393
— strophanthi, 423
— valerianæ ammoniata, 454
— zingiberis, 438
Tinctures, 201
Tissue change, agents acting on, 157
Tobacco, 394
— antidotes to, 395
— toxic actions of, 395
Toleration, 127
Tolu, balsam of, 453
— syrup of, 453
Toluol, 330
Tongue, inflammation of, treatment of, 567
Tonics, 157
— cardiac, 147
— formulæ for, 888
— gastric, 131, 157
— — formulæ for, 887
— hæmatinic, 157
— — formulæ for, 888
— intestinal, 136, 158
— nerve, 158
— vesical, 141
Tragacanth, 498
— compound powder of, 498

Tragacanth, mucilage of, 498
Traumatol, 331
Treacle, 497
Treatment, empirical, 5
— indications for, 14
— irrational, 4, 561
— limits of, 12
— rational, 5
— symptomatic, 9
— — fallacies of, 9
Treman on the use of the stomach-tube in the horse, 823
Trinitrini, liquor, 323
Trinitroglycerin, 323
Triticum, 485
— liquid extract of, 485
Triturations, 196
Tropacocaine, 383
Trypanblue, 329
Tube, rectum, employment of, 188
— stomach, employment of, in the horse, 822
Tubercular pericarditis, 735
— pleurisy, 721
Tuberculin, 521
— test, 521
— — directions for use in cattle, 521, 522
— — — — in the cat, 524
— — — — in the dog, 524
— — — — in the horse, 524
— — — — in swine, 523
— — practical points in connection with, 522
— — Villar's views on, 522
Turpentine, oil of, 440
— — antidotes to, 442
— — contra-indications of, 443
— — French, 440
— — toxic actions of, 441
— — use of, 442
— Venice, 446
Tympanites as a symptom, 45
— acute, of rumen in cattle, 592
— chronic, 595
— formulæ for, 872
Tympany, gastric, acute, in the dog, 607
— — — in the horse, 578
'Typhus, abdominal,' 805
— canine, treatment of, 805, 813 (see also Canine typhus)
Typical cases of disease, 11

U

Unguentum acidi borici, 282
— — carbolici, 332
Unguentum aconitinæ, 352
— althææ, 500
— belladonnæ, 385
— betulæ, 448
— cantharidini, 507
— chrysarobini, 482
— gallæ, 478
— — cum opio, 478
— hamamelidis, 482
— hydrargyri, 246
— — ammoniati, 251
— — iodidi rubri, 252
— — — viride, 252
— — nitratis dilutum, 253
— — oxidi flavi, 247
— — — rubri, 246
— iodi, 266
— — intinctum, 266, 906
— iodoformi, 342
— methyl salicylatis compositum, 492
— paraffini, 345
— picis liquidæ, 447
— plumbi iodidi, 233
— potassii iodidi, 270
— resinæ, 445
— simplex, 504
— staphisagriæ, 357
— sulphuris, 272
— — iodidi, 272
— zinci oxidi, 233
Urethane, 322
Urinary antiseptics, 142
— organs, drugs acting on, 139
— — symptoms in connection with, 52
Urine, agents exerting a modifying action on, 141
— albumin in, 55, 58
— bile pigments in, 58
— blood in, 56
— casts, organized, in, 63
— characters of normal, in various animals, 53
— chemical examination of, 58
— epithelium in, 64
— hæmoglobin in, 56
— incontinence of, 67
— microscopical examination of, 63
— morbid conditions in connection with, 54
— pus in, 58
— retention of, 66
— sugar in, 58, 62
— suppression of, 54
Urotropine, 325
— new, 326
Urticaria, treatment of, 767

Uterine inertia, use of pituitrin in, 518
— irrigation, 836
Uva ursi, 485

V

Vaccine, anti-anthrax, 528, 529, 552
— anti-distemper, 527, 551
— anti-mastitis, 551
— anti-swine erysipelas, 529
— black quarter, 524, 526
— strangles, 549
— therapy, 538
Vaccines, 524, 548
— autogenous, 548
— mixed, for wounds, fistulæ, etc., 527, 552
— sensitized, 556
— stock, 526, 548
Valerian, 454
Vaseline, 345
— oil, white, 345
— white, 344
— yellow, 345
Vaso-constrictors, 148
— local, 149
Vaso-dilators, 150
Venesection, 159
Venice turpentine, 446
Ventilation, importance of, in respiratory diseases, 563, 702, 706
Veratrine, 355
— toxic actions of, 356
— uses of, 356
Vermicides, 138
Vermifuges, 138
Vertigo, 743
Vesical sedatives, 141
— tonics, 141
Vesicants, 162
Villar's observations on tuberculin, 522
Villate's injection for quittor, 906
Vinegar, 284
— toxic actions of, 284
Vinum antimonialis, 254
— ipecacuanhæ, 483
— xericum, 292
Visible mucous membranes, symptoms in connection with the, 37
Vis medicatrix naturæ, 4
Vitriol, blue, 235
— green, 240
— oil of, 278
— white, 234
Volatile oils, 435
Vomiting as a symptom, 49

W

Wash, black, 246
— yellow, 247
Water, 287
— camphor, 449
— cherry-laurel, 485
— chloroform, 298
— cold, uses of, 164, 288
— distilled, 289
— drinking-, a necessity for sick animals, 85, 101
— hot, uses of, 190, 288
— peppermint, 436
— rose, 451
— tar, 447
Wax, bee's, 504
— paraffin, 344
'Weed,' treatment of, 765
Weights and measures, 176
— — metric system of, 177
— — symbols of, 176
Wheaten flour, 500
Whisky, 292
White arsenic, 255
— lead, 231
— liniment, 895
— lotion, 232, 900
— paraffin, 344
— precipitate, 251
— scour, treatment of, 649
— vaseline, 345
— — oil, 345
— vitriol, 234
Wines, 202
Wintergreen, oil of, 492
Witch hazel, extract of, 482
Wood charcoal, 275
— tar, 447
'Wooden tongue,' treatment of, 252, 269
Wormseed, American, oil of, 474
Worms, formulæ for, 869, 870
— in dogs, erroneous views with reference to, 746, 787
— — preparation necessary prior to administration of vermicides, 475, 476, 477
— — treatment of, 473, 474, 475, 476, 477
— — mixtures for, 870
Wounds, septic, 846, 847
— treatment of, 843
— — polyvalent serum for, 534
Wright, Sir A., internal antiseptics in the treatment of pneumonia, 709
— — on the treatment of infected wounds, 285, 850

Y

Yellow oxide of mercury, 247
— — — ointment, 247
— paraffin, 345
— vaseline, 345
— wash, 247
'Yellows, the,' 670
Yohimbine, 493
— toxic actions of, 493

Z

Zinc and its medicinal salts, 233
— — — general actions of, 233
Zinci carbonas, 234
— chloridum, 235
— oleas, 909
— oxidum, 233
— sulphas, 234
— sulphocarbolas, 333, 336
Zincum, 234
Zingiber, 438

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