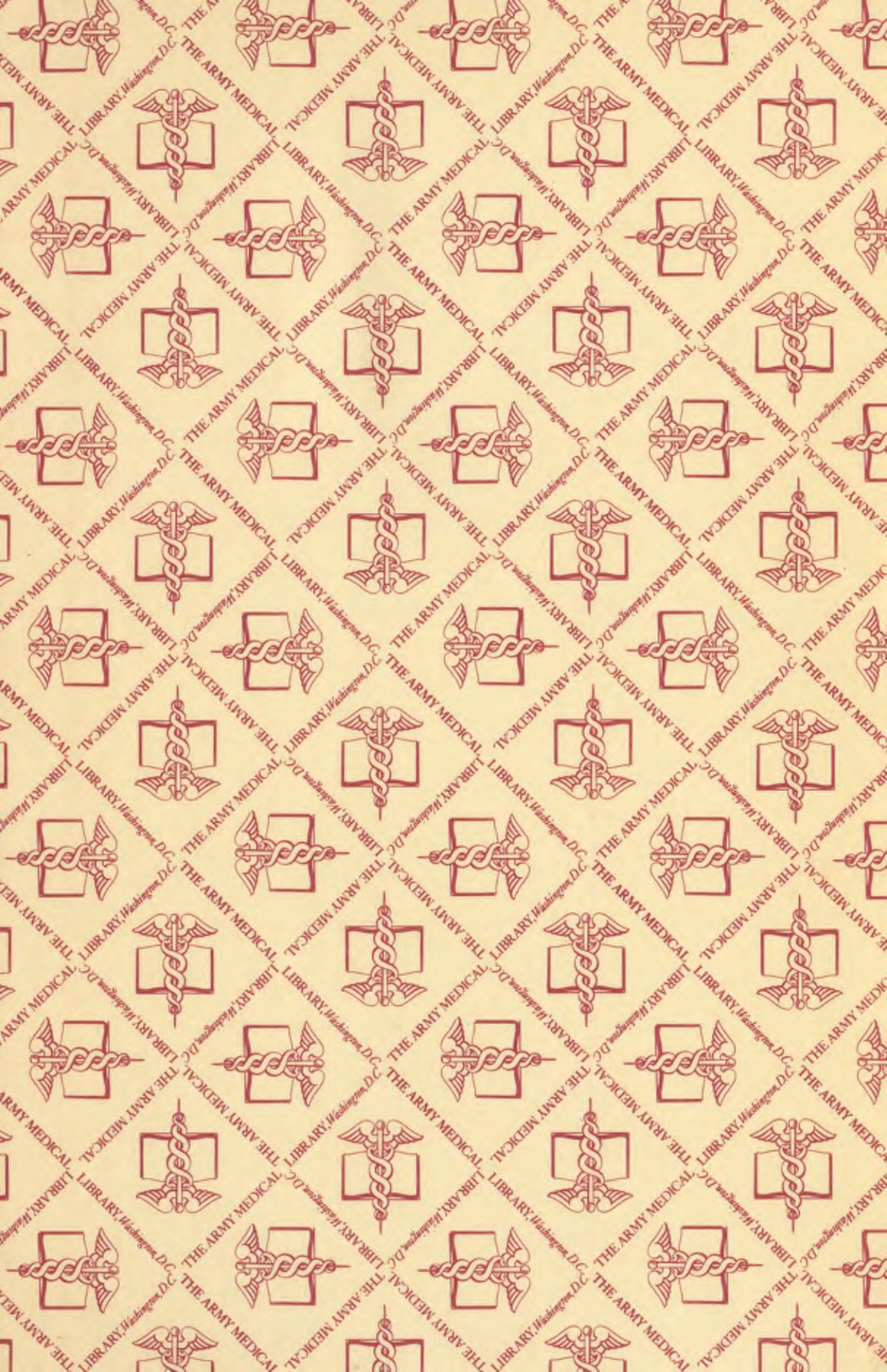
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Manual

on

Therapeutics

by

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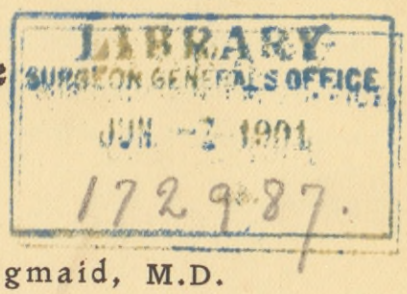

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PREFACE.

THIS work has been prepared especially for the use of students, with a view of presenting a concise statement of facts for quick review on the subject of Therapeutics, in conjunction with and after an attendance upon a full course of lectures.

No attempt has been made at extended physiological discussion, further than simply stating the facts, together with their mode of production and causation, as they are most generally recognized by authorities on the subject, and the application of such facts in their relation to practical therapeutics.

Having pursued this course with reference to the physiology, it necessarily precludes extended and detailed statements and explanations in the discussion of the various drugs and other therapeutic agents in their every-day relation to bedside work. It might be urged that this is a shortcoming in the effort of the entire work, but it is imperative that such a course be pursued in order to avoid volume, and thus defeat its original purpose.

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CHAPTER I.

INTRODUCTORY.

The subject of Therapeutics is often confounded with, and thought of as being identical with the subject of Materia Medica. It would be no more amiss to mistake Anatomy for Surgery, or *vice versa.* Just as Surgery finds the practical application for anatomical facts in the treatment of disease and injuries, so does Therapeutics find practical application for physiological facts in the treatment of disease. The subject of Therapeutics differs from Materia Medica in every particular. Whilst the study of Materia Medica deals with the physical, botanical and chemical properties of drugs, their relations and incompatibilities, Therapeutics deals with their physiological relations to the human economy and their influence on functional activities of the various organs in the treatment of disease. This at once brings out the difference between a *drug* and a *medicine.* A *drug* is an active agent, with chemical and physical properties and relations; a *medicine* is that same agent, with physiological and therapeutical properties in its application to the treatment of disease. This gives Therapeutics a distinct place in the study and practice of medicine. It borrows from physiology the facts which it applies in the sick-room in the relief of the sick. It borrows from pathology the facts which point out the indications for treatment, and makes diagnosis and prognosis of practical value to the sick, instead of a mere accomplishment of the physician.

Medicinal agents can be effective in so far as they influence to greater or less activity the function of any organ, and therefore are the only means which the physician has to relieve disturbance of such function. On the other hand, medicinal agents are of little or no value where the disease is of an organic or destructive type, except in so far as they may aid in checking the progress of tissue destruction, or may stimulate or act upon such parts or structures of the organ which have not yet undergone pathological change, and become palliative, temporarily, to prolong the life of the patient.

It is a common fault amongst practicing physicians to place an overamount of confidence in the power of medicines. With many of them, the administration of medicine is the burden of work in the treatment of disease. Such overconfidence leads to one of two evils: with the enthusiast who makes no observations in the sick-room, save that of admiring his own hopefulness for success, and thus overlooks many important facts necessary to the proper management of the case, it leads to carelessness; or, on the other hand, in the keenly observing physician, who after the administration of medicine, without regard as to the nature of the disease, always expects relief, it may lead to scepticism as to the value of medicine in the treatment of any disease. To expect that every medicinal agent recommended for the relief of certain conditions, never fails to give that relief under all circumstances, no matter what the lesion may be, whether it be organic destruction or functional depression, is necessarily doomed to disappointment. If as often as digitalis is given in cardiac failure it would be expected to relieve it with as much certainty as its administration, it would surely lead to a lack of faith in its efficiency; for more frequently does the drug fail than do the expected good. This is no fault of the drug, but is wholly dependent upon the condition of the lesion. In a heart organically and hopelessly diseased, digitalis can necessarily give no relief. If the organic lesion be such as can be compensated by cardiac stimulation, or if the lesion be wholly functional, digitalis is sure to give relief.

Again, if Diuretics fail to produce an increased renal secretion, it is unfair to conclude that these drugs are of no use; for when the kidneys are functionally depressed or sluggish in activity, these drugs usually are of much avail. When the kidneys are organically diseased, have undergone fatty destruction, or have been converted into fibrous tissue, it would be a miracle if such drugs could squeeze urine out of a lump of fat or a bundle of connective tissue.

It therefore becomes of first importance to the physician to study the nature of the pathological lesions which he is about to treat and determine the fact as to whether they are amenable to treatment, before he prescribes or administers his medicinal remedies in the hope of relief. A close study of this kind will at once make a keen observer of the physician as to when medicines are to be given and when they are to be withheld; and as a practical

result the physician will find himself prescribing remedies less often than he does by going about it in a routine way.

It must not be overlooked that the treatment and proper management of disease depend in many cases far more upon other conditions than the mere administration of medicines; such as diet, good nursing, systematic feeding, rest, and the proper surroundings for the patient. These factors have oftentimes more to do with the well-being and recovery of a patient than the medicines which are administered.

A new factor has within recent years entered into the field of therapeutics which promises to change the practical treatment of disease in many respects. It is the development of *Antitoxins* and *Serum Therapy*. The discovery of the causation of infectious diseases being due to toxin-producing bacteria, has revolutionized surgery; but it has done very little for the practicing physician, save that of giving him new ideas as to the cause of diseases, and consequently has changed the general management of the same. It taught him to treat and take care of the patient, instead of treating the disease. It also taught him asepsis and cleanliness in the sick-room, and the proper isolation of infected patients to prevent the spreading of disease to the surroundings. But the development of antitoxins, although very few of them are now of practical usefulness, may as decidedly produce changes in the management and treatment of infectious diseases as it has modified surgical procedures. It is too early to pass judgment on the future value of these substances, even though their present is problematical. To condemn them is as far from truth as to enthuse over them; and it takes the element of time to determine in how far they will give us control over the self-limited infectious diseases.

Serum therapy, or the use of extracts of certain glandular and other animal substances for the treatment of structural and functional diseases of various glands or organs, is as far in the future as the usefulness of antitoxins. Certainly it has been demonstrated that, in some cases and for some diseases, they are of decided and very certain value; in other instances, they have so far proven worthless. But their present uselessness is not to be taken as a conclusion that they are to remain worthless, for at this time they are only in their incipiency, and their further investigation and development, within the next ten or fifteen years, may tell us greater truths and make us wiser men in the medical profession.

AVENUES OF ADMINISTRATION.

In the use of drugs in practical medicine, we have to enter the system by the various avenues in such a manner as will render the drug of easy absorption to enter the general circulation. No drug is capable of producing constitutional effect without being absorbed, and is only active so long as it remains in the circulation.

The avenues generally employed for administration, are the Mouth or *Ingestion*, *Hypodermically*, by the *Rectum*, *Inunction*, and by *Inhalation* or entrance through the lungs.

Ingestion. The giving of medicine by the mouth is by all means the most frequently employed, because it is the most convenient. Given in this way, it acts about twice as soon as when given by the bowel, and about half as soon as when given hypodermically. It acts very much more promptly when given on an empty stomach than after a meal, since the absorption, in the absence of food, is more rapid.

The *intensity* of action of a drug, the quantity being the same, is likewise about twice as great when administered by the mouth as when given by the bowel, and about half as intense as when given hypodermically. To illustrate: ¼ of a grain of morphine has about as much effect when given by the mouth as ½ grain when given by the bowel, or ⅛ grain when given hypodermically; in other words, the ratio, generally, when administered in any one of these three ways, both in time and intensity of action, are about as 1 to 2 to 4. This rule is a very general one, and is more constant in vegetable drugs than any other remedies; probably because the vegetable substances are more apt to undergo change and destruction on going through the Liver with hepatic circulation, on their way from the intestinal canal to the general circulation, than mineral or earthy salts.

It is well to bear in mind that medicines, unless for special reasons, should always be administered *freely diluted* to save unpleasant local effects in the stomach. Sensitive stomachs often reject a medicine when in concentration, while they are not inconvenienced by the same quantity of the same medicine when given in a dilute form.

Hypodermically. Next in frequency of employment to ingestion or mouth administration is hypodermic medication. This method is chiefly employed when

promptness and *certainty* are desired. A medicine given in this manner acts quicker and with more definite effects than any other, except that of inhalation, because it enters the circulation directly and becomes active. The drug used must be in perfect solution and be thrown into the subcutaneous cellular tissue, where it is taken up by the lymphatics and carried immediately into the blood current. Occasionally, for immediate action, the injection is made directly into a vein, called *intravenous medication;* but this cannot be practiced entirely without risk to the patient, and should be avoided if other means will suffice.

In giving hypodermic injections, the following precautions should be observed: To have the hypodermic needle aseptically clean; to have the drug employed in complete solution; to have the water employed as a solvent freshly boiled, so that it is free from poisonous elements; to have the air in the syringe expelled before the needle is inserted, and to exercise carefulness not to enter a bloodvessel inadvertently. The abscesses, swellings and inflammations which occasionally follow the use of the hypodermic needle, are probably entirely due to carelessness and uncleanliness on the part of the physician, introducing toxic substance along with the injection. That such abscesses are due, as was formerly claimed, to the peculiarity of some drugs is probably a convenient delusion, but that they are bacteritic in origin is more in keeping with the facts.

By the Rectum. Medication by the bowel, either in suppositories, or by injections in liquid form, is employed when a slow and prolonged effect is desired. This organ, primarily not intended for the absorption of substances, takes up very slowly and very incompletely medicines which may be introduced into it; and hence it is necessary to administer very much larger doses to produce the same effect than when the medicine is given by the mouth. Some drugs, especially the insoluble salts of the metals, are not absorbed by the rectum in any such quantity as will render them useful for medication. Some liquid substances even, like the tincture of Digitalis, are absorbed so sparingly by the bowel that they are of no practical use, although the extract of this same drug is taken up readily.

Inunction. Inunctions are a form of medication in which the active substance is mixed with fat and applied to the skin, to be absorbed for constitutional effect. Of all methods of medication, they are the most slow in taking effect,

and can only be employed where the rapidity of action of the remedy is not of great importance. They consist of ointments and other fatty substances, and are applied to various parts of the skin and kept in contact until absorption through this organ has taken place. They are principally confined to the use of mercurials in syphilis, and the use of Codliver oil in infants where it acts both as a food and as a medicine. The inunction of Codliver oil is incapable of doing very much good in an adult, but in infants, where the skin is thin and pliable, the absorption takes place readily, and life may be maintained in this manner for a long time in cases where the digestive tract is unable to retain or digest food.

Inhalation. This method of medication is wholly confined to volatile substances like the anæsthetics or Amyl Nitrite. A volatile gas taken into the lungs in this way produces a quick effect, but is just as fugacious in action. These vapors are eliminated as readily as they are absorbed, and consequently are only useful for an immediate but transient action. The action of Amyl Nitrite, when inhaled, manifests marked symptoms in a fraction of a minute, and is therefore especially appropriate to meet emergencies.

DOSAGE.

There is no hard-and-fast rule which fixes doses of medicines, although such is often the belief of the student when he finds them specified in text-books. *Medicines must always be given for their effect;* and to meet the end of therapeutics, no other limitation can be fixed. The quantities to do the required work constantly vary in different individuals and under different conditions, and the doses needed to meet certain indications can only be measured by the relief which follows, identically the same as the food or drink for an individual must be sufficient to maintain normal body conditions. But it is necessary to have some general rule for quantities or doses to govern us, from which the particular dose for a given case can be estimated or obtained; and hence the doses put down in text-books are only intended to give the general average quantity which may be needed under the most common circumstances, and any conditions varying from the general average, either in individual peculiarity or in severity and urgency of the disease, must be accommodated by the practicing physician at that time.

Where active drugs, like Morphine, Strychnine, Digitalis and the like, have to be given in large quantities, it is advisable to administer them either in single large doses, far apart, or in small, frequently repeated doses.

If the case be one of emergency or accident, where immediate relief must be given, the doses should be as large as comparative safety will permit. But such doses should not be repeated until after a reasonable lapse of time and the full effects of the preceding dose are in evidence, as a guide by which to gauge the additional quantity needed to give the desired relief without taking undue risks of danger.

If, on the other hand, the case be one of continued depression or pain, as in acute illness, where stimulation and relief must be continuous, it is far better and safer to give the drug in small but rapidly repeated doses, so as to get the overlapping effects of each successive dose, in an ascending scale, to a point where relief is obtained. In this manner the physician can have a drug under complete and safe control, and at the same time attain the end at which he aims.

It must be remembered that the frequency of repetition of doses at short intervals produces an accumulation of a drug in the system, and an excessive action may follow, simply because the time between the various doses is insufficient to allow elimination to occur; hence where the dose of medicine is frequently repeated, it should be only half or even a third of the general average dose; whereas if the same medicine be given at intervals of six or eight hours, the quantity may be two or three times as large without producing unpleasant results. It is always better to estimate on the quantity to be given in each twelve or twenty-four hours, and divide that amount into as many doses or installments as may be desired to meet the indications. In this manner the danger of accumulation from the rapid repetition of small doses is averted.

The principal conditions which somewhat modify doses are: *Age*, *Disease*, *Sex*, *Body Weight*, *Temperament*, *Social Station*, and *Personal Peculiarities* or *Idiosyncrasies*.

Age. The very young and the very old alike require smaller quantities of any medicine than the robust adult. In infants the doses must be especially carefully gauged, because in them an over susceptibility exists to all foreign influences, and especially so to drugs.

Because drugs influence the human organism somewhat in proportion to body weight, several rules to govern us in doses for children are used by the practicing profession.

Crowling's Rule, in which you divide the age of the child at the following birthday by 24, and the result is the proportionate dose for that child; thus, the following birthday of a child being 4 years, we would have $^4/_{24}$ or $^1/_6$ of the dose of the adult, as the dose for that child.

Another rule is that known as *Young's Rule* for doses in children. He adds 12 to the age of the child and divides the age by the sum, to derive the proportionate quantity of the adult dose; thus, the age of the child being 2 years, we would have 12 plus 2, or 14, and 2 divided by this, or $^2/_{14}$ or $^1/_7$ of the dose of the adult being the dose for the child.

There are two general exceptions to these rules which are worthy of notice, viz: *Catharatics* usually have to be given in larger doses than the rules specify to produce the same effect upon a child's intestinal canal; while *Neurotics*, including *Narcotics*, or all drugs which dominantly affect the nervous system, should be given in much smaller doses than these rules indicate.

Disease. Any great pain or extreme emotional suffering, as well as excessive depression from bacteritic poisons, often bar the system against the effectiveness of remedies; and hence two or three times the ordinary quantities or doses are sometimes required before any effects become manifest. This is probably due to the fact that the nervous system is incapable of responding to any influence less powerful and impressive than the one which it is then trying to bear.

Sex. It is generally true that women require less medicine to produce the same effect than men need. This is probably partly true because in them the nervous susceptibility is greater than in men, but it is also in part true that the average body weight of the two sexes varies, and the female, usually being of less weight than the male, requires the smaller dose. This is a very general rule and is so full of exceptions, that it is of little practical account.

Body Weight. Body weight itself, regardless of sex or other conditions, has some influence in modifying the action of drugs when given in the same quantities.

This is truer in the lower animals probably to a greater extent than in the human subject; but even in man, an individual weighing two hundred pounds usually requires more than the one of half that weight.

Temperament. Temperament influences the effects and actions of medicines only in so far as the nervous susceptibility is concerned. Those of a *sanguine* temperament, of fair complexion, highly emotional, and very susceptible to all impressions, are more readily influenced by the same quantities of medicine than people of a *phlegmatic* temperament, who are cool, composed and deliberate in disposition.

Social Station. *Social station* in life has very much the same effect as temperament in modifying the influence of medicine. People of a high degree of nervous development, mental or emotional, and leading a "society life," or professional and business men who do heavy mental work, are far more readily influenced by medicinal agents than those who do manual labor, like mechanics and artisans.

Idiosyncrasies. There are certain personal peculiarities or idiosyncrasies found in individuals which we at the present time are not in a position to explain. We simply recognize their existence, and regard them when we find them to be true. They are not explainable on ordinary physiological or psychical grounds or known physiological laws, and hence no provision can be made for them in advance where they exist. These peculiarities are so marked that even ordinarily very innocent drugs will produce the most alarming toxic symptoms when given in small doses. This peculiarity in certain individuals is not wholly confined to drugs, but may be found in food-stuffs and in odors as well. I am personally acquainted with a family of three sons and two daughters, with their parents, who cannot even tolerate the odor, much less the taste of meats of any kind, and who, by eating or even tasting of them, are thrown into convulsions, with intense vomiting and cramps. They are hearty and hale, but never permit any animal food or meats to be brought into the house on account of this peculiarity. These are not prejudices or acquired notions with people so afflicted, but are innate; and hence the individual is incapable of controlling them or of being educated out of them.

CHAPTER II.

GENERAL PHYSIOLOGY.

In the study of the physiological actions of drugs, we have to consider all the local and general effects which a drug is capable of producing, together with its sequences—the fate, or chemical changes, and the elimination of the drug itself. But because these various physiological effects are so constantly repeated throughout the entire subject of therapeutics, it is only necessary here to give a general outline or key to the various factors to be considered and the terms used, for the convenience of the student.

Under physiological effects we have to consider *Local Actions*, *General Physiological Actions*, *Toxicology*, *Therapeutic Effects*, together with the *time*, *place*, and *nature* of the *elimination* of drugs.

Local Actions. The *local action* of a drug is the effect which it has when locally applied to any part. It does not differ from the *constitutional* effect in *kind*, but it is greater in its *intensity of action*, because it is usually in more concentrated form. The local influence is manifest to some degree in every drug which is administered for constitutional effects, and is always in more concentrated form at the *points of ingestion*, *absorption*, and *elimination;* and the organs or glands eliminating it are usually either stimulated or depressed, according to the peculiar action of the drug. If the drug be an irritant, the organs of elimination and the organs of absorption are apt to be irritated thereby, and hence kidneys already damaged by disease are apt to be endangered by the use of such highly stimulant medicines as are excreted by them.

Many drugs are administered internally only for their local effects, such as are affecting the secretions of the Liver, the secretions of the Gastro-intestinal Canal, the secretions of the Kidneys, or to influence intestinal peristalsis. All these effects must be accepted as local actions, because they do not by intention affect any other part of the organism.

General Physiological Action. A physiological action may be defined as being the primary effect which a drug produces when circulating in a healthy organism. This statement is however not sufficiently comprehensive, for a physiological action cannot be separated from a *toxic action*, except for the covenience of study, since the toxic action is merely an exaggerated physiology. The distinction therefore between the two is more one of convenience than of fact, and because of this convenience we usually call physiological effects those which are primary, and which are not intense enough to threaten the life of the animal or individual.

Toxicology. The toxicological effects of drugs are their later effects when given in large doses, and include the secondary depressing or exhausting effects of such drugs, together with the later symptoms and the mode of death; whether from arrest of respiration, the circulation, from exhaustion, or from the local corrosive and destructive action of the drug.

It is often considered an unnecessary and useless burden on memory, by the student, to study the toxicological and physiological symptoms which the various drugs produce when given in full doses; because when a drug is given in therapeutic quantities, these effects are not as manifest, though they are present, and hence it is not an uncommon impression that these physiological and toxicological effects are entirely at variance with and different from the therapeutic effects; and to study them is therefore looked upon as being no more than an accomplishment and source of discipline to the student's mind. This is an error. The study of the symptoms of poisonous drugs is not only necessary to recognize and properly treat accidental poisoning by such drugs when it occurs, but the symptoms produced by many of them, especially those of vegetable origin, are, in many respects, so closely allied to the symptoms arising from the toxines of bacteritic infection in acute infectious diseases, that it at once becomes to the student an advance study in symptomatology, preparatory to the study of Practice of Medicine. Bacteritic poisons, like many of our drugs, are of vegetable origin, and give rise to symptoms which chiefly differ from them in local lesions and height of toxicity. Both produce somewhat the same changes in pulse, in intellection, in respiratory movements, changes in nutrition and digestion, and some drugs, like toxines, even produce changes in body temperature.

The study of the main physiological and toxicological effects of every drug is also important, because from these exaggerated symptoms, which do not differ from milder ones in any respect but that of intensity, it is far easier to study their cause of production than it would be from the milder manifestations; and hence the more pronounced effects are noted, and from them the sources or physiological causes are determined. It is not necessary for a student to understand the minutiæ of physiological experimentation, and how these facts are determined experimentally. The student cares only for physiological results and their proper application in therapeutics, while the technique and minutiæ of experimentation belong to the laboratory specialist.

Therapeutic Effects. The therapeutic action of a drug is in every way identical with its physiological effects, except that it occurs in a diseased individual in opposition to the effects of such disease, and hence its manifestations are different, due to the physiological derangement which the disease produces. The therapeutic effects are only less apparent because they are less intense. A drug given to relieve a symptom of a disease is only given in sufficient quantity to give that relief, and the result is usually the restoration of the normal function of the part affected; but because of the absence of surface manifestations from drugs given in disease, it is not to be concluded that in such small quantities they have no effect.

Therapeutic Limit. The *therapeutic limit* of a drug is a term used to indicate the maximum quantity which can be given to an individual without harm or danger to life. Generally, drugs are only given in such quantities as will answer the purpose; but in occasional cases of very severe pain or other suffering, they have to be pushed to a maximum point in the attempt to relieve the patient, and to determine whether the drug is capable of combating it, or whether resort must be had to some other more powerful agent. To illustrate: In renal or biliary colic, Opium is often given in the largest safe doses without relief of pain, and then the more powerful anæsthetics must be employed.

These therapeutic limits are usually indicated by local or general manifestations by which they can be recognized, as, for instance, the therapeutic limit for Strychnine is the coming on of

slight local muscular rigidity, with restlessness and increase of spinal reflexes. The therapeutic limit for Arsenic is the appearance of puffiness in the face and about the eyes, and occasional irritation of the gastro-intestinal canal. The therapeutic limit for Digitalis is its characteristic pulse, very slow and full. The therapeutic limit for Belladonna is the dilatation of the pupils and extreme dryness of the mouth, etc. These limits are guides to the physician, which allow him to get the best use out of a drug in emergency, without taking any chances of either injuring or threatening the life of a patient.

Elimination of Drugs. It is only natural, when a drug is ingested, to ask the question as to what its *fate* is—what changes, if any, it undergoes in the digestive fluids; what changes it may undergo or produce while circulating through the tissues; how it may affect the nutrition; what effect it may have upon waste products, and whether it will increase or diminish their elimination, and how the drug itself is ultimately eliminated; whether it be eliminated unchanged as ingested, or whether it may have undergone partial destruction or oxidation and be eliminated as a different chemical compound.

It is also important to inquire into the fact as to what organs or structures ultimately eliminate drugs, because the eliminating organs are usually affected by the substance which they attempt to eliminate, and their functions are often thereby decidedly altered. Some drugs are eliminated as they are ingested, without any change; some are oxidized or destroyed in various parts of the body, and no trace of them in the secretions can be discovered. Others again are changed while circulating, but as yet we do not exactly know where or in what organs such changes take place; while some few of them, like Arbutin and Benzoic Acid, are changed at the point of elimination, and the change which they undergo is what gives them their therapeutic value.

The chief emunctories or glandular organs which are concerned in the elimination of drugs are the *Kidneys*, the *Bowels*, the *Skin* and the *Lungs*. Some drugs escape through one or two of these channels; while others, like the mercurials, bromides and potash salts, have universal elimination, escaping with every excretion and secretion of the body.

PHYSIOLOGICAL OUTLINE.

In the study of experimental physiology we have the two chief factors: *The effect on the circulation* and the *effect on the nervous system;* besides the minor effects on *respiration, body temperature* and *inhibition.*

Circulation. The factors to be considered in the circulation are *pulse-rate* and *blood pressure;* that is, whether the pulse-rate is less or greater than normal, and whether the blood pressure is increased or diminished.

Pulse-rate can be either increased or diminished directly by a drug,—

First, by stimulating or depressing the pneumogastric or inhibitory apparatus to the heart. (Stimulating the pneumogastrics, either at their origin in the Medulla or at their terminals in the heart, will diminish the pulse-rate, and depressing them will increase the pulse-rate.)

Second, the pulse-rate can be increased or diminished by directly stimulating or depressing the *Heart* or its contained ganglia.

Third, pulse-rate can be changed by stimulating or depressing the *cardiac accelerator centres.*

Pulse changes can also be produced indirectly by changing the tension of the bloodvessels, and thereby increasing or diminishing the resistance to the blood current; or by depression of the afferent or sensory spinal nervous system, preventing afferent impulses from reaching the vaso-motor apparatus and lessening the *tonus* of the bloodvessels, as is illustrated in the effects of Aconite.

Blood pressure can either be increased or diminished by a drug,—

First, by stimulating or depressing the *Heart* directly.

Second, by stimulating or depressing the *vaso-motor centres.*

Third, by stimulating or depressing the *muscular coats* of the *bloodvessel walls.*

Indirectly, the blood pressure is often influenced through other functional activities, such as excessive muscular contractions or changes in the respiration; but these facts are not important in therapeutic studies. In a great many drugs, several or all of these factors may be influenced in producing the changes

which occur in the circulation. A drug like Digitalis stimulates all the factors of the circulation; while Atropine would modify only the vaso-motor centres and pneumogastrics.

Nervous System. In the study of the effect of drugs on the nervous system, we have on the one hand increasing *stimulation* to a point of excitation terminating in *general convulsions*, which is the climax of stimulation; while on the other hand, we have different degrees of *depression*, ending in *complete paralysis*, which is the opposite extreme. This stimulation or depression may be in the *Spinal apparatus*, it may be in the *Brain itself*, or it may be in both, including the entire Cerebral Spinal Axis.

A *convulsion* may be *cerebral* or *spinal* in origin. The *clinical distinction* is, that a *Spinal Convulsion* is accompanied by active tetanic spasms with consciousness preserved, unless abolished by arrest of respiration.

A *Cerebral Convulsion* is epileptiform in type, and consciousness is abolished.

The *experimental distinction* is made by making section of the Spinal Cord. If the convulsion be of *cerebral origin*, it will not occur below the point of section of the cord. If it be of *spinal origin*, section of the spinal cord will not affect it.

Spinal Reflexes. In the study of the effects of drugs on the nervous system, it is of great importance to know the state of the *spinal reflexes;* whether they be diminished or increased, and how such diminution or increase may be produced.

The *spinal reflexes* can be increased or diminished, directly, in five ways:

By stimulating or depressing the motor cells in the anterior Spinal Cord.

By stimulating or depressing the cells in the Sensory or *receptive* side of the Cord.

By stimulating or depressing the peripheral motor nerves.

By stimulating or depressing the *sensory nerves.*

By stimulating or depressing the dominant *inhibitory reflex centres* in the Medulla or Setchenow's centres.

Indirect changes in the spinal reflexes can occur from im-

pulses coming from the brain directly, and are of psycho-motor origin. Physiologically, they belong to the true spinal reflexes, because their impulse is usually generated through a sense perception from one of the special sense organs; but in the physiological study of drugs this factor is eliminated from consideration.

Inhibition. All physiological processes, be they glandular, muscular, or of nervous origin, are provided with two sets of nerve forces or impulses: A *Vito-motor* or *exhilarant nerve supply*, and an *Inhibitory nerve supply*.

These two forces are in direct opposition or antagonism to each other, for the purpose of *moderating* and *limiting* physiological functional activities. When the *vito-motor* or exhilarant impulses are increased, the functional activity of the organ influenced is increased proportionately; and, on the other hand, when the *inhibitory impulses* are increased or stimulated, the functional activity of such organ is *diminished* in proportion to the force of such impulses. The physiological purpose of this *inhibitory* apparatus is to *regulate, direct*, and give *limitation* to physiological processes within such bounds as the organism may require. It is therefore not a negative influence, but an *opposite force* which is applied to an active physiological operation, and holds the same relation to such activity as the feeling of satiety bears to hunger, or the brake of a car wheel holds to a moving train; namely, to check it, to regulate it, or even, if necessary, to arrest it.

The most striking of these inhibitory processes, and those which come physiologically into question in the study of drugs and their therapeutic uses are: *Cardiac inhibition*, *Inhibition to intestinal peristalsis*, *Inhibition to spinal reflexes*, and *Inhibition to heat production*.

Cardiac inhibitory force is applied through the fibres of the *Pneumogastrics*, which, when stimulated either centrally or at their cardiac peripheral terminals, will diminish the cardiac rate and give regularity to pulse-beat. This inhibitory process, if actively stimulated, is capable of arresting a heart in relaxation; as is illustrated in some cases of digitalis poisoning, and probably in some forms of shock, due to violence to the epigastric region. Experimentally, the heart is readily arrested by an electric current applied to the distal end of the pneumogastric nerve after section.

The *inhibitory apparatus to intestinal peristalsis* is operated

through the fibres of the *Splanchnic nerves*, and regulates the rate and time of intestinal movement, both during the period of ingestion and at the time of intestinal evacuation. Of this apparatus we avail ourselves very frequently in overcoming constipation, and many forms of constipation are probably due to an excessive inhibition to intestinal peristalsis, which, if released, will allow natural intestinal movements to go on.

Inhibition to spinal reflexes is exerted through the dominant *inhibitory reflex centres* in the Medulla or Setchenow's centres, which, if stimulated, diminishes spinal reflexes, and if paralyzed, results in spinal convulsions. There is little doubt but that some forms of hysterical nervousness and excessive susceptibility to reflex impulses, are as much due to a faulty or insufficient spinal inhibition, as they are due to excessive susceptibility of the receptive centres in the cord. In the common nervous disease known as *Chorea*, it has been shown experimentally and clinically that at least some forms of this disease are due to disturbed or faulty spinal inhibition; not to a degree that the reflexes, as it were, can run wild and produce convulsions, but to a degree in which proper muscular direction and limitation to muscular control, are in part or wholly lost, resulting in a complete incoördination of groups of muscles.

There is also a very striking inhibitory apparatus to the vaso-motor system known as *vaso-dilators;* but this is not demonstrable in the study of drugs, and hence it is not of any practical importance to the subject of therapeutics. In how far drugs may influence this system in lowering blood pressure and the cause be ascribed to an effect upon the bloodvessel walls, we do not now know.

The *inhibitory apparatus to heat production*, or body temperature, is not yet physiologically demonstrated, but is most forcibly shown clinically in some fevers, especially in *thermic fever* or Sunstroke, where the heat inhibitory centres become paralyzed and body temperature rapidly rises to the temperature of the surrounding medium.

Reasoning from analogy, it would seem quite probable that our psychic phenomena, *emotional* and *intellectual*, are controlled and directed by a dominant inhibitory apparatus, which in metaphysics is known as the *Will*, and that this apparatus gives us the power to say *no*, to refuse to do certain things; it gives us the power to resist certain external influences, and to exert us

to obey others. It is this inhibitory force that guides our intellectual operations and coördinates them so as to think consecutively. The chief difference between this form of inhibition and other physiological inhibitory processes lies in the fact that it is accompanied by consciousness and is exercised at our wish; whereas the rest are wholly without our knowledge, much less under our control. The proper balance between intellectual force and this inhibitory power is what gives an individual intellectual equanimity and power of deliberation.

There is not a reasonable doubt that many forms of insanity, especially delusional insanities and mania, are due to a loss of this inhibitory power. The man laboring under the influence of a delusion, thinks consecutively on some particular line; but his thinking or impulses are excessive, and only differ from natural mental operations in this respect. This emotional excess appears in many cases to be due to a want of checking power, or inhibition. The *maniac* may be under the domination of excessive morbid impulses which are in every way natural and in keeping with psychic laws, except that they are without moderation and without self-control or inhibition.

It is likewise probable that many of our suicides are committed under what is known as "temporary insanity," where a morbid impulse, for the time being, gets complete control of the individual, and the act is executed before any self-control or inhibition can be called into play. It is just as natural to have such momentary insanity, without any permanent derangement of mental operations, as it is to have momentary loss of inhibition of the heart's action, of heat production, or of spinal reflexes, without having the slightest functional damage or organic lesion of any part or organ.

Our *emotional inhibitory power*, like the rest, is what gives us moderation in our likes and dislikes. Individuals with a good emotional inhibition are always moderate, deliberate, and naturally calculating in all their actions; or, in other words, they have themselves always "well in hand." On the contrary, people with uncontrollable temper, or with impulses of joy and ecstacy, which manifest themselves in great external demonstration, are individuals who are probably possessed of a deficient inhibitory apparatus to their emotional nature, and are consequently "always apologizing" for what they have done.

CHAPTER III.

ANTISPASMODICS

A Class of remedies which are serviceable only in mild spasms and in nervousness of functional type, such as mild hysteria or reflex spasms in children.

Antispasmodics are:—**Musk, Castor, Valerian, Assafoetida, Camphor, Oil of Amber, Compound Spirits of Ether, Hops and Cimicifuga.**

MUSK—(Mochus)

Musk is derived from the preputial glands or follicles of the musk deer. It is used in substance; dose, 10 to 15 grains, given in emulsion by the rectum. It is slightly irritant. The Tincture of musk is ineligible, and should not be used. It is not poisonous and an overdose has little effect save that of producing gastric discomfort.

Therapeutic uses: The best use for musk is in the crisis of low fevers, as low typhoid, low stages of pneumonia, in drunkard's pneumonia, pneumonia of debilitated old people, and in hiccoughs occurring in those conditions. It has been used in hysteria, but it is not commendable.

CASTOR

Castor is an unctuous principle derived from the beaver. It can be used to meet the same indications for which musk is used, but it is less active and less reliable; dose, 10 to 20 grains.

VALERIAN

Preparations. Tincture of Valerian; dose, 1 to 2 fluidrams. Ammoniated Tincture of Valerian; dose, 1 to 2 fluidrams.

Fluid Extract of Valerian; dose, ½ to 1 fluidram.

Valerian is a mild sedative to the nervous system, comparatively free from toxic properties. In large doses, nausea, vomiting

and distress may follow, but no serious poisoning has been produced.

Therapeutic uses: It can be used in hysteria and in mild nervous excitement, but is not comparable to other nerve sedatives; but it can be used as a placebo in hysteria, for it has all the properties of a medicine, except that of activity.

Valerianate of Ammonia, made of valerianic acid, is of some value in nervous headaches, hysteria, and neuralgia; dose, 10 grains. It is usually given in the form of an elixir.

ASSAFŒTIDA.

Preparations. The resin itself in 5 to 8 grain doses in pills.
The tincture; dose, 1 to 2 fluidrams.
The emulsion; dose, ½ ounce by the mouth; 2 or 3 ounces by the rectum.

Assafœtida is locally stimulant and slightly irritant to mucous membranes, producing increased glandular action and increased peristalsis in the digestive tract. In large doses it is capable of producing gastro-entritis. It acts as a mild sedative to the nervous system.

Therapeutic uses: It can be used in hysteria, in reflex spasms of children, in whooping-cough, and as a carminative in children and old people. It, being eliminated in part by the lungs, can be used in chronic bronchitis of the aged.

CAMPHOR.

Preparations. Gum camphor; dose, 5 to 8 grains in pill, capsule or emulsion.
Spirits of Camphor; dose, 10 to 15 drops. It is of 10 per cent. strength.
Aqua Camphor (or Water of Camphor); dose, ½ ounce to an ounce.
Liniment of Camphor used externally.

The local action of camphor is that of a stimulant, and on mucous membranes an irritant.

Toxic Symptoms. An overdose of camphor produces pain in the stomach, vomiting, and purging, followed by headache, delirium, unconsciousness, epileptiform con-

vulsions, respiration depressed, pulse rapid and weak, body temperature falling, with general collapse.

Gastro-intestinal symptoms are produced by its local irritant action. The nervous symptoms are the outcome of its influence upon the central nervous system. Camphor in small doses is a slight stimulant to the heart, but the blood pressure does not elevate because it is depressant to the vaso-motor centres. Large doses are depressant to the entire circulation. It is eliminated by the kidneys as a campho-glycuronic acid.

Therapeutic uses: The best uses for camphor internally are in nervous and relaxing diarrhœas. Being irritant to the intestinal canal, it cannot be used in diarrhœa of inflammation. In relaxing diarrhœas it should be combined with chloroform and opium. Camphor has also been used as a nerve sedative in hysteria, in sexual excitement, and in chordee, but it is of little value in these indications.

Oil of Camphor is a volatile oil derived from camphora officinarum and contains camphor in solution. It may be used to meet the indications for camphor in doses of 5 to 15 drops.

Camphoric Acid, derived from camphor by the action of nitric acid, is very insoluble, and should be given in powder or capsule form; dose 10 to 20 grains.

Therapeutic uses: It is very useful to arrest night sweats of phthisis. Here it should be given before retiring. Since it is eliminated unchanged by the kidneys, it is very serviceable in cystitis, depending upon alkalinity of the urine with fermentation in the bladder. It renders the urine acid and it has probably slight antiseptic power which aids in arresting fermentation in the bladder.

Monobromate of Camphor in 10 grain doses has been used with varying success in nervous headaches, spermatorrhœa, and chordee.

COMPOUND SPIRITS OF ETHER.

Compound Spirits of Ether (or Hoffmann's Anodyne) is composed of 1 pint of alcohol, ½-pint of ether, and 6 fluidrams of ethereal oil. The dose is from ½ to 2 fluidrams, best given in ice-cold water.

The symptoms produced by a full dose, are those of mental and physical excitation and increased rapidity of the pulse. Large quantities produce intoxication identical with that of ether or alcohol, muscular inco-ordination, stupor, pulse full and strong, and reflexes lessened. It is a stimulant to the heart in moderate doses, and can be used in cardiac weakness or syncope, but its best uses are in hysterical angina pectoris or functional heart pain, associated with nervousness. Sometimes it is of service even in true angina pectoris. It is an excellent carminative in flatus of old or nervous people.

HOPS.

Preparations. Tincture; dose, 1 to 2 fluidounces.
Fluid Extract; dose 1 to 2 fluidrams.

Humulus or hops contain a bitter principle, and are feebly tonic. They are of no use in internal medicines save that of a mild stomachic. In poultices they have been used to apply heat and moisture to parts too tender to bear the weight of other poulticing material. The hop pillow has at times been used as a placebo in hysterical insomnia. It has no inherent value save that of producing mental impression.

CIMICIFUGA.

Preparations. Tincture; dose, 1 to 2 fluidrams.
Fluid Extract; dose, 20 to 30 drops.

The fluid extract is perhaps the most desirable preparation.

Cimicifuga (or Black Snakeroot) in moderate amounts has no marked effect upon the system. Ingested in large quantities it is followed by nausea, distress, headache, and general depression of both the nervous system and circulation.

Therapeutic uses: The most serviceable place in medicine for Cimicifuga is in chorea of childhood, where it should be given in ascending doses either until the chorea yields or until it produces a frontal headache (its therapeutic limit), at which point it should be discontinued. In chorea it classes itself with arsenic, quinine and antipyrin. It has been used in rheumatism, in chronic sciatica, and in chronic bronchitis, but it is of doubtful value in these indications.

CHAPTER IV.

ANÆSTHETICS.

The practical anæsthetics are:—**Nitrous Oxide, Sulphuric Ether, Chloroform, and Bromide of Ethyl.**

Anæsthetics are used to meet two general purposes in medicine:—

1st. To produce anæsthesia for the relief of pain—pains of all kinds too severe to be controlled by an analgesic.

2d. For the purpose of controlling local spasms and convulsions, such as renal or biliary colics or asthma, and to control general convulsions, such as strychnic, tetanic, puerperal, uræmic, and violent hysterial convulsions.

The anæsthetics, except nitrous oxide, produce anæsthesia and muscular relaxation by a direct depressant action upon the cerebro-spinal nervous system. Nitrous oxide acts mechanically by producing asphyxia.

NITROUS OXIDE.

Nitrous oxide is a non-poisonous gas wholly foreign to the animal economy. It is usually administered unmixed with air from a containing bag, with a tube attached, to which a mouth-piece is fitted having a double valve, one opening into the tube from which the gas is inhaled, the other opening into the air for exhalation. Oxygen, or air, is, therefore, cut off; but CO_2, or dioxide of carbon is constantly eliminated, and thus there is less CO_2 in the blood under the gas anæsthetic than normal. When mixed with more than five per cent. of air it will not produce anæsthesia.

The anæsthesia is produced wholly by the exclusion of oxygen from the respiration, or by the production of asphyxia. This asphyxia produces unconsciousness, and the anæsthesia, or insensibility, is the direct sequence of the unconsciousness. An asphyxia thus produced differs from a strangulation-asphyxia in the fact that in the latter there are added the poisonous effects of CO_2.

When nitrous oxide is administered, the face becomes flushed and livid. The patient becomes unconscious and the muscles

relaxed. The heart becomes very rapid, and the blood pressure suddenly elevated. The blood pressure elevation is due to the asphyxia, producing a reflex vasomotor spasm, as all asphyxia does. The increased rapidity of the heart is likewise a reflex impulse produced by the asphyxia. Nitrous oxide is probably the safest and the most fugacious of the practical anæsthetics. It is safe, because their is no poison in the system to be eliminated, but simply a supply of oxygen need be furnished; it is fugacious, because so soon as air is inhaled consciousness returns. When, therefore, alarming symptoms arise during a nitrous oxide anæsthesia, prompt artificial respiration is the treatment.

Uses. The anæsthetic, being prompt in action and short in duration, is well fitted for short operations, such as lancing of felons and abscesses, and for the extraction of teeth.

It is contra-indicated in cases of marked atheromatous changes in the bloodvessels, because of the sudden rise of blood pressure; cerebral bloodvessels may be ruptured and death occur from apoplexy. Such cases have occurred. It is not too safe in advanced organic heart disease with failing compensation, because here the rise of arterial pressure offers resistance sufficient to arrest a weak heart.

ETHER.

The vapors of ether are about two and a half times the weight of atmospheric air, and are highly inflammable. When anæsthesia is produced by lamp or gas light, the source of light should be from an elevated point, to prevent accident from igniting the ether vapors.

Symptoms. The first symptoms of ether inhalation are those of excitement—mental, emotional and physical. In females, erotic excitement often occurs, which at times goes on to a full sexual orgasm. There is struggling, followed by muscular rigidity, respiration is irregular, choking, interrupted by cough, and the pulse is somewhat excited.

The Stage of Anæsthesia now follows, with complete unconsciousness, insensibility, muscular relaxation, reflexes lost, respiration slow, regular, and automatic; pulse full and regular, blood pressure elevated, and temperature usually normal. This is the stage during which surgical operations are performed.

If the anæsthetic is pushed too far a stage of paralysis occurs, in which there is deep coma, respiration becomes shallow and irregular, face livid, pulse weak and rapid, temperature falling, and finally death, usually by arrest of respiration; in rare cases cardiac arrest occurs.

Physiology. Physical, mental, and emotional excitement in the early stage of ether is probably due to slight stimulation of brain and spinal centres. The subsequent unconsciousness is due to direct depressant action of ether on the brain. The anæsthesia is in part due to the unconsciousness and in part to the depression of the sensory cord, and the muscular relaxation and loss of reflexes are due to depression of the motor cord.

Ether depresses the centres of the brain, spinal cord, and medulla in the following order: The brain, the sensory cord, the motor cord, then the centres in medulla, including respiratory and vasomotor centres.

The full strong pulse with blood pressure elevation, is the outcome of stimulation of the heart, and probably there is slight stimulation of the vasomotor centres.

In toxic quantities ether depresses the entire circulation; heart, vasomotor centres and bloodvessel walls, producing the weak, rapid pulse of the late stages of ether poisoning. It is a direct depressant to the respiratory centres, and thus kills.

Contrast with Chloroform. To contrast the physiological actions of chloroform with those of ether we find that chloroform, like ether, depresses the brain, the sensory cord, the motor cord, and the centres in the medulla in the same order. They are, therefore, alike in their action on the nervous system, except that chloroform is the more prompt and more powerful.

On the circulation, chloroform acts the direct opposite of ether, being an active *cardiac depressant* from the beginning, while ether is a *cardiac stimulant* except in excessive quantities. Upon this one fact depends the relative safety and danger of these two anæsthetics. Chloroform in small quantities is a slight stimulant to the vasomotor centres, but in large doses it depresses them.

Accidental deaths from ether in the human subject are usually from respiratory arrest or asphyxia; only in rare cases does cardiac paralysis occur. Accidental deaths from chloroform, on the contrary, are in the great majority from sudden heart paralysis, and in

rare cases (and those cases mostly in children) does respiratory paralysis become the cause of death. Experimentally, in the lower animals, chloroform, like ether, is more apt to produce death by asphyxia. This is probably due to the fact that in animals the heart is normal and healthy, which is not always the case in human adults.

From statistical records of deaths occuring from these two anæsthetics, it would appear that chloroform is from four to five times as dangerous as ether; since they have produced accidental deaths in about that proportion.

Treatment of Accidents. If respiration fails, as is usual in accidents from ether, discontinue the anæsthetic, apply artificial respiration, draw the tongue forward, and use strychnine and cocaine hypodermically to stimulate the respiratory centres. If the heart is weak, hypodermics of digitalis should be given, and external heat supplied to support the tempertaure.

If the heart should suddenly fail, as it does most frequently in accidents from chloroform, stop the anæsthetic, invert the patient with the head low, to favor the flow of blood from the abdominal vessels into the right heart and thus stimulate contraction, and give digitalis and strychnine hypodermically,—digitalis to stimulate the heart, and strychnine to stimulate both heart and respiration. Prompt artificial respiration should be performed to expel the residual chloroform unabsorbed from the lungs, and to aid the elimination of the anæsthetic.

It is often recommended to use an electric current or to pour ether or cold water over the chest of a patient whose respiration or heart has been arrested by an anæsthetic, in the hope of producing a reflex impulse to either heart or respiratory centres; but it is difficult to understand how these measures can be of any value, when we recollect that the whole reflex apparatus is paralyzed by the anæsthetic to a degree that even the surgeon's knife or saw cannot produce a reflex impulse.

Administration. Ether can be administered from an inhaler or cone, as concentrated as is in keeping with sufficient air to maintain life. After the patient is under the full anæsthetic influence the ether should be given, drop by drop, so as to keep the anæsthetic under control, and quantity as small as possible.

Chloroform, on the contrary, should be given freely diluted with air, and only drop by drop, because both by its concentration as well as by its quantity it can produce sudden heart arrest. In the administration of ether, attention should be given most prominently to the respiration, although the pulse likewise should be kept under observation. In the administration of chloroform the greatest attention is given to the pulse, and when the patient turns a livid pale and the pulse becomes weak, the anæsthetic should temporarily be discontinued.

Chloroform has the advantage over ether as an anæsthetic in being more prompt, the first stage less distressing, and the after effects with less nausea and depression, but it has the disadvantage of its danger to the heart. Ether has the advantage, on the contrary, of being more safe, because it stimulates the heart instead of depressing it.

In organic diseases of the brain, lungs, throat, heart, blood-vessels and kidneys, the anæsthetics are more dangerous than in health; but if an anæsthesia must be produced, chloroform is preferred to ether in organic diseases of the lungs, throat and brain; being given in small quantities, it is less irritant to those lesions. Ether is preferred in organic diseases of the kidneys and heart.

After prolonged anæsthesia from ether or chloroform in tedious surgical operations, cloudy swelling or acute fatty degeneration may occur in the kidneys, in the heart muscle and elsewhere.

In mixing blood with either chloroform or ether, the blood corpuscles are disintegrated by the action of the anæsthetic. This disintegration of blood probably does not take place in the circulation under an anæsthetic, because neither jaundice or anæmia follow the use of an anæsthetic.

Chloroform is very useful in 10 to 15 drop doses in emulsion as a carminative to relieve intestinal colic, in hysterical or nervous vomiting, in nervous or relaxing diarrhœas, and in relieving cough.

BROMIDE OF ETHYL.

Bromide of Ethyl is a very volatile liquid, producing anæsthesia promptly and the patient recovering quickly after the anæsthetic is discontinued. In point of safety it is a trifle more safe than chloroform but is more dangerous than ether. It has the disadvantage in not producing complete muscular relaxation as do ether and chloroform. It attacks the nerve centres probably in the following order:—First, the sensory cord, then the cerebral

centres, while the centres in the motor cord are rather excited than depressed. It has been recommended as an anæsthetic in childbirth, from the fact that it relieves the suffering without producing complete unconsciousness and without lessening the uterine contractions.

CHAPTER V.

HYPNOTICS.

They are: **Opium and its Alkaloids, Chloral, Chloralamide, Chloralose, Chloral Camphor, Hyoscine, Sulphonal, Trional and Paraldehyde.**

The remedies of this group have their dominant physiological action upon the cerebral Cortex, acting as depressants to produce sleep.

OPIUM.

Preparations. Tincture of Opium, dose, 5, 10 to 20 drops.
Deodorized Tincture of Opium; dose, 5, 10 to 20 drops.
Camphorated Tincture of Opium (or paregoric), dose, 1 to 2 fluidrams to ½ fluidounce.
Extract of Opium; dose, ½ to 1 grain.
Denarcotized Powdered Opium; dose, 1 to 2 grains.
Dover's Powder (being made up of 1 grain of opium, 1 grain of ipecac, and 8 grains of sugar of milk in every 10 grains); dose, 5 to 10 grains. This preparation is not well fitted for use in children.

All of the liquid preparations of opium except paregoric are 10 per cent. by weight. Paregoric is a little less than two grains of opium to the fluidounce. It also contains camphor, oil of anise, and benzoic acid, and is, therefore, the most constipating of the opium preparations. Deodorized Tincture of Opium is more elegant than

the tincture for internal use, as it contains no narcotine, and therefore is less apt to produce nausea. Denarcotized Powdered Opium, Extract of Opium and Deodorized Tincture are comparatively free from the alkaloid narcotine and are less apt to sicken the stomach. For suppository use, the Extract of Opium should always be selected.

Effect of Therapeutic Dose. The effects of a moderate dose of opium, as 2 or 3 grains, are those of a feeling of restfulness, drowsiness with slight narcotic dreams, probably followed by sleep, which sleep may last from four to six hours.

The *after-effects* that follow the sleep are frequently those of nausea, headache, depression, probably vomiting, and constipation. Less frequent is itching at the nose, and sometimes a general pruritus. In nervous women opium occasionally produces excitement and wakefulness instead of sleep. In very young children opium in large doses may produce dangerous depression. These after effects of a therapeutic dose are of great importance, and do not come on until the primary effects of opium pass off. The nausea and sick stomach, with headache, may be prevented by preceding or accompanying the opium with a full dose of one of the bromides. The nausea is relieved by maintaining a horizontal position, and this may distinguish it from a nausea of irritation. The constipations so constant after opium, are produced in part by lessening the secretions of the intestines, and in part by diminishing intestinal peristalsis through stimulation of the splanchnic nerves, which are inhibitory to intestinal movement.

Symptoms of Poison. After a toxic dose of opium there is drowsiness, with opium dreams, immediately followed by sleep, which sleep progressively deepens, pupils contracted to a pin point, respiration slow and deep, and becoming progressively slower; pulse is slow, full, and regular; face pale and livid; the skin natural, and the temperature is normal.

After some hours, if the dose be lethal, the sleep becomes a coma, and the respiration still slower, but now becoming shallow and irregular; the pulse rapid and weak, the temperature falls, and a clammy sweat of collapse appears. The patient, if death follows, dies from asphyxia or paralysis of the respiratory centres. The pupils are contracted throughout the course of opium poisoning unless death occurs, when it will dilate in the death agony, as it does in deaths from any other cause.

Physiology. The dominant symptom in opium poisoning is the sleep, produced by direct depression of the cerebral centres. The respiratory centres are depressed from the beginning; first diminishing the rate, then the depth of respiration. The contracted pupils are produced by stimulation of the oculo-motor centres, and this is the best diagnostic sign to distinguish opium poisoning from other narcotic poisons, although it is not absolutely pathognomonic. The pulse is slow and full, and the blood pressure is slightly elevated; the slow pulse is due to centric and peripheral stimulation of the pneumogastric nerves. The full pulse with blood pressure rise is due to slight stimulation of the heart. In advanced poisoning the heart is depressed, giving a rapid, feeble pulse.

Opium lessens the secretions of the kidneys, respiratory tract, mouth and intestines, and is much used in medicine for this purpose.

There is an apparent difference in the effects of opium upon some of the lower animals, such as the frog, the mouse, and the bird, from what is observed in higher animals and the human subject.

In the frog, opium produces violent spinal convulsions like strychnine, followed by paralysis. It is evident, that here, its dominant action is on the spinal cord. But as you ascend the animal scale and reach the animals whose brain development dominates that of the spinal cord, as in the horse, the dog and in man, this spinal excitement is replaced by its action on the brain, acting at first as a mild stimulant and then depresses it.

It would, therefore, seem that this difference depends upon the relative development of the spinal cord and cerebral system, and opium always attacking the highest developed nerve structure most, it is but natural that animals with more spinal cord than brain, should have the spinal centres more affected by this drug.

Recapitulation. The physiological facts, therefore, are that opium at first stimulates but later depresses the brain, stimulates the oculo-motor centres, depresses the respiratory centres, stimulates the pneumogastric nerves, stimulates the heart slightly, and checks certain secretions. In small doses it diminishes and in toxic doses it increases intestinal peristalsis; that in advanced poisoning all these structures become alike depressed.

Diagnosis of Opium Poisoning. Opium poisoning resembles any condition producing coma. It must, therefore, be distinguished from alcoholic coma, from uræmic coma, from other narcotic poisons, advanced sun-stroke, apoplexy, brain congestion or brain concussion.—Equally contracted pupils are the most reliable symptom, but no absolute diagnosis can be made. It is only a working or probable diagnosis that can be arrived at.

Treatment. In the treatment of opium poisoning three indications must be met: First, to administer the antidote; second, to empty the stomach; third, to support the respiration.

The best chemical antidote for opium is permanganate of potash, and should be given in 3 to 5 grain doses in dilute solution. This antidote oxidizes the alkaloids of opium in the stomach. The antidote should be repeated at intervals in small doses thoroughout the course of poisoning, since opium, being eliminated in part by the stomach, will be oxidized constantly and prevent the re-absorption of the poison. In the absence of this antidote tannic acid can be used.

The stomach can be emptied by a stomach pump or siphon, unless it contains solid food, when an emetic should be used, such as sulphate of zinc, mustard, ipecac or apomorphine. The most reliable and most promptly acting emetic is apomorphine, given hypodermically in $\frac{1}{8}$ to $\frac{1}{6}$ of a grain dose. It acts in a few minutes, and has no physiological relations to morphine.

The respiration must be supported by keeping the patient awake, by administering respiratory stimulants, such as strychnine, atropine, and cocaine hypodermically, and caffeine or strong coffee administered by the mouth, and by performing artificial respiration.

Atropine, aside from stimulating respiration, aids in producing wakefulness; caffeine, aside from stimulating respiration, also tends to wakefulness, and aids the heart if becoming weak, and stimulates the kidneys, thus assisting the elimination of the poison. Strychnine and cocaine stimulate more directly the respiratory centres.

The patient is kept awake to maintain voluntary respiration; automatic respiration is abolished, and thus breathing stops when sleep occurs. Keep the patient awake by command, flatulation, or, which is better than any, the use of a dry electric brush which produces extreme pain without injuring the part. As a last resort use artificial respiration, performed according to Syl-

vester's method, or, which is better, forced respiration, consisting of a face mask with a mouth-piece and bellows attached. Or, if all this fails, trachial intubation or even a trachotomy, with a tube introduced and bellows attached, may be justifiable. In advanced opium poisoning the accumulated CO_2 from diminished respiration acts as a second poison, and aids in the rapidly approaching fatal asphyxia.

Chronic Opium Poison, as is found in opium or morphine eaters, can be treated either by an instant withdrawal of the drug, by a rapid withdrawal of the drug, extending over a period of about ten or twelve days, or by slowly withdrawing the drug extending over a period of several weeks. The symptoms arising during this period, as diarrhœa, loss of appetite, insomnia and depression, must be treated on general principles.

Therapeutic Uses: The general indications for opium are: to relieve pain, to produce sleep, to check certain secretions, to allay irritation, and in the form of Dover's powder it has been used as a sudorific to break up colds.

To Relieve Pain. How opium relieves pain is not definitely known. Possibly it may do it by depressing those cerebral centres which appreciate this form of sensation and translate it into consciousness. It is useful in all forms of pain, such as pain from inflammations, irritations, or neuralgic pains. In neuralgic pains antipyrin and phenacetine are as useful as opium, but they have no influence upon inflammatory pain. Pain too severe to be controlled by opium, must be relieved by an anæsthetic. It is here where the analgesic and the the anæsthetic meet.

To Produce Sleep. This drug is useful in all forms of insomnia: in sleeplessness from mental excitement, in sleeplessness from nervous exhaustion, or insomnia from pain. In insomnia from pain it is the best of the hypnotics; in sleeplessness from mental excitement, as mania, delirium tremens or delusional insanities, it is more efficient when combined with other hypnotics. In nervous exhaustion, as in the sleeplessness of low stages of disease, opium stands among the first, because it rather supports than further depresses the already exhausted nervous system.

To Check Certain Secretions. Opium is used to check morbid or excessive secretions of the intestinal canal, in the different forms of diarrhœas;

to lessen secretions of the kidneys, in incipient diabetes or polyuria, and in true diabetes, and to lessen excessive expectorations in bronchitis. It can be used to check salivary secretions, but atropine is better.

To Arrest Irritation. Opium is the best drug we have to lessen irritation. In irritation of the intestines, in all forms of diarrhœa, the irritation of peritoneal inflammation, and in irritation of the stomach with excessive vomiting, opium is our most reliable remedy. In vomiting it should be given hypodermically for prompt action, and in suppositories by the rectum for prolonged action. It is also useful in irritation of the respiratory tract in bronchitis to relieve cough, and in irritation and pain of the skin, as in smallpox, burns and scalds.

Opium controls convulsions in young children very promptly, but it is not without risk that it is so used.

Opium is also used to control internal hemorrhages. Here it probably acts by its sedative influence upon general functional activity and quieting the nervous system.

Morphine and Codeine. The two alkaloids of opium used in practical medicine are morphine and codeine. Morphine as a sulphate or hydrochlorate is given hypodermically, in doses, of ⅛, ⅙ to ¼ of a grain; by the mouth, ¼ to ½ of a grain. Therapeutically, morphine differs from opium mainly in the fact that it is probably less constipating, less nauseating in its after affects, and more prompt in action, lending itself to hypodermic use.

Codeine Sulphate is given in ¼ to ½ grain doses, but is less certain and less reliable in its action than morphine. It is used in diabetes with better results, it is claimed, than can be obtained from the use of morphine.

CHLORAL.

Chloral is a crystalline substance, freely soluble in water and deliquescent on exposure; dose, 5 to 20 grains. It is given at times in larger doses, but not with entire safety. It is incompatible with antipyrin, forming a mono-chloral-antipyrin. This product is less poisonous than chloral.

Locally, chloral is irritant, antiseptic, and slightly anæsthetic, and because of these properties it is sometimes used for the dressing of sluggish, painful ulcers.

A therapeutic dose of chloral, 15 to 25 grains, produces a sleep not to be distinguished from a natural sleep. The drowsiness is natural, the respiration and pulse are deep and regular as in natural sleep, and the patient, if awakened, again drops off to sleep as in natural sleep. It is sometimes called "the counterfeiter" of natural sleep. This hypnotic effect lasts from five to eight hours.

Chloral circulates in the system as chloral and is eliminated by the kidneys as uro-chloralic acid. It is not decomposed in the alkaline circulation into chloroform and formic acid, because such decomposition takes place at higher than body temperature.

Toxic Symptoms. The symptoms of an over-dose are: sleep, progressively deepening; the pupils at first contracted, later becoming dilated; respiration slow, finally shallow and irregular; muscular relaxation and paralysis; reflexes lost, anæsthesia comes on, pulse first slow, later rapid, but loses in force from the beginning; marked temperature fall, and finally death,—usually from asphyxia, occasionally from sudden heart paralysis.

Physiology. Chloral is a universal depressant. The deep sleep is its dominant symptom, and is produced by direct depression of the brain-centres. The shallow, irregular respiration is due to depression of the respiratory centres. General paralysis is due to depression of the motor side of the spinal cord. The subsequent anæsthesia is due to depression of the sensory cord. This anæsthesia does not become apparent in any therapeutic or safe dose, and is therefore a toxic condition. The pulse is at first slow, because of an early slight stimulation to cardiac inhibition; the late pulse rapidity is due to pneumogastric depression. The fall of blood pressure is due principally to direct cardiac depression, though the vasomotor centres and even the bloodvessel walls share this action.

The temperature fall is in part the outcome of the failing circulation allowing rapid heat radiation, but, in part it may possibly be due to depression of the heat producing centres in the medulla.

Treatment of Poison. As in opium poisoning, so in chloral, the patient must be kept awake, the stomach washed out, the respiration be maintained by the use of strychnine and cocaine hypodermically, and, if need be, artificial respiration, the heart being supported by hypodermics of digitalis, and ammonia given by the mouth, and the temperature supported by external heat.

Strychnine and cocaine are especially useful in this poisoning, because they support the heart, respiration and the spinal cord.

As to chronic poisoning in "chloral fiends," three types of poisoning have been described: one in which local vasomotor paralysis with congestion is a very pronounced symptom; another, in which dyspnœa is the most pronounced symptom, and in which probably the heart and respiratory centres suffer heavily; a third, where there is cutaneous eruption with pustules and ulceration, probably the outcome of deleterious effects upon the trophic centres of the spinal cord. In all cases there is general depression, and loss of appetite with emaciation. The treatment consists in discontinuing the drug and treating the symptoms as they arise.

Therapeutic Uses: By virtue of its depressant action on the brain, chloral is a useful hypnotic in all conditions of insomnia, except that occasioned by pain, where it should be combined with at least sufficient opium to relieve the pain. In insomnia from mental and nervous agitation or excitement, in insanity or from overwork, chloral is one of the most useful hypnotics; but, like opium, in violent excitement of mania and delirium tremens, it is more efficient when combined with other hypnotics, like hyoscine or morphine.

By virtue of its great depression of the motor cord it becomes an active anti-convulsant in the convulsions of strychnine poisoning, in uræmic, puerperal, tetanic, and even violent hysterial convulsions. It is occasionally used in epileptic convulsions where the attacks recur in rapid succession.

It is also useful to allay local spasms, as in night cramps of pregnant women and old people, producing sleeplessness; it can be employed in whooping-cough and hiccough. In acute chorea where the choreic movements prevent sleep, chloral is a useful palliative to secure rest and sleep.

Chloral is *contra-indicated* where there is a weak heart, especially so if from organic disease. Its dangers may be lessened by preceding it with a dose of digitalis.

CHLORALAMIDE.

Chloralamide is a compound of chloral formed from formamide and chloral. Its physiology differs from that of chloral in the fact that it depresses the circulation and spinal cord much less than chloral, and increases the respiratory rate, whereas chloral depresses it; but, like chloral, it depresses the brain and produces

sleep. It is therefore safer than chloral, but less powerful and less certain in its hypnotic action. It can be given in doses of 15 to 25 grains, and can be used in place of chloral where there is a damaged heart.

CHLORALOSE.

Chloralose is prepared by heating anhydrous-chloral with glucose, forming an anhydro-gluco-chloral or chloralose; dose, 5 to 8 grains, best given in solution; but it can be given in capsules.

Physiologically, chloralose differs from chloral in being much less depressant to the respiration, much less depressant to the heart, and excites the motor cord instead of depressing it as does chloral. Depression of heart and respiration do not occur unless the quantity is large. It coincides with chloral in depressing the brain and producing prompt and natural sleep.

Therapeutic uses: The physiology would indicate that chloralose is useful in medicine only as a hypnotic. In insomnia from mental excitement, from mental over-work, or inhabitual insomnia, chloralose is one of the most valuable hypnotics. It is as prompt as chloral in effect, and in the same doses it is more powerful than chloral, but the therapeutic dose should not exceed 10 grains at most. From 10 to 15 grains have produced restlessness and excitement in sleep, without returning consciousness, and the patient afterwards remaining unaware of the fact of this excitement. No dangerous symptoms have as yet followed ordinary doses of chloralose. It is, therefore, a practical hypnotic probably co-equal with chloral, and in cases of cardiac weakness it is safer than chloral.

CHLORAL-CAMPHOR.

This is prepared from equal parts of chloral and camphor triturated in a mortar until it becomes a liquid. It is not a mixture of chloral and camphor, but there is a chemical re-action, and the product differs from both ingredients. Its principle use is, locally, externally to allay itching in ivy or sumac poisoning, in pruritus vulva and to allay pain in neuralgia of nerves located superficially. It relieves itching by its local anæsthetic effect. There is no legitimate use for it in internal medicine.

HYOSCINE.

Hyoscine is one of the two alkaloids of hyoscyamus, and is official as a hydrobromate; dose, $\frac{1}{150}$ to $\frac{1}{80}$ of a grain.

Symptoms. In a large dose hyoscine produces drowsiness, muttering delirium, followed by sleep; the pupils are dilated, the mouth and throat dry, the voice husky (sometimes lost), respiration slow and pulse slow,—both maintaining their fullness, unless the dose be very large, when they yield; reflexes are lessened, and if death be produced it kills by asphyxia.

Physiology. The deep sleep is the dominant symptom produced by direct depression of the cerebrum. To the respiration and heart it becomes a depressant only when used in excess. The loss of reflexes and muscular relaxation are due to depression of the motor cord. It also depresses the sexual centres in the lower spinal cord.

Treatment of poisoning by this drug consists in administering the antidote, tannic acid, and treating the symptoms as they arise. No case of fatal poisoning is on record.

Therapeutic uses: It is a valuable hypnotic in insomnia from any form of mental excitement, or brain unrest from over-work; in delirium tremens, acute mania, and in sleeplessness from delusional or confusional insanity.

Because of its depressant action upon the spinal cord, and especially upon the spinal centres presiding over the sexual organs, it is especially useful to allay different forms of sexual excitement and sexual perversion, such as spermatorrhœa, nymphomania, chordee, masturbation, and in "night emissions" in dreams. Hyoscine, the bromides, and sulphonal are the three most valuable remedies to reduce undesirable sexual excitement. Hyoscine has also been used with variable results to allay the tremors of paralysis-agitans.

SULPHONAL.

Sulphonal is a very insoluble salt, the ordinary dose of which is from 10 to 20 grains. It can be given with safety in 30 to 40 grain doses. It is very slow in its action, producing sleep in from one to three hours after administration. This slow rate of action is because of its insolubility, and therefore being slowly absorbed. It will act more promptly if administered with a hot albuminous drink, as beef-tea or hot milk, which hasten its solution.

The symptoms following the ingestion of a single large quantity of sulphonal are mainly those of deep and prolonged sleep, during which there is slight lessening of the reflexes, respiration

slightly lessened and the pulse slightly weakened. 1500 grains have been taken in a single dose without more serious symptoms than deep sleep for many hours, followed by mental depression, tremors, staggering of gait and weakness, after which complete recovery occurred. It is therfore probably not a dangerous poison in single doses, however large.

Chronic Poison. Chronic sulphonal poisoning is of frequent occurrence. It is produced mainly by the prolonged daily use of sulphonal for chronic insomia. The first and characteristic symptom of this poisoning is a *pink color of the urine,* deepening into red, and the urine containing blood corpuscles, tube-casts and albumen. Following this, are abdominal symptoms of colicky pains, retracted abdomen, obstinate constipation, vomiting and loss of appetite; then follow the symptoms of nervous depression with tremors, mental depression, local palsies and ascending paresis with exhaustion. Advanced poisoning is often fatal.

We have no satisfactory treatment for this poisoning. It has been suggested to wash out the system by giving water hypodermically, into the bowel, and by draught, in the hope of aiding the elimination of the drug; but when the symptoms are marked, this treatment does not seem to alter the final result.

Therapeutic uses: The chief use for sulphonal is in insomnia, due to insane mental excitement, and in insomnia of convalescence, or from overwork. Sulphonal should not be used in insomnia of confusional insanity, because it increases the existing exhaustion.

It is also used to allay sexual excitement of all types accompanying sexual disorders; it has been suggested in hysteria, and has been recommended as an intestinal disinfectant, given in 5-grain doses after meals.

TRIONAL

Trional is closely allied to sulphonal in its chemical constituents. Physiologically it produces about the same symptoms, and is about as safe as is sulphonal, but as a hypnotic it acts more promptly and with more certainty. The ordinary dose is from 10 to 25 grains. It is safe in larger doses if needed.

Like sulphonal, trional, after long continued daily use, may produce chronic poisoning. Gaerlich reports a case in which, after the use of it during fifty-six days, there came on general paralysis,

mental depression, incoherent speech, staggering and ataxic gait, tremors of hands and disturbed vision; the case recovered after the drug had been discontinued.

Therapeutic uses: Trional is useful as a hypnotic only. It acts promptly, does not disturb the stomach, and sleep is not preceded by narcotic dreams. It is useful in all forms of insomnia except that due to pain, and where there is extreme exhaustion of the nervous system, because its free use interferes with general nutrition.

PARALDEHYDE

Paraldehyde is an irritant, nauseous liquid; the ordinary dose is from 10 to 30 minims. This is an active hypnotic but not free from danger. Like chloral it depresses the brain, and is an active depressant to the heart, to the spinal cord, and to the respiration. Because of its local irritant action it is prone to disturb the stomach. It can be used in insomnia from all causes, but, because of its unpleasantness, it is less used than the other hypnotics.

CHAPTER VI.

MYDRIATICS

This is a class of remedies whose chief characteristics are the production of wakeful delirium and the dilatation of the pupils.

They are:—**Cannabis Indica, Belladonna, Stramonium, Hyoscyamus, Cocoa and Eucaine.**

CANNABIS INDICA

Preparations. Tincture; beginning dose, 10 to 15 drops.
Fluid Extract; beginning dose, 1, 3 to 5 drops.
Extract; beginning dose, 1 grain.

The active principle of this drug not being known, a preparation must be tested physiologically to determine its activity; starting with a small dose and slowly increase it until a peculiar mental intoxication becomes manifest. This is its *therapeutic limit.*

Symptoms. After a large dose, cannabis indica produces mental excitement with mental confusion, followed by drowsiness, pulse rapid, blood pressure slightly elevated, pupils dilated, some dryness of the mouth and skin, respiration slightly increased; finally, some numbness in the extremities appears, probably due to depression of the sensory cord. No case of fatal poisoning from this drug is on record.

Therapeutic uses: This drug has been used to produce sleep and to relieve pain, but in neither indication has it been satisfactory. At present, one of its best uses is to relieve the distress and give comfort in the late stages of consumption, alternated with opium. Here it acts only as a palliative.

Another very good use is in idiopathic hemicrania (or sick headache). In this condition it will not arrest the paroxysm, but its constant use over a long period of time may finally stop the attacks from recurring. It should be given in ascending doses until the physiological limit is reached, and should be continued, with occasionally diminishing then increasing the doses, for a number of months. During this period, the attacks should be aborted by a dose of one of the antipyretics, such as antipyrin or phenacetin, combined with a full dose of bromide of sodium. About 12 grains of antipyrin with a dram of sodium bromide should be given in one dose when the first signs of an attack appear. All causes that are apt to provoke attacks should be avoided, so that the "headache habit" shall be broken up. If the patient's general health needs attention it should be carefully looked after.

Diagnostic Land-marks of Hemicrania. The most common distinguishing features of hemicrania from other forms of headache are:

1. *Heredity.*—True hemicranias are handed down from ancestors to offspring, and can be traced through family lines; they usually travel on the female side of the house. Hemicranias in men are proportionately not very common.

2. *Periodicity.*—Hemicranias are more or less periodical in their attacks. In women they usually start when menstrual life becomes

established, and in the earlier years the attacks mostly come at menstrual periods. Later in life they are much more frequent and are especially aggravated by general ill health. The headaches usually persist through menstrual life, and after menopause they slowly disappear.

3. *Premonitory Symptoms.*—Premonitory symptoms before the attacks come on, such as a feeling of languor, yawning, drowsiness, and sometimes disturbed vision are common, and may rightfully be called an *aura.* The individual always knows that an attack is coming, before the true pain begins.

These headaches appear at puberty in both sexes and last through middle life. The attacks are provoked most frequently in the female by approaching menstruation, excitement, over-exertion, depressing emotions, fatigue, or a fit of temper. Hemicranias must be distinguished from neurasthenic headaches which they resemble very closely.

BELLADONNA

Preparations. Tincture of Belladonna; dose, 10 to 15 grains. Fluid Extract of Belladonna; dose, 3 to 5 drops.

Extract of Belladonna; dose, $\frac{1}{8}$ to $\frac{1}{4}$ of a grain.

There is also an official plaster and an ointment for local external use.

The active principle of belladonna is the alkaloid *atropine,* official as atropine sulphate; dose, $\frac{1}{120}$ to $\frac{1}{80}$ of a grain.

The local action of belladonna is sedative.

Early Symptoms. Dryness of the mouth and throat, some dilation of the pupils, with slight exhilaration of the pulse, are the first symptoms that appear after a full therapeutic dose. This is its *therapeutic limit.*

Toxic Symptoms. Toxic doses produce wakeful, talkative, sometimes wild delirium, pupils are dilated, the throat, mouth, and skin dry, slight fever, respiration rapid and deep; pulse rapid and hard or corded, reflexes lessened, and a peculiar skin rash resembing scarlet rash. If the dose be fatal the symptoms change in character in the later stages, when temperature falls, respiration becomes shallow and irregular, mental stupor, pulse quick and feeble, blood pressure falls, skin clammy, and death from asphyxia. This asphyxia is due in part to depression of the respiratory centres, and in part to motor nerve paralysis.

Physiology. The wakeful delirium, with incoherent talk, is possibly caused by depression of psychic inhibition. This is not physiologically proven, but it is a reasonable deduction.

The dilatation of the pupils is both active and passive; passive, in so far as the oculomotor nerves are paralzed peripherally; active, in so far as the sympathetics are stimulated. Atropine also paralyzes visual accommodation.

The dry mouth and skin are due to the checking of glandular secretions by depressing the peripheral nerves to the secretory glands. Belladonna lessens the secretions of the mouth, throat, skin, and of the lachrymal and lacteal glands by this action.

Belladonna probably slightly increases the secretions of the kidneys; upon the secretion of the intestines it has little or no influence.

The quick and deep respiration is due to stimulation of the respiratory centres. This is one of the practical and useful respiratory stimulants. In toxic doses it becomes a paralyzant to respiration.

The rapidity of the pulse is due, chiefly, to depression of the pneumogastrics peripherally; but there is slight stimulation to the heart directly, and probably to the accelerator nerves of the heart. The corded character of the pulse and the blood pressure elevation are due, mainly, to stimulation of the vasomotor centres; also slight stimulation to the heart. The blood pressure fall in the late poisoning is due to depression of the entire circulation; heart, vasomotor centres, and vessel walls.

The temperature rise or the fever, is possibly due to depression of the heat inhibitory centres. The lessening of the reflexes is due to depression of the motor nerves peripherally.

Belladonna is an active depressant to all nonstriated muscles, and has little or no influence on striated muscles. Small doses of the drug *increase* intentinal peristalsis by depressing the splanchnics peripherally, which are inhibitory. Large therapeutic, and toxic doses, *lessen* peristalsis by depressing the muscular structure of the intestines.

Recapitulation. It is evident from its physiology that belladonna acts peripherally where it is depressant, and acts centrally where it is a stimulant; thus, it depresses peripherally the sphlanchnics, inhibition to spinal reflexes, peripheral motor nerves, pneumogastrics, non-striated muscles, secretory nerves, and oculomotors; whereas it stimulates the res-

piratory centres, vasomotor centres, and probably the pneumogastric centres.

In the treatment of belladonna poisoning the antidote, tannic acid, should be given, the stomach emptied, the symptoms treated as needed; the bladder should be emptied with a catheter, since belladonna is eliminated by the kidneys and the bladder is paralyzed so that there is retention of urine and reabsorption of the alkaloid contained in the urine.

Therapeutic uses: The general indications for belladonna are: as a respiratory stimulant, as a vasomotor stimulant, to check morbid secretions, to relax local spasms, as a mydriatic, and locally as a sedative.

As a respiratory stimulant atropine is useful in respiratory depression from poisons, as opium, carbolic acid, chloral, and the like. It may also be used in respiratory exhaustion, as in asthma, in emphysema, and in chronic bronchitis.

From its stimulant action on the vasomotor centres, it becomes useful in shock and collapse where vasomotor relaxation always exists, and in consequence of which there is rapid fall of body temperature. As a vasomotor stimulant it aids in arresting the rapid loss of heat by radiation.

From its checking secretions of the respiratory tract, salivary glands, the skin, and lacteal secretion, it becomes useful in bronchorrhœa, ptyalism, in colliquative sweats of phthisis and of influenza, and to check lacteal secretion when so desired.

It being paralyzant to non-striated muscles, such as are found in all tubular structures of the body, it becomes useful in various colics, as in biliary colic, renal colic, somtimes in intestinal colic, in asthma, in whooping-cough, and in incontinence of urine in children, due to irritability or oversensitiveness of the bladder. Here it should be given at bed time in as full doses as the child can bear. In all these indications it gives relief by depressing non-striated muscles.

Belladonna is also useful in relaxing the various sphincters where there is undue rigidity or spasm; and is always more efficient when it can be locally applied than when internally given. In spasms of striated muscles, as wry neck, it is very useful when injected into the body of the muscle where it depresses the peripheral motor nerve terminals to the muscle.

Belladonna is sometimes used to relieve pain, but it only does this when the pain is due to a muscle spasm or by its local

sedative action. It is, therefore, acting indirectly, and is not a true analgesic.

As a mydriatic, belladonna is used by oculists. It differs from other mydriatics in being more permanent in its action, and paralyzes accommodation.

As a local sedative it is used in painful ulcers, and when applied to boils or carbuncles. It is likewise used because of its influence on intestinal peristalsis in chronic constipation combined with strychnine and aloin, where the dose should always be small; also in combination with cathartic pills to prevent griping.

STRAMONIUM

Stramonium has the corresponding preparations of belladonna, namely: a tincture, fluid extract, extract, ointment, and plaster, and are given respectively in the same doses. The active principle called "daturine" probably is atropine. Its effects are identical with atropine, producing the same physiological symptoms in the same way, and answering the same therapeutic indications. From habit or custom stramonium has been used in asthma more frequently than belladonna, but has no advantage over it.

Very useful in asthma is a cigarette made of equal parts of belladonna and stramonium leaves, or in persons not addicted to the use of tobacco, the cigarette can be made of equal parts of tobacco, stramonium and belladonna leaves. In an asthmatic attack this cigarette smoked and the smoke inhaled, often gives prompt relief. The tobacco is an advantage because the pyridine, which is formed in the combustion of tobacco, is itself valuable in asthma.

HYOSCYAMUS

Preparations. Tincture; dose, 15 drops to ½ a fluidram.
Extract; dose, ½ to 2 grains.
Fluid Extract; dose, 3 to 5 drops.

The active principles are the two alkaloids, hyoscine and hyoscyamine. Hyoscine has been considered under the hypnotics. Hyoscyamine, official as a sulphate, is similar in its physiological effects to atropine; but it is less active and is given in doses of $\frac{1}{100}$ to $\frac{1}{75}$ of a grain. It fulfils the indications for atropine and can be substituted for it.

The crude drug hyoscyamus differs slightly in its effects from belladonna, in that it produces drowsiness, which is due to the presence of the alkaloid hyoscine. In its general uses, hyoscyamus can be applied like belladonna in all particulars, but it is less certain in effect. It has some influence in allaying cough, but is less valuable than chloroform or opium for this purpose.

COCOA

Preparations. Fluid Extract of Cocoa; dose, ½ to 1 fluidram.

Cocaine Hydrochlorate, the alkaloid; dose, ¼ to ½ a grain.

Its local action is anæsthetic, paralyzing the peripheral sensory nerves.

Cocoa leaves probably contain several active principles, but only the alkaloid cocaine is used.

Symptoms. When cocaine is given in large doses it produces mental excitement with delirium, dilated pupils, rise of temperature, respiration deep and quick, pulse rapid and strong, and reflexes increased with muscular rigidity. In advanced poisoning there occurs a general convulsion of both cerebral and spinal origin, followed by fatal asphyxia.

Physiology. The brain excitement with delirium is due to direct cerebral stimulation. The crude drug cocoa produces more mental excitement than the alkaloid; this is probably because it contains several active principles.

The increased respiration is due to a direct stimulant to the respiratory centres, but in toxic doses it becomes a paralyzant to these centres.

The rapidity of the pulse is chiefly due to peripheral pneumogastric depression, and may be in part due to stimulation of the heart.

The strength of the pulse and the blood pressure rise are both due to cardiac, vasomotor, and vascular stimulation. In toxic doses the circulation yields. It is a circulatory stimulant that is of practical value.

The heightening of the reflexes, with spinal convulsions, is due to direct stimulation of the motor cord. In toxic doses both spinal cord and spinal nerves become depressed.

To muscles cocaine is a stimulant, and in toxic doses it becomes a muscle poison, producing in the lower animals muscular rigidity.

The dilatation of the pupils is probably produced by stimulating the sympathetics. It is less pronounced and less permanent in this respect than atropine.

Cocaine is eliminated chiefly by the kidneys, and the action of the kidneys is increased by its influence. It is probable that cocaine is a stimulant tonic to the gastro-intestinal canal, increasing the appetite and digestion.

The local anæsthetic influence of cocaine is produced by its depression of the peripheral sensory nerves. It has no such anæsthetic action when internally given, except in fatal doses.

Therapeutic uses: Cocaine is used as a local anæsthetic, as a mydriatic, as a vasomotor stimulant, as a respiratory stimulant, as an antemetic, and as a spinal stimulant and general nerve tonic, like strychnine.

As a local anæsthetic it is used on all mucous membranes, and over cutaneous surfaces, to allay or prevent pain. In the uretha, in the eye, in the mouth, and in the nose and throat, cocaine is used by direct application, usually in 2 to 4 per cent. solutions. It penetrates mucous membranes promptly and produces anæsthesia in a few minutes. When so applied there is, at first, a blanching of the mucous membrane, due to its constricting influence upon the small bloodvessels, but this is followed by increased redness. When used as an anæsthetic over a part covered by skin, it is to be injected hypodermically, and is thus used for minor operations. The largest quantity thus injected should never be more than would be safe when given internally, for the amount thus absorbed and getting into the general circulation may be the bulk of the drug injected. Its anæsthetic influence lasts from ten to twenty minutes. A ligature should be applied to the part, if possible, to keep the cocaine at the place of operation.

To dilate the pupils, cocaine has the disadvantage in not paralyzing accommodation, but has the advantage in being more transient in its action than atropine.

As a vasomotor stimulant, cocaine, like belladonna, can be used in shock and collapse. Here it should be used hypodermically. It has an advantage over atropine in being a more powerful stimulant to the circulation, stimulating the heart, bloodvessels and vasomotors; but it is not quite as active on the vasomotors alone.

As a respiratory stimulant it is more active than atropine, and can be used in respiratory depression from poisons, and in exhaustion of the respiratory centres, as in asthma, in emphysema, in chronic bronchitis, and in phthisis.

As a general nerve stimulant, it can be used in neurasthenia or in the exhaustion from acute diseases, as in low pneumonia and low typhoid. Here it should be combined with strychnine and be given hypodermically. In their relation to the nervous system, the respiration, and the circulation, strychnine and cocaine are closely allied and combine happily.

EUCAINE

Eucaine Hydrochlorate is a synthetic alkaloid closely related to cocaine. It is soluble in water, and is an active local anæsthetic. In its general physiological effects it acts like cocaine, but is less powerful; it stimulates the respiration, produces spinal excitement like cocaine, and kills by asphyxia. It differs, however, from cocaine in that it does not dilate the pupils, and does not affect the circulation, except that the pulse-rate is slower than normal, probably because of pneumogastric stimulation.

It is mostly used as a local anæsthetic. Here it has the advantage of cocaine in being less poisonous and less dangerous; and in watery solution it does not undergo decomposition when heated or on long standing, as is the case with cocaine. Over mucous membranes it is a trifle more irritant than cocaine, and is about as prompt and permanent in its anæsthetic action.

CHAPTER VII.

EXCITO-MOTORS (or Spinal Stimulants)

These drugs are classed together because their dominant action is stimulation of the spinal motor system.

They are: **Nux Vomica and its Alkaloids.**

Preparations. Tincture; dose, 10 to 25 drops.
Fluid Extract; dose, 1 to 5 drops.

Extract; dose, ¼ to ½ of a grain.

The alkaloids are *strychnine* and *brucine,* of which strychnine alone is official, as a sulphate; dose, 1/30 to 1/20 of a grain.

The alkaloid brucine has the effects of strychnine except that it is not as powerful, and that it is probably more stimulant to the circulation than strychnine, but is less stimulant to the nervous system.

When nux vomica or its alkaloid, strychnine, is given in ascending doses, the first physiological manifestations are, stiffness of the muscles of the back and neck, and restlessness. This is its *therapeutic limit.*

Toxic Symptoms. When strychnine is given in ascending doses to the production of poisoning the symptoms appear gradually; stiffness of the muscles, jerking in the arms and legs, constantly increasing until a full convulsion is developed.

When the drug is given in a single toxic dose, the first sign of poisoning probably is a sudden general convulsion; in which the patient usually lies with arms flexed, hands clinched, legs and feet extended, resting on his heels and the nape of the neck, in a position of opisthotonus, with eyes wide open, consciousness present, and there is a so-called *sardonic grin* on the face. This position of the body is determined by the relative strength of the muscles. All muscles are in contraction, but the stronger groups of muscles, as those of the back and the flexors of arms and hands, determine the position. The convulsion is of spinal origin, and is general, while it lasts; the relaxation to follow is as complete as the convulsion is universal. During the convulsion there is complete asphyxia, produced by spasm of the muscles of respiration locking the chest, it being a cramp-asphyxia.

The drug kills by asphyxia; if during a convulsion, it is a *cramp-asphyxia;* if during a period of relaxation between convulsions, the asphyxia is in part due to exhaustion and in part due to depression of the peripheral motor nerves.

Diagnosis of Poisoning. A strychnic convulsion must be distinguished from all other spinal convulsions, such as hysterical convulsions, tetanic convulsions or uræmic convulsions. It most closely resembles the convulsions of traumatic tetanus, from which it is most readily distinguished by the locking of the jaw. In tetanus the locking of the jaw is the first symptom; in strychnine poisoning the muscles of mastication are the last to be involved, but an absolutely certain diagnosis can hardly be made without chemical examination.

Treatment of Poisoning. It consists in administering an antidote, such as permanganate of potassium or tannic acid, getting rid of the poison, and subduing the convulsions. Since the strychnine convulsion is produced by a reflex impulse reaching the cord, it is necessary that the patient should be kept in a quiet place. Air currents, noise, intense light or a touch may produce a convulsion. It is, therefore, with risk that either an emetic or a stomach pump can be used to empty the stomach, unless the patient is first put partially under the influence of chloroform. The convulsions must be subdued by the administration of active depressants to the motor cord, such as chloroform or nitrate of amyl for prompt action, and chloral, the bromides, or physostigma, for more permanent action.

Physiology. The dominant action of strychnine is stimulation of the motor cord, producing these violent convulsions. The convulsion itself is provoked by an afferent reflex impulse, since the motor cells of the spinal cord cannot create, but only transmit motor impulses. The motor nerve paralysis that occurs in advanced poisoning does not appear in therapeutic doses; it is therefore a purely toxic effect. A large quantity of strychnine thrown directly into the circulation will kill an animal instantly without the occurrence of a convulsion. Here death is produced entirely from motor nerve paralysis.

Under the influence of strychnine the respiration is markedly increased. This is due to stimulation of the respiratory centres. In poisoning by the drug there is asphyxia during the convulsions, but consciousness is always present unless abolished by prolonged asphyxia.

Strychnine increases the blood pressure chiefly by direct stimulation of the vasomotor centres, also slightly stimulating the heart and bloodvessels, but to them it is more of a tonic than a stimulant. During a convulsion the blood pressure is enormously elevated. This additional elevation is due in part to the muscular spasm, and in part to the asphyxia. To muscles, generally, strychnine acts as a tonic, increasing their nutrition and growth. So also to the digestive tract it acts as a stimulant tonic, increasing glandular secretions of the intestines as well as toning up their muscular coats. The special senses of sight and hearing are increased in acuteness, probably from the stimulant action of this drug.

The elimination of this drug takes place chiefly by the kidneys, and it is eliminated as strychnine, and probably in part as strychnic acid.

Therapeutic Uses: The general indications for strychnine are, as a spinal stimulant, as a respiratory stimulant, as a vasomotor stimulant, as a gastro-intestinal stimulant, and as a cardiac and muscle tonic.

As a spinal stimulant strychnine is useful in palsies due to functional depression, such as palsies in chronic lead poisoning, palsies from the excessive use of tobacco, diphtheritic palsies, and in fact in all toxic palsies where there is no structural change in the affected part; also in exhaustion of the nervous system in chronic neurasthenia. In the exhausted stages of acute fever, strychnine is one of our most reliable remedies. In palsies due to degenerations, hemorrhages, or any organic change, in the part affected, strychnine is of no value, because it cannot arrest progressive degenerations. If there be inflammatory processes at the point of lesion, as in apoplexy, strychnine not only fails to do good, but may do harm, by increasing the inflammatory process through its stimulant action on the circulation and nervous system. It is also useful in amaurosis from excessive use of tobacco, and from chronic lead poisoning, or in any functional amaurosis where the optic nerve is not undergoing degeneration.

As a respiratory stimulant it is useful in poisoning from respiratory depressants, and is the most useful of all respiratory stimulants in respiratory exhaustion in emphysema, chronic bronchitis of old and debilitated people, and in pneumonias. Here it classes itself with the other respiratory stimulants, of cocaine, atropine, caffeine, aspidospermine and ammonia. Of these, strychnine is probably the most valuable, and the rest are useful in the order mentioned.

As a vasomotor stimulant it is of practical value in shock and collapse, and classes itself with the practical vasomotor stimulants, of atropine, strychnine, cocaine, digitalis and ergot. Of these, atropine is probably the most active, while ergot is the purest.

As a gastro-intestinal stimulant tonic it is useful in atony of the digestive tract, with or without constipation. It acts as a stomachic, increasing the secretions of the digestive ferments and increasing the tone of the muscular walls of the intestines.

As a cardiac and muscle tonic, strychnine is useful where there is lack of general nutrition; in chronic organic heart disease, or in cardiac neurasthenia; also in cardiac weakness in low diseases, as typhoid, influenza and the like. Here strychnine can be given in much larger doses than the ordinary, and is much more efficient

and certain when given hypodermically. These hypodermic injections can vary in quantity from 1/30 to 1/10 of a grain, depending on the low condition of the patient and the frequency of their repetition. In a low stage of pneumonia or typhoid 1/10 of a grain can be given hypodermically every eight or ten hours.

CHAPTER VIII.

DEPRESSO-MOTORS.

The dominant action of these drugs is the lessening of spinal reflexes; some depress the cord, others the motor or sensory nerves.

They are: **Physostigma, the Bromides, the Nitrites, Lobelia, Gelsemium and Conium.**

PHYSOSTIGMA (or Calabar Bean).

Preparations. Tincture; dose, 10 to 20 drops.
Fluid Extract; dose 1 to 2 drops.
Extract; dose, 1/10 to 1/6 of a grain.

Its active principle is the alkaloid physostigmine, or better known as *eserine,* official as a sulphate; dose, 1/30 to 1/20 of a grain.

A second alkaloid, calabarine, has been believed to be present in tracible quantities; but whether this be true or not, it does not modify the action of the crude drug from that of its chief alkaloid eserine.

Toxic Symptoms. In large doses, physostigma or calabar bean, produces nausea, probably vomiting, sometimes purging, with contracted pupils, the pulse slow and full, blood pressure elevated, until late in the poisoning when the heart fails; respiration slow, finally shallow and irregular, absolute loss of reflexes, followed by paralysis, with rigidity and tremors of the muscles, and kills by paralytic asphyxia. The muscle tremors with paralysis are *characteristic* of this poisoning.

Physiology. Nausea and vomiting, when they occur, are due to local irritation. The purging is not constant, but when it exists it is probably the outcome of increased intestinal peristalsis, since this drug provokes active peristalsis by direct stimulation of the muscle walls of the intestines. The respiration is slow and shallow, and finally arrested, due to direct depression of the respiratory centres. The contracted pupils are produced probably by a stimulation of the peripheral oculomotor nerves and a depression of the sympathetics. It is, therefore, directly antagonistic to atropine in its action on the pupils.

The pulse is slow and full, the blood pressure slightly elevated, due to stimulation of the heart muscle and bloodvessels. After toxic doses there is cardiac paralysis. The slowing of the pulse is due to pneumogastric stimulation.

The muscular tremors and rigidity accompanying the spinal paralysis are probably due to direct stimulation of eserine upon the muscles, independent of their nerve supply. It is, therefore, a muscle stimulant, and in large quantities a *muscle poison.*

The general paralysis is the direct outcome of depression to the motor cord. This is its dominant physiological action.

In poisoning by calabar bean, the treatment consists in emptying the stomach and administering strychnine, digitalis, and whisky, to support the circulation and respiration, and the application of external heat.

Therapeutic uses: Calabar Bean or eserine, because of its depressant action on the motor cord, can be used in allaying spinal convulsions, such as strychnine convulsions or the convulsions of traumatic tetantus. It is also used as a practical myotic by oculists; and because of its stimulant action to muscles directly and the increased peristalsis thus produced, it becomes serviceable in chronic constipation, depending upon sluggishness or muscular atony of the intestines, but it should be combined with other laxatives. For this indication it deserves more liberal use by the profession than has heretofore been accredited to it.

BROMIDES

They are: **Bromide of Potassium, Bromide of Sodium, Bromide of Ammonium, Bromide of Strontium, Bromide of Lithium and Bromide of Gold.** The first four are the most generally used by the profession.

These bromides, in their main physiological actions and therapeutic uses, are very nearly equal in value. However, minor differences of advantage and disadvantage may be mentioned. They differ to a slight degree because there is a difference in the action of the respective bases potassium, sodium, ammonium, strontium and lithium, which combine with hydrobromic acid. Lithium and potassium are in themselves sedative poisons, and are locally more irritant than the rest, and their salts share this peculiarity. Sodium as a base is indifferent in its general action, and is the natural alkali of the circulation; ammonium is slightly stimulant; while strontium has little local effect. They also differ slightly in the proportion in which they take hydrobromic acid in combination to form the salts. Here again, the base potassium takes a smaller per cent. of the acid than any of the rest and is therefore the least active as a bromide. The base lithium takes the highest per cent. of acid in this group and is probably the most active. It would then appear that bromide of potassium, for general purposes in medicine, is the least desirable, and yet by the profession the most frequently used. This frequent use over the other bromides is probably more a habit than a choice.

Hydrobromic acid has the same general effects as the bromides, and can be used for the same indications, but it has the disadvantage in being more irritant locally.

With the exception of these minor differences above mentioned, all bromides can be considered together under the same heading. The doses of these salts can be put down as from ten grains to a dram, and in urgent cases two or three drams can be given with none other than good effects.

The bromides are locally irritant to mucous membranes; when applied in concentrated form to vital tissues, nerve, muscle, gland, or any other soft structures, they act as sedative poisons, arresting functional activity and finally killing the part. Internally given they will ultimately act as universal depressant poisons; depressing brain, spinal cord, sexual functions, respiration, glandular action, circulation, and temperature.

Symptoms. Given in a single large dose of half an ounce to an ounce, the bromides produce some gastric distress from local irritation, probably vomiting, followed by drowsiness, stupor, languor, and slight depression of the circulation and respiration, but these symptoms soon disappear without leaving any ill after-effects. Fatal poisoning from a single dose is hardly possible in an adult.

Bromism. When these bromides are given in repeated doses, continued over a length of time, they will develop a condition technically called *bromism,* in which the early symptoms are drowsiness, some fetor of the breath, and an acne eruption. The appearance of these symptoms mark the *therapeutic limit.*

But when the bromides are indefinitely continued, the above-mentioned symptoms will increase; there will be mental stupor, depression, loss of memory, reflexes lessened with partial anæsthesia, at first occurring on mucous membranes and then becoming cutaneous; respiration is diminished, heart slightly depressed, body temperature yielding, and finally death may occur from a condition of *asthenia* or complete exhaustion, in which every functional activity of the body is depressed alike. Such a process of poisoning is always slow and is easily guarded against. The only treatment necessary is the discontinuance of the drug, and the recovery that follows is complete. The bromides are, therefore, exceedingly safe remedies, and yet of great practical usefulness.

Physiology. The drowsiness and stupor are due to direct depression of the cerebrum. The lessening of the reflexes is principally the depression of the sensory nerves and the sensory side of the spinal cord. The motor side of the cord feels their effects but slightly. Cardiac depression is hardly perceptible in even the largest therapeutic doses, and in toxic doses the heart yields but slightly, and the fall of blood pressure is in part due to this, and in part due to vasomotor depression and depression of the bloodvessels. The lessening of respiration is due to depression of the respiratory centres.

The nervous system seems to be the most susceptible to the action of these salts, and they dominantly act as depressants upon the entire cerebro-spinal axis, including the sexual centres, in the following order: First the brain, then sensory cord and nerves, and finally the motor cord, motor nerves, and sexual centres. They are, therefore, useful in all kinds of excitement of the brain, spinal cord, or the sexual apparatus.

Elimination. The bromides are rapidly absorbed and therefore rather prompt in action, but they are very slowly eliminated, and hence are very permanent in their action. They are slowly eliminated because they depress the functional activity of the very glands which attempt to throw them off. It is because of this slow elimination that there is an accumulation of these bromides in the body when given in the ordinary dose

over a long period of time and produce a condition of bromism, which is truly a state of saturation. Of a single ingestion, about one-half is eliminated in twelve or fifteen hours, a third in the subsequent twelve hours, and traces can be discovered in the urine many days after the ingestion. They are eliminated by all known secretions and excretions of the body; chiefly, however, by the kidneys, skin, and bowels. But they have been found in all the liquids of the body, even in the milk of nursing women and in the acne pustules that appear on the skin. This slow elimination is of great advantage in the treatment of such diseases as epilepsy, hysteria, and insomnia, for the dose repeated twice a day is as effective as the same quantity given in eight or ten different parts. The doses, therefore, should be estimated on the whole quantity given in the twenty-four hours, rather than the quantity given at each single ingestion.

Therapeutic uses: *Contra-indications.*—The continuous use of the bromides diminishes general nutrition. They are, therefore, contra-indicated in such conditions as senile dementia or confusional insanity, in which there is brain exhaustion, and where the nutrition is already below normal.

From the physiology of these bromides we readily infer that they are useful in all forms of cerebral excitement, of spinal excitement, and of sexual excitement.

In the cerebral excitements, of mania, delusional insanity, delirium tremens, epilepsy, insomnia, and even in neuralgic headaches, the bromides are in the list of useful remedies. In violent excitement of insanity they only form a basis for treatment, and must be combined with, or followed by, more active agents. In insomnia from mere nervousness or from worry, the bromides are very useful hypnotics. Their value lies in allaying the mental unrest, and quieting the nervous system, and thus supplying the natural conditions for sleep. In neuralgic headaches they act more rapidly when combined with one of the antipyretics, such as antipyrin or phenacetine; also in painful menstruation, when neuralgic in character, the bromides combined with antipyrin are most valuable. In "sleep-walking," in sleep disturbed by dreams, and in the "night cries" of children in dreams, the bromides act as a specific. Here they should be given at bed-time.

In epilepsy the bromides are the most valuable drugs we have. They are probably not curative, but in many cases they are permanently palliative. Most serviceable among them for this use are the bromide of ammonium and bromide of strontium combined,

To this mixture should be added a small quantity of Fowler's solution, and should be given morning and night in such doses as will control the epileptic attacks. Another combination that is frequently used, is bromide of ammonium with antipyrin and Fowler's solution. The arsenical preparation is added to prevent the acne eruption which is apt to follow the prolonged use of the bromides. To this treatment can be added, with advantage, one or two doses a day of atropine, or two ½ dram doses daily of fluid extract of *solanum carolinense,* the active principle of which is solanine, an alkaloid very similar to atropine.

Spinal Excitements. Because of their depressant influence upon the spinal cord and nerves, chiefly sensory, the bromides are useful in spinal convulsions from strychnine, tetanus, hysteria, uræmia, of puerperal origin, and in reflex convulsions of children. By themselves they are not active enough, but in combination with more active spinal depressants they form a good basis for treatment, because their action is very permanent. They lessen spinal convulsions by depressing the sensory nerves and cord, and thus they do not allow afferent impulses to reach the excited centres. In hysterical convulsions the bromides are the best drugs we have, and act best when given in a few large doses. In nervousness and fretfulness, and in reflex convulsions of children, the bromides are frequently useful because they are so safe and yet effective. Children will bear relatively very large doses without any other but desirable effects.

Sexual Excitements. Like hyoscine and sulphonal, the bromides are of great value in all forms of sexual excitement, such as nymphomania, masturbation, chordee, night emissions and the like. In these indications the combination of bromides and hyoscine is more efficient than either one alone.

They are oftentimes useful to quiet sick stomach; in vomiting from pregnancy and in sea-sickness, they are very useful. In sea-sickness or "train-sickness" it is better to bring the patient under the full influence of the bromides before the boat or train is entered, and thereafter given in quantities sufficient to maintain the impression throughout the trip or voyage. Locally, they can be used to benumb mucous membranes in the nose and throat.

NITRITES.

The nitrites are all similar in action physiologically and therapeutically. Nitrite of amyl, being volatile, is probably the most

prompt in effect, and the most fugacious of the class. Nitro-glycerine is the most powerful and the most permanent in action. They all act in the circulation probably as *nitrous acid,* and there is some reason to believe that they are eliminated by the kidneys as *nitrates.*

They are: **Nitrite of Amyl, Nitro-glycerin or Spiritus Glonoini, Nitrite of Potassium, Nitrite of Soda, and Nitrite of Ethyl or so-called Sweet Spirits of Nitre.**

Nitrite of Ethyl or Sweet Spirits of Nitre is not considered here, because its therapeutic uses class it with the diuretics, though in every particular in large doses it produces the same general physiological and the same toxic symptoms as do the other nitrites.

NITRITE OF AMYL

Nitrite of amyl, a very volatile liquid, is used in doses of 5 to 10 minims, usually by inhalation, but it can be given hypodermically or by the mouth. When inhaled, its effects are felt in a fraction of a minute. The symptoms produced are those of flushing of the face and a feeling of fullness of the head, the pulse is very rapid and full but soft, and the respiration halty and irregular. There is muscular weakness with rapidly approaching paralysis. These are symptoms that can be produced by a large therapeutic dose.

When a toxic dose is given, the above symptoms become exaggerated, unconsciousness occurs, the pupils dilate, the pulse becomes feeble and rapid, the face now becomes cyanotic and pale, temperature falls, the respiration becomes shallow, and there is profound spinal paralysis, and death from asphyxia.

Physiology. The dominant spmptom produced by this drug is profound muscular relaxation and paralysis, which are due to a paralyzant action on the motor cord, including probably the psycho-motor region of the brain. This drug has little or no effect upon the sensory apparatus, either cord or nerves.

The pulse is very rapid, which rapidity is principally due to centric pneumogastric depression, augmented by the widening of the bloodvessels, thus diminishing arterial resistance. The *full* and soft pulse is due to direct cardiac stimulation; but the blood pressure, instead of rising, truly falls from the beginning. This fall of blood pressure, in spite of cardiac stimulation, is due to paralysis of the muscular coats of the bloodvessels and probably

centric vasomotor depression; large doses depress and may paralyze the heart. To the respiratory centres, nitrite of amyl, and in fact all the nitrites, are direct depressants.

All nitrites are eliminated, it is believed, by the kidneys, as nitrites of the organic waste products. The symptoms following a full dose of nitrite of amyl are marked and sometimes almost alarming, and yet the records show that the drug is a very safe one, and that accidental fatal poisoning is a very rare circumstance, if it ever occurred.

The cyanosis of the face is produced by the presence of methæmoglobin in the blood, giving it a chocolate-brown hue. This blood lesion occurs early in the poisoning and persists post-mortem.

The rapid fall of body temperature is in part due to loss of heat from reduced circulation, and in part, to the presence of methæmoglobin, preventing proper oxidation of the blood.

Therapeutic uses: Because of its paralyzant action to the motor cord and its promptness in action when inhaled, it becomes one of the most useful remedies we have to allay general convulsions, and even local spasms. It is useful in all forms of spinal convulsions: in strychnic, tetanic, uræmic, and hysterical convulsions; but in puerperal convulsions occurring after the birth of the child, nitrite of amyl is *contra-indicated;* because of its paralyzant action on non-striated muscles, it produces relaxation of the uterus, and thus precipitates post-partem hemorrhage. In epilepsy, with premonitory symptoms or an *aura* before the paroxysm, nitrite of amyl inhaled may promptly abort the attack. Here it should be used in pearls, each containing 5 minims, crushed in a handkerchief and promptly inhaled when the aura is felt; or it may be carried in a bottle and inhaled when needed. It has no curative effect upon epilepsy, but simply wards off attacks. In local spasms, as violent asthma, hysterical asthma, sometimes in dysmenorrhœa, and in hiccoughs, inhalation of nitrite of amyl may give prompt relief.

Being a stimulant to the heart, it can be used in sudden heart failure, in syncope, in ordinary fainting, and in heart depressions from poisons; but here it should be used moderately, for a large dose is rather depressing than stimulating to the circulation. In angina pectoris, nitrite of amyl is prompt and useful to break up an attack. It should be given by inhalation so that quick effect may be obtained.

SPIRITUS GLONOINI (or Nitro-Glycerin)

Spiritus Glonoini or the official one per cent. alcoholic solution of Nitro-Glycerin, is given in doses of one to two drops. Physiologically it differs from nitrite of amyl chiefly in the fact that it is not as prompt in effect, but is more permanent and more powerful. The physiological effects are like those of nitrite of amyl; the heart is rapid, blood pressure falls, pulse is full, cyanosis, and reflexes are lessened. In over-doses it is a powerful and promptly acting fatal poison.

Therapeutic uses: It is confined chiefly in its therapeutic uses to meet indications of the circulation: in angina pectoris it is one of the most useful remedies we have. In organic heart disease, with failing compensation, it has the double value of stimulating the heart and increasing its contraction, while at the same time it relaxes the bloodvessels and diminishes arterial resistance. It can be used in cardiac weakness occurring in acute diseases, or to bring about reaction in syncope.

Nitrite of potash and nitrite of sodium can be used in doses of 1 to 2 grains to meet any of the indications put down for the other nitrites. They produce the symptoms common to the nitrites, and being permanent in their action, they can be used as substitutes. They are, however, less certain than nitrite of amyl or nitro-glycerin.

LOBELIA

Preparations. Fluid Extract; dose, 1 to 5 drops.
Tincture; dose, 5 to 20 drops.

The active principle is the alkaloid *lobeline,* a liquid alkaloid.

Toxic Symptoms. In large doses lobelia produces intense and persistent nausea and vomiting. The vomiting does not relieve the nausea, and is repeated throughout the course of the poisoning. The respiration is depressed, the pulse becomes rapid and feeble, and general paralysis becomes complete; cold sweat, approaching collapse, temperature fall, and finally death, partly from asphyxia and partly from exhaustion due to the excessive vomiting.

Physiology. The dominant symptom here is progressive paralysis, which is due to depression of the motor nerves, beginning at their peripheral ends. The weak pulse is due to depression of the heart and vasomotor centres.

To the respiration it is a direct paralyzant. The vomiting is probably of centric origin, stimulating the vomiting centres in the medulla.

Uses. Lobelia has only one legitimate use in medicine, and that is in *asthma,* when associated with bronchitis. Here it can be combined with an expectorant mixture or be given by itself. In spasms and convulsions it is of no value, because it affects the motor nerves, and does not reach the excited cord, nor could it be given in a sufficient dose to affect a spasm without unpleasant nausea being produced.

Treatment of Poisoning. The treatment of lobelia poisoning rests on general principles; wash out the stomach, if necessary, with tannic acid solution, give a hypodermic of morphine, or opium by the rectum to check the vomiting, give strychnine and digitalis hypodermically to support the heart and respiration, some whisky by the mouth, and the application of external heat.

GELSEMIUM

Preparations. Tincture; dose, 5 to 10 drops.
Fluid Extract; dose, 3 to 5 drops.

The active principles are the alkaloid *gelsemine* and *gelseminic acid.*

Toxic Symptoms. The main symptoms are those of progressive paralysis with a rapidly failing heart, failing respiration, dilated pupils, internal squint, ptosis, dropping of the lower jaw, and death, if it occurs, from asphyxia. Occasionally there is a short period of convulsions preceding the paralysis. These convulsions are possibly due to inhibitory depression of spinal reflexes, preceding the paralysis of the motor cord, which is its dominant action. The depression of the heart and respiratory centres is direct, and although the heart is much depressed, the respiration usually fails first.

Characteristics of gelsemium poisoning are the ptosis, the internal squint, and dropping of the lower jaw, associated with general paralysis.

Treatment of Poisoning. The treatment of the poisoning consists in emptying the stomach, administering the antidote, tannic acid, the prompt administration of digitalis and whisky to support the heart, strychnine or atropine hypodermically to support the respiration, and the application of external heat.

Therapeutic uses: This drug has no good use in medicine. As a spinal depressant it is of no value, because it depresses the heart too much, even in therapeutic doses. It has at times been recommended in hemicranic neuralgias; it occasionally does good, more often it fails.

CONIUM

Preparations. Tincture; dose, 10 to 20 drops.
Fluid Extract; dose, 3 to 5 drops.
Its active principle is the liquid alkaloid *conine.*

Toxic Symptoms. Conium is a quiet, painless, rapidly depressant poison, with failing respiration, failing circulation, dropping of the eyelids or ptosis, dilated pupils, and a progressive general paralysis. It kills by asphyxia. The general paralysis, which is its dominant action, is produced by paralyzing the peripheral motor nerves. It is only in advanced poisoning that the motor cord is affected. The depression to the respiratory centres and to the circulation is direct.

Characteristic of the poisoning is the dropping of the eyelids or ptosis, associated with general paralysis.

Treatment of Poisoning. The treatment of poisoning consists in the administration of whisky, digitalis, strychnine, and probably cocaine, to support the heart and respiration. The stomach should be emptied, after the antidote, tannic acid, has been administered.

Therapeutic uses: In practical medicine this drug, like gelsemium, has no very good uses; and it is important to the physician more as a dangerous poison than as an agent for good. It has occasionally been used in insanity to quiet maniacal excitement. Here it is given in full doses, and probably produces this quietude by a depressant action on the motor apparatus and subduing the mania by inducing physical weakness.

CHAPTER IX.

CIRCULATORY OR CARDIAC STIMULANTS

The circulatory stimulants are **Ammonia, Alcohol, Digitalis, Strophanthus, Caffeine, Sparteine and Adonidin.**

AMMONIA

Preparations. Aqua or Water of Ammonia; dose, 10 to 20 drops.

Aqua Fortior or Stronger Water of Ammonia, dose, 5 to 10 drops.

Spiritus, or Spirits of Ammonia; dose, 20 drops to 1 fluidram.

Aromatic Spirits of Ammonia; dose, 20 drops to 1 fluidram.

Chloride and Carbonate of Ammonia; dose of each, 5 to 10 grains.

Chloride and Carbonate of Ammonia are chiefly used as expectorants, and will be discussed under that heading.

Locally, ammonia is actively irritant and corrosive. It can even be used as a counter-irritant to produce a blister; here the stronger water of ammonia is used, covered with a watch crystal to prevent its evaporation. When inhaled, ammonia produces active irritation and even strangulation.

Toxic Symptoms. A large quantity of concentrated ammonia taken by the mouth, may produce immediate œdema or spasm of the glottis by its irritation, and *kill in a few minutes by strangulation asphyxia.* In such a case prompt tracheotomy is the only relief.

When an overdose is taken in more diluted form, there is intense pain in the stomach, vomiting, retching, probably followed by blooded purging; pulse weak and rapid, respiration depressed, collapse and death. In this case the treatment consists in giving the antidote, emptying the stomach, and treating the symptoms. The antidote is vinegar or any diluted acid. In the absence of an acid, an oil can be used, which combines with the alkali and forms a soap.

When ammonia is given in moderate quantities, diluted, there is an increase in the rate and depth of respiration, the pulse becomes rapid and full, the blood pressure rises, and in the lower animals especially, there is a condition of heightened reflexes.

Physiology. The increase in respiration is due to direct stimulation of the respiratory centres; in toxic doses these are depressed. The increased pulse-rate and blood pressure rise, are due to stimulation of the heart and bloodvessels directly. Ammonia is, therefore, a promptly acting and powerful but fugacious cardiac stimulant. Small quantities, when thrown into the circulation directly in concentrated forms, or when given in toxic doses, act as a cardiac paralyzant.

Ammonia acts in the system as ammonia, but is eliminated by the kidneys as *nitric acid.* It cannot, therefore, be used as an alkali to the urine to overcome excessive acidity. The heightened reflexes which ammonia produces are probably due to stimulation of the motor cord, but the drug is never used in medicine for this purpose.

Therapeutic Uses: Ammonia can be used as a quickly acting cardiac stimulant in syncope, or heart failure from any cause; but it must be reinforced by a more permanent drug where a prolonged effect is desired. In ordinary fainting, ammonia can be given by inhalation, but in this case it acts by its local irritation to the respiratory tract, producing reflex excitation of heart and respiration; for, not a sufficient quantity can be inhaled without strangulation to act as a direct stimulant. As a respiratory stimulant ammonia can be used, and in its effect it is prompt and active, but its therapeutic employment, both as a respiratory and cardiac stimulant, are not as serviceable as its physiology would indicate, because its local irritant action prevents its free use. Its best practical use in medicine is as an ant-acid to the stomach, to overcome excessive or unnatural acidity in gastric catarrh. Here it should be given in the form of aromatic spirits, freely diluted, before eating. Locally, externally, ammonia is occasionally used as a stimulant in the form of a liniment, or in concentrated form, as a counter-irritant.

ALCOHOL

All alcohol is derived from the fermentation of sugar and its derivatives, starch and cellulose. Chemically pure alcohol is of about 96 per cent. strength. The ordinary strong alcohol of commerce is about 92 to 93 per cent. The official diluted alcohol is 45½ per cent. by weight, or 53½ per cent. by volume. *Proof spirit* contains 50 per cent. alcohol.

The alcoholic beverages can be classed as *distilled* and *fermented.* The fermented beverages can be subdivided into *malts*

and *wines;* the malts are derived from fermented grain; the wines, from fermented fruit juice.

Malts. The more important malts are beer, ale, porter and brownstout. Their average per cent. of alcohol varies from three to fifteen per cent.; most of them contain from three to eight per cent. They contain, besides the alcohol, bitter principles and sugar extractives. They differ in color, light or dark, in proportion as the amount of charring is intense when fermentation is arrested by heat.

Wines. These can be classified into *heavy* and *light wines,* based upon the per cent. of alcohol they contain. The *heavy wines* contain from ten to twenty per cent. of alcohol. The *light wines* contain from three to ten per cent. of alcohol. Aside from the alcohol in them, they contain unfermented sugar, if a *sweet wine,* or are termed a *dry* or *sour wine,* when the sugar is all fermented. They also contain the acids of the fruits from which the wine is made. In an old wine there is developed an ether or ethereal oil, which adds to it both in virtue and in elegance.

There is likewise a difference between the bottled wines or champagnes, and the non-bottled wines, in so far as the champagnes have dioxide of carbon or CO_2 in solution, having been bottled before fermentation was complete. They are, therefore, often of use to arrest vomiting in the early stages of acute diseases, where the stomach is irritable.

The distilled beverages are the *whiskies* and *brandies;* whiskies, from the distillation of grain; brandies, from the distillation of wines or fermented fruit juice.

Whiskies. The chief whiskies are rye or corn whisky, gin, rum and arrack. Their average per cent. of alcohol is from 48 to 53. Gin differs from other whiskies in the fact that it contains either oil of juniper or oil of turpentine. It is therefore not fit for use in the sick room, except as a diuretic, because it is more irritant than the rest. Rum is neither a whisky nor a brandy truly speaking; for it is distilled from sugar cane. Cheap rum is distilled from the refuse of sugar refineries, consisting of amorphous sugar extractives or molasses.

A *green* or newly distilled whisky differs from an old whisky in the fact that it contains a large amount of fusil oil or *amylic alcohol,* which disappears from the wkisky by oxidation on ageing. Fusil oil is locally more irritant than alcohol, and besides, it is an active general poison. Green whisky, therefore, should never be

admitted into the sick room, but should be from five to seven years old before it is used as a medicine.

Brandies. Brandies, or distilled fruit juice, differ very little from whisky in therapeutic virtue, except that they are said to be slightly constipating in their influence, due probably to the fruit acids in them; while whisky is slightly laxative. Brandies, being derived from fruits, are however, vastly more expensive than whiskies, and have no special advantage for use in the sick room except that of taste.

Alcoholism. From alcohol we may have *acute, sub-acute,* and *chronic poisoning;* each one of which presents features for separate study.

Acute Poisoning. An over-dose of alcohol, or any one of its beverages, produces symptoms like that of ether, in which there is emotional excitement, and noisiness; this is followed by stupor, muscular inco-ordination with staggering gait, lessening of reflexes, muscular weakness, partial anæsthesia, partial or complete unconsciousness, pulse at first full but later weak, the respiration slow and finally irregular, fall of body temperature, and, if the dose be large enough, death, usually by asphyxia.

Diagnosis. If the alcohol has been taken in repeated quantities instead of a single draught, death frequently occurs either from a superinduced suppression of urine from acute nephnitis, or a sudden congestion of the lungs, or an intercurrent apoplexy. Such complications will make a diagnosis of alcoholism difficult and doubtful. The diagnosis rests between alcoholism, opium or chloral poisoning, brain congestion, uræmic coma and apoplexy. A working differential diagnosis may be made; but an absolute diagnosis is impossible.

Treatment. Acute alcoholism should be treated by evacuating the stomach, supporting the respiration and the heart with strychnine and digitalis, and the application of external heat to maintain body temperature.

Sub-acute Poisoning. An alcohol poisoning, which may be called sub-acute, is usually produced by a long continued *drunken debauch,* in which the individual is continually intoxicated from one to six or even eight days; during which time there is very little food taken, and alcoholic stupor takes the place of natural sleep, and in consequence of this star-

vation and loss of sleep, a condition of systemic exhaustion is present. At the end of such period of debauch, the individual may discontinue the alcohol, and as the symptoms of intoxication disappear, there develop tremors, mental depression, feeling of anxiety, sleeplessness, irritability of the stomach, and probably mental hallucinations. These symptoms grouped together are vulgarly called "the horrors."

But these symptoms may become exaggerated and develop into a true *delirium tremens* or alcoholic mania; in which state the hallucinations develop into delusions, and the delusions, consisting of sounds and visions, always of an unpleasant or horrifying nature, crazing the individual into a mild mania. An alcoholic *hallucination* differs from a delusion, in the fact that in the former the mind still recognizes that the visions and sounds are mere phantoms and have no objective reality; while in a *delusion,* these subjective terrorizing visions enter consciousness as so many realities. This mental condition, going from depression to hallucination, and to delusion, then followed by mania, is a series of natural psychological steps in which each successive condition becomes the cause of its successor. The mania is always one of fear and self-defense, and in this respect differs from other forms of acute mania, which are aggressive.

This form of alcoholism may terminate: first, in ultimate recovery; second, in insanity, in which case the insanity is always of a delusional character; or third, it may terminate in death. A fatal prognosis is warranted, when in spite of all treatment the patient is losing in strength, the heart becomes weaker, and the mania continues. It may terminate in permanent insanity, if the patient, after proper food and sleep, does not cease to be demented.

The tremors of alcoholism should not be confounded with paralysis agitans. They can be distinguished from this disease by the fact that alcoholic tremors can be arrested by giving alcohol, but which has no effect on the tremors of paralysis agitans. Also, alcoholic tremors are not vibratory like those of paralysis agitans, but are an irregular muscular unsteadiness or a mere trembling.

Treatment. The treatment of this form of alcoholism consists in cleaning out the system of effete matters, the securing of rest and sleep, the providing of nutritious food, and supporting the patient's heart and temperature.

Cleaning out the system is best done by giving a brisk mercurial purge to open the bowels, and at the same time act as a stimulant to the liver and kidneys, and thereby setting the emunctories to acting. Follow this up by hyoscine, or chloral and opium, preceded by two or three drams of one of the bromides, to produce sleep. When, in these cases, the insomnia is unusually stubborn, and the patient complains of headache and sharp darting pains through the head, it is well to examine the urine for albumen, for it can often be found in great abundance. It must not be forgotten that this is not a condition of alcoholic depression, but one of *systemic exhaustion,* and consequently the free use of strychnine and digitalis for the support of the nervous system and the circulation are of first importance. The irritability of the stomach invariably present, can very often be overcome by the use of the tinctures of capsicum and nux vomica. The food should consist of easily-digested, nutritious articles, and be administered as the stomach can bear it.

Chronic Alcoholism. This form of poisoning occurs in cases where the alcohol is used over a course of many years in greater or less excess. The pathological lesions are either those of *fatty infiltration* or of *sclerosis* with contraction of the different organs affected. It is not necessary that an individual should take enough alcohol at any one time to become intoxicated. It is rather the "moderate inebriate" who developes these lesions by the length of time during which the alcohol has been so used, and its constant influence operating upon the cell organization.

If the alcohol has been taken in diluted form, or especially as a malt liquor, the organic lesions are usually those of fatty infiltration of the glandular structures, most marked among them are the kidneys and liver; the heart muscle likewise sharing the change. The excess of fat is probably due to the sugar extractives in the malt which are productive of fat, but it certainly is in part also due to constant interference with nutrition.

In cases where the alcohol has been taken in a concentrated form, as whisky, brandy, or gin, the lesions usually are a sclerosis of the liver and kidneys with contraction, fibrosis of the bloodvessels with subsequent atheroma, degeneration of the heart muscle, alcoholic sclerosis of the brain and spinal cord, and not infrequently an alcoholic neuritis. These stronger beverages, by

their constant irritation, produce chronic inflammation and fibrous tissue formation with contraction, wherever there is concentrated contact of the alcohol; such as you have in the kidneys on the way of elimination; in the liver, when passing through the portal circulation after absorption; and in the interior of the blood-vessels while it circulates through them. The lesions are usually most pronounced in the organs where alcohol is most concentrated when it passes through them.

Treatment. For this condition there is no special treatment, since the organic destruction cannot be undone. The only hope for prolongation of life consists in quitting the alcohol absolutely, and leading a regular and careful life.

Physiology. Alcohol in moderate quantities is a stimulant to the brain, to the respiratory centres, and probably stimulates the spinal cord. In toxic quantities, like ether, it depresses the brain, the sensory cord, the motor cord and the centres of the medulla, including the respiratory and vasomotor centres.

Its action on the circulation is like that of ether; in moderate doses it stimulates the heart directly; in toxic doses the heart, vasomotor centres, and even the bloodvessel walls, become depressed.

Digestion. In small doses alcohol somewhat stimulates digestion; in *larger doses* it retards or even may arrest digestion. The small dose probably aids digestion by stimulating the secretion of the gastric glands and increases the amount of digestive fluids. The larger dose retards digestion by precipitating the digestive ferments, and may even kill them so that they will not become redissolved and digestion is arrested. This is an important fact in the use of alcohol in the sick room; when given in *small doses,* it should be given *with food;* but, if it is needed in *large doses,* it should be given *between feeding.* It has recently been determined that the malt liquors probably interfere with digestion to a greater degree than the stronger beverages.

On Nutrition. Alcohol in small quantities retards tissue waste, and thus acts as an *accessory food;* it does not nourish the tissues and increase their growth, as do articles of common diet, but it checks the destruction of tissue by being itself converted into heat and force. This food value of maintaining the strength of the economy is only marked when

there is *under-feeding* or starvation, as there is in low diseases with rapid wasting, where sufficient food cannot be taken to supply the needs of the system. Under conditions of full feeding very little alcohol is so converted and destroyed, but the bulk of it is eliminated as alcohol, and consequently can do nothing less than harm.

On Temperature. It has been claimed that in moderate doses alcohol slightly elevates body temperature. This is doubtful. In toxic doses it reduces temperature, and in all conditions of drunkenness there is subnormal temperature in proportion to the degree of intoxication. Alcohol may increase the amount of heat production, but it likewise increases heat dissipation. It elevates superficial temperature of distant parts, as the hands, feet, nose, and ears, by increasing the peripheral circulation, but this is done at the expense of general body temperature. In large doses the loss of heat is increased from the dilatation of the bloodvessels which promotes rapid heat radiation, and thus a fall of the body temperature.

Elimination. Alcohol, when ingested, is in part oxidized or destroyed in the system, and in part eliminated by the kidneys, lungs, skin and bowels. Being a local irritant, it always irritates the organs at the points of absorption and at the points of elimination.

Local Action. Locally, alcohol is a stimulant, if concentrated it is irritant, and antiseptic. In prolonged contact with living tissue it will kill cell life by coagulating the albumen.

Therapeutic Uses: The general uses in medicine for alcohol are, as a *cardiac stimulant,* to *maintain the system* in low wasting diseases, *in animal poisons,* and it is sometimes used in shock.

As a stimulant to the heart, alcohol can be used in syncope, heart depression from poisons, heart failure from organic diseases of the organ itself, and in cardiac weakness in the low stages of infectious fevers; in fact it is serviceable in all forms of cardiac weakness, except in failing heart from ether or chloroform. Here it is too nearly identical with those drugs to act as an antagonist.

In acute diseases with low stages, as in typhoid, in influenza, in low pneumonia and the like, alcohol can be used continuously. Not only does it maintain the circulation, but it maintains the general nutrition and strength of the patient

through the crisis, by checking tissue waste. When it is given in such diseases, it should never be pushed to a point where free elimination can be discovered on the breath; for it is not the alcohol that is eliminated, but the alcohol that is destroyed and used by the economy that does the good. In chronic diseases with progressive exhaustion, as in phthisis, alcohol is one of the most reliable drugs at command to prolong the life of the patient and give comfort. Here it acts most exclusively by the checking of tissue waste, or taking the place of food, and the quantity given in twenty-four hours can often be very large without ever producing a sign of intoxication or even any elimination discoverable on the breath, showing that all the alcohol is used up in the system. The only serious thing to guard against in such use of alcohol is the contraction of the habit in cases where the disease is not far advanced. But it must be remembered that a person suffering from infectious disease, well advanced, is in a condition when it is physiologically impossible to contract the habit. The danger is during convalescence, when the alcohol is continued too long.

In animal poisons, as snake bites, or bites and stings from any poisonous animal or insect, alcohol is our best remedy. It should be given to a point of tolerance; that is, to a point where alcoholic symptoms becomes distinctly manifest, to counteract the poison.

In shock alcohol has been much used. It is, however, of little service, because it is not a vasomotor stimulant, and if given at all, it should be used very moderately.

DIGITALIS

Preparations. Tincture; dose, 5 to 20 drops.
Infusion; dose, 1 fluidram to ½ fluidounce.
Powdered Leaves; dose, 1 to 3 grains, in pill form.
Fluid Extract; dose, 1 to 3 drops.
Extract; dose, ¼ to ½ grain.

The *tincture,* the *infusion* and the *powdered leaves* are the three preparations most employed. For hypodermic use the tincture should be employed. The so-called active principle *digitaline* is an uncertain and indefinite substance. It does not fully represent the drug, though it is a complex body. Whether digitalis has one or a number of active principles is not definitely made out; but digitaline, digitaleine, digitoxine, and digitonine,

have all been claimed to be the active principles of the drug, but none of them represents its full virtue.

When digitalis is given in repeated small doses, the first physiological manifestation is that of a *slow, full, strong pulse,* becoming slower and stronger as the drug is increased, and the pulse wave is larger than normal. This is its *therapeutic limit.*

Toxic Symptoms. When the drug is given in a single toxic dose, the symptoms are those of nausea, repeated vomiting, with gastric distress and pain; the reflexes are lessened, and later lost; respiration is diminished; then vertigo, stupor, and convulsions may follow. The urine at first increased, finally becomes suppressed; the pulse at first is full, strong and slow, with blood pressure rise, then it becomes dicrotic, finally rapid and irregular, with blood pressure falling, and death occurs from cardiac spasm, the heart being arrested *in systole.* In rare cases the heart becomes arrested *in diastole.*

Physiology. The nausea and vomiting are probably the outcome of its local irritation, and they occasionally occur in therapeutic doses.

The early lessening, and later loss of reflexes are due to two factors: The lessening of the reflexes is due to stimulation of the inhibitory centres to reflexes or Setchenow's centres; while the absolute loss of reflexes in the late poisoning, is due to depression of the motor cord.

Circulation. All the important and practical physiological facts of digitalis centre around the influence it has upon the various factors of the circulation. The early or physiological pulse is slow, full and strong, with an elevated blood pressure. The later dicrotic, and finally irregular and rapid pulse, with blood pressure fall, is exclusively a toxic pulse.

The slow pulse is produced by stimulation of the pneumogastrics peripherally and stimulation of the heart directly. It increases the cardiac rhythm and causes a more complete systolic contraction than normal, and a longer and more complete diastole or relaxation than normal, filling the heart with blood to repletion. The fullness of the pulse, the increased pulse wave, and the blood pressure elevation, are jointly produced by stimulating the heart muscle, its contained ganglia, the vasomotor centres in the medulla, and the bloodvessel walls.

The dicrotic pulse in the poisoning, is the outcome of an attempted systolic contraction during a diastolic period. The late

irregular and rapid pulse, with blood pressure fall, is an exaggerated dicrotism, the pulse becoming feeble because the heart is slowly going into spasm, beginning at the apex and obliterating gradually the ventricular cavities until the whole heart is arrested in contraction. The blood pressure fall in the late stages of the poisoning is due to this progressive cardiac spasm; the heart not pumping any blood, the arteries become empty, and the blood pressure falls to zero. During the poisonings a mitral murmur is occasionally heard, which is due to spasm of the papillary muscles of the heart, not allowing the valves to close, and thus there is slight regurgitation of blood back into the oracle.

Occasionally diastolic arrest of the heart occurs, with a relaxed heart full of blood as though it were paralyzed; but this cardiac arrest is due to pneumogastric stimulation or an arrest from excessive inhibition; for, if the pneumogastrics are cut, no such cardiac arrest will occur, or if section of the pneumogastric nerves be made after the arrest of the heart in diastole, the organ will resume action, showing that it is not an arrest from cardiac depression but from cardiac inhibition.

It is manifest from its physiology that digitalis is a stimulant to all the factors of the circulation; the heart, the vasomotor centres, the bloodvessel walls and the pneumogastric nerves. It is further evident that digitalis at no time during the poisoning, and in no dose however large, ever paralyzes any part of the circulation, but it *always stimulates,* and even kills by excessive stimulation of the circulatory apparatus.

Diuretic Action. The increased flow of urine produced by digitalis is in a great measure due to changes in the circulation, producing contraction of the blood-vessels and forcing the liquids into their physiological channels; namely, the kidneys. It is probably more effective and more certain in its action when there is vascular relaxation than in the normal condition. It probably has also a slight action, on the kidney structures themselves, stimulating their secreting cells.

Accumulative Action. Digitalis is absorbed very slowly from the intestinal canal, and is therefore *slow in its action.* Its rate of elimination by the kidneys is still more slow than its rate of absorption. It is therefore very *permanent in its action.* Because of this slow elimination the drug may accumulate in the system and produce excessive symptoms. It is believed that this accumulation is

more apt to occur under the following circumstances: First, when after the prolonged use of digitalis, there is not an increase in the flow of the urine (as evidence of elimination). Second, when it is given to support the heart in acute fevers, especially pneumonia, and the temperature suddenly drops, excessive action is said to have occurred. Third, after tapping the abdominal cavity in dropsy from organic heart disease, where digitalis has been used probably for weeks, it is said to show excessive action. In this last case an excessive action is due to the large quantity of digitalis reabsorbed into the general circulation, which may have been contained in the dropsical effusions of other parts of the body, and which effusions may become absorbed to supply the leakage that takes place from the bloodvessels in the abdominal cavity to refill it.

These accumulative actions can occur, and probably have occurred, but they are certainly so scarce, that they should not create timidity on the part of the physician to use this drug boldly when it is urgently needed to support a failing heart.

Treatment of Poisoning. In the treatment of accidental poisoning by digitalis, it is necessary to empty the stomach, to give the antidote, tannic acid, to keep the patient quiet on his back, and to administer cautiously aconite or veratrum viride to control the excessive circulation, and prevent fatal cardiac spasm.

Chronic poisoning occasionally occurs from the prolonged therapeutic use of the drug in chronic heart disease. It manifests itself chiefly in indigestion, vomiting, slight diarrhœa, loss of appetite and emaciation. Under such conditions the drug should be discontinued.

Therapeutic uses: The *contra-indications* to digitalis are: First, and most important, in aneurism; second, in atheroma; third, in excessive cardiac hypertrophy with or without valvular lesion; fourth, when it disturbs digestion or produces vomiting.

In aneurism, the danger is not so much in the elevation of the blood pressure, as it is in the volume of the pulse wave, increasing the tension in the aneurismal sack, which may rupture it. It must be remembered the lateral pressure in an aneurism is many times greater than it is on any other part of the bloodvessel; because the blood forced into the sack, *whirlpools* in a double circle in the sack, and it is only forced out through the

distal opening of the aneurism into the artery again by the reactive force of the walls of the aneurism itself. It is, therefore, readily seen from this fact, that the resisting power of an aneurismal sack, is in inverse proportion to its internal blood pressure; that is, the artery is much weaker at that point than elsewhere, while the lateral pressure upon the vessel is much greater at that point than at any other.

Indications. *The one great indication for digitalis is cardiac weakness.* Cardiac weakness may be produced: First, by organic lesions of the valves, such as mitral insufficiency or stenosis, aortic insufficiency or stenosis; second, from degenerative changes in the heart muscle itself; third, from functional heart weakness from all depressant poisons, including infectious diseases; and fourth, from cardiac exhaustion due to overwork or starvation.

In the organic valvular lesions, digitalis is the most useful drug we have. In mitral insufficiency it has a special advantage in producing a complete contraction of the heart, forcing the blood towards the aortic opening, and carrying more blood into the general circulation while less blood is regurgitated into the oracle. Again, in mitral stenosis it has a special advantage through its pneumogastric stimulation, producing a prolonged diastolic period, and thus allowing more blood to flow through the contracted valve from the auricle into the ventricle, and thereby supplying a greater amount of blood to the general circulation.

In lesions of the aortic valves, digitalis is of less service than in lesions of the mitral valves. In aortic insufficiency, the blood being thrown into the aorta with greater force under the influence of digitalis, is regurgitated from that elastic tube back into the heart with an equally increased force, and consequently not as much blood is furnished to the general circulation. But yet, when in this lesion the heart becomes insufficient, digitalis should be used, since there is no other alternative.

Besides these individual advantages, digitalis in the valvular lesions is capable of bringing about a more or less permanent relief, especially in mitral lesions, by producing a compensatory hypertrophy of the heart muscle. It aids this increase of cardiac growth, first, by stimulating the pneumogastrics and prolonging cardiac diastole, and thereby giving the heart its normal amount of rest; second, it increases the nutrition of the heart by its

complete contraction or systole, forcing the exhausted blood out of heart muscle itself, and thus allowing more free circulation of fresh blood in it giving it more nourishment; third, the nutrition of the heart is probably further increased by the stimulation of the trophic fibres of the pneumogastric nerves, and by this means increasing the cell metabolism of the heart. The conspiracy of these three factors tends to increase cardiac growth and strength producing compensation to such a degree that the heart may be able to supply all the demands put upon it.

A cardiac hypertrophy following valvular lesions may be *absolute,* it may be *compensatory,* or it may be *excessive.* An absolute hypertrophy is a condition in which the heart is stronger and larger than normal, but it may not be strong enough to compensate for the valvular lesion, and therefore relatively a weak heart.

A compensatory hypertrophy is a condition in which the strength and muscular growth of the heart has increased to a par with its working demand. It is therefore doing the work.

In excessive hypertrophy the heart is stronger than normal or necessary, and rather needs sedation than stimulation. Excessive hypertrophy occurs most frequently in cases of aortic stenosis.

In cardiac weakness from degenerations of the heart muscle, neither digitalis nor any other drug can be of much value; but it can be used as a palliative, stimulating such muscle fibres as are still normal, and thus relieving, temporarily, the distressing symptoms.

As a diuretic, digitalis is somewhat uncertain in its action, but it can be used, especially in cases where there is a dropsical effusion caused by organic disease of the heart, where it subserves the double purpose of stimulating both heart and kidneys.

In advanced organic heart disease, with lesions both of the valves, and a failing compensation of the heart muscle, the combination of tincture of digitalis, tincture of strophanthus, and tincture of nux vomica, often acts more happily than any one of these alone could do.

In the so-called "irritable heart" with irregularities of cardiac beat, if accompanied by excessive hypertrophy, aconite is indicated to regulate and steady its action. If there be irritability with cardiac weakness, digitalis, through its pneumogastric stimulation, will give the most relief.

In functional weakness of the heart, the outcome of depressant poisons, or in a failing heart in the low stages of such diseases as pneumonia, typhoid, influenza and the like, digitalis is of service in all cases; but where the circulation fails as a consequence of complete exhaustion of the general nervous system, digitalis is very disappointing, and the hypodermic use of strychnine should be employed in its stead.

In shock and syncope, or in any emergency where prompt relief is imperative, digitalis can only render requisite aid if it be given hypodermically; for, when given by the mouth, its effects are too slow to meet the indication.

STROPHANTHUS

Strophanthus is official as a *tincture* only—dose, 5 to 10 drops.

The active principle is the glucoside *strophanthine.* It is locally more irritant than digitalis, and occasionally produces irritability of the stomach.

The physiological effects following ordinary doses of strophanthus, are mainly those noticeable in changes of the circulation. The pulse becomes more strong, full and slow, like that of digitalis. There is also some increase in the flow of urine, due to direct stimulation of the kidneys. This drug is more active and more constant in its diuretic action than is digitalis.

Toxic Symptoms. After a toxic dose of strophanthus, there is pain in the stomach, followed by nausea and repeated vomiting; the pulse at first is slow, full, and strong, finally becoming rapid and losing in force; respiration becomes shallow and irregular, and there are muscular tremors with muscular rigidity, which in lower animals are almost equal to a convulsion; finally death occurs from paralysis of the respiratory centres.

Physiology. The slow, full and strong pulse with blood pressure elevation, is probably the outcome of its stimulant action on the muscular structures of the circulation; namely, the heart and the bloodvessel walls. It has little or no action on the vasomotors or pneumogastrics.

The muscular tremors and muscular rigidity are produced by the direct action of the drug upon the muscles themselves, independently of their nerve supply. It is, therefore, a muscle stimulant, and in large quantities a *muscle poison,* and this is its

dominant physiological action. All muscular structures of the body seem to share this stimulant action, but the heart muscle appears to be a trifle more susceptible to its action than the other muscles. To the respiratory centres strophanthus is a direct paralyzant, which accounts for the shallow, irregular and finally arrested respiration in cases of poisoning. Its diuretic action depends mainly upon its stimulating effect on the secreting cells of the kidneys.

Therapeutic uses: Strophanthus stands next to digitalis as a powerful and reliable cardiac stimulant in all forms of heart weakness. It is less permanent and probably a trifle less powerful than digitalis, but it has the advantage in being much more prompt in its action. It is more prompt, but less permanent in action than digitalis, because it is more readily absorbed and more rapidly eliminated by the kidneys.

In practical medicine it meets all the indications for which digitalis can be used. In organic heart disease, with or without valvular lesion, or in functional cardiac depression from poisons, or in cardiac exhaustion, strophanthus is efficient and useful. In emergency cases it is more prompt than digitalis, and to that extent has an advantage. In very advanced valvular lesions with falling compensation of the heart muscle, and a very irritable stomach depending upon this condition, strophanthus is often borne by the stomach when digitalis is rejected.

As a practical diuretic, strophanthus is more active and more constant in its action than digitalis, and is often used in medicine for the purpose of getting rid of dropsical effusions, especially when this dropsy is dependent upon heart disease.

CAFFEINE.

Caffeine is the *alkaloid* of coffee, and is official as a citrate; dose, 1, 3 to 5 grains.

The alkaloids theine, caffeine, theobromine, and the alkaloids of *gurano* and *cola nut,* are all very similar, if not identical, in their physiological relations. Caffeine, being the most active in the list, can be taken as a type of the group.

In coffee itself there is present, besides the active principle, a volatile aromatic oil, which is not found in the raw coffee bean, but which is developed in roasting. It is this volatile oil, that

gives coffee its pleasant flavor; but this volatile oil, at one time believed to be itself active, has probably little or no physiological relations to the animal economy.

Symptoms. The symptoms following a large dose of caffeine are those of increased mental activity, passing into mental excitement, with headache and probably delirium. In some of the lower animals these symptoms are even followed by general convulsions. The respiration is increased in frequency and depth, the pulse is more rapid and full, and the blood pressure elevated. There is an increased flow of urine, the reflexes are increased, and muscular tremors and muscular rigidity are marked. In the late poisoning the circulation fails, blood pressure falls, respiration becomes shallow and weak, and finally kills by paralyzing the respiratory centres.

Physiology. The increased mental activity followed by excitement, is due to direct stimulation of the brain. This drug stimulates the centres of the brain which are concerned in intellection, and increases the working power of the brain. In this respect it differs from the cerebral stimulation of opium, cannabis indica, alcohol and cocaine, all of which rather increase the emotions.

To the circulation it is a very moderate stimulant; stimulating probably the heart muscle and the bloodvessel walls, and has little or no influence on the pneumo-gastrics or the vasomotor centres. The increased flow of urine is due to a direct action on the secreting structures of the kidneys, and is more active in its diuretic influence than digitalis or strophanthus, in those who are not addicted to the daily use of coffee.

The muscular trembling and rigidity are due to a stimulant action on the muscles directly, and is, therefore, like strophanthus, a *muscle poison.*

The increased respiration under caffeine is due to direct stimulation of the respiratory centres, but in large doses it becomes a paralyzant to these centres. This respiratory stimulation is not very decided, although it classes itself as a practical respiratory stimulant with such drugs as strychnine, atropine, cocaine, and probably ammonia, of which it is the least effective and reliable.

In the lower animals the reflexes are heightened, and sometimes spinal convulsions are produced. These are the outcome of the stimulant action it has on the motor cord. In man this spinal stimulation is not sufficiently manifest to make this drug useful in spinal affections.

Therapeutic Uses: First—Caffeine is useful as a cardiac stimulant in all conditions of heart weakness. It lacks activity and certainty, so that it should not be relied upon by itself in cases of gravity, but is rather an adjuvant, to be combined with more active cardiac stimulants. It is well fitted in heart disease with dropsy, where both its diuretic effect and its cardiac stimulant action conjointly are available.

Second—It can be used as a cerebral stimulant, to rouse up the brain to greater activity, when there is a sudden heavy mental effort to be made and the intellect works sluggishly. Public speakers often take a cup of strong coffee before they appear before an audience, because thinking and the flow of thought, seem to be more easy under its influence. It will, however, not rouse up a brain to greater activity when it is exhausted from over-work, but rather increases the evil and produces mental confusion. It is also of service in nervous headaches, sometimes in migraine and neurasthenic headaches.

In the treatment of narcotic poisoning, such as chloral and opium, caffeine is of great value. It combines its cerebral stimulant effect to produce wakefulness, with its respiratory stimulation, its cardiac stimulation, and its diuretic action, aiding the elimination of the poison, each of which is an important factor in the treatment of all such poisonings.

Third—As a respiratory stimulant it can be used in all forms of respiratory depression from poisons, or in exhausted respiration in pulmonary diseases; but better results can be obtained from strychnine or cocaine.

Fourth—As a diuretic it acts as a direct stimulant to the kidneys, and increases the watery constituents of the urine. It can be used in all forms of dropsy, for the purpose of eliminating the fluid. In those who are not addicted to the daily use of coffee, the diuretic action of caffeine is very certain and decided.

Of the three drugs, digitalis, strophanthus, and caffeine, their cardiac stimulant actions and their diuretic actions, are in inverse proportion: as a cardiac stimulant, digitalis stands first, strophanthus second, and caffeine third; but as diuretics, the reverse is true; caffeine stands first, strophanthus second, and digitalis third.

Chronic Caffeine Poisoning. This occurs in people who use coffee or tea as a beverage in excess. The chief symptoms are sleeplessness, headaches, which

are somewhat periodical and resemble migraine; anæmia, nervousness, loss of flesh and neurasthenia. The treatment consists in discontinuing the coffee or tea, and instituting careful hygiene with open air and exercise.

SPARTEINE.

Sparteine is a liquid alkaloid from broom or scoparius. It is official as a sulphate; dose, 1/5 to 1/2 of a grain.

The dominant action of this alkaloid is probably a quieting influence on the spinal cord; but it has been introduced as a stimulant to the circulation, which physiological action is surely not very decided, if not somewhat doubtful. The pulse under its influence becomes slower in rate and the blood pressure slightly increases, but this increase of blood pressure may be the outcome of the diminished pulse rate rather than that of direct stimulation to the heart. It is, perhaps, more used in practical medicine as a diuretic in different forms of dropsy, than as a heart stimulant; and it has been used as a sedative to the nervous system in tachycardia. In toxic doses it kills by paralytic asphyxia.

ADONIDIN.

Adonidin is a glucoside, derived from adonis vernalis, a plant growing in Europe. The dose of adonidin can be put down as 1/10 to 1/5 of a grain.

This principle has been introduced as a cardiac stimulant, but it is very rarely, if at all used by the general profession. From experimental work it would appear that it acts as a stimulant to the circulation, first diminishing the pulse rate and increasing the pressure, but finally becoming a depressant to the entire circulation. There are no special therapeutic indications for which this drug can be highly recommended.

CHAPTER X.

CIRCULATORY DEPRESSANTS.

They are: **Tartar Emetic, Veratrum Viride, Aconite, Hydrocyanic Acid, and Vegetable Acids; Oxalic Acid, Acetic Acid, Tartaric Acid, Citric Acid.**

The first four of these have their dominant action upon the circulation, and are truly circulatory depressants; but veratrum viride and aconite are the only two that are used in practical medicine for this purpose, and they are, by all means, the more desirable ones.

The vegetable acids are classed under this heading, because, in toxic doses, they are active depressants to the circulation, although they are never used in practice for this purpose. It is well to state that they are placed here for want of a better classification, since their therapeutic application would not assign them any better place.

TARTAR EMETIC.

Tartar emetic, or tartrate of antimony and potassium, is the one of the antimony preparations most used in medicine. The dose, as a cardiac sedative or sudorific, is from $\frac{1}{20}$ to $\frac{1}{12}$ of a grain. As an emetic, the dose is from $\frac{1}{2}$ to 1 grain. There is also official, a *wine of antimony,* which contains about 2 grains of tartar emetic to the fluidounce, and its dose is proportionate, from $\frac{1}{2}$ to 1 fluidram or more.

Tartar emetic is incompatible with acids and alkalies, especially so with tannic acid or any substance containing it. The local action of tartar emetic is irritant, producing redness of the skin and pustules. It has occasionally been used as a counter-irritant where it was desirable to have a slowly acting and prolonged counter-irritation.

First Effects. When tartar emetic is given in therapeutic doses repeated, the first effects noticeable are those of a little slower and softer pulse, with probably a little clamminess of the skin. When the dose is increased there is

developed nausea, followed by vomiting, the pulse slower and softer, and more perspiration.

Toxic Symptoms. A toxic dose of tartar emetic produces some pain in the stomach followed by nausea, this nausea is followed by vomiting, and after a time the vomiting is followed by free purging. The nausea, vomiting, and purging progressively increase, and are continued throughout the course of the poisoning. The matters vomited are at first the contents of the stomach, followed by mucous and bile. The character of the stools is large and watery, resembling the "rice-water" stools of Asiatic cholera. The pulse is slow, then becomes weak, and finally rapid and thready, and the blood pressure falls from the beginning. The respiration is slow, shallow, and weak; reflexes are lessened; body temperature falls, a cold, clammy sweat, muscular cramps in the extremities, and finally death, with or without convulsions, from general exhaustion.

Treatment of Poisoning. The indications for treatment are: the administration of its antidote, *tannic acid,* the washing out of the stomach, the prompt use of morphine hypodermically, and applications of counter-irritation over the epigastrium to check the vomiting and purging; strychnine and digitalis hypodermically, and whisky by the mouth, should be given to support the heart and respiration; and the application of external heat to maintain body temperature. Poisoning by this drug produces a series of symptoms not readily distinguishable from a case of Asiatic cholera. A certain differential diagnosis could only be made either from the history of the poisoning or by chemical examination of the secretions.

Physiology. The nausea and vomiting produced by antimony are probably of both centric and local origin. It stimulates the centres of emesis in the medulla, as well as irritating the mucous membrane of the stomach.

The clamminess of the skin from therapeutic doses is probably in part due to stimulation of the perspiratory glands, and in part due to a relaxed circulation. The free sweat in poisoning is due to collapse.

The large watery stools are due to attempted elimination of the drug by the intestinal glands, stimulating them to excessive secretion. This is one of the avenues of elimination of tartar emetic. It is also eliminated in part by the stomach, by the

kidneys, and probably by the bronchial mucous membrane. It slightly increases the secretion of urine by its stimulant action upon the kidneys, but in toxic doses the urine becomes scanty, then bloody and finally suppressed, due to the irritation of the drug upon the renal tissues.

The slowing of the pulse rate is the outcome of pneumogastric stimulation, but in advanced poisoning these nerves are depressed and the heart becomes rapid. The blood pressure fall and the weakness of the pulse are due to direct depression of the heart and vasomotor centres. This is its dominant physiological action. The respiration is depressed from the beginning. The reflexes are lessened, because there is some depression to the sensory cord. The motor apparatus does not yield to the depression except in enormous doses.

The muscular cramps that occur late in the poisoning are probably the outcome of depletion of the general circulation from the excessive liquid or serous purging, draining the circulation of its serum and thus interfering with the blood supply to the muscles. This same fact probably explains the muscular cramps in greater or less degree, which occur in prolonged excessive serous purging, whether from disease or poisons.

The convulsions that occur in the late stages of antimony poisoning are probably the outcome of diminished circulation in the brain or cerebral anæmia. These convulsions occur in the late stages of veratrum viride and aconite poisoning, and are probably in all three cases produced by anæmia of the brain.

Therapeutic uses: Tartar Emetic has formerly been used a great deal as a circulatory sedative in all inflammations with arterial excitement; in acute pneumonia, and in fact in all diseases where there is an excited heart. These are unwarranted uses of the drug, and it is very rarely now that tartar emetic is employed for any of these purposes. In pneumonia, it not only depresses the circulation, but it produces a general depression which tends to systemic exhaustion. In diseases of children the use of this drug is hardly warranted for any purpose. As an emetic, it can be used in adults when it is desired to produce revulsion or shock by emesis, as in violent hysteria or alcoholic mania, and for this purpose it is the best emetic we have. For all other emetic purposes, however, it is less desirable and more dangerous than most of the practical emetics. In acute bronchitis or to break up a cold, the

wine of antimony can be used as a sudorific; but even here it is less effective and more unpleasant than citrate of potassium.

VERATRUM VIRIDE

Preparations. Tincture; dose, 3 to 5 drops.
Fluid Extract; dose, 1 to 3 drops.

The alkaloids are *jervine* and *veratroidine.* Jervine is the *dominant alkaloid,* and controls almost the entire action of the drug; veratroidine is present in but traceable quantities. Neither of these alkaloids are used in practical medicine in their free state; but only the tincture and fluid extract are official.

The symptoms produced by therapeutic doses repeated, are those of a slow, gentle, soft pulse. When pushed beyond this, the pulse becomes slower and softer, and there is a little clamminess of the skin, with nausea. These symptoms mark its *therapeutic limit.*

Toxic Symptoms. A toxic dose of veratrum viride is followed by pain in the stomach, nausea, intense vomiting, the pulse is slow and weak, but finally becomes rapid; reflexes are lost, with complete muscular relaxation and paralysis; respiration is slow and shallow; body temperature falls; and finally death occurs from either asphyxia or syncope.

Treatment of Poisoning. Wash out the stomach with a tannic acid solution, place the individual on his back with the head lower, and administer strychnine and digitalis hypodermically to support the heart and respiration. These may be re-enforced by the use of cocaine and whisky; morphine can be employed hypodermically to control the vomiting; and the application of external heat. The patient should be kept in an inclined position with the head lower to increase the flow of blood from the abdominal vessels to the right heart to cause cardiac contraction; and under no circumstances should he be allowed to rise, because such exertion is capable of putting enough additional tax on the heart to cause its prompt arrest.

Physiology. The cause of the nausea and vomiting in veratrum viride is not fully made out; but it is probably of both centric and peripheral origin.

The slow, weak pulse, with blood pressure fall, is produced by its depression of the heart and vasomotor centres equally. Of all vasomotor paralyzants, this is the most powerful. This depression on the circulation is its *dominant physiological action* and is directly antagonistic to digitalis.

The muscular relaxation and profound motor paralysis are due to depression of the motor cord. This motor cord paralysis stands next in importance to its action on the circulation, but it cannot be used in practical medicine to control convulsions, (because it is not its dominant action,) except in the few cases where both spinal and circulatory excitement may coexist.

The respiratory centres are depressed from the beginning, and to such a degree that they sometimes become paralyzed before arrest of the heart occurs.

Of the alkaloids, when separately administered, it may be said that jervine, the dominant alkaloid, produces physiological effects identical with those of the crude drug, except that there is no vomiting. The minor alkaloid, veratroidine, has its dominant action, not upon the circulation, but as a respiratory paralyzant. It is present in the drug, however, in such small quantities that it does not materially alter its physiological effects or its therapeutic uses.

Therapeutic uses: Veratrum viride is used exclusively for its action on the circulation. It has been used in inflammations with high bloodvessel tension; in acute inflammation of serous cavities, in meningitis, in peritonitis, in pleurisy and in pericarditis. It has also been used and recommended in the early stages of acute pneumonia with high pulse tension. In the later stages, when the circulation becomes weak, its antagonist, digitalis, has been suggested. The depression of the circulation by veratrum viride is claimed to lessen the the extension of pulmonary involvement, by relaxing the vasomotor system over the entire body and equalizing the circulation. In the late stages of the disease, digitalis is recommended to support the right heart when it becomes embarrassed from forcing the blood through the diminished lung territory.

This, on physiological grounds, would seem to be very helpful in the treatment of the disease, but when we recollect that acute pneumonia is a *specific fever* of an infectious type, and that the high pulse tension is rather from the *elevated temperature* than from the inflammation of the lung, it

becomes a trifle difficult to see that this method of treatment has very many advantages; while at the same time, clinical experience seems to confirm this suspicion, because so soon as the temperature in pneumonia is reduced by antipyretic means, the pulse tension yields in direct proportion to the loss of heat.

Veratrum viride has its best uses at present in medicine, in checking the force of the circulation, when there is organic disease of the circulatory apparatus; as in apoplexy, where the circulation is to be reduced promptly; in aneurism, to take the strain off the aneurismal sack, and lessen the chances for its rupture; in excessive hypertrophy of the heart with cardiac pain and distress, and in advanced atheroma where the bloodvessels are in danger of rupture. In all these indications veratrum viride is a useful remedy. It is useful because it depresses the heart and lessens the force of the blood current, and because it relaxes the bloodvessels and relieves their tension.

ACONITE.

Preparations. Tincture; dose, 1 to 5 drops.
Fluid Extract; dose, 1 to 2 drops.

The active principle is the alkaloid, *aconitine.*

Locally, aconite is slightly irritant and anæsthetic.

Symptoms. When aconite is given in small repeated doses, the first effects are those of slight tingling in the mouth and of the lips, the pulse slow and soft, and probably slight perspiration. This is its *therapeutic limit.*

Toxic Symptoms. In toxic doses aconite is a powerful and promptly acting poison, without tumultous symptoms and without pain. The symptoms are those of rapid depression of the circulation, the pulse slow and weak, and finally becoming rapid and thready; tingling and numbness in the extremities, followed by anæsthesia; reflexes are lessened, and finally lost; the pupils are somewhat dilated; the respiration is slow and irregular, with rather short inspirations and long drawn-out expirations; the voice is reduced to a whisper; the skin is cold and clammy; rapid fall of body temperature, and finally death, with or without convulsions, from heart paralysis or syncope. Consciousness is usually preserved throughout the course of the poisoning, unless it be abolished by a convulsion.

Treatment of Poisoning. Aconite, being such a rapidly acting poison, must be met by very prompt measures for relief. The administration of digitalis, alcohol and strychnine hypodermically, washing out the stomach with a tannic acid solution, giving hot concentrated whisky by the mouth, and the application of external heat, are the main indications to be met. The person should be kept on his back with the head lower, to favor the flow of blood to the right heart from the abdominal vessels.

Aconite is a more dangerous poison in single large doses than is veratrum viride, because the latter produces vomiting and the poison is thrown out; whereas in the former there is local anæsthesia of the stomach and vomiting occurs in but very exceptional cases.

Physiology. The principal physiological action of aconite is its depressant influence on the heart. The early slow pulse and the later rapid pulse with blood pressure fall, are probably entirely the outcome of this direct cardiac paralyzant action. The vasomotor centres are probably not depressed except in very advanced poisoning, nor are the pneumogastrics appreciably affected.

The tingling, numbness, and finally partial anæsthesia with muscular relaxation and loss of reflexes, are chiefly due to depression of the peripheral sensory nerves, and later the sensory cord. The motor cord is not depressed except in advanced poisoning.

The respiration is both weak and shallow, and has this peculiarity of a prolonged expiration. The weakness and loss of force in the respiration, are directly due to depression of the respiratory centres, while the long drawn-out expiration, followed by jerky inspiration, is probably due to depression of the afferent fibres of the pulmonary pneumogastrics.

The fall of body temperature is in a great measure due to the reduced force of the circulation; the clamminess of the skin or perspiration, is in part due to a reduced circulation, and in part probably due to an action directly on the secreting glands of the skin.

The convulsions may or may not occur in the late stages of fatal aconite poisoning, but when they do occur they are probably produced by cerebral anæmia.

The tingling and numbness which may occur in very large therapeutic doses, but which are always present in toxic doses, are *characteristic* of this poisoning.

Therapeutic uses: Aconite is first and foremost a circulatory depressant; in simple or excessive cardiac hypertrophy, in aneurisms, in apoplexy where it is desirable to reduce the force of the circulation, and in inflammations with excited circulation, as in pleurisy and in pneumonia; it is in fact useful to meet all the indications put down for veratrum viride. It is believed to be less serviceable in pneumonia to equalize the circulation than is veratrum viride, because veratrum viride is a vasomotor paralyzant, while aconite shares very little of this action.

Aconite has also been used in neuralgias when due to a cold, where it should be given in small doses, and rapidly repeated, until the full effects of the drug are felt. In irritative fevers of dentition or in reflex fevers from gastro-intestinal irritation in small children, aconite is of some use to reduce such rise of temperature. It is possible that it may reduce any fever of reflex origin by its depressant action on the peripheral sensory nerves, not allowing any reflex impulses to occur. As an antipyretic in the specific fevers, where it was at one time much used to reduce the temperature, it has probably no influence for good. In the vomiting of pregnancy, aconite is often of value when given in full doses, and it probably checks this vomiting by its anæsthetic action upon the sensory nerves of the stomach. It is oftentimes used externally, because of its local anæsthetic action, in liniments to allay peripheral pains, or to check local itching. It is sometimes combined with other remedies as a local application in cases of violent pruritus vulva.

HYDROCYANIC ACID AND CYANIDES.

Hydrocyanic or prussic acid is official as a two per cent. watery solution; dose 1, 3 to 5 drops.

The ordinary therapeutic dose of this acid has no appreciable influence upon the system; but when pushed beyond this, there is developed some depression of the heart and respiration.

Toxic Symptoms. An overwhelmingly large dose of this acid is capable of taking life in a few minutes, as it were, *by shock,* by producing a universal paralysis. When the quantity taken is less overwhelming, the symptoms are usually those of a labored, irregular respiration, unconsciousness, followed by violent epileptiform convulsions, the face is livid, with probably bloody froth about the mouth; the eyes staring, pupils

dilated, the pulse rapid and almost imperceptible, and death occurs from paralytic asphyxia.

Hydrocyanic acid poisoning can be confounded with poisoning from *nitro-benzole* both of which produce about the same symptoms and have the same peculiar odor. A probable post-mortem distinction may be made by exposing the corpse to an air current. If the case is one of hydrocyanic acid poisoning the odor will readily disappear, because the acid is very volatile; nitro-benzole, being non-volatile, the odor remains.

Treatment of Poisoning. Not much relief can be given by treatment in this poison, because it is too rapid in its action. Fatal cases usually die within ten minutes after the symptoms arise. When a person lives fifteen minutes, recovery will probably occur spontaneously. Only one case is on record in which death took place after thirty minutes from the time the first symptoms occurred. This fact would indicate that hydrocyanic acid is not only very rapid in its action, but is equally fugacious. It is probable that artificial respiration could give some relief, but stimulants, internally given, have not time enough to take effect.

Physiology. Hydrocyanic acid is universal in its depressant action; paralyzing the heart, the vasomotor centres, the spinal cord, the sensory and motor spinal nerves, the brain, and the respiratory centres directly. None of the higher tissues escape this poison. The cyanotic appearance of the face and its bloated appearance, with bloody froth about the mouth, are probably the outcome of the sudden complete asphyxia. The blood pressure behaves peculiarly; at first it rises very high and the pulse is very rapid, but again falls as suddenly, and the heart is arrested. This blood pressure rise is probably produced by the sudden asphyxia; indicating at the same time that the vasomotor centres are paralyzed later than either the heart or the respiration; for, to produce this momentary blood pressure rise, the vasomotors have to be intact.

The blood itself has a peculiar cherry-red color, somewhat resembling that of red ink. This is believed to be due to the combination of cyanogen with the hæmoglobin of the blood, forming a *cyano-hæmoglobin.*

Therapeutic uses: Hydrocyanic acid has a very limited use in practical medicine, both because it is fugacious in its influence, and because of its danger. It is,

however, used in gastralgia, where 3 to 5 drops can be given, repeated several times. Here its value probably depends upon its local anæsthetic action; for, like aconite, it depresses the peripheral sensory nerves of the stomach and produces local anæsthesia. It has also been used to check reflex vomiting in similar doses, but it is inferior to cocaine or carbolic acid. Locally externally it has been used to allay itching; and finally, it is used in cough mixtures to allay bronchial irritation and check the cough; but it is questionable whether it has any value for this indication. When it is given in conjunction with opium, it usually checks cough successfully, but when it is given by itself for the same purpose no appreciable effect can be noticed, and so the acid may get credit for what the opium does.

As a sedative to the circulation the drug is not used in practical medicine, although it is capable of depressing the heart in therapeutic quantities.

Cyanide of Potassium and Cyanide of Sodium are sometimes used in medicine to meet the same indications that hydrocyanic acid will fulfil. They are probably a little more permanent in their action but have no other advantage.

OXALIC ACID

Oxalic Acid, when internally used, is given in doses of 1/6 to 1/4 of a grain. In practical medicine it has only two legitimate uses: One is externally as an antiseptic or disinfectant to the hands in cleansing them for surgical work; the other therapeutic use is as an emmenagogue to promote menstruation. In large doses it can act as an abortifascient, but it should never be so used.

Toxic Symptoms. Oxalic Acid is important to the profession more as a poison than as a therapeutic agent. Like hydrocyanic acid, it is capable of acting as a paralyzant to the circulation and the entire nervous system.

The chief symptoms are those of nausea, vomiting, with intense pain in the stomach, rapidly extending over the whole abdomen, bloody purging, the heart becomes weak and rapid, respiration shallow, the urine bloody and suppressed, unconsciousness, followed by violent convulsions, and death due to respiratory and cardiac arrest. The chief lesions of this poisoning are the gastro-intestinal corrosion, the inflamed kidneys with fatty degeneration of the secreting cells, and the tubules of the kidneys

filled with oxalates. The oxalates in the kidneys are a *post-mortem characteristic* of oxalic acid poisoning. Oxalic acid, in one large dose may kill in a very short time; but even cases not immediately fatal, may subsequently result in death from an induced Bright's disease.

Treatment of Poisoning. Give the antidote, *lime*, either in the form of lime water, chalk, or unslacked lime. This is the only antidote. All the other alkalies form soluble oxalates with the acid, which are as poisonous as the acid itself, whereas the oxalate of lime is insoluble. The rest of the treatment should be conducted on general principles. To relieve the pain and vomiting, opium can be given hypodermically. Strychnine, digitalis, and alcohol can be used to support the respiration and the circulation.

ACETIC ACID.

Preparations. *Strong* or *glacial* acetic acid, and *dilute* acetic acid; dilute acetic acid contains five parts of water to one of the acid.

For internal purposes the dilute acid is used, and sometimes, in its stead, ordinary *cider vinegar* is substituted. The only legitimate internal uses for acetic acid are, to arrest hemorrhage from the stomach or hemorrhage from the intestines, and in post-partum hemorrhage from the womb; and can be used in the absence of lemon juice in cases of scurvy, but is inferior to it.

Cider vinegar differs essentially from the ordinary dilute acetic acid in the fact that it contains both acetic acid and *malic acid*, and is, therefore, more actively astringent than the official acetic acid, and is preferable to it for the arrest of hemorrhage.

Externally both vinegar and dilute acetic acid have been used over rheumatic joints and sprains, but their efficiency is somewhat questionable. A better external use for dilute acetic acid or vinegar, with subnitrate of bismuth, made into a paste, is in the treatment of sun-burns. This is efficient if applied soon after the scald has occurred.

Toxic Symptoms. The symptoms of poisoning by the strong acetic acid, are chiefly those of local irritation; pain, nausea, vomiting and purging, with collapse. These are followed by some depression of the heart and respiration.

The treatment consists in administering the antidote, an *alkali* or *alkaline carbonate*, such as soap, to neutralize the acid. The after-treatment consists in soothing the local corrosions.

TARTARIC ACID.

This acid is derived from grapes or from wine. It is less poisonous than acetic acid, but more irritant than citric acid. The symptoms of poisoning are those of local irritation, producing a gastro-enteritis. The treatment consists in the administration of the antidote, an *alkali*, and relieving pain.

Tartaric acid is freely used by pharmacists for the purpose of preparing tartrates, but in practical medicine, as an internal remedy, it has probably no good use, save only that it may be employed as a substitute for lemon juice in the treatment of scurvy, and may be used as an acidulous drink.

CITRIC ACID AND LEMON JUICE.

Citric acid is derived from lemon and lime fruits. The acid itself is chiefly used in making pharmaceutical preparations. *Lemon juice* and *lime juice* are preferred for medicinal purposes. The juices of these two fruits are in every known respect identical, and it is indifferent which is selected.

The best use in practical medicine for lemon or lime juice is as an *anti-scorbutic*. In this disease it acts both as a prophyllactic, and as a curative agent; second, it is employed to relieve hepatic torpor or biliousness occurring in hot climates, it being a stimulant to the liver. It has also been used in rheumatism, and as an acidulous drink in the sick room, as there are very few conditions which prohibit this use. Lemon juice differs in its therapeutic value from the pure citric acid, and is usually more efficient and reliable. Upon what this difference depends is not understood. In scurvy, where the juice is used in large doses, it sometimes produces nausea. This irritation to the stomach can, in part, be lessened by first heating the juice to a boiling point. Lemon juice is sometimes used as a vehicle, and especially is it most valuable when so used in the administration of citrate of potash, where it disguises the taste of the potash and renders it more agreeable to the stomach.

CHAPTER XI.

ASTRINGENTS.

The action of this class of remedies is chiefly local. Their properties are *astringent, styptic, irritant,* and *antiseptic.*

The difference between a *styptic* and an *astringent* is: a styptic coagulates blood and seals a bleeding vessel mechanically, whereas an astringent acts upon the vital tissues themselves, causing constriction and denseness of the structures.

All the astringents, classed as mineral and vegetable, are at the same time styptic, except *gallic acid* which is only astringent.

The general indications for these astringents are: To arrest local *hemorrhages,* to check excessive or morbid *secretions,* and to overcome undue local *relaxation.*

The **contra-indications** to these astringents are acute inflammations in their early stages; because all the astringents in concentrated form act as irritants, and some of them are active corrosive poisons. In the late stages of inflammations, when excessive secretion takes place, these astringents may be directly indicated.

The astringents, for convenience, can be divided into *vegetable* and *mineral* astringents.

VEGETABLE ASTRINGENTS.

They are: **Tannic Acid, Gallic Acid, Nutgalls, Catechu, Kino, Hæmatoxylon, Krameria, Oak Bark, Gallic and Pale Rose, Geranium, Rhus Glabra, Agaric Acid or Agaricin, and Hamamelis.**

These vegetable astringents depend for their activity upon the *tannic acid* they contain. In some of them it is present as a *gallo-tannic acid,* in others as a *kino-tannic acid.* Nutgalls, rhus glabra, and oak bark contain gallo-tannic acid; the rest contain chiefly kino-tannic acid.

Tannic Acid. Tannic acid is a non-crystalline substance, official as a *gallo-tannic* acid, and is derived from nutgalls. It is readily soluble in glycerin and water. The dose of it can be put down as from 3 to 10 grains. In over-doses

it is capable of producing local irritation with gastric discomfort, frequently followed by vomiting.

When it enters the stomach the great bulk of it is converted by the gastric secretions into a gallic acid. It is absorbed, circulates, and is ultimately eliminated as a *gallic acid.* Traces of tannic acid may be absorbed in part as a tannate of albumen, and in part as a tannate of sodium, but the great bulk of it is converted into a gallic acid.

Therapeutic uses: Being astringent, it becomes useful in diarrhœas with excessive secretions; in summer diarrhœas of choleraic type, and in excessive secretion from the kidneys. Externally it has been used in baths to check excessive cutaneous secretion, in colliquative sweats, and even in local excessive sweating in the armpits or about the feet. For the arrest of hemorrhages from the nose, from the throat, from the stomach, or even when used by spray, in hemorrhages from the upper air passages, and by enema in hemorrhages from the bowels, tannic acid is an astringent remedy of some value.

One of the important uses for tannic acid consists in its *antidotal* properties, in the treatment of poisoning from the alkaloids and tartar emetic. It is a very incomplete antidote to the alkaloids, forming tannates of the alkaloids which are less soluble, but not wholly insoluble, and, therefore, after this antidote is administered the stomach should always promptly be emptied, to prevent their being redissolved and absorbed.

Gallic Acid. Gallic acid is a derivative from tannic acid, produced by a process of fermentation. It differs from tannic acid in that it is not as actively astringent and irritant, and is not styptic. It can be used in doses of from 10 to 15 grains. When ingested, it enters the circulation as a gallic acid, and is eliminated by the kidneys unchanged.

Therapeutic uses: In medicine it can be used to meet the same indications for which tannic acid is applicable; remembering, however, the fact that it is less astringent and less active to arrest hemorrhages. When, therefore, a hemorrhage can be reached directly, *tannic acid* is the better of the two drugs to use; when the hemorrhage is such that you have to reach it through the medium of the circulation, *gallic acid* should be employed, because it does not undergo any change in the stomach and is absorbed more rapidly, it can be

given in larger doses, and acts more promptly. It is, therefore, most desirable in hemorrhages from the kidneys or in hemorrhages from the lungs, when they are to be reached through the medium of the circulation.

Nutgalls. These are the official source from which tannic acid in its free state is derived; but they are themselves official and can be used in doses of 5 to 20 grains in powder, to meet any of the indications common to the astringents. They have no advantages and a great many disadvantages over most of the other astringent remedies.

Catechu. Catechu depends upon the kino-tannic acid it contains for its entire activity. It is official as a *compound tincture,* in doses of 1 to 2 fluidrams, and in *troches,* each containing one grain. It is an active astringent, mostly employed in diarrhœas, where it should be combined with equal parts of paregoric and a drop of carbolic acid to each dose. In this combination it forms a very valuable astringent mixture in summer diarrhœas, or diarrhœas with a great deal of secretion and large watery stools.

Kino. Kino, like catechu, depends entirely for its activity upon kino-tannic acid, and is official as a *tincture;* dose, ½ to 1 fluidram. It is wholly confined in its medicinal use to the treatment of diarrhœas. It is a trifle more actively astringent, but at the same time more unpleasant to the palate than is catechu.

Hæmatoxylon. Hæmatoxylon or logwood, contains both kino-tannic acid, and hæmatin or *hæmatoxylin,* a crystalline principle which gives the drug a rather pleasant sweetish taste. It is therefore a little more pleasant to take than the rest of the astringents, and is often preferred in the diarrhœas of children. The presence of the hæmatoxylin is apt to discolor the stools of infants to a peculiar reddish color somewhat resembling blood, and may alarm mothers, thinking the infant is passing blood, when it is simply the discoloration produced by the drug. In adults, the combination of extract of hæmatoxylon, aromatic sulphuric acid, paregoric and syrup of ginger forms a very excellent combination for ordinary relaxing diarrhœas. Hæmatoxylon is official as an *extract;* dose, 5 to 20 grains.

Krameria. Krameria or rhatany is official as an *extract;* dose, from 5 to 10 grains; a *tincture,* dose, ½ to 1 fluidram; and *fluid extract,* dose, ½ a fluidram.

Of these preparations, the tincture is the most desirable when prescribed in the form of a liquid, and the extract, when given in capsules or pills. For its activity it depends upon gallo-tannic acid, and can be used in all forms of diarrhœa, except in the early stage of an acute intestinal inflammation.

Oak Bark. Both white-oak bark and black-oak bark are used in medicine, but the white-oak bark (quercus alba) is official. They depend entirely upon the presence of gallo-tannic acid for all their activity, and are employed for the purpose of making cheap astringent douches, washes and baths. When tannic acid is needed in large quantities for vaginal douches in leucorrhœas, for gargles, or for baths to check colliquative sweats, oak bark is the most available.

Gallic and Pale Rose. The preparations of these roses are not employed for their astringent properties. Although they contain traces of gallic acid, they are more used as vehicles and flavors, because of the presence of a volatile aromatic oil.

The preparations are: a fluid extract, a honey, a confection, a water (aqua rosa), and *cold cream* (unguentum aqua rosa). Of these preparations, the confection used as a pill-mass, the water as a vehicle, and the ointment or cold cream for local external application, are the ones employed with frequency in medicine. None of these preparations possess any therapeutic properties, but are merely employed for the pleasantness of their flavor and odor.

Geranium. Geranium is official as a fluid extract; dose, ½ to 1 fluidram; and is with many physicians a popular astringent in diarrhœas. It contains both gallic and tannic acids, and is rather certain in its action, but it has no other advantages to recommend it especially for this use.

Rhus Glabra. Rhus Glabra, or ordinary sumac berries, contain a large percentage of both tannic and malic acids. Because of the presence of this malic acid, in addition to the tannic acid, rhus glabra becomes a favorite astringent to use in gargles for ordinary sore throat. It is

official as a *fluid extract*, and when internally used it can be given in doses of ½ a fluidram. As an astringent gargle it should be combined with chlorate of potassium, glycerin, and water. This gargle can be used at frequent intervals in sore throats from colds, or in catarrhs of the throat. In so far as any astringent can be useful, this one will subserve as good a purpose as any that can be suggested. But gargles generally, can only be of service in such persons as are capable of allowing a gargle to get back into the pharynx and in direct contact with the inflamed part; and it is only a small percentage of individuals who are capable of doing this.

Agaric Acid. Agaric acid is derived from a parasitic fungus or moss, growing on the European larch. The crystalline acid itself can be used in doses of ¼ to ½ grain. More frequently, however, an impure extract, under the name of *agaracin* is employed, the usual dose of which is from 2 to 5 grains.

For this acid there are at present only two good uses in medicine: One is to arrest colliquative sweats or the *night sweats* of phthisis, in which case it probably acts like atropine, by paralyzing the peripheral nerves to the secreting glands. The other use is to render an *alkaline urine acid* in cases where the alkalinity of the urine tends to ammoniacal fermentation in the bladder, and a subsequent cystitis due to this fermentation. In this indication agaric acid may arrest the process by rendering the urine of a natural acid reaction, being itself eliminated by the kidneys as agaric acid.

Hamamelis. Hamamelis or *witch-hazel* is used as a fluid extract; dose, ½ to 1 fluidram.

Its activity depends on tannic acid, a resin and a volatile oil. Its influence is mainly astringent, due to the tannic acid it contains; but in how far the resin and volatile oil may modify or impart to its therapeutic virtues is not determined.

Therapeutic uses: This drug has the reputation with many clinicians of being superior to ordinary astringents, in hemorrhoids, and in varicose veins about the lower extremities, both as an internal remedy and locally applied. In relaxing diarrhœa it is a useful astringent. It is much used locally by the laity as an application to bruises,

sprains, and superficial inflammations; but here it probably has little value beyond the good the alcohol it contains may do.

Other Astringents. A few other vegetable and mineral astringents may be mentioned here, because they are valuable and very powerful astringents, but are, for other reasons, classed under different headings. They should be named here, however, because of their astringent properties and practical usefulness.

They are: *Acetic Acid,* ordinary Vinegar (which is a composition of acetic and malic acids), the *Solution of Perchloride of Iron,* the *Tincture of the Chloride of Iron,* the *Solution of the Subsulphate of Iron,* and *Sulphuric Acid.*

MINERAL ASTRINGENTS

The soluble salts of the mineral astringents, in concentrated form, are all violently irritant, antiseptic, and some of them are corrosive. In dilute form they are actively astringent, styptic and some of them sedative. The insoluble salts of these astringents possess most of the properties of the soluble salts in a less degree of activity. They are all poisonous, and take life either in part or entirely by causing gastro-enteritis.

They are: **Alumen** (*or Alum*), **Plumbum** (*or Lead*), **Bismuth, Cerium Oxalate, Zinc, Copper, Argentum** (*or Silver*).

ALUMEN (or Alum)

Alum is used in medicine either in the form of potash alum or ammonia alum; the former is official, while the latter is commercially more used because it is much cheaper. It exists as the ordinary crystalline alum, the dose of which, as an astringent, is from 10 to 15 grains; as an emetic to children, a teaspoonful; and to adults, a tablespoonful, which can be repeated if necessary.

Then we have the "dried alum" or alum exsiccatum, in which the water of crystallization has been driven off by exposing it to high temperature. This is much more irritant locally than is the crystalline alum, because it dehydrates the part with which it comes in contact. Locally, alum is astringent, irritant, and slightly antiseptic.

Toxic Symptoms. When taken internally in toxic doses, alum produces violent pain in the stomach, repeated vomiting, sometimes purging, followed by general collapse; and death occurs from toxic gastro-enteritis.

Treatment of Poisoning. This consists in promptly administering the antidote, washing out the stomach, and controlling the vomiting and purging by the use of opium; and the application of external heat if collapse occurs. The antidote is any *alkaline carbonate*, such as carbonate of sodium or potassium, and even ordinary soap can be used.

Therapeutic uses: Alum has been used internally to control colliquative diarrhœas of relaxation. It has been used to arrest hemorrhages from the stomach or from the intestinal canal, and as an emetic, but in this indication it is somewhat uncertain. When it acts it does so with promptness, but emesis does not always follow its administration.

The best uses for alum are for its local influence to arrest bleeding from the nose, bleeding from the lower bowel, where it can be used as an injection, and in bleeding from the mouth. Alum is both actively styptic and powerfully astringent. In ordinary pharyngitis and tonsilitis, it is sometimes used as a gargle, but this employment of it is hardly warranted, because it is injurious to the teeth. Externally, alum can be used with advantage in local sweating, in excessive perspiration under the arms, or about the privates, and in excessive or fetid perspiration of the feet. In excessive general sweating, as in colliquative sweats in consumption, alum can be used in the form of a bath or by sponging. It is sometime employed to stimulate granulating surfaces, and if applied in the form of dried alum powder, it is capable of acting as an escharotic, and is occasionally so employed to reduce exuberant granulations.

PLUMBUM (or Lead).

Of Lead we have two sets of salts, the *soluble* and the *insoluble*.

The soluble salts are the *acetate*, which is the one generally used in internal medicine, in doses of from 1, 3 to 5 grains. The *nitrate*, which is not used in practical medicine. The *subacetate*, official in the form of a solution of subacetate of lead (liquor plumbi subacetatis), known popularly as "Goulard's Extract." This latter salt is used mostly for external astringent purposes. Of these three salts, the nitrate is the most poisonous.

The insoluble salts are the *oxide* and the *carbonate*. The oxide of lead, or litharge, is mostly used for the purpose of

making lead plasters. The carbonate of lead is used almost entirely in the arts for the purpose of making paints, but it can be employed locally for the dressing of burns and scalds.

The local action of soluble lead is *astringent, sedative, irritant* and slightly *antiseptic,* but its sedative action predominates.

Therapeutic uses: The uses for lead in practical medicine at the present day are very limited. It is vastly more important to the profession as an accidental poison than as a medicinal agent; yet, it is used internally in diarrhœas, especially in dysentery, combined with opium and mercury in pill form. This use of it, at one time very popular, has now been replaced to a very great extent by the local treatment of dysentery with enemata. Lead poisoning, of a subacute type, can be produced by this use of lead, in prolonged or chronic dysentery. Indeed, I have myself seen this occur in two cases.

Externally, a solution of the subacetate of lead is most frequently employed combined with laudanum in the form of the so-called "lead-water and laudanum," over sprains and bruises to reduce swelling and inflammation. It is the astringent and sedative action of lead that is called into play in reducing such swellings. The chemical incompatibility in the preparation of lead-water and laudanum (the lead combining with the meconic acid of the opium forming an insoluble meconate of lead), does not seem to lessen its therapeutic value.

Lead Poisoning. Lead poisoning may, with advantage, be divided into *acute, subacute* and *chronic poisoning,* each of which has peculiarities and features for separate study.

Acute Poisoning. The symptoms produced by a toxic dose of one of the soluble salts of lead are: A sweetish metallic taste in the mouth, pain in the stomach radiating through the abdomen, nausea, violent and repeated vomiting of whitish curdy matter, due to a chloride of lead formed in the stomach with hydrochloric acid; usually diarrhœa, but occasionally constipation, depending on whether the irritant or the astringent action of the metal prevails; the stools are black, due to the sulphide of lead formed in the intestines with the sulphuretted hydrogen; neuralgic darting pains through the extremities, muscular cramps, finally depression of the heart and respiration, coma, collapse and death from gastro-enteritis. The *characteristic* symptoms of acute lead poisoning, are the *white* color of the matter *vomited* and the *black stools.*

Treatment. The treatment of acute lead poisoning is that of any of the metallic poisons. Give the antidote, wash out the stomach, administer opium, if need be, to control the pain, and support the patient with stimulants. The antidote should be either a *soluble sulphate*, such as sulphate of sodium or magnesium, or it can be a *soluble chloride*, as common salt, or dilute hydrochloric acid, forming a chloride of lead, or a *soluble carbonate* or lithiate, all of which precipitate the lead as an insoluble salt. Of these, the best antidote is a soluble sulphate, as sulphate of lead is the most insoluble salt.

Sources of Subacute and Chronic Lead Poisoning. The subacute and chronic form of lead poisoning do not come from the ingestion of single large doses, but rather occur where lead is insidiously entering the system in small quantities continuously. The most common sources for these two forms of poisoning are: First, *workers* in lead *factories* and *paint mills*. Second, *painters*, who are continuously exposed to the metal. Third, through *drinking water* conducted through lead pipes. Less frequent sources, but no less important, are the cases that come from *hair dyes*, *cosmetics*, *seamstresses* working in silks loaded with lead, and from *canned fruits* and fruits preserved in *earthern vessels*, the glazing of which contains lead.

Drinking water becomes contaminated with the metal when conducted through lead pipes, because all ordinary water contains a certain amount of di-oxide of carbon or CO_2, which converts the metal into a carbonate of lead, and the excess of CO_2 will finally convert it into a bicarbonate of lead. The carbonate of lead is only slightly soluble, but the bicarbonate of lead is freely soluble in water, and hence the ingestion of the poison when such water is used. Waters containing soluble *sulphates*, soluble *chlorides*, soluble *silicates* or soluble *lithiates*, will convert the lead in solution, into insoluble salts, and deposit it upon the sides of the lead pipe, which furnishes protection against contamination of the water. Hence, waters that are pure and free from these earthy salts, should never be conducted through lead pipes; whereas waters containing either one or several of these salts, are entirely safe to be conducted through lead pipes. A crude way to determine the presence or absence of these salts in a certain water to be conducted through lead pipes, is to throw a piece of new lead pipe into the stream from which the water is to be

taken, and allow it to remain there for a given time, to see whether such deposits are formed upon its inner and outer surfaces.

Symptoms of Subacute Poisoning. In what may be called a *subacute* form of lead poisoning the dominant symptoms are usually *gastro-intestinal*, whereas in truly *chronic* lead poisoning the lesions are most pronounced in the *nervous system*.

The symptoms are: Colicky pains centering around the umbilicus, obstinate constipation, the pulse wiry or corded, malaise, and general wretchedness, loss of appetite, heavily coated tongue, and, if of long standing, usually marked anæmia and jaundice, a *blue line* on the gums at their junction with the teeth, darting neuralgic pains, and "wrist-drop." These symptoms may or may not be accompanied by more marked involvement of the nervous system.

The colicky pains around the umbilicus are so located, because the cramps are mostly confined to the small intestines. It is to be distinguished from an ordinary "wind-colic" by the fact that in the latter the abdomen is distended and tympanitic, whereas in lead colic the abdomen is scaffoid, retracted and hard.

The corded pulse which is said to be present, may be due to the colic, the contraction of the intestinal walls, forcing the blood back into the general circulation. It is probable, however, that it is often a change in the bloodvessel walls or an arterial fibrosis, giving the pulse this tense character.

The constipation is in part the outcome of the intestinal spasm, and probably in part due to inactivity of the liver, for the liver is torpid, and the stools are of a clay color.

The *blue line* at the edge of the gums is itself *characteristic* of lead poisoning when it exists, but not in all cases of lead poisoning does it occur. It is most frequently observed in people who are careless with their teeth, and do not keep them clean. The particles of food lodging at the junction of the teeth with the gums, undergo decomposition and give rise to sulphuretted hydrogen, which penetrates the tissues and meets the lead in the blood, in the capillary loops of the gums, and there converts it into an insoluble sulphide of the metal and deposits it. It is this that gives the gums this bluish discoloration. In persons who keep their teeth very clean, and in persons having no teeth at all, this blue line is not to be observed.

The *wrist-drop* from lead poisoning is usually bilateral, although cases of unilateral wrist-drop from lead poisoning have occurred. However the most common cause for unilateral wrist-drop is a pressure palsy.

Chronic Lead Poisoning. In chronic lead poisoning of long standing, where the lead has entered the system in very small quantities but constantly, the nervous system, and not the digestive apparatus, suffers most severely. Any form of nervous disease or nerve lesion may be produced by this metal; and in making a diagnosis, where the history of the poisoning is obscure, the only suggestion that may lead to the discovery of the cause of the disease, may lie in the fact that the nervous diseases produced by lead, are often *atypical* in form.

Among the most common nervous diseases produced are: (1) tremors, resembling alcoholism; (2) chorea, which differs from other forms of chorea probably only in the fact that it is more obstinate to treatment; (3) epilepsy, with or without severe headaches and vertigo. This generally occurs when the lead has been used as a hair dye. (4) pruritus; (5) obstinate insomnia; (6) lead asthma, occurring most commonly in workers in lead who inhale the metal either in the form of dust or fumes; (7) anterior polio-myelitis, which may sometimes be distinguished from polio-myelitis due to other poisons, by the fact that when produced by lead, the sphincters of the bowel and bladder are usually paralyzed; whereas from other poisons or causes, they remain intact until very late in the disease; (8) loss of all sexual power and sexual desire; (9) multiple palsies; (10) in rare cases neuritis; (11) local or partial anæsthesia, associated with muscular atrophy; (12) *lead arthritis* occasionally occurs, closely resembling gout or inflammatory rheumatism; (13) internal strabismus, and amaurosis.

Nephritis of an interstitial type is very frequently present in chronic forms of lead poisoning. Albumen is not always present in traceable quantities, but microscopic examination will reveal the presence of casts and renal epithelial cells. In all cases where there is a doubt as to the presence or absence of lead poisoning, it is well to examine the urine for the metal.

Treatment of Poisoning. The treatment of chronic lead poisoning is first, to *cut-off* the *source* of the poison; second, to *relieve* the *symptoms*, such as the

colic and constipation; third, to *eliminate* the *poison* from the system; and fourth, to *repair* the *damage.*

To cut-off the poison, it is necessary to discover its source, and if that is impossible the patient should at all times be removed from the locality.

To relieve the colicky pains, opium and a full dose of belladonna should be employed for temporary relief, and attempts to open the bowels as promptly as possible, for more permanent relief. The constipation being so obstinate, it is well to start by giving a few repeated small doses of calomel, say, a grain every half hour until five grains are given. This is to be followed by a full dose of epsom salt, and at the same time giving a rectal injection to open the lower bowel. If this should fail to produce purgation, a resort to croton oil becomes necessary. The bowels should be kept open by the daily use of epsom salt, or some other active saline.

The advantage of salines over any other cathartic, depends in a measure upon the large watery stools they produce, which liquid is taken directly from the circulation; and it is to the degree that fluid is taken from the circulation that the watery stool aids in the elimination of the poison from the system. The further elimination of the poison can be enhanced by the administration of iodide of potassium, in doses of from 10 to 15 grains three or four times a day. This iodide combines with the lead in the circulation, as it does with every other salt of a metal, forming a soluble double iodide of lead, and thus aids in its elimination. The daily use of sulphur baths are used, and are probably serviceable.

The local palsies, the strabismus, and other lesions, usually yield very satisfactorily to treatment, by giving strychnine, pushed to its therapeutic limit, and the application of electricity and massage.

BISMUTH

There are two classes of the salts of bismuth, the *soluble* and the *insoluble.*

The soluble salts are the *citrate* of bismuth, the *ammonio-citrate* of bismuth, the *tartrate* of bismuth, and the *salicylate* of bismuth. These soluble salts of bismuth are very closely allied to each other in their local influences and therapeutic uses. The dose of each can be put down as from 5 to 10 grains. They differ from the insoluble salts, in that they are far more irritant,

more actively astringent, and more poisonous; producing, in toxic doses, violent and even fatal gastro-enteritis.

The insoluble salts are the *subnitrate* of bismuth and the *subcarbonate* of bismuth. These two salts are probably identical in their therapeutic effects and in their therapeutic value. The dose of each can be put down as from 10 to 30 grains for an adult, and for children proportionate doses.

Locally, the insoluble salts are *astringent, sedative,* slightly antacid and somewhat *antiseptic* to the digestive track, but they are free from irritant properties.

Physiology. When bismuth is taken in the form of subnitrate or subcarbonate, no constitutional symptoms follow single doses. It enters the stomach and intestinal canal, and there acts as a mild astringent, a mild antiseptic and somewhat sedative, and in the lower bowel it is finally converted into a sulphide of bismuth, giving rise to a black or greenish black color to the stools. Not sufficient bismuth subnitrate is absorbed or dissolved by the intestinal juices to produce any constitutional effects, unless in cases where bismuth is taken over a long period of time continuously. Where it is used locally externally as a desiccant powder in the dressing of burns and scalds, and remains in contact with a raw granulating surface, it is finally dissolved by the secretions of the wound and absorbed in sufficient quantities to produce what may be called *chronic bismuth poisoning.*

Symptoms. The symptoms of chronic bismuth poisoning from an insoluble salt like the subnitrate, are peculiar; dark spots in the mouth, the cheeks, on the palate, and about the gums, followed by ulceration and ptyalism; the stomatitis and salivation constantly increase, and there is a peculiar garlicky odor to the breath, probably produced by the thalium contained in the bismuth; an obstinate diarrhœa of large watery stools, albumen and tube casts in the urine, as an evidence of nephritis.

The salivation and obstinate diarrhœa, with nephritis, are evidence of local irritation by the bismuth at the points of elimination,

Therapeutic uses: Bismuth subnitrate, being free from irritation and rather soothing to inflamed mucous membranes, becomes useful in the treatment of *inflammations of all mucous surfaces.* It can be used in ordinary stomatitis

in children, in acute coryza, in acute gastritis and gastric ulcer, where it soothes the inflamed stomach and at the same time acts as an anti-emetic, when there is vomiting associated with the gastric irritation. In all cases of gastritis or gastric catarrh and in gastric cancer, the bismuth should be given on an empty stomach, and can often be associated to great advantage with a little opium and carbolic acid. In enteritis, acute or subacute, bismuth can be used, and is probably best given an hour or two after eating. In acute colitis or dysentery, bismuth can be used by the mouth, but it is more efficient when thrown directly into the bowel. In the treatment of sun-burn, a paste made of bismuth and dilute acetic acid or vinegar, and applied shortly after the sun-burn has occurred, is probably its most efficient treatment. It has formerly been used as an injection in acute gonorrhœa to soothe the inflammation in the early stages.

Other Bismuth Salts. Recently a series of bismuth salts, combined with organic acids, have been introduced into medicine to replace the older inorganic preparations; claiming that they are more actively antiseptic and disinfectant to the gastro-intestinal canal.

They are: *Bismuth napholate,* under the name of "Orphal," containing 80 per cent. of bismuth and 20 per cent. of batanaphtol; *bismuth subgallate,* and *bismuth phenolate.* They are especially recommended to arrest fermentation or septic processes in the digestive tract in summer diarrhœas, typhoid diarrhœa, tubercular diarrhœa, diarrhœas of fermentation, and subacute or chronic gastric catarrh, depending upon fermentation.

These preparations of bismuth can be given in doses of 5 to 15 grains to adults, and to children in 1 to 3 grain doses.

CERIUM OXILATE.

Cerium Oxilate is a white, tasteless powder, soluble in mineral acids. In its medicinal value it resembles bismuth subnitrate very closely, and is of some value to check reflex vomiting of pregnancy and vomiting of gastric irritations. It should be given in pills, in doses of 3 to 5 grains on an empty stomach.

ZINC.

Here we have again the two classes of salts, the *soluble* and the *insoluble.*

The soluble salts are the *sulphate* and the *acetate,* but only the sulphate is now official. The two salts are identical in their

therapeutic uses, and the dose can be put down, as an astringent, from 1 to 3 grains; and as an emetic from 10 to 30 grains. The soluble salts of zinc are locally *astringent* actively *irritant* and slightly *antiseptic.*

Insoluble Salts. The *Oxide* and *Precipitated carbonate* of Zinc are insoluble in ordinary menstrua. They are used mostly for external applications in the form of official Zinc ointment or as a desiccant powder. The combination of the precipitated carbonate of zinc, subnitrate of bismuth, Boric acid, a little Calomel, and starch, form a most valuable desiccant powder to treat "heat scalds" that occur in fat babies about the privates, under the arms, or about the neck.

Toxic Symptoms. A toxic dose of a soluble salt of zinc produces violent gastro-enteritis with all its concomitant symptoms: Nausea, violent vomiting, purging, pain in the abdomen, with general collapse, and death from toxic gastro-enteritis.

Treatment of Poisoning. The treatment of poisoning consists in the administration of the antidote, *soap* or some other *alkaline carbonate,* converting the zinc into an insoluble carbonate; washing out the stomach and treating the symptoms as they arise.

Therapeutic uses: Sulphate of zinc can be used as an astringent in diarrhœas, but it is not a valuable remedy. As a stimulant emetic, where it is desirable to empty the stomach promptly, it is one of the best; as an injection in subacute and chronic gonorrhœa, it is constantly used; in ordinary leucorrhœa, injections of zinc are capable of doing a great deal of good.

The Oxide of zinc is a valuable remedy in the treatment of chronic diarrhœa, given in 3-grain doses in pills.

COPPER

Copper is official only as a Sulphate. Internally the dose is, as an astringent, from ¼ to ½ a grain; as an emetic, 3, 5 to 8 grains.

Locally, sulphate of copper is astringent, violently irritant, corrosive, and antiseptic.

Toxic Symptoms. After the ingestion of a toxic dose, there is intense pain in the stomach, followed by vomiting of greenish matter, purging, at first the contents of the intestines, then the mucous and blood; the extremities become cold, unconsciousness, preceded by delirium, and probably followed by convulsions; respiration and heart become weak; pain in the back, bloody urine, which finally becomes suppressed, and death follows from gastro-enteritis. Gastro-enteritis dominates in this poisoning, but there is also direct depressant action upon the central nervous system, the circulation and the respiration.

Treatment of Poisoning. The best antidote for copper is *yellow prussiate of potassium;* but eggs, milk, or any other albuminate, act as an antidote; even alkaline carbonates, like soap, can be used. Wash out the stomach, maintain the body temperature, give opium to relieve the vomiting and pain, and strychnine and digitalis to support the heart and respiration.

Chronic Poisoning. Injurious effects from the use of copper in canned vegetables, for the purpose of retaining their green or natural color, has been investigated in Europe and in this Country with negative results. No harm traceable to it has been discovered; but cases of chronic copper poisoning have occurred amongst those who work in copper factories, and who are exposed to the metal and to its salts in various ways. In these cases the reported symptoms are closely allied to a chronic poisoning from any other salt of a metal. The symptoms are chiefly those of the nervous system; chorea, muscular tremors, wrist-drop, neuralgias, local palsies and the like. The treatment, like that of lead poisoning, consists in cutting off the source of the poison, and aiding the elimination of such as may be stored up in the general system.

Therapeutic uses: Copper is more important to the physician as a toxic agent than as a therapeutic aid. As an emetic, it has been used and can be used, but it is more dangerous and no more efficient or certain than either zinc or mustard. As an astringent in diarrhœa and in hemorrhage, it is far inferior to other and more safe remedies; so that it has, for good reasons, practically dropped out of use. In phosphorus poisoning it still subserves the uses of an antidote, and can be employed both as an emetic and an antidote. It is

sometimes used by the surgeon in the form of powder as an escharotic, to reduce exuberant granulations.

ARGENTUM (or Silver)

Of Silver we have the two salts, the *Nitrate* and the *Oxide.*

The oxide of silver is an insoluble salt, and is at present very rarely used in medicine. Its dose, if at all employed, is from ½ to 2 grains.

Silver nitrate, the preparation which is almost exclusively employed in medicine, we have in two forms: the *Crystal*, and the *fused* or *stick silver*, commonly spoken of as lunar caustic. The crystal alone is employed for internal use; the dose is from ¼ to ⅓ of a grain. The stick or fused nitrate of silver is exclusively employed for local caustic purposes.

Locally. When applied in dilute form, nitrate of silver acts as an *astringent*, as an *antiseptic*, and distinctly as an *alterative.* In concentrated form it is an *irritant* and *caustic*, or mild escharotic. Its caustic or escharotic action depends entirely upon its combination with the albumen of the tissues, forming an insoluble albuminate of silver. It is, therefore, a very superficial caustic, limiting its own action by the hard albuminous clot which it produces.

When internally administered, nitrate of silver probably combines with the peptones in the stomach and intestines, and is absorbed and enters the circulation as a *peptonate of silver.*

Toxic Symptoms. When taken in toxic doses, nitrate of silver produces two distinct classes of symptoms: *Gastro-intestinal*, the outcome of local irritation; and *cerebro-spinal*, the outcome of its action on the central nervous system.

The gastro-intestinal symptoms are, pain in the stomach radiating over the abdomen, vomiting and purging. The matters vomited and the stools may be of *grayish brown* color, due to the oxide of silver, after conversion by the gastric and intestinal contents; or, if the stomach be empty, the matters vomited may be curdy *white*, due to the chloride of silver produced in the stomach by the free hydrochloric acid.

The cerebro-spinal symptoms are those of headache, dizziness, delirium, unconsciousness, followed by epileptiform convulsions, depression of heart and respiration, and finally death from paralysis of the respiratory centres.

Somewhat *diagnostic* of acute silver poisoning, are the presence of the peculiar color of the matters vomited, and the whitish stains of silver about the mouth and throat. When it is brought in contact with the mucous membranes or cutaneous surfaces, the stain is milky white, due to the formation of albuminate of silver. When this is exposed to light for a time, the albuminate is slowly reduced to an oxide, producing a brownish or black stain.

Treatment of Poisoning. In treating acute silver poisoning, the antidote, *common salt*, or any soluble chloride, or even dilute hydrochloric acid, should at once be given; the stomach should be emptied, and then the general symptoms treated. Opium can be given to relieve the pain; strychnine and cocaine should be used freely to support the respiration.

Chronic Poisoning. Chronic silver poisoning, or the condition known as "argyria," has been produced formerly, when silver was still employed extensively in the treatment of general nervous diseases, where the drug was given for a long period of time constantly. It consists in the production of a brownish or slaty discoloration of the mucous membranes of the eyes, mouth, nose and internal organs, and then extends over the skin. It may be in spots or become general. This discoloration is due to the deposit of silver in the tissues, probably in part as the metal itself, and probably in part as an oxide. When this discoloration occurs, it is most likely to be permanent, and cannot be relieved by any treatment. A safeguard against this misfortune, where silver is used continuously, can be had by watching the mucous membrane of the mouth, which is said to show the discoloration before the skin becomes involved.

Therapeutic uses: At the present time silver is employed almost exclusively for its *local effects* both internally and externally. Its use in general nervous diseases is happily a thing of the past, and there are now very few physicians who so employ it. Locally, its service and value depend more upon its antiseptic and alterative influence than any other local property it possesses.

It is useful as a caustic, to reduce excessive granulations, and to cauterize ulcers and chancres; but as a caustic in punctured poisoned wounds, as bites from dogs and cats, or stings from poisonous insects, it is too superficial in its effect to be of any value, and besides, it seals the wound with an impervious clot of

albuminate of silver, so that no other remedy can penetrate to counteract the poison. At present its greatest service is its employment in catarrhal inflammations of all mucous membranes. In granular conjunctivitis, in the treatment of chronic catarrhs of the nose, in ozena, in urethritis, especially that of specific character; in gonorrhœa it can be used at any stage of the disease, depending upon the strength of the solution employed.

It is of very great service in affections of the digestive tract; in the mouth and throat, when there is ulceration, such as aphthous ulcers about the mouth, and in follicular tonsilitis. In ordinary pharyngitis, in the acute stage, silver nitrate should be used by direct application to the inflamed part with a camel's-hair brush. The strength of the solution thus employed can vary from 20 to 60 grains of silver to the fluidounce.

In the stomach it is useful for the treatment of gastric ulcers, and even acts as a palliative in gastric cancer. It is the most useful remedy at our command in subacute and chronic gastric catarrh, or so-called "acid dyspepsia." Here it should be given in pill form, about an hour before the meal, so that it gets into the stomach when empty. It has been suggested that in this affection, the silver should be preceded by an alkali to neutralize the free acid which may be present, and protect the silver against its conversion into a chloride. This is of no avail; for the presence of the alkali will convert the silver nitrate into an oxide, which is equally inert and insoluble with the chloride.

It is difficult to administer silver internally without having some, or even all, of it converted into an insoluble compound before it can produce its effects; for silver nitrate is reduced by all known organic substances. If it be put into capsules, the capsules, before the silver is released, will reduce it. To give it in solution, a part or all of it is likely to come in contact with the mucous membranes in passing to the stomach, and is converted into an albuminate of silver on its way. If it be given in an emulsion, it is likely to be reduced by the acacia before the patient takes it; but administered in pill form, using manna as a pill mass, it has probably the greatest chance of getting into the stomach as a nitrate. It should, therefore, always be given in pills, made in such a way that the silver nitrate shall not go into solution in making the mass.

In affections of the small intestines, silver is of doubtful value, because very little of it will run the gauntlet of the stomach without being reduced into an insoluble compound; but

in affections of the large intestines, like dysentery, where silver can be thrown into the bowel directly, it is of great service. In chronic dysentery, with dysenteric ulcers in the large bowel, an injection of nitrate of silver, of the strength of 1 to 2 drams to a half gallon of water, may be of great service. If such an injection fails to be expelled in due time, it must be followed by an injection of a common salt solution, to reduce the silver and prevent poisoning.

CHAPTER XII.

TONICS.

These mineral tonics, for convenience, can be subdivided into two classes: The *Iron preparations* on the one hand, and the *Mineral acids* on the other.

The *Iron preparations* are tonics to the circulating medium or the blood, and are therefore spoken of as ferruginous or *chalybeate tonics.*

The *Mineral acids* are tonics to the digestive tract, and its accessory organs, through their influence upon the secreting glands of the stomach, the intestines and the liver, increasing these secretions by direct stimulation.

The Iron preparations that are used in practical medicine have some properties which are common to them all: First, they are all *chalybeate* in their influence; second, they are all somewhat *astringent;* third, in concentrated form they are all somewhat *irritant;* and fourth, some of the preparations of iron sharing these common properties, have, besides, qualities which are *peculiar to themselves.*

We can therefore divide, for therapeutic purposes, all the preparations of iron into three classes, based upon their *dominant* action.

First, the *chalybeate* preparations, or those whose dominant therapeutic action is *ferruginous.*

Second, the *astringent* preparations, or those whose dominant therapeutic action is *astringent;*

And, third, the *preparations of peculiar properties* which being both astringent and chalybeate, but have properties peculiar to themselves, hereafter to be specified.

This is by no means a scientific classification, but one which is very convenient for study, and which is based wholly upon their practical application, and dominant therapeutic action in practical medicine.

The influence that iron has upon the animal economy is not well understood. It is known that iron, when ingested, is slowly absorbed from the intestinal canal and enters the circulation; and that after a period of time it is again eliminated, chiefly by the intestines and the kidneys; but what influence it has, and how it produces its effects while in the system, is not clearly demonstrated. One of the chief therapeutic properties of iron is its ferruginous influence upon the blood, and on that account one of its *greatest uses* is the indication of *general anæmia;* but how it relieves anæmia is somewhat problematical. It may do so by directly stimulating the blood elaborating organs, or it may do it by imparting iron to the hæmoglobin of the red blood corpuscles themselves, or it may have both these effects; but the practical usefulness of iron rests as yet almost wholly upon an empirical basis.

CHALYBEATE PREPARATIONS.

The chalybeate preparations are those which have their chief influence upon the blood itself and upon the blood-making organs. Their greatest therapeutic indication, therefore, is *anæmia,* and are *contra-indicated* in plethora.

In this group of iron preparations the astringent property is the least marked, while the ferruginous property dominates.

They are: **Reduced Iron** (ferrum reductum), **Saccharated Carbonate of Iron,** the **Citrate,** the **Tartrate,** and the **Lactate of Iron.**

Reduced Iron. The Reduced Iron or "*iron by hydrogen*" is insoluble in ordinary menstrua, and is always given in pill form; dose, 1, 3 to 5 grains. It is one of the valuable tonics to overcome anæmia.

Saccharated Carbonate of Iron. The Saccharated Carbonate of Iron is also insoluble, and can be given in pill or lozenge form, in doses of 3 to 5 grains. It is probably the most reliable of this group for general use in anæmia.

The Citrate, Tartrate and Lactate of Iron All of these are soluble in water, and comparatively free from astringent properties, are excellent preparations to use in cases of anæmia where pills cannot be taken. They can be given in doses of from 3 to 5 grains.

"Blaud's Pill" is prepared from dried sulphate of iron and carbonate of potassium, of each 2½ grains to each pill. The carbonate of potassium converts the sulphate of iron into a protocarbonate in the process of making the pill, and is, therefore, a good chalybeate pill in the treatment of anæmia.

Anæmias. To coadjust the iron preparations to their use in anæmias, it is well to classify anæmias as they occur to the physician at the bedside.

First, we have the *essential anæmias*, of which pernicious anæmia and chlorosis are types.

Second, we have the *dependent* or *accidental anæmias*, or such forms of anæmia as depend entirely upon other diseases for their existence.

Of the latter class, we have anæmia due to *hemorrhages* or loss of blood, anæmia due to *starvation*, anæmia due to chronic *wasting diseases*, like pthisis, cancer, chronic diarrhœa, nephritis, or chronic suppurations; and anæmia due to *poisons*, such as anæmia following chronic malaria, and chronic lead poisoning, and anæmias following all forms of bacteritic toxines.

In these *accidental* anæmias, the chalybeate preparations of iron are the most applicable, and will materially aid in removing the anæmia, but only in so far as the cause of the anæmia, or the disease upon which it depends, can be removed or cured. If the disease can be cured, iron will relieve the anæmia; if the disease is incurable, as in phthisis, cancer, or chronic Bright's disease, iron is of no value to relieve the anæmia, and has no effect upon it.

In chlorosis, the iron preparations are the best remedies we have; but they should always be combined with small doses of arsenic to obtain their best effects. In pernicious anæmia, they

are probably of no value, and if anything, they may do harm. If there be any drug to which pernicious anæmia may yield, it is to the bold use of arsenic.

ASTRINGENT PREPARATIONS.

The astringent preparations of iron are those whose *dominant* action is astringent, although they possess chalybeate properties.

They are: **Sulphate of Iron, Solution of the Subsulphate of Iron**, or "Monsel's Solution," and the **Perchloride of Iron.**

Sulphate of Iron. The sulphate of iron is used, usually, in the form of a *dried* sulphate, and is given in pill form; dose, 1 to 3 grains. It is actively astringent and ferruginous, and in large doses it is irritant.

It can be used in cases where it is desirable to combine both astringent and chalybeate effects, as in chronic diarrhœa with anæmia, where you have its astringent action arresting the diarrhœa, and its chalybeate action relieving the anæmia.

Subsulphate of Iron. The solution of subsulphate of iron, or "Monsel's Solution," is exclusively used as a styptic to control hemorrhages — hemorrhages from the stomach, hemorrhages from the bladder, hemorrhages from the nose and throat, hemorrhages from the womb, and hemorrhages from the intestines. It is of all the iron preparations the most actively astringent and styptic.

In hemorrhages from the stomach, it is best given in dilute solution; dose, from 5 to 15 minims. In hemorrhages from the intestines, it may be better to give the crystal in capsules, in the hope of reaching the intestines without its undergoing solution in the stomach.

In overdoses, subsulphate of iron is an active irritant poison, producing nausea, vomiting, and purging, with collapse. Its antidote is any soluble alkaline carbonate, or soap.

Perchloride of Iron, or its solution, is more astringent than the sulphate, but less so than the subsulphate, and is not very often used in medicine. It is not a desirable chalybeate preparation, because its astringent and irritant influence bars its free use.

PREPARATIONS HAVING PECULIAR PROPERTIES.

These are preparations of iron which are both astringent and chalybeate, but each one has a property peculiar to itself.

They are: The **Tincture of the Chloride of Iron**, the **Iodide of Iron or Syrup of the Iodide of Iron**, the **Hydrated Sesquioxide of Iron** and **Dialyzed Iron.**

Tincture of the Chloride of Iron. The tincture of the chloride of iron is actively astringent and chalybeate in effect, but it is besides a very active *diuretic.* This diuretic action probably depends upon the presence of *hydrochloric ether,* which is formed from the action of hydrochloric acid upon the alcohol in the process of preparing this tincture; and the preparation is *peculiar* because of this diuretic influence. The dose of it is from 5 to 20 drops, freely diluted.

Therapeutic uses: The tincture of the chloride of iron is used in erysipelas, Bright's disease, diphtheria, scarlet fever, chronic suppuration, and in anæmia.

In *erysipelas* it acts almost as a *specific;* but to secure its full value, it must be given in a very bold manner. From 15, 20 to 30 drops freely diluted in water, should be given every one or two hours if the stomach will bear it. Unless it is given in as large doses as the stomach will retain, it will have little effect upon erysipelatous inflammations.

In chronic *Bright's disease,* and even in the acute type, especially if it be of catarrhal form, the tincture of the chloride of iron is capable of doing as much good as any remedy we have; but in this affection, it is not so much the large doses, as it is the length of time during which the drug is constantly being used, that it proves to be superior in its influence for good.

In *anæmia* of all kinds, the tincture of the chloride of iron is one of the most efficient ferruginous preparations of iron we have; but it has the disadvantage of producing constipation and headache, due to its astringency, unless a laxative be associated with it to keep the bowels regular.

In *diphtheria* and *scarlet fever,* the tincture of the chloride of iron is very much used by the profession. It certainly has some direct valuable influence upon these diseases, but how it affects them we do not know; nor do we know how it affects erysipelas,

and yet clinical evidence is too strong to deny that it has direct influence upon this disease. In diphtheria and scarlet fever it is also valuable to maintain a free action of the kidneys, and thus prevent the possible subsequent Bright's disease which is apt to follow these two diseases. But here, as in erysipelas, this iron preparation must be used very freely to derive any benefit from it.

In *chronic suppurations*, chronic abscess formations with anæmia and emaciation, or in pustular eruptions of the skin with anæmia, the tincture of iron constantly used, in as full doses as can be tolerated, is a remedy that has no superior. It is a noticeable fact, that the tincture of iron given in moderate doses, like the other astringent preparations of iron, is liable to produce headache with irritability of the stomach, from an induced constipation. But when it is given in very full doses, and the doses rapidly repeated, there is usually occurring a looseness of the bowels, but without irritation and without disturbance of the digestion.

The tincture of iron is often used as a gargle in ordinary sore throat; but this employment of it should be condemned, on account of its very great destructiveness to the teeth. When it is used in any kind of tonsilitis, it should always be applied with a brush. When internally administered for any purpose, it should always be with *specific directions* that it should be taken through a glass tube, so as not to come in contact with the teeth.

Iodide of Iron. The Iodide of Iron in 1 to 3 grain doses, or the Syrup of the Iodide of Iron, which is a more pleasant preparation, in doses of 15 minims to a fluidram, are very extensively used in scrofula with anæmia; in scrofulous bone diseases in children, in rickets, in scrofula with enlarged lymphatic glands, with or without suppuration. In all of these scrofulous affections the Iodide of Iron, or its syrup, is of some service, and has the *peculiar* action and therapeutic effect of a *ferruginous alterative.*

In adults it is probably better to give the iodine and the iron separately, so that they may be proportionate and in conformity to the needs of the patient; while in children the Syrup of the Iodide of Iron may be preferable.

Hydrated Sesquioxide. The Hydrated Sesquioxide of iron is *peculiar*, because it is used as an *antidote* in *arsenic poisoning.* It combines with arsenious oxide

and forms an insoluble arsenate of iron. In the use of this as an antidote to arsenic, there are two imperative conditions to be observed: First, that it is *freshly prepared;* second, that it is given in *excess.* It must be freshly prepared, because it will not act as an antidote when it has been of long standing; and it must be given in excess, because it does not combine with arsenic in any other than that relation.

This antidote can be prepared from a solution of perchloride of iron or from the tincture of the chloride of iron, with an alkali like ammonia, sodium, potassium or magnesium. Officially, it is precipitated with magnesia, since the magnesia in excess is itself slightly antidotal to arsenic and is itself not irritant. It is known as *ferrum oxidum hydratum cum magnesium* or "antidotum arsenisi."

Dialyzed Iron. Dialyzed iron is of no value in general medicine, or in the treatment of anæmia, because it is not absorbed, but remains in the intestinal canal as so much inert foreign matter. But in the absence of the hydrated sesquioxide of iron, or the ingredients from which it is prepared, the dialyzed iron can be used as an antidote in arsenic poisoning. It acts as an antidote only to the extent that it is reduced in the stomach into a hydrated sesquioxide, and is, therefore, uncertain.

Other Preparations. Phosphate of iron, the Lactate of iron, and the Bromide of iron, are all preparations that can be used in 5 grain doses, and have the properties which belong to the ferruginous tonics, but they have no special advantage over those which have been discussed.

The different salts of iron combined with the alkaloids, that are sold in the drug stores, cannot be recommended. Iron combined with the alkaloids and other tonic substances is oftentimes a very useful tonic, but the proportions in which they are needed is so constantly changing, in each individual case, that it is best that they should be combined by the physician at the time, and for each case in which he wants to use them.

All the iron preparations, when freely administered, are apt to produce by their astringency, constipation, headache, and irritability of the stomach; and in persons with a rheumatic diathesis, the iron preparations are sometimes *contra-indicated,* because they seem to have a tendency to produce rheumatic relapses. The black stools that follow the free use of iron are

partly due to a tannate of iron produced in the small intestines, and in part due to a sulphide of the metal, formed in the large intestines, by combining with the sulphuretted hydrogen of the lower bowel.

Ferratin. Under the name of *ferratin* or *hæmatoyen*, various proteid compounds containing iron, in organic combination have recently been introduced into medicine, to replace the older iron preparations. These substances can be derived from eggs, liver tissue, and animal blood.

It is claimed that they are freely absorbed and are superior to the inorganic iron compounds in medicinal usefulness, but this lacks clinical proof.

Manganese. Manganese Sulphate and Manganese Oxide have both been suggested to use in anæmia, in place of iron, or as an adjuvant to iron. They have, however, not gained clinical confidence nor clinical endorsement.

MINERAL ACIDS.

The mineral acids are: **Sulphuric Acid, Nitric Acid, Nitro-hydrochloric Acid, Hydrochloric Acid** and **Phosphoric Acid.**

These mineral acids have some physiological and toxic properties in common:

First, They are all violent local irritants and corrosive poisons.

Second, They all produce death by a toxic gastro-enteritis and nephritis.

Third, The *antidote* for them all is the same, viz: soap or any other alkali or alkaline carbonate, as soda, potash, ammonia and the like.

Poisoning by these mineral acids are to be distinguished from each other, by the different colored stains they produce when they come in contact with animal and vegetable tissues: Sulphuric acid stains *black;* nitric acid, a *deep yellow;* nitro-hydrochloric acid, a shade *lighter yellow;* and hydrochloric acid, still *lighter yellow.*

SULPHURIC ACID.

Preparations. Of Sulphuric Acid we have the *concentrated*, the *dilute* and the *aromatic*.

The concentrated sulphuric acid is rarely used in internal medicine, but it can be given 1 to 3 drops *freely diluted*. It is, however, more used externally as a caustic.

The Dilute sulphuric acid is of 10 per cent. of strength, and is given in doses, of 5 to 15 drops.

The Aromatic sulphuric acid is of 20 per cent. strength, and contains aromatics which give pleasantness to the taste. Its dose is from 5 to 10 drops.

Toxic Symptoms. A single toxic dose of sulphuric acid produces violent pain in the mouth, throat and stomach, extending over the abdomen, intense retching and vomiting of black tarry matter, purging of bloody stools streaked with black, the urine at first is bloody, then suppressed; and finally death in collapse from gastro-enteritis. This poison may prove fatal even a number of days after the poisoning has occurred, from a superinduced nephritis, or perforation of the stomach or intestines.

The post mortem lesions after this poisoning are, the evidences of corrosion and the destruction in the mouth and stomach, the inflammation of the intestines and kidneys, and the black marks about the mouth.

The treatment of the poisoning consists in the administration of the antidote, any *alkali* or *alkaline carbonate*, the free use of opium to relieve pain, and the maintaining of body temperature.

Characteristic of this poisoning are the black stains that may be found about the person or clothing. They are produced by charring or dehydrating the tissues and leaving behind the carbon.

Therapeutic uses: Since the dominant therapeutic action of sulphuric acid is *astringent*, it becomes especially useful in colliquative diarrhœa, in summer diarrhœas of choleraic origin, and in true Asiatic cholera. In its relation to cholera it acts both as a *prophylactic* and as a *curative* agent. It can be used to arrest excessive sweating in phthisis. As a tonic to the gastro-intestinal canal it is of little value, although it has been much employed for this purpose. Externally it has been employed as a caustic to destroy gangrene and venereal warts,

NITRIC ACID.

Of Nitric Acid we have again the *concentrated* and the *dilute*. The concentrated is more used locally as an escharotic; the dilute, which is of 10 per cent. strength, can be used internally in doses of 5 to 15 drops.

Locally, as an escharotic, nitric acid is more used than any other mineral acid, for the destruction of warts, chancres, and gangrene. When a saturated solution of concentrated pure nitric acid and cocaine is made, it can be used for the destruction of warts without inflicting any pain, the cocaine producing complete anæsthesia as rapidly as the acid will destroy the tissues.

Toxic Symptoms. As a poison, it produces symptoms identical with those of sulphuric acid poisoning; namely, violent gastro-intestinal corrosion, with pain, nausea, vomiting, collapse, and death from gastro-enteritis. Relief is to be given by the administration of an antidote, any *alkali* or *alkaline carbonate*, and thereafter treating the general symptoms.

Therapeutic uses: Nitric acid is less astringent when internally given, than is sulphuric acid; but it is distinctly more of a stimulant tonic to the gastro-intestinal canal and to the liver, increasing the secretion of intestinal juices and of bile. It can, therefore, be used in atonic dyspepsia, in hepatic congestion and hepatic torpor; but for any of these indications it does better when it is combined with some bitter stomachic.

NITRO-HYDROCHLORIC ACID.

Nitro-hydrochloric Acid is made by combining 9 parts of nitric acid with 41 parts of hydrochloric acid. The mixture should stand uncorked until the reaction has taken place, which takes from 3 to 10 hours. This is not a mixture of the two acids, but there is a true chemical change, which is, however, very unstable.

When freshly prepared, it is of a deep orange or mahogany color, which, on standing for a time, becomes more of a lemon yellow, and finally the color wholly disappears, as the decomposition into its component elements progresses. This decomposition is hastened by *heat* and *light;* and it is, therefore, important that this acid should be kept in a dark bottle, and in a cool place. It is therapeutically most active when it is *freshly prepared*, and

is of a mahogany or orange color. Its usefulness and activity diminish in proportion as its color fades.

Of this acid we have official, the *dilute*, of 10 per cent. strength, and the *concentrated*. The concentrated can be used in doses of 3, 5 to 8 drops freely diluted at the time of administration. The official dilute is an ineligible preparation, and is not a nitro-hydrochloric acid, but merely a mixture of the two component acids; for, in the presence of water, this acid decomposes on standing, into a mixture of nitric and hydrochloric acids.

As a toxic agent, it produces the symptoms common to sulphuric and nitric acids, the same gastro-intestinal and renal irritation, with general collapse, and kills by gastro-enteritis.

Therapeutic uses: As a gastro-intestinal and hepatic stimulant tonic, nitro-hydrochloric acid is of all the mineral acids the most valuable. In Oxaluria it acts as a specific; in hepatic torpor or biliousness, in catarrhal jaundice, and even the early stages of hepatic sclerosis, this drug is one of the most valuable cholagogues. In gastro-intestinal torpor, and in the lack of appetite during convalescence from acute diseases, where the tongue stays coated, nitro-hydrochloric acid, combined with such stomachics as strychnine, compound tincture of gentian and compound tincture of cinchona, makes probably the happiest and most efficient stomachic mixture available.

HYDROCHLORIC ACID.

Of Hydrochloric Acid we have the *concentrated* and the *dilute*. The concentrated can be given in 1 to 5 drop doses, freely diluted; the dilute in 10 to 20 drop doses.

This acid can be used internally as a stimulant tonic in dyspepsia, and it can be used locally as an astringent and escharotic, but it is not as astringent or escharotic as are sulphuric and nitric acids, nor is it as good a tonic as is nitro-hydrochloric acid.

Phosphoric Acid. Dilute phosphoric acid can be used in internal medicine in doses of 5 to 15 minims. It acts as a mild stimulant tonic to the digestive tract, and shares the therapeutic virtues of the other mineral acids.

It was for a long time used by the general profession as an alterative, to meet indications where phosphorus should have been used. It has probably no alterative influence upon the system, and has, therapeutically, no relation either to phosphorus and its uses, or to the phosphates and their applications.

CHAPTER XIII.

ALTERATIVES.

This is a class of remedies whose effects in therapeutic doses, and whose toxicological actions are so far apart that each one becomes a study by itself, and neither the toxicological nor the physiological effects, give us any clue to their therapeutic peculiarities. The physiology, the toxicology and the therapeutics therefore, become separate studies for most of the drugs of this class.

They are called *alteratives*, because their continued use is capable of producing changes in cell metabolism and in cell structure in conditions of mal-nutrition. The lack of knowledge of the peculiar kind of influence they produce, is in part dependent upon the fact that they are employed in a class of diseases, the causes and pathology of which are not well understood. They are employed in such affections as *gout*, *rheumatism*, *syphilis*, *scrofula*, and other diasthetic diseases of more or less obscurity. It is evident, therefore, that the practical therapeutics of very many of these drugs depends entirely upon clinical experience or empiricism.

They are: **Phosphorus, Arsenic, Mercury, Donovan's Solution, Gold Salts, Iodine, Iodides, Iodoform, Iodol, Aristol, Sozoiodol, Codliver Oil, Calcium Phosphate, Hypophosphites, Colchicum, Sarsaparilla, Guaiacum, Mezereon, Jambul, Sassafras, Taraxacum, and Ichthyol.**

PHOSPHORUS.

Preparations. The metal itself in pill form; dose, $\frac{1}{120}$ to $\frac{1}{80}$ of a grain.

Phosphoretted Oil, containing one per cent. by weight of phosphorus; dose, 1 to 3 drops.

The official pill of phosphorus, each containing $\frac{1}{100}$ of a grain; dose, 1 pill.

The Elixir of Phosphorus; dose, $\frac{1}{2}$ to 1 fluidram.

Physiology. Phosphorus, when given in moderate doses, produces no appreciable physiological effects, and consequently the therapeutic and the toxic effects must be at great variance. When, however, it is given in small doses rapidly repeated, there is finally developed a peculiar "matchy taste" in the mouth, which indicates its *therapeutic limit.*

When ingested, it is rendered soluble by the fats and oils in the intestinal contents, and is probably thus absorbed as phosphorus, circulates in the system as phosphorus, produces its effects as phosphorus, but is ultimately decomposed and is probably eliminated by the kidneys as *hypophosphorous acid.*

There is no therapeutic relation between phosphorus and the phosphates, the phosphites, the hypophosphites or phosphoric acid. Although they are all derived from the same metal, they have no relation in common with phosphorus, and cannot be used in medicine to meet the indications for phosphorus.

Phosphide of zinc, which can be given in $\frac{1}{20}$ to $\frac{1}{12}$ of a grain doses, and can be used instead of phosphorus, because it probably decomposes in the circulation, and circulates and acts as phosphorus, and not as a phosphide.

Therapeutic uses: Phosphorus has two general uses in medicine: first, as a *nerve tonic,* and second, *in the bone diseases,* as rickets and osteomalacia.

As a nerve tonic, it is useful in all forms of chronic neurasthenia, such as cerebral exhaustion of extreme type, in exhaustion of the spinal cord, and in sexual exhaustion due to over sexual indulgence. It is also serviceable in neuralgias which may be directly dependent upon neurasthenia. It is not so much the quantity of phosphorus taken that brings about desirable results, as it is the length of time over which the phosphorus impression is kept up. I have also seen it do very prompt and efficient service in cases of carbuncles which appeared in crops, extending over several months, and in which all other treatment was without avail, but which yielded very promptly to the internal use of phosphorus.

In bone diseases, it is useful in such affections as rickets, osteomalacia and in un-united fractures or in fractures in which the union is much delayed.

But in un-united fractures and the delayed union of bones, the use of phosphorus is often disappointing. This is probably so because in the great majority of cases of fractured bones

which refuse to unite, there is either a scrofulous or syphilitic infection of the system.

In rickets and osteomalacia, both phosphorus and the phosphates are much used; although they have no physiological or therapeutic relation, each one is doing a special and necessary work in assisting bone construction: *Phosphorus* is a stimulant to the bone producing cells and aids to increase their number and development, whereas the *phosphates* are mere *bone salts*, and furnish material or food for the construction of bone; and therefore both can be used together with increased benefit, since each one does a work which the other cannot accomplish.

PHOSPHORUS POISONING.

Toxic Symptoms. After the ingestion of a toxic dose of phosphorus, the symptoms may arise in from two to twelve hours, depending entirely upon the fact whether the phosphorus has been taken in a liquid form, and was rapidly absorbed, or whether it was taken in the form of the metal, when the absorption is necessarily slow, and the symptoms delayed until it has entered the circulation.

The early symptoms are those of languor, slight pain in the stomach, a little nausea, and after a time, may be followed by vomiting. These symptoms progressively increase, the vomiting becomes more frequent, the nausea more persistent, the pain more severe, extending all over the abdomen, and is followed by purging. These gastro-intestinal symptoms slowly but progressively increase in intensity, and may thus continue for three or more days; then, in some cases, there is a remission of the vomiting, purging and pain, but epigastric tenderness persists.

After a time the symptoms recur, beginning often with deep jaundice, fever, swelling and tenderness over the region of the liver, the purging and vomiting recur, and the matters vomited are dark brown in color. At this time, a series of nervous symptoms begin to appear; severe headache, pupils become dilated, delirium, muscular tremors, the delirium becoming wild, oftentimes maniacal, occasionally erotic in character, followed by unconsciousness, occasionally convulsions, coma, and finally, after many days of suffering, death occurs from a condition of *asthenia* or general exhaustion.

During the course of the poisoning, the stools change in character. Early in the poisoning, they are usually the contents

of the intestines, and are often phosphorescent in the dark. This is somewhat *diagnostic* of phosphorus poisoning. In the later stages of the poisoning, the stools become a very light clay color, due probably to the absence of bile and biliary coloring matter.

The matters vomited are at first the contents of the stomach, followed by mucous and bile, and are phosphorescent in the dark; and later in the poisoning they become dark, which dark color is probably due to partly decomposed blood that oozes from the gastric walls.

The urine becomes scanty, and contains albumen and tube casts, together with crystals of *leucine, tyrosine* and *sarcolactic acid*; these three substances are only present in the urine when there is rapid tissue destruction going on.

It is peculiar to this poisoning that the early symptoms should be so very mild, but progressively increase, often over many days, and that the later symptoms should become so exceedingly violent. Also, that the early, as well as the later symptoms should so closely resemble the onset of an acute disease, so that often, without history, a poisoning may not be suspected. It may be said, that there are very few poisons whose symptoms are so mild in the beginning, and whose course of poisoning so prolonged, and yet whose ultimate termination is so surely fatal and the symptoms so severe, as that of phosphorous.

Post-mortem Lesions. The one great post-mortem lesion after phosphorous poisoning is that of *universal fatty degeneration.* This fatty destruction is probably most marked in the glandular organs, like the kidneys, the liver and the spleen. But it extends to all soft tissues; especially to the mucous membranes of the intestinal canal and of the stomach, the genito-urinary tract, and the muscular structures of the heart and bloodvessels; all suffer this degeneration.

Diagnosis. Phosphorous poisoning so closely resembles *acute yellow atrophy* of the liver, that from the symptoms alone, it is impossible to make a differential diagnosis. In both cases there are the same gastro-intestinal symptoms, the same jaundice, the fever, and the rapid atrophy of the liver; in both you have the presence of leucine, tyrosine and albumen in the urine; and in both you have the delirium, muscular tremors, dilated pupils, convulsions and coma. A differential diagnosis,

therefore, can only be made by chemical examination of the excreta or from the history of the case.

It should also be mentioned that in the height of phosphorus poisoning, when the temperature is elevated, the vomiting and purging frequent, the matters vomited dark in color, and the jaundice intense, it so closely resembles a case of *yellow fever*, that a distinctive diagnosis is not easy. Probably the most marked difference would be the absence of an injected conjunctiva in phosphorus poisoning, which is so marked in yellow fever.

Treatment. The prognosis in this poisoning is, unfortunately, bad. Very few cases of advanced poisoning, if any, recover. This frequently fatal termination of phosphorus poisoning depends entirely upon the fact that phosphorus *destroys* all the tissues with which it comes in contact, instead of simply depressing their functional activity temporarily, as most poisons do.

In the way of treatment, all that can be done is to administer the antidote, to remove what phosphorus there may be unabsorbed in the stomach and intestines, and then to relieve the suffering of the patient. The antidote consists in the administration of small repeated doses of *sulphate of copper*, 3 grains every 5 minutes, until free vomiting is established. The sulphate of copper acts both as an emetic and as a chemical antidote, converting the phosphorus into an insoluble phosphite of copper. This should be followed by the administration of *permanganate of potassium*, which is itself a more rapidly acting and a more complete antidote than is copper, destroying the phosphorus by oxidation. The stomach should then be emptied and washed out, and a saline cathartic administered to sweep out what phosphorus there may be in the intestinal canal. No oils or fats should be administered for either cathartic or diatetic purposes, since phosphorus is soluble in oils, and would thus hasten the absorption of what might otherwise remain in the intestinal canal.

The suffering can best be relieved by the free use of opium, which can be given in part hypodermically, some by the bowel, and some by the mouth. Stimulants are of no avail and have no effect, because all functions yielding from an excess of this poison, yield because their structures are destroyed, and not because they are depressed.

Chronic Poisoning. Chronic phosphorus poisoning is apt to occur in match makers, who may suffer from the poisoning either by absorption through the skin,

or more frequently by the inhalation of the phosphorus fumes. The most common lesion is *necrosis* of the *lower jaw bone*, which is possibly produced by the phosphorus entering the bone through a decayed tooth. This lesion is often accompanied by tremors, local palsies, and sometimes by very stubborn neurasthenia.

ARSENIC.

The preparations of arsenic, which are most used in medicine, are:

Arsenious acid or oxide; dose, $\frac{1}{40}$ to $\frac{1}{20}$ of a grain, and should be administered in pill form.

"Fowler's Solution," or the solution of the arsenite of potassium; the strength of which is 4 grains of the arsenite of potassium to the fluidounce, and the dose is from 1, 3 to 5 drops, increased if circumstances require it.

There are also official, the solution of the arsenate of sodium, the solution of the chloride of arsenic, and the solution of arsenious acid itself, all three of which are of about the same strength as "Fowler's Solution," namely, 4 grains to the fluidounce, and can be used in like doses, but they have no advantages over the other preparations.

Local Action. Locally, arsenic is a violent *irritant* and *escharotic*, destroying all soft tissues with which it comes in contact. It is occasionally used locally in this way for the purpose of destroying malignant epithelial growth. When it is used for this purpose, it should be made into a paste and kept in contact with the part until all the malignant structures are destroyed.

Therapeutic Limit. When a preparation of arsenic is administered in small doses rapidly repeated, the first effects of *arsenicism* are, slight swelling of the eye-lids, noticeable at first in the morning on rising, but after a time remain permanent, and the swelling may extend over the entire face; and if the drug be continued long enough, a general anasarca may thus be produced. But in some cases, instead of this œdematous swelling of the face, the first influence may manifest itself by a gastro-intestinal irritation, with some pain, a little tendency to diarrhœa, and loss of appetite. Occasionally these two effects co-exist; more frequently, however, it is one or the other that marks the place beyond which it is unsafe to push an

arsenical preparation; either one occurring, marks the *therapeutic limit* of this drug.

The dropsical swelling of the face is probably in part due to a subcutaneous cellulitis, caused by the irritant action of the arsenic; but when it becomes general, there is usually albuminuria associated with it, which may be converted into a true Bright's disease.

Toxic Symptoms. When arsenic is taken in a single toxic dose, there is immediately a burning pain in the mouth, œsophagus, and stomach, rapidly extending over the whole abdomen, which is followed by nausea, intense and persistent vomiting, bloody and mucous purging in the early stages of the poisoning, but later the stools become large and serous; pain in the back and loins, the urine becomes scanty, bloody, and finally suppressed; excessive and constant thirst; cold extremities; respiration weak and shallow; the pulse feeble and rapid; fall of body temperature; convulsions, coma, and finally death in collapse, mainly from toxic gastro-enteritis and nephritis.

When the quantity of arsenic taken is not an overwhelming one, there is sometimes, in the course of the poisoning, a remission of symptoms, in which the nausea, vomiting and pain, may entirely subside; but the tenderness over the stomach, the longing for water, and the cold extremities persist, as an evidence that convalescence is not at hand. After several hours the symptoms recur, and run the ordinary course to a fatal termination.

Death from arsenic poisoning may occur in from five hours to six or seven days, depending wholly upon the quantity of arsenic which has entered the system. In cases where the course of the poisoning is very prolonged, there is apt to appear a skin eruption of papular or pustular form.

Atypical Acute Poisoning. There are cases of arsenic poisoning in which the symptoms do not conform to the ordinary type. They have been described as being of three peculiar forms:

First, cases in which there is immediate general collapse, with cardiac and respiratory failure, without the usual gastro-enteritis, and the patient dying in collapse in a very few hours.

Second, cases in which the most pronounced symptom is that of stupor and sleep, with occasional paroxysms of pain, but in the main aspect, closely resembling opium poisoning.

Third, cases in which excessive liquid purging is the most pronounced symptom, resembling Asiatic cholera.

Post-mortem Lesions. The post-mortem lesions of acute arsenic poisoning are chiefly those of gastro-intestinal corrosion and inflammation, swollen and inflamed kidneys, and extensive fatty degeneration of the organs. Sometimes, yellow patches are found in the intestinal canal, which are probably due to a deposit of the sulphide of arsenic.

Treatment of Poisoning. In arsenic poisoning it is of the first importance that the antidote, *hydrated sesquioxide of iron*, be given immediately. This antidote must be *freshly prepared* and be given *in excess*. Thereafter, the symptoms should be treated on general principles; the pain, diarrhœa and vomiting should be controlled by the moderate use of opium, and body temperature kept up by external heat.

Chronic Poisoning. Chronic poisoning from arsenic may be of two types:

First, the cases of acute poisoning which have not resulted fatally, but in which the lesions have become chronic. In this type of cases, the chief lesions are those of obstinate dyspepsia, chronic diarrhœa, usually Bright's disease, and, above all, a *general neuritis*, in which every nerve trunk is excessively sore and sensitive. Following this neuritis, there may be local or general anæsthesia, local palsies, sometimes poliomyelitis with wasting of the muscles, and an unnatural growth of hair over the body. The anæsthesia is apt to be most marked in the extremities. The local palsies, the wasting of muscles, and the free growth of hair, are probably the direct outcome of the neuritis, not allowing either motor, sensory, or trophic impulses from the spinal cord to reach the peripheral structures. Occasionally the palsy is the outcome of myelitis, associated with a neuritis. The difference can be determined by the presence or absence of pain on pressure over the affected nerve trunks.

Second, Chronic arsenic poisoning may be *insidious* in its origin, where arsenic is taken in minute quantities over a period of time, unknown to the individual. The principle sources of this form of poisoning are the cheap greens which are used to color toys, confections, and wall paper. Paris green, which is an arsenite of copper, has recently become a common source of chronic poisoning.

The chief symptoms here are indigestion, colicky pains, slight diarrhœa, neuralgias, sometimes neuritis with emaciation, and very often *dryness of the mucous membranes*, which is probably due to glandular atrophy, and produces a dry hacking cough, sometimes conjunctavitis and inflammation of other mucous membranes.

The treatment here is, the removal of the arsenic from the system, and removal of its source; good hygiene for the patient, and the use of strychnine, electricity, and massage, to restore lost function.

Physiology. The toxic effects of arsenic are no clue to the method in which it affects the system when used in therapeutic doses; and therefore its usefulness in medicine is almost entirely empirical. It is, however, known that large quantities always increase tissue destruction, whereas small quantities rather increase tissue growth and act as a tonic to the entire economy.

On the nervous system, toxic doses of arsenic act especially as a depressant to the sensory apparatus and the respiration; but the therapeutic dose has no such effect. Arsenic is eliminated from the system, unchanged, chiefly by the kidneys and intestines; and the copious serous stools in the late stages of the poisoning, are due to an attempt at intestinal elimination.

Therapeutic uses: Arsenic is the one substance used as a medicine, which tests the physician's skill to apply it most efficiently, to its different indications. In some of the indications for arsenic, the drug only becomes valuable when it is given over a long period of time in small doses; its value depending entirely upon the length of time during which the arsenical impression is kept up. In other indications, its usefulness depends upon the *intensity* of its impression, rather than upon the length of time it is used, and must therefore be given on an ascending scale, and be pushed to its therapeutic limit.

The general indications are: *Chorea, chronic malaria, chronic skin diseases, chronic bronchial catarrh, asthma, scrofula, anæmia, neurasthenia, chronic rheumatism* and *chronic syphilis.*

In *chorea* of childhood, arsenic is the most reliable remedy we have; but in this disease it should be given in the form of "Fowler's Solution," in ascending doses, and pushed to its therapeutic limit, and then continued until all choreic evidences have disappeared. In chorea of the adult it is of less value, because

chorea occurring in later periods of life, is usually a symptom of an organic nerve lesion.

In *chronic malaria* or malarial cachexia, arsenic is one of the most useful remedies. In most cases it does best service when given in ascending doses to the full limit. It is likewise useful in acute malaria, after the chills have been broken up by quinine. Here it should be given in tonic doses combined with iron, as an after treatment. In malaria it probably produces its effects, like quinine, by directly killing the germs in the circulation.

The use of arsenic in *chronic skin diseases*, stands in striking contrast to its use in malaria. Here it should never be given in any but small doses, but should be continued over a long period of time. It is useful in atrophic or dry, scaly, skin diseases, such as dry eczema, or dry seborrhœa with falling of hair, and in skin diseases of scrofulous origin; but in all cases the drug must be discontinued, if any acute inflammation, with intense itching, appears on the part affected by the disease.

Arsenic is a most useful remedy in chronic nasal and bronchial catarrhs; especially such as are seen in scrofulous or phthisical individuals, who take cold on the slightest exposure, and have hacking coughs from Fall until Spring. In such cases the best results can be obtained when the arsenic is used throughout the entire Winter season, but should be given in small doses.

In certain forms of *asthma*, arsenic acts almost as a specific; especially is this true in asthma associated with chronic bronchitis, or in asthma of nervous origin, and it often gives relief in asthma associated with phthisis. In some of these cases, it does best service when it is pushed to its full effect. In other cases again, it does better when the small doses are used, but continued over many months. In asthma which is only a symptom of either organic heart disease or of Bright's disease, arsenic is of no value.

In *scrofulous* children with lack of development, enlarged lymphatic glands, and poor appetite, the prolonged use of arsenic with codliver oil, is probably the best treatment that can be instituted. But in this indication, it should be used over a long period of time and in doses of 1 to 2 drops of "Fowler's Solution" after each meal.

In *anæmias* of all kinds, arsenic is one of the remedies of great service. In pernicious anæmia, it is probably the only substance that has a possible chance to effect a cure. In this

disease it must be given in ascending doses, and pushed to a point where mild symptoms of arsenical poisoning appear, before any value can be expected. In chlorosis or simple anæmia, and the anæmias after acute diseases, arsenic, combined with iron and strychnine, is capable of doing much good.

In neurasthenia, arsenic acts as one of the best nerve tonics; and in combination with strychnine, it becomes a remedy of more power than probably any other combination that could be made.

In chronic rheumatism, in rheumatoid arthritis, and in chronic syphilis, arsenic can often be used as a tonic to great advantage.

HYDRARGYRUM (Mercury).

For convenience and brevity of study, the preparations of mercury can be divided into two classes:

First, Those preparations which in over-doses act as *acute, irritant and corrosive poisons.*

Second, The preparations which are *non-corrosive* and *non-irritant* in their local effects.

This division is not based upon any physiological or therapeutic effects, but wholly upon their *toxic actions.*

The corrosive preparations are: **Bichloride, Biniodide** or **Red Iodide, Proto-iodide** or **Yellow Iodide, Acid-nitrate, Ammoniated Mercury, Subsulphate of Mercury, Yellow Oxide** and the **Red Oxide.**

Of all these, the Bichloride, the Red iodide and the Yellow iodide, are the three preparations used in internal medicine; the rest are used for local, external purposes. They are all corrosive, irritant poisons; but the bichloride is probably the most poisonous, and, therefore, furnishes a type of the class. The yellow and red oxides are the least poisonous, and are practically insoluble in ordinary menstrua, but yet they are soluble in the intestines to a sufficient degree to produce active acute poisoning.

The *non-corrosive preparations* are: **Mild Chloride or Calomel, Blue Mass** or **Massa Hydrargyri, Mercury with Chalk** or **Hydrargyrum, cum Creta,** the **Ointment** and the **Oleate.**

Of this class, calomel is the *type;* and the rest act very similar to it, while all of them are free from local irritation, and, therefore, cannot produce corrosive or irritant poisoning. Blue mass, mercury with chalk, and the ointment are made directly from the metal; the oleate is prepared from the yellow oxide.

The doses of the preparations used internally are as follows:

Bichloride, ranges from 1/50 to 1/10 of a grain.

Red Iodide, ranges from 1/12 to 1/8 of a grain.

Proto or Yellow Iodide, ranges from 1/8 to 1/2 of a grain.

Calomel, ranges from 1/10 of a grain to 10 grains.

Blue Mass, ranges from 1/2 to 10 grains.

Mercury with chalk, being about of the same strength as calomel, ranges from 1 to 5 to 10 grains.

"Yellow Wash" and "Black Wash" are two non-official mercurial preparations which are sometimes used locally, externally in skin diseases.

Black Wash is made by putting a dram of calomel into a pint of lime water, the alkali reducing the calomel into a black oxide.

Yellow Wash is made by adding half a dram of bichloride to a pint of lime water, the lime water reducing the bichloride into a yellow oxide.

The great range of doses in these mercurial preparations entirely depends upon the different therapeutic indications for which they are used. It should be stated here that in poisonous quantities the irritant and corrosive preparations are very prompt in producing symptoms of acute local poisoning, because they are freely soluble in the gastro-intestinal canal and act as irritants; while the non-irritant preparations have no local corrosive effect. On the contrary, the non-corrosive preparations, like calomel and blue mass, are much more prompt in producing constitutional effects, or so-called *ptyalism*, than the corrosive preparations. This is true because they are absorbed in larger quantities than the corrosive preparations, since the latter are converted into, and absorbed as a very insoluble albuminate of mercury. But all mercurial preparations, when long enough used, will finally accumulate in the system and produce constitutional effects, or ptyalism.

Toxic Symptoms. The corrosive preparations of mercury produce about the same type of symptoms when taken in toxic doses, except that they differ in degree of severity. The bichloride is probably the most severe of the class, and a study of its toxic symptoms is a study of the entire class.

It produces violent pains in the mouth and stomach, extending over the abdomen, followed by intense nausea, vomiting, and purging; the stools are small, bloody and mucous, resembling

those of acute dysentery; the urine is bloody and later suppressed, and death in collapse from toxic gastro-enteritis.

Treatment of Poisoning. The treatment of the poisoning consists in the administration of the antidote, which is any *albumen* or soluble *albuminate*, such as white of eggs, milk, beef juice, or blood, forming an insoluble albuminate of mercury. If these cannot be obtained, an alkali or alkaline carbonate, like soap, magnesia or soda, can be used, converting the mercury into a yellow oxide, which is, however, only less soluble and less poisonous than the bichloride itself, and must be removed from the stomach. The rest of the treatment consists in allaying the gastro-intestinal irritation and corrosion, and the irritation of the kidneys.

Bichloride is absorbed from the intestines probably as an *albuminate of mercury*, and this may be true of red iodide and other corrosive preparations. These soluble preparations of mercury are the slowest of all the mercurials in producing constitutional effects, because the albuminate of mercury, into which they are probably reduced, is very slowly dissolved and absorbed; while in poisonous quantities, these preparations act without this reduction, and are very prompt in producing local irritation and corrosion.

Non-corrosive Preparations. Of the non-corrosive preparations, calomel is the *type*, and a study of its peculiarities is a general study of the entire class.

When calomel is taken internally in one single large dose, the only effect it produces is probably some griping, followed by purgation, in which the stools are large, serous and bile-stained, an evidence that it is not producing any irritation, but rather a stimulation of the intestinal glands and the hepatic function.

Ptyalism. When, on the contrary, calomel or any of the non-corrosive preparations is taken in small, but often repeated doses extending over some days, the symptoms of *ptyalism* occur. The early symptoms of this condition are tenderness of the teeth, swelling of the gums, some fetor of the breath, and a little increase in the flow of saliva. This group of symptoms, or any one of them, marks its *therapeutic limit*.

When, however, the drug is continued, the above symptoms increase in severity; the flow of saliva becomes more abundant and ropy in character, the gums more swollen, the teeth more tender and finally become loose, the tongue swells, and later on,

necrosis of the jaw with a loss of teeth may occur. To these are added, the constitutional symptoms of some fever, anæmia, emaciation, ulceration of the mouth and general exhaustion, which may result in death. The *post-mortem lesions* are wide spread fatty degenerations of all the organs.

A single dose of calomel or any insoluble preparation of mercury, is incapable of producing these constitutional symptoms, because only a small quantity of each ingestion is absorbed; the balance of it passes off with the intestinal contents as so much inert foreign matter. When a mercurial, like calomel, is given in rapidly repeated small doses, every successive dose is entirely dissolved and absorbed, and accumulation with constitutional ptyalism may follow. This difference of absorption of small and large amounts is due to the fact that calomel is reduced in the small intestines to a *black oxide*, by the alkalies of the intestinal secretions, and is thus absorbed; and the quantity that can be reduced at one time, is limited by the amount of alkalinity present. The accumulation and subsequent ptyalism is directly caused by the fact that mercury is more slowly eliminated than it is absorbed.

Chronic Poisoning. Chronic poisoning by mercury is principally found in those who work in quicksilver, either in manufacturing pursuits or when employed as miners. The symptoms resemble those of chronic lead poisoning or chronic poisoning from any of the salts of the metals. They are chiefly those of "wrist-drop," local palsies, with trophic changes, and other forms of nervous diseases. In one form of chronic poisoning there is produced emaciation and cachexia, very closely *resembling scurvy.*

The treatment, like that of chronic lead poisoning, consists in removing the cause, and eliminating the metal by the administration of iodide of potassium, and then repair the damage done by appropriate treatment.

Physiology. There is very little known about the specific relations which mercurial salts have to the general nutrition; yet it is quite certain that the small quantities are apt to increase general nutrition and increase the blood corpuscular elements, and acting therefore as a *tonic.* The large doses, on the contrary, increase tissue destruction and diminish the number of blood corpuscles, and thereby produce anæmia and even cachexia.

There does not seem to be any material difference in the different mercurial preparations or salts, in their influence upon the general system. After their absorption they all seem to have about the same influence and produce identical effects, with, however, different degrees of promptness and intensity of action. This last variation is probably wholly due to the difference in the rate of absorption. It would seem, therefore, that whatever practical differences there are in the use of various preparations of mercury, are mainly due to the difficulties of absorption, of local irritation, and of corrosion, which some preparations have over others.

The mercury after absorption, permeates all vital structures, and is found in all soft and hard tissues of the body. It is *eliminated* by all *secretions* and *excretions* of the body, including the milk of nursing women. It is found in the stools, the saliva, the urine, the perspiration, the bronchial secretion, the lachrymal secretion and in the milk.

The mercury, when first ingested, is eliminated freely and promptly; but as the doses are multiplied this elimination becomes lessened, and an accumulation in the system occurs, which produces a condition known as ptyalism, in which the free flow of saliva and the soreness of the mouth, are probably the direct outcome of attempts at elimination by those glandular structures.

Therapeutic uses: The general therapeutic uses are: As an *antisyphilitic*, an *antiphlogistic*, as a *cholagogue purgative*, as a *hydragogue diuretic*, as a *tonic*, and locally, as an *antiseptic*.

As an Antisyphilitic. The stages of syphilis are usually described as three:

The *primary* stage, which is characterized by the sore or chancre at the point of infection.

The *secondary* stage, which is characterized by the constitutional infection, with swelling of the glands, fever, sore throat, cough, skin rash, and rheumatoid pains.

The *tertiary* stage, which is best known by its gummatous formations and deposits.

In all of these stages of syphilis, mercury is probably the greatest remedy we have. The mercurial treatment should begin as soon as the diagnosis of syphilis is positive. The mercury should be pushed to a point of mild ptyalism, to determine how much the patient can bear, and then the dose should be reduced to a point where the mercurial symptoms disappear. This treat-

ment, modified to suit the individual case, should be continued for *two or even three years;* and after a full course of mercurial treatment, the *iodides* should be used, both because they are themselves antisyphilitic, and because they aid in the elimination of the mercury that may be deposited in the tissues.

Administration. The different ways in which mercury is given in syphilis are, *by the mouth* or ingestion, *by inunction* and *hypodermically.*

When given by the mouth, it is best administered in pill form in ascending doses, keeping the patient under close observation until the first symptoms of ptyalism occur.

When given by inunction, as is necessary in cases where the stomach will not bear the mercury without being deranged by it, or in young children, it is best to use the ointment or the oleate of mercury, which should be applied to different parts of the body on different days, and used only once a day, thus: The first day it should be applied to the inner side of the thigh; the second day, it should be rubbed into the groin; the third day, it should be applied to the axillary region; the following three days, it should be applied to the corresponding places on the opposite side of the body; and on the seventh day, it can be applied over the abdomen. The amount used should, at first, be no more than ½ a dram of the ointment, and this should be increased as the patient can bear it. It should always be rubbed into the skin thoroughly (until it is almost extinguished), to promote prompt absorption.

It is best to apply the mercury to the places above mentioned, because in those locations the skin is thin, and the mercury will penetrate it more promptly than elsewhere. Regions where there is a free growth of hair should always be avoided, for the reason that the mercury, after repeated applications, will itself produce an inflammation of the hair follicles, which may last for weeks and is troublesome to relieve.

In syphilitic infants, these inunctions are given by putting the mercurial ointment on the binder, and in that way keeping it in constant contact with the skin of the abdomen, where it is slowly absorbed.

In old syphilis, with marked anæmia, a good treatment is the combination of the bichloride of mercury with the tincture of the chloride of iron in proper proportion. Where there is a distinct *syphilitic cachexia,* the iodides associated with tonics, should be

substituted for the mercurial treatment, because mercury will increase an existing cachexia.

In some cases of syphilis, the so-called "mixed treatment" is sometimes more satisfactory than either the iodides or the mercurials alone. This consists in combining a mercurial, generally the bichloride, with iodide of potassium, and is administered in the compound syrup of sarsaparilla to disguise its taste.

In tertiary or old syphilis, the iodides can be used instead of mercury. But when there is a gummatous growth in a vital organ threatening life, such as the heart, the brain, or the spinal cord, a mercurial should be employed, because it is more rapid in its action.

Mercury has recently been used a great deal in the treatment of syphilis by hypodermic administration. For this purpose the bichloride is most frequently employed, and should be administered once or twice daily in doses of $\frac{1}{12}$ to $\frac{1}{8}$ of a grain. At the place where the mercury is to be injected, a small quantity of a 4 per cent. solution of cocaine should first be injected to prevent the severe pain which follows a mercurial hypodermic. The one advantage this method has over other treatments, is probably its promptness of action, and it also saves the stomach.

Antiphlogistic use. As an antiphlogistic, mercury has been used in inflammations of serous membranes, of mucous membranes, and in inflammations of the glandular structures themselves.

In inflammations of serous membranes, it is used and recommended in such as are of sthenic type, and in which the exudate is of a fibrinous or adhesive character; like sthentic or acute peritonitis, acute iritis, endocarditis, pericarditis, meningitis, pleuritis and arthritis. It probably produces good effects in these inflammations by lessening the amount of fibrinous exudation, and by aiding the reabsorption of what exudate there may have been thrown out. The mercurials should be used in these inflammations in small doses, repeated until mild mercurial effects are noticeable.

In inflammations of serous membranes which are of septic origin, and with an exudate of serum or pus, mercurials should be withheld. In such inflammations there is a tendency to hectic fever and cachexia, which a mercurial rather aids to increase than to diminish.

In inflammations of mucous membranes, or catarrhal inflammations, mercury is usually used in the form of calomel. But it is most efficient in catarrhal conditions of the stomach and intestines, and in the pseudo-membranous inflammations, like diphtheria and dysentery. In these conditions it is probably more its antiseptic influence than any other, which gives great value to it.

In inflammations of gland structures themselves, or parenchymatous inflammations, mercury has been used with asserted good effects. It is used in acute hepatitis, in catarrhal nephritis, and is sometimes employed in croupous pneumonia; but in this disease it is of doubtful value.

As a *cholagogue purgative*, mercury is one of the most useful to stimulate the liver and increase intestinal glandular action, and is indicated when the color of the stools shows the absence of bile.

As a *hydragogue diuretic*, Calomel is the only preparation of mercury which is so employed. It acts as a direct and active stimulant to the secreting structures of the kidneys. But its indications in dropsies will be discussed under diuretics.

As a *tonic*, the bichloride of mercury is usually selected, and it has been asserted that when used in very small doses long continued, it has a tonic effect upon the general system and nutrition, like that of arsenic and iron.

Antiseptic use of Mercury. As an antiseptic for the dressing of wounds in surgical work, the bichloride of mercury is always preferred, because it is freely soluble and because of its active germicidal power. It must however not be overlooked, that corrosive sublimate is reduced into an insoluble albuminate of mercury so soon as it comes in contact with a wound or its secretions, and becomes inert. It is therefore neither penetrating nor lasting in its antiseptic virtues.

The *antiseptic power* and practical antiseptic value of *calomel* are usually underestimated and often overlooked. For ordinary surgical purposes it is of no use, because it is insoluble; but in its proper place, on septic local sores, it is an unique antiseptic. It must not be forgotten that calomel is the only available antiseptic which penetrates the skin and other tissues. No other known antiseptic will penetrate the cutaneous structures and act as an antiseptic in the deeper tissues. The bichloride of mercury

itself will not penetrate the skin, since it is converted into an insoluble albuminate so soon as it comes in contact with animal tissues. Calomel, on the contrary, is rendered soluble by the secretions of wounds, ulcers, and the secretions of the skin itself, and is rapidly and readily absorbed, and acts as a powerful local antiseptic in such conditions as punctured wounds, dissecting wounds, running sores, and the like. In boils and carbuncles, if it be applied liberally and early, before pus formation has occurred, it will often arrest their further development. It should be applied in the form of an ointment, of the strength of 1 to 2 drams of calomel to the ounce of ointment base, and should be kept in contact with the part constantly, so as to allow of free and continued absorption.

In *skin diseases*, most of which are now recognized to be of sporadic origin, calomel is one of the most valuable agents we have; and here again its value depends upon its antiseptic power.

In the treatment of chancres (soft and hard), and ulcers of syphilitic origin, and in indurated poisoned wounds of all kinds, calomel, used as a dressing, is a most efficient antiseptic remedy.

In the gastro-intestinal canal, where there is fermentation or bacteritic toxicity of any kind, with or without diarrhœa, the antiseptic value of calomel should not be overlooked. Its free use in dysentery has more value than any other internal remedy we possess. Given in large single doses, it evens acts as an effective *enthelmintic* to expel intestinal worms.

In gonorrhœa, especially in chronic forms, in which there are ulcers in the uretha sluggish in healing, and even in acute gonorrhœa, the external use of calomel in ointment form, applied over the course of the uretha and kept in place by a proper dressing, will frequently aid in shortening the course of the disease, and ulcers which have resisted all other treatment, will often heal rapidly and kindly.

Donovan's Solution. The solution of the iodides of arsenic and mercury (Liquor Arsenisi et Hydrargyri Iodidi), or "Donovan's Solution," contains one per cent. each of the iodide of arsenic and the red iodide of mercury; dose, 1, 3 to 5 drops.

The therapeutic influence of this preparation is rather mercucial than arsenical. It is a very active alterative in such conditions as call for either arsenical or mercurial medication. It is of great service in skin diseases of scaly type, especially when

this condition is dependent upon scrofulous or syphilitic taints. It is used in chronic rheumatism, chronic gout, and sometimes in chorea, especially in chorea in children when the disease is dependent upon hereditary syphilis. In such cases it often answers good purposes where arsenic alone fails.

GOLD SALTS.

Preparations. Chloride of Gold and Soda (auri et sodii chloridum); dose, 1/10, 1/6 to 1/4 of a grain.
Iodide of Gold; dose, 1/10 to 1/6 of a grain.
Oxide of Gold; dose, 1/10 to 1/6 of a grain.

Chloride of Gold and Soda. Chloride of Gold and Sodium is freely soluble, locally irritant, and taken in large quantities internally, it produces violent irritation and corrosive gastro-enteritis.

Toxic Symptoms. The symptoms of poisoning from this salt are very similar to those produced by bichloride of mercury: There is intense pain in the abdomen, nausea, vomiting, bloody purging, suppression of urine, collapse and death from toxic gastro-enteritis.

Physiology. In moderate doses it is said to produce a slight increase in the heart's action, with probably a little increase in its strength, elevation of temperature, and some increase in the flow of urine.

Therapeutic uses: It is used as a *nerve tonic* in neurasthenia, and in different forms of neuralgia, such as ovarian neuralgia associated with ovarian irritation, in hysteria, and the like.

It is also used and recommended as a treatment in *alcoholism*, for the purpose of breaking up the alcoholic habit, under the name of "Keely Cure." As to how far these gold salts enter into this treatment in the "Keeley Cure," and what else may be used in conjunction with the gold salts we do not know; but certain it is, that in the cases so treated, there may be more influence in the *moral impression*, the moral support of the patient, and the individual's own resolution, than there can be in the use of these remedies. It is a treatment that can always be employed without harm, but that it succeeds any better than any other systematic treatment is doubtful.

These gold salts, including the *iodide* and the *oxide* of gold, have been used very extensively as alteratives in scrofula, old syphilis, rheumatic joint diseases, and in sclerosis of the nervous system; and their alterative influence is probably similar to that of the mercurials or arsenical preparations.

IODINE.

Preparations. Tincture of Iodine, used locally.

The Compound Solution of Iodine (Liquor Iodi Comp.), or "Lugol's Solution;" dose, 5 to 10 drops.

Iodine Ointment, used externally.

There is a Compound Tincture of Iodine, very similar to the official compound solution of iodine, but it is no longer official.

The Compound Solution of Iodine is the only preparation that should be used internally. This contains iodide of potassium in sufficient quantity to hold the iodine in a watery solution.

The Tincture of Iodine should never be used internally, because it is an alcoholic preparation, and so soon as it gets into the stomach, in the presence of water, the iodine is precipitated.

Locally, iodine is an active irritant, and is often used for counter-irritation.

Iodism. When iodine is given internally in therapeutic doses frequently repeated, it may produce a group of symptoms technically known as *iodism*. There may be some irritation in the stomach, pain over the frontal sinuses, running at the nose, sometimes a little sore throat, and an acne eruption. These symptoms may all be present, but more frequently there are only one or two marked, and whenever any of them occur, they mark the *therapeutic limit* of the drug.

Toxic Symptoms. The symptoms produced by a toxic dose of iodine, are those of violent irritation in the mouth, stomach, and intestines, extending over the abdomen, nausea, vomiting, and violent bloody purging; the urine becomes scanty and bloody; there is headache, probably delirium, weak pulse, failing respiration, and at last collapse, and death from gastro-enteritis.

Acute poisoning from iodine has followed the injection of tincture of iodine into the serous cavities; injections into the pleural cavities, its employment in hydrocele and in other serous cavities, to produce adhesion and obliterate them. In such cases sufficient has been absorbed to produce violent general symptoms

of iodine poisoning. The symptoms do not materially differ from those produced by the drug after ingestion. There is distress and vomiting, some purging, the urine becomes suppressed, followed by depression of the heart and respiration. The gastro-intestinal symptoms are caused by the attempts at elimination of iodine by its mucous membranes.

Chronic Iodine Poisoning. Cases of chronic poisoning from iodine are on record, and they are usually spoken of as three types:

First, Cases in which the nervous symptoms dominate, with neuralgias, chilliness, headache, dizziness, and ringing in the ears.

Second, Cases in which gastro-intestinal irritation is most marked, with constant diarrhœas, pain in the stomach, vomiting, and loss of appetite.

Third, Cases in which the glandular system suffers most severely, and most susceptible seem to be the glandular structures concerned in reproduction. The mammary glands and the ovaries in the female, and the testicles of the male, undergo rapid atrophy; and then the lymphatic glands all over the body begin to break down. This is followed by emaciation, anæmia and cachexia, spoken of as *iodic cachexia.*

Treatment. In the treatment of iodine poisoning it is only necessary to administer the antidote, *starch,* forming an insoluble iodide of starch, and then allay the local irritation by giving demulcent drinks and by the cautious use of opium.

Physiology. Iodine, when ingested, is probably absorbed and circulates as an *iodide,* and is eliminated as an *iodide.* The elimination takes place by the kidneys, intestines, and in part by the respiratory mucous membranes. The "frontal headache," or pain over the frontal sinuses, the running at the nose, and the sore throat, which occur after the too free use of iodine, are probably produced by an attempt at elimination by these mucous membranes, and become irritated by the presence of the iodine.

The relation of iodine to the nutrition of the cell structures, is not understood any more than that of mercury or arsenic. Its internal uses, therefore, are mainly empirical. In toxic quantities it is capable of producing extensive fatty degeneration, like the mercurial salts.

Therapeutic uses: Internally, iodine is used principally in *scrofulous affections;* In scrofulous sore throat, in enlargement of lymphatic glands from scrofula, in scrofulous bone diseases like rickets, and in simple or "Swiss" goitre. When employed in exophthalmic goitre, it frequently does more harm than good, because this is primarily a disease of the nervous system.

Locally, iodine is used in the form of the tincture, applied with a brush, or in the form of an ointment, over chronic inflammation of joints and sprains. It is applied to sore throats, to enlarged lymphatic glands, and as a counter-irritant over deep seated inflammations.

It is probable that the true value of iodine in its internal and local uses, stands in *inverse ratio* to the frequency of its employment.

Syrup of Hydriodic Acid. Sypup of Hydriodic Acid is prepared by passing a current of hydrosulphuric acid gas through an alcoholic solution of iodine. It is a colorless syrup and contains one per cent. of absolute hydriodic acid. It is chemically very unstable, and readily decomposes on exposure to air and light, liberating free iodine, and is then unfit for use.

In medicine, it is used in all scrofulous diseases: In rickets, scrofulous catarrhs, in scrofulous enlarged glands, and in simple goitre. It is probably identical in its therapeutic indications with iodine, but it is much more pleasant to take, and far less disturbing to digestion. The dose, for children, is 10 to 20 drops, given after meals; to adults, 1 to 2 fluidrams, which can be given three or four times a day.

IODIDES.

The iodides are: **Iodide of Potassium, Iodide of Sodium, Iodide of Ammonium,** and **Iodide of Strontium.**

These iodides, like the bromides, can be discussed together, because the difference between these various salts is very slight, and is mainly dependent upon the different bases combined with iodine. The base *potassium,* is more depressant and irritant than the rest, and is more disturbant to the digestion, and more generally poisonous than the other bases. The base *sodium,* is

practically indifferent to the system, because it is the natural alkali of the circulation. The *ammonium* and *strontium* iodides, are the least disturbant to the digestion, and are, therefore, most desirable for internal use.

All these iodides are *incompatible* with all the *alkaloids*, and, therefore, should never be prescribed with tinctures or other preparations of substances containing alkaloids. They are all deliquescent, and can, therefore, not be prescribed in powder or capsule form, but should be in solution.

The doses of these iodides are about the same, and can be put down as from 5 to 15 grains for ordinary purposes, but in syphilis they can be given up to 30, 40, and even 60 grains to the dose. They can be administered with compound syrup of sarsaparilla or some bitter tincture containing no alkaloid, such as tincture of gentian or compound tincture of cardamon. But where the stomach is very susceptible, the best vehicle in which to administer them is milk. When they are to be given in milk, the iodides should be prescribed in concentrated form, so that each 2 minims of the solution contain 1 grain of the salt, and at the time of administration the dose should be mixed with the milk and the draught taken immediately.

Physiology. These iodides, when taken internally in large enough doses, produce symptoms somewhat like those of iodine, of which the most marked is an acne eruption, although sometimes there is salivation and drowsiness. They are readily absorbed, circulating as iodides, and are eliminated, chiefly by the kidneys, unchanged.

Therapeutic uses: The chief uses for the iodides are: (1) In *chronic syphilis;* (2) in *rheumatism;* (3) in *inflammations* of *serous membranes,* and (4) for the purpose of aiding the *elimination* of the salts of the metals in chronic poisoning.

In *tertiary syphilis* the iodides are co-equal with mercury, except that they are not as prompt in action. They can always be used to alternate with mercury through the course of an anti-syphilitic treatment. In this employment they should be pushed to their full effect; but it is to be remembered that in cases where constitutional effects appear after small doses, the value of the treatment is probably as great as in cases where very large doses can be taken before constitutional effects are felt; for it is not the *quantity* of an iodide that is taken, that determines the therapeutic

value in syphilis, so much as it is the point at which the susceptibility of the individual who takes it shows itself, and therefore each individual will get the maximum benefit at the point where susceptible influence is felt.

In old syphilitic cases who have been under prolonged use of mercury, a change of treatment to the iodides sometimes acts very happily. In syphilitic cachexia the iodides, conjoined with tonic treatment, should replace the mercurial.

In *chronic muscular rheumatism* or rheumatic gout, the iodides are sometimes very serviceable. If there be an element of gout connected with the rheumatism, it is well to combine the iodides with some colchicum. If the rheumatism is of a subacute type and involves the joints, it is often good treatment to combine these iodides with the salicylates.

The iodides have been used very extensively in inflammations of serous membranes with adhesions; adhesive pleurisy, pericarditis, and in adhesive peritonitis. In these chronic adhesions, the iodides are probably capable of doing some good, so long as the adhesions have not organized into fibrous tissue.

In *asthma* and chronic bronchitis, the iodides have been used, but are probably of questionable value, unless such asthma or bronchitis depends upon some constitutional taint.

In *chronic interstitial* Bright's disease the iodides are much used, but are of no service at all; for they are incapable of breaking up and dissolving fully developed fibrous tissue, as exists in all cases of contracted kidneys.

In *aneurism*, the iodides are employed for the purpose of aiding the formation of a *fibrous clot* in the aneurismal sack; but it is hard to understand how the iodides should, under some conditions, aid the formation of a fibrous substance, and under other conditions, cause its destruction and reabsorption. It is, therefore, more probable that the iodides are of no value in aneurism, except that they may be of some possible service in cases where the aneurism and arterial atheroma are produced by syphilis. In such cases the iodides may aid in so far as they relieve the syphilis.

The iodides are useful for the purpose of aiding the elimination of the salts of the metals in chronic poisoning; as in chronic lead poisoning, and chronic poisoning from mercury. Here they combine with the metal, and form double iodides which are soluble and can be eliminated.

IODOFORM.

This is a rather insoluble powder, and of very offensive odor. Locally, it acts as an *anæsthetic*, probably as an *antiseptic*, as a *stimulant*, and as an *alterative*. Its local influences are its most important properties, for the drug is rarely used for any other than local purposes.

Iodoform does probably not itself act as an antiseptic, for the germs of various infections have been cultivated in solutions of iodoform. It is, however, claimed (but lacks proof), that when iodoform is put into a wound, it is decomposed by the secretions, and new iodine compounds are formed which are said to be antiseptic. Be that as it may, the drug is locally so used, and mechanically it has *aseptic* properties through its dessicant action, and it is certainly a local alterative of great value. Some Surgeons take the wise precaution of sterilizing their iodoform before they introduce it into a wound. This is highly commendable.

Toxic Symptoms. Iodoform may produce acute poisoning when ingested, but most of the recorded cases of poisoning have occurred from absorption of the iodoform introduced into wounds. In either case the symptoms are the same. They are, headache, delirium, contracted pupils, the pulse rapid and weak, and often fever, followed by collapse. The symptoms very closely resemble those of acute meningitis.

No satisfactory treatment has as yet been suggested for this form of poisoning, beyond that of removing the iodoform and treating the symptoms. In cases of poisoning, where the symptoms are very marked, it often terminates fatally. The post-mortem lesions are chiefly those of extensive acute fatty degeneration. The drug, when it enters the circulation, probably circulates as an iodine compound, and is found in the urine as various organic iodine compounds.

Therapeutic uses: The only legitimate employment for iodoform is as a local dressing. Here it is employed in the dressing of old ulcers, where its alterative and stimulant properties make it a very valuable application. As an antiseptic in the dressing of fresh wounds it has been much employed, but of late it has, to a great extent, been abandoned. When thrown into a fresh wound, the maximum quantity so used, should not exceed a dram; for larger quantities might produce dangerous poisoning from local absorption. In weeping

skin diseases, in the treatment of chancres and ulcerative lymphatic glands, in tubercular glands or tubercular ulcers of any sort, iodoform is one of the valuable dressings. It is useful in suppositories for inflamed hemorrhoids, and in acute dysentery, where the ulcers are low down in the bowel.

Iodol. Iodol is a grayish brown powder, a little less soluble than iodoform, but has the advantage of being less unpleasant in odor. In toxic doses it produces about the same symptoms as iodoform: fever, headache, delirium, contracted pupils, rapid pulse, convulsions and coma. Post-mortem, the same fatty degenerations are found.

It is not as valuable an alterative as iodoform in its local use, because it is less soluble; but in general medicine it is employed for the same purposes; namely, as a local dressing in ulcers, wounds, chancres, and skin diseases.

Aristol. Aristol is another iodine compound, made from thymol and iodine. It is an insoluble powder, and is employed, like iodoform and iodol, in the dressing of wounds and sores. It has the reputation of being distinctly antiseptic, but this lacks definite proof. In its local employment, more can be expected from its alterative and dessicant properties than from its antiseptic value.

Like the other iodine compounds, it is capable of producing acute poisoning, and after death, fatty degeneration can be discovered in the glandular organs.

Sozoiodol. Sozoiodol is only a convenient name for what is chemically known as diiodparaphenolsulphuric acid, which is a compound of mercury and iodine. It is claimed for it that it is antiseptic without being poisonous to the higher animals. This claim lacks confirmation, and appears to be contrary to facts. This acid can be used in dilute form for the dressing of poisoned wounds. Its local irritant influence, however, is a serious objection to its practical employment.

CODLIVER OIL.

Codliver oil or *Oleum morrhua* is the oil obtained from the fresh livers of the Cod. The rancid oil, formerly used in medicine, should not be employed. It has no advantages over the fresh oil,

and has a great many serious objections, among which should be mentioned its deleterious and disturbing influence on digestion and the whole digestive apparatus.

The dose of codliver oil can be put down as from a *teaspoonful* to a *tablespoonful*, and increased if more can be borne. It may be administered in emulsion, in capsules, in suspension in other liquids, or the plain oil itself can be taken, preceded by a pinch of common salt on the tongue, and followed by another pinch of salt. This is a very excellent way of taking it, for the taste of salt is more intense and more prolonged than that of the oil, and consequently it covers the nauseousness of the oil very successfully.

Physiology. Codliver oil is an exceedingly complex body, and *none of its component parts or ingredients will meet the indications for codliver oil.* It is the combination of all its ingredients, and the nature of its complexity, that gives it its medicinal virtues.

It has two properties by virtue of which it serves as a medicine: First, it is *nutritive* in so far as it is an oil; second, it is *alterative* by virtue of the other compounds it contains, and, therefore combines the virtues of both a *food* and a *medicine.* When ingested, it is usually absorbed quite readily and rapidly, and should be given in as large doses as can be digested; but in all cases where it disturbs the stomach, lessens the appetite or produces diarrhœa, it does harm and should at once be discontinued. On the contrary, it does good service when its use is followed by an increase in strength and body weight.

Therapeutic uses: Codliver oil is useful in all conditions of low nutrition with wasting; in the early stages of phthisis, before the disease is established in the lungs, codliver oil is capable of doing much good in building up the general system and the general nutrition, and may forestall the disease. In the established disease, however, it has no specific action upon the lesions in the lungs, but simply supports the patient and prolongs life, in so far as it aids the maintenance of general nutrition and strength.

It is used in cachexia from syphilis, cachexia from scrofula, and in delayed convalescence from acute diseases. It is serviceable in catarrhs of the respiratory tract, especially when it is dependent upon a low condition of nutrition.

Codliver oil is vastly more serviceable in children, and is much better borne and more readily digested than it is in the adult; and in the same proportion, its medicinal effects are far more prompt, more marked and more satisfactory. Children as a rule, soon learn to like codliver oil in any form in which it may be offered; in those in whom there is a lack of growth, due to a taint of scrofula, and after prolonged summer diarrhœas with emaciation, codliver oil is often of greater service than any other substance we can employ.

In cases where the stomach will not tolerate the oil, or where it produces diarrhœa, it should be given by *inunction*. Especially is it useful, given in this way, in children with gastro-intestinal catarrh and constant diarrhœa, and whose stomachs will not retain nor digest food. This inunction can maintain life for many days without feeding the child at all by the mouth, and so aids in the relief of the intestinal catarrh. Here the inunction should be applied all over the body, and be covered with either oiled silk or paraffin paper to prevent it from soiling the clothes. The inunction should be repeated twice in twenty-four hours, and on every third day, the oil should be removed by a soap bath, to prevent it from becoming rancid and unpleasant to the surroundings.

Calcium Lacto-Phosphate. Calcium Phosphate can be given in doses of from 5 to 20 grains; in children, from 1 to 5 grains. This salt has no therapeutic relation to phosphorus, and produces none of the physiological or toxicological effects which follow the ingestion of phosphorus. The lacto-phosphate of calcium is usually employed, because it is more freely soluble.

Therapeutic uses: It is used in medicine chiefly as a *bone food* in rickets, osteomalacia, in delayed union of fractured bones, and in children where there is a lack of bone salts and lack of bone development, which may be due to scrofula or to syphilis. Calcium phosphate, though in no direct relation with phosphorus, is used in the same kind of bone affections in which phosphorus is serviceable; but it differs from phosphorus in the fact that it simply supplies the bone salts for the construction of bone, whereas phosphorus stimulates the growth and multiplication of bone constructing cells.

In children with scrofula or scrofulous catarrhs and a lack of growth, calcium phosphate, in a fifty per cent. emulsion of cod-

liver oil, in which each teaspoonful contains 3 grains of the phosphate, is an admirable preparation. In pregnant women, in whom there is a tendency to a rapid decay of the teeth, which is probably due to the tax on the system for phosphates, for bone construction in the fœtus, the constant administration of calcium phosphate during pregnancy is useful, and may prevent this rapid decay.

Hypophosphites. The hypophosphites which are found so numerous in the market, consisting of the hypophosphites of the alkalies and the hypophosphites of the alkaloids, are all useful tonics in general debility, in the convalescence from acute diseases, and in mild forms of neurasthenia. They are usually prepared as syrups or as glycerites, and are pleasant and agreeable to take.

COLCHICUM.

Colchicum, or meadow saffron, is official in preparations of the *Seeds* and preparations of the *Root.*

Of the Seeds we have the Tincture (fifteen per cent. strength); dose, ½ to 1 fluidram.

The Wine (fifteen per cent. strength); dose, ½ to 1 fluidram.

Fluid Extract; dose, 2 to 5 drops.

The preparations of the Root are:

The Wine of the Root (forty per cent. strength); dose, 10 to 15 drops.

The Extract of the Root; dose, 1 to 2 grains.

The Fluid Extract of the Root; dose, 1 to 3 drops.

The *Wine of the Root* is the most elegant and the most reliable of these preparations, and is the one almost exclusively used by the profession.

The active principle of colchicum is the alkaloid *Colchicine,* which itself is not official, but it has been used hypodermically in doses of $\frac{1}{50}$ of a grain, with asserted good results, in different forms of rheumatism and rheumatic gout.

When colchicum is taken internally in frequently repeated doses, the first manifestation of its presence is a little looseness of the bowels or a tendency to slight diarrhœa. If the dose be increased, this diarrhœa will proportionately become more free. This is its *therapeutic limit.*

Toxic Symptoms. When colchicum is taken in toxic quantities, the symptoms are immediate and decided. Intense griping pain in the stomach, and violent purging, of large watery stools tinged with mucous. This purging is continued throughout the course of the poisoning. It is somewhat characteristic of colchicum, that the excessive purging constitues almost entirely the toxic symptoms. Nausea, vomiting and sometimes irritation of the kidneys have occurred, but these are never very marked. The purging is continued until at last the patient dies in collapse from a toxic enteritis.

The minimum and maxim fatal doses take life in about the same length of time. This is so, because the fatal result is to be wrought out by purging, and to kill by purgation requires a certain length of time. The excessive purging is probably the result of an attempted elimination of the colchicum by the intestinal glands, keeping up a constant stimulation and excessive secretion into the intestines themselves.

Treatment of Poisoning. The treatment of the poisoning consists in the administration of the antidote, *tannic acid*, the washing out of the stomach, and, if need be, sweeping out the intestinal canal with a saline cathartic; then opium should be used freely to control the pain and excessive purging. External heat should be applied to support body temperature, and if the heart and respiration become weak from the exhaustion, they should be supported by strychnine, whisky and digitalis.

Therapeutic uses: The use of colchicum in medicine is almost exclusively for the relief of *gout.* In purely rheumatic affections, this substance does not seem to have proven itself of as much value as the salicylates and other anti-rheumatic remedies. It can be used in acute gout, in chronic gout, and in the so-called rheumatic gout.

In acute gout it is not safe to push colchicum too hard, for fear of producing what is called a *retrocedent gout;* that is, a gout of one of the lower extremities may be transmitted to the internal organs, when the intestinal canal becomes irritated by the too free use of the drug; for gout will always attack parts which offer least resistance, or which are in a state of inflammation. In all forms of gout, the wine of the root of colchicum

should be employed, since it is probably the most constant in strength and the most elegant of its preparations.

Colchicum is known to aid the elimination of uric acid and other nitrogenous waste products from the system; and if an excess of uric acid in the system is in part or wholly the cause of gout, it would seem probable that colchicum cures it by *increasing the elimination of uric acid.*

Sarsaparilla. Of sarsaparilla, the two preparations that are of any practical value are: the Compound Syrup of Sarsaparilla; dose, 1 fluidram to ½ a fluidounce, and is mainly used as a vehicle; and the Compound Fluid Extract of Sarsaparilla, which can be given in from 1 to 2 fluidram doses. The former of these preparations is too weak to have much medicinal value. The latter is a very complex preparation, containing a whole series of ingredients, all of which are calculated to be alterative in their influence, and it can be used, and at times is very serviceable, in old rheumatism, in chronic gout, in rheumatic gout, and even in very chronic syphilis.

Guaiacum. *Preparations:* Tincture; dose, ½ to 1 fluidram. Ammoniated Tincture; dose, ½ to 1 teaspoonful.

The Resin guaiac is sometimes used locally in sore throats.

For internal use, the ammoniated tincture is probably the more elegant and the more employed by the profession.

Guaiac is a very complex resinous substance, containing *guaiaconic acid, guaiac acid, guaiacresinic acid, guaiac resin,* and probably a crystalline substance, *guaiacin.*

Therapeutic uses: Guaiac taken internally produces very little appreciable effect, save that of slight irritation of the stomach, and probably a little perspiration. In medicine, it has in times gone by, been very much used in chronic syphilis, chronic rheumatism, sciatica, and as a local application in tonsilitis, and simple catarrhal pharyngitis; but at the present time it is not much used in medicine, and is mainly respected as a relic of the past.

Mezereon. Mezereon contains a neutral crystalline principle, *daphnin,* and a volatile acrid liquid. It has no legitimate use in internal medicine, and when taken in large

doses, it is a violent local irritant, producing gastro-enteritis with all its concomitant symptoms.

The little that it is used at present in medicine is in the form of an ointment, as a mild counter-irritant to prolong a counter-irritation which has been produced by either mustard or cantharides.

Jambul. This is prepared from the *Bark* and *Seeds* of the Eugenia Jambolana, an East India tree. The active principle of this substance is not definitely known, but is probably an *Oleo-resin.* The bark, the seeds, and the rind of the fruit, all contain the active principle; but the preparations made from the seeds appear to be the most constant in strength and the most reliable. No preparations are at present official; but the *Fluid Extract* of the seeds or of the bark can be used in doses, beginning with 10 to 15 drops, three or four times a day, and slowly increase to ½ a fluidram.

It has but one use in practical medicine at present recognized, and that is in *diabetes melletus.* In some cases where it is administered, the sugar rapidly diminishes in quantity, and apparent cures have been effected. In other cases it seems to have no influence upon the disease. How it acts in this affection we do not know, because we do not fully understand the true cause of diabetes, but in all cases of glycosuria the drug should be tried.

Sassafras. The active principle of sassafras is a volatile oil, which at one time was believed to have alterative value; but at present it is recognized only as a flavoring substance.

Taraxacum. This is the ordinary dandelion plant, which contains a bitter principle that is slightly stomachic. It was at one time believed to be diuretic in its influence, but this is probably a mistake. At present it is used in the form of the extract, principally as a pill mass, in which to exhibit other drugs.

Ichthyol. Ichthyol is a *fossil resin,* derived from fossil fish, by a process of destructive distillation. It appears in the market as ichthyolates of the alkalies; Ichthyolate of ammonium, Ichthyolate of sodium and Ichthyolate of potassium.

These different ichthyolates do not appear to have any medicinal differences, and it matters little which is used. The *Ichthyolate of ammonia* is most commonly kept in the shops, and is the most frequently employed. It has the advantage of mixing with other substances a little more freely than do the other ichthyolates. It mixes readily, and in any proportion, with oils, with fats to make ointments, with water, and with glycerine. It can, therefore, be prescribed in the form of a liniment, or as an ointment for external local purposes.

Therapeutic uses: Ichthyol, being comparatively free from irritant properties and locally antiseptic, becomes a useful remedy in the different kinds of skin diseases, like Eczema, Psoriasis, in Tinea Versicola and in Erysipelas. In erysipelas it should be mixed with equal parts of sweet oil or glycerine with a few drops of carbolic acid, applied directly to the part affected, and covered with oiled silk.

It is also useful in sprains of joints, local inflammations, inflamed lymphatic glands, and as an external local application in tonsilitis.

In internal medicine, it has at present no known good uses, and is very rarely so employed.

CHAPTER XIV.

SERUM THERAPY.

Under Serum Therapy we have two distinct classes of substances: **Animal Extracts** and **Antitoxins.** The former are yielded by the different lymphoid or gland tissues of animal life, while the latter are induced in the animal organism by the presence of *bacteritic toxins.*

ANIMAL EXTRACTS.

They are: **Nuclein, Thyroid Extract, Suprarenal Extract, Extract of Spleen, Extract of Bone Marrow, Extract of Testicle, Extract of Pituitary Glands** and **Snake Poison.**

NUCLEIN.

Nuclein is an organic body which can be derived from the nuclear substance of both animal and vegetable tissues. It is a phosphorized proteid, combined with nucleinic acid. For practical uses in medicine, it is usually derived from unicellular fungi, such as the *Yeast* plant, and occurs in commerce as a yellowish-white powder, of acid taste and acid reaction.

Therapeutic uses: In practical medicine, it has been highly recommended in all septic conditions and septic fevers. It is claimed to be free from toxic effects to the higher animals, and yet is said to be germicidal. In septic fevers, like *puerperal fever,* it has been given hypodermically in a five per cent. solution, in doses of 10 to 30 minims. This use of nuclein has as yet no great abundance of clinical support, and needs further trial to establish its usefulness.

Locally, nuclein is of some value as an application to poisoned wounds, suppurating glands, and old ulcers. It has also some influence upon an ulcerated sore throat or follicular tonsilitis, and in diphtheria. In all of these local uses it is more efficient when it is applied in powder form.

Protonuclein. Protonuclein of the market, is a nuclein prepared from the lymphoid or glandular tissues of healthy animals: The Thyroid, Thymus, Corpora Quadrigemina, Pineal Gland, Pituitary Bodies, Liver, Spleen, Salivary

Glands, and the Pancreas, are all used to extract this substance. Its activity is preserved by investing it in gum benzoin and sugar of milk, which is said to keep it indefinitely.

The protonuclein derived from animal glands, is said to be richer in nitrogenous elements and phosphorus, than the nuclein prepared from yeast, and is, therefore, claimed to be more effective.

Its value in specific diseases, is said to depend upon the increased leucocytosis it produces in the blood and tissues, and in this manner it augments the *phagocytic* or germ-destroying power of the tissues, and affords increased resistance to the progress of the infection.

Therapeutic uses; Protonuclein is said to be antitoxic in all kinds of specific diseases; in chronic suppuration, in septic endocarditis, phthisis, diphtheria, puerperal fever, typhoid fever, and the like. It can be given hypodermically in 10 to 20 minim doses, of a five per cent. solution, or by the mouth, in 3 grain doses.

Hypodermically injected, around the base of tumors and ulcers of malignant type, it is said to have most remarkable effects; but how much of this claim can be clinically verified, remains to be seen. For hypodermic use, the solution should always be made with water, at a temperature which is never above 90° Fahrenheit. A temperature 103° is said to destroy its activity.

THYROID EXTRACT.

Thyroid Extract can be prepared by taking the green thyroid gland, crushing it in a mortar, and then preparing a glycerine extract from it, of a strength so that every 40 minims of the extract, shall contain the virtue of 10 grains of the gland substance. This extract can be administered hypodermically or by the mouth. The green gland itself can be used, either raw or slightly boiled, to the amount of ½ a gland per day. The gland can also be dried and powdered, and this powder exhibited in doses of 1 to 3 grains three times a day, increased to a point of tolerance, or until physiological symptoms appear.

The active principle contained in this gland is probably a *thyro-iodine*, a proteid body containing a certain per cent. of iodine. It is believed that this thyro-iodine has necessary relations to general nutrition and cell metabolism, because the removal

of the gland itself in an animal, or its destruction by disease in a human being, gives rise to a certain diseased condition called *myxœdema*, which in turn yields to the daily exhibition of this gland substance.

Physiology. When thyroid extract, or the gland substance itself, is adminstered in large doses continuously, it finally produces a condition called *thyroidism*, the chief symptoms of which are, rapid loss of body weight, shortness of breath, weak rapid pulse, nervousness, and rapid loss of strength. This group of symptoms indicates the discontinuance of the substance, or at least a diminution in the dose, and may be called its *therapeutic limit.*

When given internally in large quantities to the lower animals, it is capable of producing elevation of temperature, increase in the pulse rate, nervous trembling, and shortness of breath; and in some cases it develops symptoms very much resembling those of exophthalmia.

Therapeutic uses: In practical medicine it has proven itself to be useful in *myxœdma*, simple or "*Swiss*" *goitre*, and in *Obesity*. In exophthalmic goitre, it increases the cardiac palpitation and other symptoms, and is, therefore, harmful and *contra-indicated.*

Suprarenal Extract. This is prepared from the *suprarenal capsules* of adrenal bodies, by making a glycerin extract of it, in which each fluidram contains the virtues of 10 grains of the dried gland. This extract can be given daily in 10 minim doses hypodermically. The dried, powdered gland can be given in doses of 1 to 3 grains, slowly increased.

These suprarenal bodies contain active principles, one of which is *neurin*, which, in toxic doses, in the lower animals, produces loss of muscular power, failure of respiration, depression of the circulation, and death by asphyxia.

This substance, *neurin*, may have some direct relation to general cell nutrition; and its absence, after the destruction of the adrenal bodies, giving rise to the so-called *Addison's disease.*

But it is more probable and is generally believed, that this substance, neurin, is a waste product, probably the outcome of wear and tear of the nervous system and the muscles, and which, instead of being produced by the adrenal bodies, is probably

destroyed by them, and frees the system of a poison which, by its presence, may cause Addison's disease. The latter view is the one most generally accepted.

Therapeutic uses: Suprarenal Extract is exclusively used in Addison's disease, and its continuous use in this affection, has proven it to be of great service.

Extract of Spleen. This extract has been employed with success in the treatment of *exophthalmic goitre;* and there is now sufficient evidence of its value in this disease, to warrant further clinical trial. It should be given as a glycerin extract, beginning with 10 minim doses, and slowly increasing it; or a powdered extract may be used, beginning with 1 to 2 grain doses and increase it.

Extract of Bone-marrow. Extract of Bone-marrow has been tried in the different forms of anæmia, and especially in pernicious anæmia, with results which are neither very encouraging nor commendable; but, like the rest of these extracts, it is still undeveloped, and may become capable of better things.

Extract of Testicle. The Extract of Testicle, or Brown-Sequard's famous "Elixir of Life," has been tried for the relief of sexual exhaustion after over-indulgence, and in the aged, who have lost sexual power by reason of years. It has been employed in general nervous debility or neurasthenia, and although some value is claimed for it in these low conditions of the nervous system, its clinical usefulness still remains to be established.

Pituitary Extract. Extract of the Pituitary glands has been prepared and experimentally tried in various diseased conditions, but in no case has it given sufficient evidence of practical usefulness to inspire clinical confidence.

Snake Poisoning. Immunity against snake venom has been produced in the lower animals, by injecting them with minute doses of snake poison, and slowly increasing the quantity, and by this means there is finally established a tolerance in the system. This fact is of far more

scientific importance than it is of practical value; for there is not sufficient reason and utility to produce this immunity, where exposure to the venom is so exceptional.

The discovery, however, of Prof. Frazer, that snake poison probably contains or carries with itself, its own *antidote* or *antagonist*, is of very great scientific interest and importance. For a long time it has been known that the poisonous snake is immune against its own venom. It has also been known that snake poison taken into the stomach, produces no toxic effects on animals or man; but the explanation of these facts has not been made clear until this late discovery.

The snake poison, consisting of two factors, the *toxin* and its *antidote* or antitoxin, is rendered harmless when ingested, because the digestive fluids probably destroy the toxin and render it inert. But the gastric secretions do not seem to have any destructive effects upon its counter-poison or *antagonist*, but which is absorbed and may thus become antidotal in the system in case of snake bites. Even so true is this, that an animal can be injected with snake venom, and an additional amount of venom afterwards given by the mouth, will in part counteract the toxic effects of the poison in the circulation; because the antidotal part is not destroyed by the digestive fluids, but is absorbed, and in the circulation counteracts the poisonous effects of the venom.

It has still further been discovered that the *bile* of venomous snakes contains large quantities of this *antidotal substance*, so much so, that after snake poisoning, if this bile be taken both internally, and applied locally, the poison may be counteracted. It is that part of this very interesting subject, that may be of practical usefulness, and give us a possible novel treatment for snake bites. If, therefore, after a bite from a venomous snake, the gall bladder of the animal, or of another snake of the same species can promptly be secured, the contained bile should be used partly internally, and partly locally over the region of the bite.

ANTITOXIN.

A *Toxin* is a poison yielded by disease-producing bacteria, after they have entered the animal system; and to this poison or toxin are due the symptoms and lesions which characterize infectious diseases.

An *Antitoxin* is a substance developed in the animal organism in the presence of, and caused by the bacteritic toxin, by induc-

tion as it were, to resist the deleterious influences of the toxin, on the functions and tissues of the different organs.

It would seem to follow then, that a bacteritic *toxin* is of *vegetable origin*, whereas an *antitoxin*, which is antagonistic to the toxin, is of *animal origin*. It is this very principle, that antitoxins are developed or produced in the animal tissues, by the presence of toxins, upon which the practical manufacture of antitoxin is based.

An antitoxin is produced by giving a minimum quantity of a toxin of pure culture, by hypodermic injection, to a domestic animal (usually a horse, mule or a goat), and this is followed successively, and at regular intervals, by as much larger doses of the toxin as the animal can bear, until there is developed in the blood of the animal, an antitoxin or *resisting power* to the toxin, of sufficient strength to be, what is known as *standard strength*. After this the animal is bled, and the serum of the blood thus drawn, contains the antitoxin of commerce.

From the above facts, in regard to the manner in which antitoxin is obtained, it would seem probable that this is exactly what takes place in the infectious fevers in man, and determines the *self-limitation* of these diseases. In the course of an infectious disease, it would seem that an antitoxin is developed in the system, to resist the toxin of bacteritic infection, and slowly, but progressively renders the individual immune against the toxin, as well as arresting the growth and multiplication of the bacteria themselves; and the period for beginning convalescence from such a disease may probably be fixed at a point where an immunizing quantity of the antitoxin is developed, and the infection becomes arrested.

This view of the subject finds support in the fact that it has recently been shown that an outbreak of tetanus in a stable of horses or mules, can at once be arrested by injecting every healthy animal with an immunizing dose of tetanus antitoxin. It has also been demonstrated that in an outbreak of diphtheria in a family of children, or in institutions for children, that the healthy ones are likewise protected against infection, by giving each child exposed to the disease, an immunizing injection of diphtheria antitoxin.

Again, it is a noteworthy fact, that it is a frequent experience in antitoxin laboratories, that such animals as are incapable of developing an antitoxin, or any protective quantity of it, are very apt to die suddenly under the influence of a toxin. This

would also suggest it to be at least reasonable to suppose, that in some cases of infectious diseases in the human subject, a fatal termination may be due to this cause.

Whether the antagonism between a toxin and an antitoxin be a species of chemical neutralization in the body, or whether it be a *physiological process*, related to cell metabolism directly, is as yet a matter of mere speculation. It is necessary that more of the nature of these two substances be known, before this fact can be determined definitely. But the weight of evidence, as well as the majority of authorities, seem to favor the view that this action and relation is of a *vital* rather than of a *chemical* character.

Antitoxin Unit. In the practical use of antitoxin in disease, the doses employed are estimated in *units;* which units are arbitrarily established, and are, as near as possible, uniform for all antitoxins to the various diseases, by all the different manufacturers who prepare them.

An *Immunizing Unit* of antitoxin may be defined, as *just sufficient antitoxin, to preserve the life of a guinea pig weighing 300 grams, which has received 100 times the minimum fatal dose of the toxin.* By this arbitary unit, as a measure, all the antitoxins are standardized in the laboratory, before they are put upon the market.

Three different strengths of antitoxin are available: *Standard, Potent,* and *Extra-potent.*

A *Standard Antitoxin* is of such strength that each cubic centimeter contains 100 units of antitoxin.

A *Potent Antitoxin* is of such strength that each cubic centimeter contains about 250 units of antitoxin.

An *Extra-potent Antitoxin* contains 500 or more units to each cubic centimeter.

No antitoxin is put upon the market which is of less than standard strength; but it may be anything above that point. It is at present a vital problem with the manufacturers of antitoxin, to discover a process by which to concentrate the serum, to a higher standard of strength, after the blood is drawn from the animal. Many processes by heating and evaporation have been attempted, but with signal failure. However, a process now on trial, by a method of freezing the serum, is to some degree promising in its results.

It may be mentioned here that it has recently been discovered, that antitoxins, on long standing, slowly lose in the

number of their units of strength, and it is noticed that those antitoxins of the higher potency, seem to lose unit-strength more rapidly than those of the lower potency. If this should prove to be constant under all circumstances, it becomes necessary to re-standardize all such antitoxins, after they have been in the market for six to eight months or more, to re-establish the strength of immunity they then may possess.

The urticaria and other skin eruptions which have occasionally followed the injection of an antitoxin, are now known to be due to the fact that the antitoxins were too new or recent. An antitoxin should therefore be allowed to become three or more weeks old before it is used, so as to avoid these skin eruptions.

The antitoxins are: **Diphtheria Antitoxin, Antitoxin to Erysipelas, Tetanus Antitoxin, Antitoxin to Glanders, etc.**

Diphtheria Antitoxin. The Antitoxin to Diphtheria is, of all the antitoxins at present used, the most practical in value. Its usefulness is fully established. The dose of it varies, according to the severity of the disease, from 800 to 3000 units.

In small children, where the disease is of moderate severity, 500 to 800 units may be sufficient. If the disease be very severe, the dose can be increased to 1500 units at the first injection, and if no appreciable improvement or reaction is noticed within twelve hours, a second injection should be given. This second injection can be from 800 to 1000 units.

In adults, the average quantity can be put down as from 1500 to 3000 units at the first injection, and this can be followed in twelve to fifteen hours, if necessary, by such an additional quantity as may be required to produce a reaction in the disease.

Antitoxin is entirely different from other medicinal agents employed in acute diseases, in the fact that in the healthy organism, if the antitoxin be pure, it is not expected that it will produce any symptoms or appreciable effects whatever, and it is, therefore, free from toxic or deleterious properties. This being true, the dose in diphtheria is gauged, not according to the individual's age or size, but wholly according to the *severity* of the *infection.*

It is administered with a hypodermic syringe into the buttock, the thigh or the back. Because of the large quantity to be injected, special large sized hypodermic syringes are prepared

for this purpose. But with a little care, an antitoxin injection can be given very easily and readily with the ordinary hypodermic syringe; the needle should be inserted under the skin to its full length, after proper antiseptic precautions have been taken, and the barrel emptied; then leave the needle in place, detach the barrel from the needle, refill it and attach it to the needle and empty it in the same manner; this can be repeated, until the full amount is injected, without inflicting any more pain upon the patient than with the larger syringe, or without the insertion of the needle more than once.

It is absolutely essential that the antitoxin in diphtheria should be given just *as early as it is possible to make a diagnosis of the disease.* It is a universal clinical experience, that when antitoxin is used in the later stages of the disease, it has practically no influence over its progress. This is probably true because, after some length of time, the toxin in the system will produce changes in the tissues, especially in the heart muscle and the nervous system, which may produce finally a fatal termination, even though the toxin of the disease should cease to be operative. It is at the same time probable, that in the advanced stages of the disease, there may be an additional infection of the ordinary *streptococcus toxin.*

This use of antitoxin in diphtheria is not only saving many lives, and reducing the death rate of this dreaded disease, but it is cutting short, by a good many days, the course of the illness. A child who has received at the proper time, the proper amount of antitoxin in diphtheria, will have practically recovered, though not safe to mix in with other children, at the end of seven to nine days; whereas the course of the disease without antitoxin, until convalescence becomes marked, is oftentimes two and three weeks.

Diphtheria antitoxin is probably as effective and reliable as a *prophylactic* to diphtheria, as it is powerful to arrest the course of the disease itself. Its immunizing power is now well established clinically, as well as experimentally. Epidemics of diphtheria breaking out in institutions for children, can effectually be arrested by giving to each healthy child an immunizing dose of 300 to 500 units of standard antitoxin.

This procedure can be recommended, and should be followed when diphtheria occurs in families of small children. When the isolation of the sick, in the event of diphtheria, cannot be made

effective, the immunizing dose used should at no time be less than 300 standard units of antitoxin.

Antitoxin to Erysipelas. The Antitoxin to Erysipelas is prepared from the *bacillus streptococcus.* This antitoxin can be tried in erysipelas with a fair degree of hope for success. It has also been used in scarlatinous sore throat and in other forms of septicæmia with asserted good effects. The degree of its usefulness and the certainty of its action are, however, still to be established by a more extensive clinical employment.

Tetanus Antitoxin. The Antitoxin to Tetanus has now established some measure of usefulness. In the fully developed disease, both in man and the lower animals, its use has not given the best satisfaction and has probably very little influence over the disease. In the cases in which it has been employed, not enough decided effect has been shown to determine whether the improvement and recovery which followed, did so in the natural course of the disease, or whether such change was due to the presence of the antitoxin. But in the lower animals, especially in the horse and in the mule, it has proven itself to be positively *prophylactic* or *immunizing* in power. When injected into the healthy animals which are stabled with the diseased ones, after an epidemic of tetanus has invaded the stable, it has arrested the spreading of the disease. It is, therefore, of some practical use to arrest the infection in its progress in infected stables, and may do good under like circumstances in the human subject.

Antitoxin to Glanders. Antitoxin to Glanders is still in its course of development. Sufficient evidence, however, has been obtained in a scientific way, to create the belief that it may in the future become of definite value in this disease.

Bubonic Disease. Recently an antitoxin to *bubonic disease* is claimed to have been developed in goats, to such a degrees of certainty, that it prevents the development of the disease in those who are not yet infected, and in some cases, it is asserted to have cut short the disease, in those who have been infected.

Phthisis Antitoxin. There is at present an attempt to make an antitoxin to *phthisis*. This antitoxin, if it should ever be developed to a degree of usefulness, will have no relation to the former "tuberculin" of Koch.

There must, however, be very serious doubt in the minds of thinking men as to whether such an antitoxin can be developed, because the disease itself is so entirely different in its course and natural termination from the other infectious diseases, that the development of antitoxin seems to be impossible.

The diseases from which antitoxins can be cultivated, and for which antitoxins are useful, are the infections which are *self-limited* in their course; and in which there is a tendency to spontaneous recovery. This spontaneous recovery and self-limitation are probably dependent upon an antitoxin developed in the system during the course of the disease.

Phthisis, on the contrary, knows no self-limitation short of death. There is no tendency to spontaneous recovery, and hence no antitoxin developed in the system during the course of the disease to arrest its progress. It is this striking difference between phthisis and other infectious diseases, which causes one to be skeptical as to the successful production of an antitoxin which will arrest this disease.

CHAPTER XV.

ANTIPERIODICS.

The remedies of this class are called *Antiperiodics*, because one of their principal uses is in periodic or malarial fevers.

They are: **Cinchona and its Alkaloids, Eucalyptus and Picric Acid.**

CINCHONA.

Preparations. Infusion of Cinchona, six per cent. strength; dose, ½ to 1 fluidounce.

Tincture of Cinchona, of twenty per cent. strength; dose, ½ to 1 fluidram.

Fluid Extract of Cinchona; dose, 5 to 15 minims.

Extract of Cinchona; dose, 5 to 10 grains.

Compound Tincture of Cinchona (Huxham's Tincture); dose, 1 to 2 fluidrams.

Of these preparations, the one that is almost exclusively used, and which is by all means the most elegant, is the *compound tincture.*

The alkaloids of cinchona are *Quinine, Quinidine, Cinchonine* and *Cinchonidine.* There are also two artificial or synthetic alkaloids, *Quinicine* and *Cinchonicine.*

Cinchona has, besides these alkaloids, a number of amorphus active principles which have therapeutic value.

Quinine is the most active of the natural alkaloids, but the rest produce effects which are apparently identical with those of quinine, only that they have to be given in about one-third larger quantities to produce the same degree of action.

The salts of these alkaloids are the *Sulphates* and the *Bi-sulphates.* Of quinine, there is also a hydrochlorate, a hydrobromate and a tannate, but the sulphate and the bi-sulphate are generally used. The bi-sulphate of quinine differs from the sulphate, only in degree of solubility. The sulphate is soluble in acids and in alcohol, but the bi-sulphate is soluble in water. The double salt, sulpho-hydrochlorate of quinine, has been introduced into medicine because of its free solubility, but it has no other differences from that of the sulphate.

Local Action. Locally, quinine in dilute form is *stimulant* to mucous membranes, and in concentrated form it becomes an *irritant* and slightly *disinfectant.*

Cinchonism. When quinine is given in a sufficient dose to produce its first physiological effects, there occurs a ringing in the ears, feeling of dullness, with slight headache, and some disturbance of vision. This group of symptoms forms what is called *Cinchonism*, and marks the *therapeutic limit* of the drug.

Toxic Symptoms. When quinine is given in toxic doses, the ringing in the ears is increased, deafness occurs, headache becomes more severe, flushing of the face, dizziness, vision becomes more disturbed by ptosis, dilatation of the pupils, and strabismus; the reflexes become lessened and finally lost; pulse weak, the blood pressure falls, the respiration yields, the temperature falls, and there may be unconsciousness with convulsions, and death from paralyzing respiration.

To produce these marked symptoms, it takes enormous quantities, since quinine cannot be classed amongst the dangerous poisons, and a fatal poisoning can hardly occur in a healthy human adult.

Physiology. The ringing in the ears and deafness, are probably produced by an increased congestion of the middle ear; and in cases of middle ear disease, quinine in large doses, is apt to increase the trouble, and should be avoided.

The headache, the flushing of the face, and occasional bleeding at the nose, are probably the outcome of congestion of the cerebral meninges.

The reflexes, after very small doses of quinine, are said to be slightly increased, which increase is possibly due to stimulation of the sensory nerves. In large therapeutic and in toxic doses, the reflexes are lessened and finally lost. The lessening of the reflexes is due to stimulation of the *reflex inhibitory centres* (Setchenow's centres), in the medulla oblongata; while the final loss of reflexes, is due to depression of the sensory cord and nerves, and later a yielding of the motor cord.

Circulation. In moderate doses quinine has only very slight influence on the circulation. It probably slightly increases the blood pressure, by vasomotor stimulation. In toxic doses, however, the entire circulation yields,

depressing the heart, vasomotor centres, and the bloodvessel walls; but in no dose in which quinine is used in medicine, is the depression to the circulation very decided.

On the Blood. A solution of quinine mixed with blood will arrest the ameboid movements of the white blood corpuscles, and lessen the oxygen carrying power of the red blood corpuscles. It is, however, not probable that these changes occur in the circulation after the administration of quinine, for no evidences of it are appreciable.

Elimination. After the ingestion of quinine, the elimination begins in from two to four hours. Traces of it, however, have been found thirty minutes after the ingestion. Of a single quantity ingested, about one-half of it is eliminated within the first fifteen to twenty-four hours, and the balance leaves the system gradually. It is eliminated by the kidneys, partly as *quinine* and partly as a *dihydroxyl-quinine.*

It is probably absorbed principally from the stomach, because it is more readily soluble in acid gastric secretions than in the alkaline fluids of the intestines; but it is held in solution, in the alkaline circulation, by the CO_2 present in the blood.

On the Uterus. The healthy uterus can be found in one of three conditions: It may be *virgin,* it may be *pregnant,* or it may be *parturient.* Quinine has no known influence upon the virgin or pregnant uterus; and it is therefore incapable of producing abortion, when it is used for the relief of malaria in pregnant women. On the parturient uterus, or the uterus in the act of giving birth, quinine has the power to increase the normal intermittent contractions. It probably does this, not through any specific action on the innervation of the womb, but through its general tonic action, and the uterus simply sharing this effect with the rest of the system.

On Infusoria. To Infusoria quinine is a poison; and in concentrated solution it is capable of preventing or checking fermentation and putrifaction. It is probable that by this action it becomes a curative agent in malaria, killing the plasmodia of the disease in the blood, or preventing their growth and reproduction.

On Temperature. In large doses quinine has the power of reducing body temperature in fevers, but it is an uncertain practical antipyretic. In health it is

incapable of reducing body temperature except in toxic doses, but it will prevent the slight rise of temperature, which normally occurs after heavy physical exercise. It probably regulates the temperature, and reduces it in fever, by a direct action on the heat centres.

On the Gastro-Intestinal Canal. On the digestive tract quinine acts as a bitter and stimulant stomachic, stimulating the secreting glands and increasing the appetite. When there is irritation of the digestive tract, quinine, in large doses, may do harm through its irritant influence.

Effect on Nutrition. Quinine increases the nutrition and cell metabolism of the entire organism, and thereby becomes a general tonic. It likewise diminishes tissue destruction, and the elimination of nitrogenous waste products in the urine. This would seem to indicate that, in some way, it had the power to preserve the tissues of the body, or act as an *accessory food*, in conditions of under-feeding in disease; and it is constantly being so used in typhoid and other low fevers.

Contra-indications. Quinine is contra-indicated in *middle ear disease*, in *gastro-intestinal irritation*, in *inflammation* of the *kidneys* and *bladder*, in acute *inflammation* of the *skin*, in *meningitis* and in *epilepsy*.

In an epileptic, it is a clinical belief that the use of large doses of quinine increase the frequency and severity of the epileptic attacks.

Therapeutic uses: Quinine is used as an *antiperiodic* in malaria, as an *antipyretic* in fevers, as a *gastro-intestinal tonic*, in *chorea* of childhood, and as an *ecbolic* in the early stages of labor.

As an Antiperiodic. As an Antiperiodic in malaria, quinine has two distinct uses: First, as a *prophylactic;* second, as a *curative* agent.

The prophylactic use of quinine is to prevent material infection of the system when exposed to the poison in malarial districts. It should be used in doses of 2 and 3 grains three times a day, during the entire period of such exposure.

As a curative agent, quinine is the best drug known for all forms of malaria, and should always be given in proportion to the severity of the infection.

Types of Malaria: For convenience of study and to coadjust the use of quinine properly to this disease, malaria can be divided into five types: *Intermittent, Remittent, Malignant, Chronic Malaria* or malarial cachexia, and *Irregular Malaria* or "Brow Ague."

This classification being based principally upon the severity of the infection rather than any other peculiarity, and consequently it has more clinical convenience than scientific accuracy.

Intermittent Type. In the Intermittent Malaria, which is the mildest and simplest form of the infection, the treatment should be commenced by giving a mercurial purge, and this followed by 15 to 20 grains of quinine, given in 5-grain installments an hour apart, so that the first part is given not more than six hours before the expected chill, and the last part about two hours before the expected chill; in this way the entire quantity or dose is active in the circulation at the time the chill occurs. It is necessary that quinine is given in this way, so that a large quantity may be in the circulation, and thus kill the plasmodia of the infection. If the doses of quinine be given at long intervals, the first part may be eliminated before the last is given, and the patient does not get the benefit of the estimated amount.

The mercurial purge can be given in divided doses, repeated, or in one single dose of 5 grains, of either calomel or blue mass. A mercurial is preferable to any other cathartic, because it at the same time opens the bowels, sets the kidneys into action, and increases the functional activity of the liver.

Remittent Type. Remittent Malaria differs from the intermittent, in that the infection is more severe. It can be distinguished from the intermittent, by the fact that in the remittent the temperature does not become normal between the paroxysms of fever, while in the intermittent, the temperature is normal between the attacks. In the treatment, the remittent differs from the intermittent only in the fact that larger doses of quinine have to be used; probably 20 to 30 grains may be needed to the dose, given in divided quantities. When the stomach is very irritable, it is better that the bowels should be opened with a mercurial and the stomach quieted, before the quinine is given.

Malignant Malaria. In Malignant Malaria, quinine must be given in very large doses; 50, 75, and even 100 grains at a single administration may be needed. To give this large quantity, some has to be administered by the mouth, some by the bowel, and some hypodermically. To get the most rapid action from quinine in great urgency, it should be given in acid solution, both by the mouth, by the bowel, and hypodermically, so as to secure prompt absorption. A hypodermic injection of quinine should not be larger than 10 grains, and the bi-sulphate is preferable on account of its greater solubility. The solution should be distinctly, but not strongly acid; and a vegetable acid should always be used, such as citric, tartaric or acetic acid.

Chronic Malaria. In Chronic Malaria or malarial cachexia, there usually exists obstinate constipation, a foul coated tongue, loss of appetite, anæmia, jaundice, enlarged liver and spleen, and the chills are irregular or wholly absent. In this type, quinine should be given at such intervals as the chills may be expected; once in five or seven days, or whatever the periods may be at which they come on, and should be in full doses, so as to make a severe cinchonic impression. During the interval between the paroxysms, the constant use of "Fowler's Solution," in ascending doses, gives the best results.

In this type of malaria, there is usually constipation. The bowels can at first be opened with a mercurial; but the daily laxative which is necessary to keep them open, should consist of the *bitter vegetable cathartics*, such as aloes and podophyllum, combined with quassia. These bitter vegetable cathartics and stomachics are, in themselves, slightly anti-malarial. If the kidneys are sluggish, a daily dose of bi-tartrate of potassium can be used to increase their activity. For the enlarged spleen, the fluid extract of ergot in full doses, given daily, has more influence than any other drug.

Irregular Malaria. In this form of the disease, the difficulty lies more in making a diagnosis than in the treatment. Sometimes it occurs as a supra-orbital neuralgia or "brow ague;" at other times it appears in periodic epileptic convulsions; sometimes there is a continuous severe headache, resembling brain tumor; and it may appear as a periodic severe dysentery.

After the diagnosis is made, the treatment consists in giving the quinine in very large doses, 30, 40 to 50 grains, to break up the attacks and arrest the disease.

In all forms of malaria, after the fever is broken up with quinine, it is well to follow it up by an after-treatment of iron and arsenic in tonic doses, continuously used for some time, to overcome the anæmia produced by the malarial poison.

In small children infected with malaria, quinine should always be given by the bowel. Here it can be given in acid solution, or it can be given in suppositories, using the more soluble bisulphate of quinine.

As an *antipyretic* in fevers, quinine is not of much practical use. It can be given in fevers, after they have reached their climax, and are already on a declining scale; or it may be of some value in fevers, after the temperature has been reduced by cold, to hold the temperature down for a longer period than it would otherwise remain.

As a *stomachic tonic*, quinine is of service in loss of appetite due to atony, and in convalescence from acute diseases where the return of appetite is slow. It is sometimes used to break up colds, and probably has some value, but its power in this respect is likely overestimated.

In *chorea* in children, quinine is of service when given in full doses. It arrests chorea probably by its stimulant action upon the inhibitory reflex centres. In practical experience, the choreic children, who are capable of taking the largest amount of quinine without the production of cinchonism, are the ones in whom the treatment does the most good.

Quinine has been found to be of some service in incontinence of urine in children, where they "wet the bed" at night. This, in some cases, seems to be due to a lack of inhibitory power to the bladder, and the drug, therefore, probably acts similar to its effect in chorea, by stimulating the inhibitory centres to the bladder. It is recommended to be given in 3 to 5 grain doses three times a day. In some children much larger doses are borne, and will effect a cure where the smaller doses have no influence.

As an *ecbolic*, quinine can be used in uterine inertia occurring in the early stages of labor, where you simply want the natural uterine contractions strengthened; and where ergot would probably be unsafe, because of its greater power to produce spasms of the uterus.

Warburg's Tincture. "Warburg's Tincture" has been used with great success in severe remittent and malignant malaria of the tropics. It is directed to be given in two doses, each ½ a fluidounce, about three hours apart, both doses to be given undiluted, and no liquids allowed between. After the second dose, it is said that a profuse sweat occurs, with fall of temperature, and convalescence following.

"Warburg's Tincture," being made up of bitter stomachics, the chief one of which is cinchona bark, can also be used in small doses as a stimulant stomachic tonic, to increase the appetite.

EUCALYPTUS.

Preparations. Oil of Eucalyptus; dose, 10 to 15 drops. As an antiperiodic, the dose is from 20 to 30 minims, given in capsules in divided parts.

Fluid Extract of Eucalyptus; dose, 5 to 15 minims.

The local action of Eucalyptus is that of an irritant to mucous membranes, producing in full doses, nausea and disturbance of digestion.

Toxic Symptoms. In toxic doses this substance produces intense pain in the stomach, nausea, repeated vomiting, purging, pain in the back and loins, scanty and probably bloody urine, and finally suppression of urine; depression of the circulation, fall of temperature, loss of reflexes, irregular respiration, stupor, and may be followed by convulsions, and death in collapse.

Physiology. In physiological doses the drug produces a condition of exhilaration or increased activity of all the functions, slight exhilaration of the circulation, increase in respiration, and spinal reflexes slightly heightened. In toxic doses, however, it, in common with all the volatile oils, becomes a general depressant to all the organs.

Elimination. It is eliminated principally by the kidneys, the lungs, and the skin. To the urine it is said to impart an odor resembling that of *violets* This same peculiarity has been claimed to follow the ingestion of the oil of turpentine.

Therapeutic uses: The oil of eucalyptus can be used for three different purposes in medicine. As an *antiperiodic,* as a *stimulant expectorant,* and as a *diuretic.* Of these, its expectorant use is its best.

As an antiperiodic in malaria, it should only be employed in such cases where quinine, for some reason cannot, or had better not be used, or where none of the cinchona alkaloids can be obtained. It is uncertain and inefficient as an anti-malarial, and can therefore only serve as a mere substitute for quinine.

As a stimulant expectorant, it is one of the best; but this will be discussed under its proper heading.

As an alterative diuretic, it is of less service than other volatile oils used for the same purpose, and is therefore not much employed.

Eucalyptol is a refined oil of eucalyptus, in which some of the foreign inert materials have been removed. It is slightly more elegant and probably a little less locally irritant than the oil itself, and it can be used in the same doses, and for the same purposes.

PICRIC ACID.

Picric or Carbazotic Acid is not now official, for the reason that it has no legitimate uses in medicine. Formerly it was used as picrate of potassium, sodium, or ammonium, in doses of 5 to 10 grains. It has been tried in malaria without good results. Since it has a destructive influence on lower animal organisms, it was formerly used in intestinal worms, in the different forms of tænia, and in trichinosis; but in none of these affections has it given any satisfaction.

Toxic Symptoms. As a toxic agent, when taken in large doses, it produces some degree of gastro-intestinal irritation, with vomiting, and staining of all the vital tissues to a greenish yellow color, somewhat resembling jaundice; a *yellow color* to the urine, general emaciation, fall of temperature, and collapse. A peculiar blood lesion exists, in which the red blood corpuscles become nucleated, and free nuclei have been observed in the blood.

CHAPTER XVI.

ANTIPYRETICS.

The drugs belonging to the class of antipyretics are grouped together, because they are all capable of *reducing body temperature* by direct influence upon the *thermogenic centres* in the brain; but not by any means are they all used in practical medicine as antipyretics, and hence for convenience of study, they may be divided into *three sub-classes*; this division being based upon the difference in the toxicology and in the therapeutic applications of the drugs in each sub-class.

Those of the *First Group*, are by all means the most poisonous, and are principally used for local purposes. They depend for their usefulness upon *anæsthetic* and *antiseptic* qualities. Of this group, *Carbolic Acid* is the type, and those associated with it, resemble it very closely in physiological and therapeutic peculiarities.

Those of the *Second Group* are less toxic than those of the first, and their greatest therapeutic use is *anti-rheumatic*. Of this group, *Salicylic Acid* is the type, and the rest are closely related to it.

The *Third Group* constitutes the true and practical antipyretics. They are still less poisonous than the drugs of the second group, and are far less so than those of the first group; but yet in large enough quantities, the symptoms produced by any of the drugs under these three groups resemble each other very closely, and naturally so, because they are nearly all derivatives and products of a Coal Tar series, and are capable of acting as universal depressant poisons to all forms of protoplasm.

First Group. The first group, or Carbolic Acid Group, are: **Carbolic Acid, Creosote, Guaiacol, Creosols, Menthol, Thymol** and **Resorcin.**

CARBOLIC ACID.

Carbolic Acid or Phenol is given in doses of 1 to 3 drops, if in liquid, or 1 to 3 grains, if in crystal.

It is derived from *Coal-Tar*, and in this respect it differs from creosote, which is a derivative of *Wood-Tar*.

It is official in a crude form, and in crystalline form. The crystalline form should always be used for internal purposes, but for local external application in ointments for skin diseases, the crude dark brown carbolic acid is preferable, as it contains a whole series of amorphous but active coal-tar products, besides xylic and cresylic acids.

Carbolic acid is neutral in reaction, and is only an acid in so far as its chemical relations to alkalies are concerned, combining with them to form carbolates. In its general physiological and toxic relations, it is in every respect an *alcohol*, and produces the symptoms peculiar to the alcohol series.

Local Action. Locally, carbolic acid is *anæsthetic*, *antiseptic*, slightly *irritant*, and in concentrated form it acts as an *escharotic*, by coagulating the albumen of the tissues with which it comes in contact. The pale white stain of the tissues is characteristic of it.

Toxic Symptoms. When carbolic acid is taken in doses of from 10 to 15 drops, it produces a peculiar tingling and numbness in the extremities, with a feeling of intoxication, very similar to that of alcohol; the heart becomes more rapid, and there is a feeling of general weakness.

In large toxic doses, the symptoms arise promptly and are at once alarming. There is some retching, with a rapidly appearing unconsciousness, followed by epileptiform convulsions, failure of respiration, heart weak and rapid, temperature falls, reflexes lost, general collapse and death from asphyxia. In very large quantities it is capable of taking life in a few minutes, acting, as it were, by shock.

The postmortem lesions after this poison, are the white marks at the point of entrance to the system, the lesions of the gastro-intestinal canal, and some fatty degeneration of the organs.

Characteristic of this poisoning are, the odor of the acid about the person, the white patches about the mouth, face and throat, and, if time enough has elapsed for elimination to take place, a peculiar *smoky color* to the urine.

Treatment of Poisoning. In treating this poisoning, the first and most important is the administration of the antidote, a *soluble non-toxic sulphate* or *sulphite*, such as sulphate of magnesium, sulphate of sodium or sulphite of sodium. This combines with the phenol and converts it into a *non-poisonous phenol-sulphate* or sulpho-carbolate. It not only combines with the acid in the stomach, but follows it throughout the circulation and converts it in all parts of the body. It therefore differs from other chemical antidotes in two striking respects: First, that it does not precipitate the acid into an insoluble compound, *but renders it non-toxic;* second, it does not merely neutralize it in the digestive tract, but *follows it through the circulation.* Beyond this, the treatment consists in evacuating the stomach and supporting the patient with external heat, and sustaining the heart and respiration with stimulants.

Physiology. The phenylic alcohol probably enters the circulation as an alkaline carbolate. In small quantities it possibly has slight stimulant influence upon the respiration and the reflexes, but in toxic doses it is a rapidly acting universal poison, depressing brain, spinal cord, motor and sensory, and spinal nerves, the heart, the vasomotor centres, respiration, and heat production, by a direct paralyzant action.

Elimination. Carbolic Acid is eliminated as *sulpho-carbolate* or phenol sulphate, as *glyco-uronic acid*, as *hydrochinon*, traces of *oxalic acid*, and part of it escapes as a free *carbolic acid.* In the urine are also contained other amorphous educts of carbolic acid, which impart to it the peculiar *smoky color.* Of these eliminated educts, hydrochinon is the most poisonous, while the phenol sulphate is free from toxic properties.

Therapeutic uses: Carbolic Acid is at present employed in practical medicine wholly for its local influence, both internally and externally. Its *antiseptic* and *anæsthetic* properties, give to it its entire usefulness.

As an *ant-emetic* it is used internally in all forms of vomiting, and especially when the vomiting is due to fermentation in the stomach. Here its value depends in part upon its disinfectant influence, but principally upon its local anæsthetic action, benumbing the nerves of the stomach.

It is useful in all forms of *diarrhœa:* summer diarrhœa, lienteric diarrhœa, typhoid diarrhœa, tubercular diarrhœa, diarrhœa

from irritation, and colliquative or relaxing diarrhœas. Its usefulness in diarrhœa again depends upon its disinfecting power, arresting fermentation, and in some kinds of diarrhœa, its anæsthetic influence is of great service; this being especially true in *lientery*. A *lienteric diarrhœa* is produced by intestinal indigestion, with fermentation. It is found mostly in people who are irregular in their eating and are overworked. There may be only one or two stools a day, but these stools are very loose, large and watery; and are apt to occur shortly after a meal. The mucous membrane of the intestines is in a condition of oversensitiveness, and the moment food is taken, peristalsis is set up, and the whole intestinal canal is emptied. Carbolic acid should, therefore, be given before eating to partially anæsthetize the mucous membrane before food is taken. It is most efficient when combined with subnitrate of bismuth and opium, given in capsules.

External uses. Externally, locally, carbolic acid, by virtue of its local anæsthetic and antiseptic actions, is useful in different forms of skin disease, especially those associated with intense itching, like eczema, psoriasis, and in vegetable poisons, like ivy and sumac.

It has also been used in the dressing of wounds, washing out of abscesses, cleansing of ulcers, and as a spray in the nose. As an antiseptic in the dressing of wounds, burns, and scalds, it has the advantage of being both antiseptic and anæsthetic, and thus lessens the pain, especially in a burn; but care must be taken that sufficient is not absorbed through a wound to produce general poisoning. This can be detected by *watching the urine for the smoky color*. If such poisoning should occur, the antidote should be administered and the dressing of the wound be removed.

CREOSOTE.

This substance differs from carbolic acid principally in the fact that it is derived from *wood-tar* instead of *coal-tar*, and can be distinguished by its odor and appearance. It is of a distinctly *smoky character*. The dose of it is 1, 3 to 5 drops, increased if needed.

Locally, like carbolic acid, it is *antiseptic*, *anæsthetic*, and somewhat *corrosive*, if concentrated.

Toxic Symptoms. In toxic doses, creosote produces local lesions and general depressant effects like those of carbolic acid; namely, depression of the heart, respiration, cerebral and spinal centres, with collapse. It differs from carbolic acid, only in the fact that it is less powerful in the same dose, but in large enough quantities, it can kill as quickly. The same *smoky urine* follows this poisoning, and the same antidote, *soluble sulphates,* is to be administered in the treatment of the poisoning. It is eliminated principally as a *creosote sulphate.*

Therapeutic uses: Creosote, like carbolic acid, is useful to check vomiting, to arrest fermentation in the stomach, to disinfect the intestinal canal in diarrhœas of all kinds, and within the recent past, it has been used a great deal as an *expectorant* in chronic bronchitis, and especially in bronchitis associated with phthisis. It probably has no direct influence upon the phthisical lesions or upon the bacilli of tuberculosis, but it relieves the bronchitis and the cough. Here it can be given in solution in whisky, in emulsions, or in capsules. The beginning dose should be from 3 to 5 minims, slowly increased to a point of intolerance by the stomach.

Externally, locally, it is very rarely used as an antiseptic and disinfectant, because carbolic acid is more active, more reliable, and does not have the unpleasant odor of creosote.

Creosote Carbonate. Carbonate of Creosote is a greenish, transparent liquid of syrupy consistency. It is nearly odorless, more pleasant to the taste, and less disagreeable to the stomach than creosote; it has no other advantages over creosote, but has the disadvantage of being very expensive.

Creosote is composed of two elements: *Guaiacol* and *Cresol.* These two separate ingredients are themselves used in medicine, and are both eliminated as sulphates; one as *guaiacol sulphate,* and the other as *cresol sulphate.*

Guaiacol. Guaiacol (pyro-catechin of methyl), is used in medicine in doses of 3, 5 to 10 drops, depending on the indications to be met. It is less disagreeable to the stomach, less unpleasant to the taste, and not as poisonous as is creosote. It fulfils all the indications which can be met by creosote internally or externally; it is also a more pleasant disin-

fectant in different forms of diarrhœa, and is a very efficient antemetic.

As an expectorant, it is used in chronic bronchitis and in phthisis to a greater extent than is creosote, because it is more easily borne by the stomach. In this condition, it should always be given in ascending doses, and pushed as far as the patient can bear it. It is, locally, anæsthetic, and has germicidal power.

It has been used at various times as an antipyretic to reduce temperature in fevers. For this purpose it has been applied in ½ to 1 dram quantities, externally over the abdomen, and covered with oiled silk to secure absorption. It is quite certain in its power to reduce elevated temperature, but is so dangerous that this use of it should be condemned.

Guaiacol Carbonate. Guaiacol Carbonate is a white, odorless, almost tasteless, slightly soluble powder. In its physiological and therapeutic relations it is identical with guaiacol, except that it is still less disturbant to the stomach, and can be used where the guaiacol may not be tolerated. As a disinfectant to the gastro-intestinal tract, it is superior to liquid guaiacol, because it is less readily absorbed. The dose of it is from 1, 3 to 5 grains.

Cresol. Cresol, like guaiacol, can be used in medicine either in its purity or as a carbonate, in doses of 1, 3 to 5 grains, and answers the same purpose as guaiacol, except that it is probably not as efficient, and is, therefore, a great deal less used by the profession. But it has germicidal power, and is a valuable disinfectant to the intestines, besides having local anæsthetic properties.

There are a number of Cresols and Cresol Compounds now used by physicians for different disinfectant purposes, the principal ones among them are the following:

Tri-cresol, which is at present largely used in the preparations of antitoxins to preserve them. It is nearly free from poisonous properties to higher animal life, and is well adapted to this use.

Creolin, which is said to be a Cresol Emulsion, prepared from resin soap, is an excellent mouth-wash and douche in aphthous stomatitis; and in skin diseases, like scabies and eczema, applied in a five per cent. ointment.

Cresol Iodide, or "Losophan," which is a sparingly soluble powder, can be used as an intestinal disinfectant in 3 to 5-grain doses.

Cresol Salicylate, or "Cresalol," which decomposes in the intestines into its component elements, and can be employed as an effective antiseptic to the alimentary canal, in 5-grain doses.

MENTHOL.

Menthol is a camphor-like substance found in the Oil of Peppermint. It is, locally, very irritant when concentrated, and powerfully *antiseptic* and *anæsthetic*, paralyzing the peripheral sensory nerves. In toxic doses, it has the effect of a universal depressant poison like that of carbolic acid, being paralyzant to all higher protoplasms.

Therapeutic uses: Menthol is rarely, if ever, used internally for any purpose. Its greatest practical service is externally, locally, to allay itching in pruritus ani, pruritus vulva, to allay the intense itching of eczema and urticaria, or to allay the itching of ivy and sumac poisoning. In ivy poisoning, it should be employed in concentrated solution, of the strength of a dram to a dram and a half of menthol to an ounce of alcohol, and be applied to the affected part with a camel's hair brush; used in this manner, it is one of the best, if not the best substance we have to allay intense itching from any cause. In ivy poisoning, the combination of menthol and fluid extract of grindelia, is probably the most efficient treatment that can be instituted.

It has also been used in neuralgic pains where the neuralgia is of peripheral type, as supra-orbital neuralgias, frontal headaches, etc.

In the gastro-intestinal canal it is too irritant to subserve any good purpose.

THYMOL.

Thymol is a camphor-like substance obtained from the Oil of Thyme. It may occur either as a liquid or in crystalline form. The crystal-thymol is used in medicine, and is rather sparingly soluble in water. Its taste and odor are not very intense, and are rather pleasant. Locally, it is a *germicide* and somewhat *anæsthetic*.

Ingested in large quantities it produces ringing in the ears, free sweating, reduction of temperature and at last general collapse, with universal depression of all the higher functional activities, and death by asphyxia. It is less toxic than either creosote or menthol in like quantities. To the urine it imparts a peculiar *olive green color*, when given in full doses, which color is probably due to the presence of *thymo-hydrochinon* and other eliminating educts.

Therapeutic uses: In practical medicine it has been used for its local influence both internally and externally. Externally, it has been employed as an antiseptic dressing to ulcers, carbuncles and wounds. This use of it is somewhat objectionable, because the odor of thymol attracts flies.

Internally, in doses of 1, 3 to 5 grains, it is a pleasant and very efficient gastro-intestinal disinfectant. It is also a very powerful anthelmintic to expel intestinal worms, when given in 5 to 15 grain doses, but it is not an absolutely safe remedy. In ulcers of the mouth and throat it is an admirable basis for a wash or gargle.

Thymacetin. Thymacetin is a direct derivation from thymol, but is less poisonous in the same quantities. It is a crystalline powder, slightly soluble in water, and can be given in 5 to 10-grain doses.

Therapeutically, it is closely related to Lactophenin, having distinct hypnotic and analgesic effects, and can be employed in medicine to relieve neuralgic pains.

RESORCIN.

Resorcin is a white, crystalline, freely soluble powder and belongs to the phenol group, as it is a coal-tar derivative.

Toxic Symptoms. Resorcin, in its toxic symptoms, is a half-breed between carbolic acid and salicylic acid. It is less poisonous than carbolic acid, but distinctly more poisonous than salicylic acid.

In physiological doses it produces symptoms like those of salicylic acid; a ringing in the ears, headache, dilatation of the pupils, some exhilaration of respiration, the pulse slightly increased, and the urine becoming that olive green color, characteristic of salicylic acid.

In very large toxic doses, the symptoms are, violent convulsions, unconsciousness, depression of heart and respiration, loss of reflexes, and rapid collapse, with fatal asphyxia, like carbolic acid. It probably circulates as resorcin, but is ultimately eliminated and escapes in the urine as an *acid-sulphate of resorcin.*

Therapeutic uses: Resorcin can be used internally in doses of 3, 5 to 10 grains, to allay vomiting and as an intestinal disinfectant, but it is rarely so used in medicine. It has been employed in rheumatism and to reduce temperature in fevers. In rheumatism it is uncertain and far inferior to the salicylates. To reduce temperature in fevers, it is both uncertain and dangerous.

Externally, locally, resorcin is slightly *anæsthetic* and distinctly *disinfectant.* By virtue of these two properties it becomes one of the most useful remedies in *itchy* and *scaly skin diseases,* like eczema, psoriasis and seborrhœa. In eczema it can be applied either in ointment or in solution. In seborrhœa of the head, with intense itching and falling of hair, a solution of resorcin, in combination with castor oil, compound spirits of lavender and alcohol, is probably one of the most efficient applications that can be used. The application of this solution should always be preceded by a thorough washing of the head with soap, to remove all oils and scales. This shampoo can be taken once a week, and the application of resorcin be made twice a week.

Second Group. The second group, *or Salicylic Acid Group,* are: **Salicylic Acid, Salicylate of Sodium, Salicylate of Ammonium, Salicylate of Strontium, Oil of Gualtheria** (Salicylate of Methyl), **Salicin, Salol,** and **Betol.**

This group differs from the former, principally in the fact that the drugs under it are less poisonous, produce slightly different symptoms, and their principal therapeutic use is in *rheumatism* and *gout.* But in common with the former group, if given in large enough doses, these drugs can produce paralysis of all the vital functions. Locally, they are both *antiseptic* and *anæsthetic,* and only less so than the carbolic acid group.

SALICYLIC ACID.

Salicylic Acid is derived from carbolic acid. It is insoluble in water, and should be given in capsules; dose, from 5 to 15 grains.

Salicylic Acid holds the same relation in practical medicine to the salicylates, as hydrobromic acid holds to the bromides. It is more irritant to the stomach, less soluble, more slowly absorbed, but produces the same constitutional effects as the salicylates. It is therefore less desirable in practical medicine than are the salicylates. But in the main physiological facts, and the general therapeutic applications, salicylic acid and the salicylates are so nearly alike, that it is practical to study them together under the same consideration.

First Effects. When salicylic acid or a salicylate is given in doses of 10 to 15 grains repeated, it produces a ringing in the ears, a feeling of fullness of the head, dizziness and headache; symptoms which are in no way distinguishable from *Cinchonism*, or the symptoms produced by cinchona or quinine. This group of symptoms marks the *therapeutic limit* of the drug.

Toxic Symptoms. In toxic doses, the ringing in the ears and fullness of the head are increased, severe headache, dizziness, free sweating, respiration is rapid and deep, until later in the poisoning when it becomes shallow; restlessness, delirium, loss of reflexes, pulse becomes labored and weak, disturbance of vision, with strabismus, ptosis, and dilatation of the pupils; finally stupor, unconsciousness, convulsions, and death from paralytic asphyxia.

Physiology. The ringing in the ears is probably produced by middle-ear congestion, the same as in quinine.

The deep, quick respiration, is in part due to stimulation of the respiratory centres, and probably in part due to stimulation of the afferent pulmonary pneumo-gastrics.

The influence of salicylic acid or a salicylate on the circulation is not appreciable in medicinal doses; but it is probable that in small doses there is a slight degree of stimulation to the heart and probably the vasomotor centres. In toxic doses, however, it becomes depressant to the entire circulatory apparatus.

On the brain and spinal cord it probably acts as a depressant in toxic doses, though slight stimulation may precede the depression. The effect of therapeutic doses is not perceptible.

On Temperature. Salicylic acid, or a salicylate, has the power of holding the temperature at normal on heavy exertion, but has no power, except in toxic

doses, to reduce the temperature below normal in health. In fever, it is capable of reducing body temperature, probably by a direct action upon the heat centres.

When salicylic acid is ingested, it probably enters the circulation as a salicylate, and is finally eliminated as *salicyluric acid.* In cases of poisoning by it, the urine becomes an *olive green,* as it does in thymol and resorcin poisoning. This green color is probably in part due to *indican,* and in part due to *pyrocatechin.* These educts are often accompanied by scanty and albuminous urine, due to irritation of the kidneys.

Salicylic acid and the salicylates have distinct power to increase the elimination of *uric acid* from the system. It has also been claimed that they have the power to lessen the further production of uric acid; and it is likely that in some such way the salicylates aid in the relief of rheumatism and gout.

The general symptoms of salicylic acid poisoning, and those of quinine poisoning, are so nearly alike, that the one can probably be distinguished from the other only by the presence or absence of the *green urine* found in salicylic acid poisoning.

Therapeutic uses: The general therapeutic uses for salicylic acid and the salicylates are, as *antipyretics* and as *anti-rheumatics.*

As *antipyretics,* the salicylates are less reliable than such drugs as antipyrin, and consequently have practically dropped out of use in fevers to reduce temperature, unless it be in the high temperature of rheumatic fever.

As *anti-rheumatics,* the salicylates are the best and most reliable agents we have. They are useful in acute articular rheumatism, in sub-acute articular rheumatism, muscular rheumatism, acute and chronic gout, lumbago, rheumatic sciatica, and in rheumatoid pains which mark the onset of some of the acute diseases, like unfluenza and measles.

In the so-called *gonorrhœal rheumatism,* the salicylates are of absolutely no value, since this condition, though rheumatoid in character, has no relation to true rheumatism, but is simply a condition of general septic infection, or a true septicæmia.

The salicylates most employed in medicine are, the salicylates of sodium, ammonium, and strontium. Of these, the ammonium and strontium salts are preferable, because they are more agreeable to the stomach, and are less apt to disturb digestion. They can be administered either in capsule, or in solution combined

with one of the bitter tinctures, such as tincture of gentian or of nux vomica; but where the stomach is very susceptible, the best vehicle in which to administer them is *milk*. The quantity administered in an ordinary case of acute rheumatism can vary from 40 to 60 grains in twenty-four hours. It is to be remembered that the effect produced, does not depend so much upon the size of the individual doses, as it depends upon the entire quantity which is administered in twenty-four hours.

OLEUM GAULTHERIA.

The Oil of Wintergreen contains about ninety per cent. of the *salicylate of methyl*. It is more liable to disturb the stomach and nauseate the patient, than other salicylates; but differs in no other respect from the rest of the salicylates when it is given in proportionate doses. The Oil of Birch is probably equally medicinal with the oil of wintergreen, and can be used in its stead. They can be used in all forms of rheumatism, administered either in capsule or emulsion, or they can be dropped on sugar and administered in that way. The dose can vary from 10 to 20 minims. Neither of these oils are very well borne by the stomach, and patients readily tire of their taste and flavor.

SALICIN.

Salicin is a bitter neutral crystalline principle, derived from Willow Bark; dose, 10 to 25 grains.

Salicin has been used in rheumatism and gout, but it is an unreliable anti-rheumatic. It has, however, the advantage of being more agreeable to the stomach than the salicylates, and can be substituted for them, where the salicylates are not tolerated by the stomach.

Salicin probably undergoes decomposition in the circulation, and is in part converted into a salicylate. It finally escapes with the urine, in part as *salicyluric acid*, and in part as *saligenin*. It can only be of use in rheumatism in so far as it may be decomposed in the system into a salicylate, and is therefore a very uncertain remedy.

SALOL.

Salol, or *phenol salicylate*, is decomposed in the small intestines, in the presence of the digestive ferments, into about three parts of *carbolic acid*, or phenol, and five parts of *salicylic acid*. It

is then absorbed, and circulates in part as a salicylate, and in part as a carbolate, and is ultimately eliminated as the educts of these two acids, viz: the salicylate as *salicyluric acid*, and the carbolate as a *sulphocarbolate, glycouronic acid, hydrochinon* and the other educts of carbolic acid.

In toxic doses, the early symptoms are those characteristic of salicylic acid; but in the later stages of the poisoning, the rapid collapse and universal paralysis of all functions, and even the *smoky color* of the urine of carbolic acid poisoning make their appearance.

It is readily seen that this drug is less poisonous than carbolic acid, but distinctly more so than salicylic acid or the salicylates.

Therapeutic uses: Salol is useful, as a gastric and *intestinal disinfectant*, in vomiting or diarrhœa, as a *disinfectant to the urine* in cystitis, as an *antipyretic*, and as an *anti-rheumatic*.

As a *gastro-intestinal disinfectant*, it should be combined with subnitrate of bismuth in capsules. It is more agreeable and less dangerous for this purpose than carbolic acid, and, therefore, is a special favorite in fermentative diarrhœas in children.

As a disinfectant to the *genito-urinary tract* in cystitis and in gonorrhœa, it becomes serviceable in so far as there is elimination of *hydrochinon* in the urine, because this substance is a very active germicide. Salol is much used as a diuretic in all stages of gonorrhœa.

As an *anti-rheumatic*, the drug can be serviceable only in so far as it contains salicylic acid, and is therefore less effective and more poisonous than the salicylates. It is doubtful whether the use of salol is warranted in rheumatism, when the other salicylates are available.

As a practical *antipyretic* for reducing high temperature in fever, its use should be condemned, because there are more effective and less dangerous antipyretics at our command.

It was at one time suggested as a diagnostic agent to determine *pyloric obstruction*. Owing to the fact that it is decomposed into its elements, in the alkaline fluids of the intestines, diagnostic value was placed upon the time its educts would appear in the urine. If the educts appeared very much later than normal, it was taken as confirmatory evidence that partial pyloric obstruction existed. On the contrary, if the educts

of carbolic and salicylic acids did not appear in the urine at all, it was supposed to be strong evidence that there is complete pyloric obstruction. But the value of these diagnostic signs, in a test of this kind, seem to be too remote and uncertain to be either of practical or scientific value.

Betol. Betol, which is a *naphtol salicylate,* is closely related to salol in its behavior in the system. It is split up into its component elements, salicylic acid and naphtol, in the small intestines by the intestinal secretions, and is absorbed as these two substances. It is less poisonous than salol, because it does not yield carbolic acid in its decomposition.

Therapeutic uses: In medicine, Betol is at present employed for its local effects only: In gonorrhœal cystitis, in fermentation in the bladder with cystitis, and as a disinfectant to the stomach and intestines in vomiting and diarrhœa due to fermentation. In rheumatism it is an inferior remedy, because it yields too little salicylic acid. The dose varies from 5 to 15 grains, best given in capsules.

Externally, it can be employed as a dusting powder or a wash in the dressing of ulcers, and in various forms of skin diseases.

Benzoic Acid. Benzoin and Benzoic Acid have physiological relations closely allied to those of the salicylates, and produce symptoms very similar to the salicylates: Ringing in the ears, hurried respiration, rapid pulse and reduction of temperature; but in their therapeutic application they have nothing in common with this group of remedies. They belong more properly to the alterative diuretics, where they will be discussed in greater detail.

Third Group. This group constitutes the true antipyretics, those drugs which are not only capable, but are practically used for the purpose of reducing high temperature in fevers.

They are: **Antipyrin, Acetanilid, Phenacetin, Phenocoll Hydrochlorate, Lactophenin, Thallin** and **Kairin.**

ANTIPYRIN.

Antipyrin is freely soluble in all ordinary menstrua. It can be given in solution or in capsules; in doses of 5 to 20 grains, depending on the purpose which it is to subserve. To children, the dose can vary from 1, 3 to 5 grains, depending upon the frequency of its repetition, and the age of the child.

Incompatibilities. Antipyrin is incompatible with Sweet Spirits of Nitre, Chloral, the Cinchona alkaloids, and, in powder form, with the Bromides.

With *Sweet Spirits of Nitre*, it forms a dirty green solution, produced by the formation of an *iso-nitroso-antipyrin*. This compound is not poisonous, but the virtues of both the nitre and the antipyrin are destroyed.

With *Cinchona*, it precipitates the alkaloids on standing in or out of their combination.

With the *Bromides* it is entirely compatible when in solution; but in powder form, on long standing, a greasy deliquescent liquid is formed, the chemical composition of which is not made out.

It is also incompatible with *Chloral*, forming a *mono-chloral-antipyrin*, which was at one time put upon the market under the name of *Hypnal*, and was recommended as a hypnotic.

Toxic Symptoms. In ordinary therapeutic doses of 10 to 20 grains, antipyrin has no appreciable influence upon a healthy individual. In larger doses, of 30 to 40 grains, it produces some ringing in the ears, dizziness, gastric irritation, and increased pulse rate.

In distinctly toxic doses, the symptoms appear promptly, and are very decided. There is intense pain in the stomach, often followed by vomiting, a pale cyanotic appearance of the face, the pulse is rapid and weak, respiration shallow, reflexes are lessened, drowsiness deepening into stupor and coma, complete unconsciousness, dilated pupils, violent epileptiform convulsions, and death by asphyxia.

Physiology. The ringing in the ears is possibly produced, like that of salicylic acid, by influencing the circulation of the middle ear.

The peculiar pale, cyanotic appearance of the face, is believed to be due to the presence of *met-hæmoglobin*. This met-hæmoglobin formation takes place after large doses of every drug under this group.

On the Circulation. Antipyrin, in therapeutic doses, has very little influence on the circulation; but what little influence there is exerted, seems rather to increase the force of the circulation and elevate the blood pressure than to diminish it. This may be due to stimulation of the heart or to constriction of the peripheral bloodvessels. In toxic doses, however, the entire circulation becomes depressed, and the blood pressure falls.

On the Nervous System. The present knowledge of the physiological action of this drug on the nervous system is incomplete. The facts, however, seem to warrant the belief, that the drug in small doses is slightly stimulant to the spinal cord, and probably to the lower brain centres; but that in large doses it becomes depressant to the sensory and motor cord, as well as to the brain, and very distinctly so to the sensory and motor nerves. The sensory nerves, however, seem to feel this depressant effect earlier and more decidedly than the motor nerves. It is possible, though not proven, that the value of this drug to control neuralgic pains, may, in part or wholly, depend upon this sedative action on the sensory apparatus.

On Temperature. Antipyrin, like the rest of this group of antipyretics, is incapable of reducing body temperature in health, unless it be given in toxic doses. In the elevated temperature of fever, it reduces the temperature promptly and with certainty; the fall of temperature being usually accompanied by a free sweat, and on rare occasions by a *skin rash*, of which the most common form is that resembling *measles*, and more rarely that of *urticaria*.

This reduction of temperature does not depend upon the sweating which occurs, although the perspiration aids it; for the temperature falls when the sweating is prevented by atropine, while at the same time it will reduce temperature quite as readily in animals that do not perspire. It is therefore probable that the reduction of temperature is due to a direct influence of the drug upon the *thermogenic centres* in the medulla; but whether it acts as a *depressant* to the *heat producing* centres, and thus lessens heat production, or whether it acts as a *stimulant* to the *heat inhibitory* centres, which, in effect, would mean the same thing, has not as yet been determined.

Antipyrin is promptly absorbed and rapidly eliminated. It has, therefore, little tendency to accumulate in the system. Moreover, its prolonged daily use has produced emaciation, loss of appetite, cyanosis, and a peculiar sensation of chilliness, or a constantly feeling of cold from the slightest exposure, and this marks its *therapeutic limit.* These effects may in part be due to an interference with nutrition; but the chilliness itself seems more likely to be due to the constant effect the drug has upon the thermogenic apparatus, making it difficult for the individual to maintain normal temperature.

Antipyrin is, locally, slightly *antiseptic,* and distinctly, but not actively, *anæsthetic.* It has these properties in common with the entire class of antipyretics.

Therapeutic uses: The general indications for antipyrin are, as an *Antipyretic,* as an *Analgesic,* and as an *Antispasmodic.*

As an Antipyretic. Antipyrin is serviceable to reduce temperature in all kinds and stages of fever; in typhoid, typhus, influenza, scarlet fever, measles, thermic fever, and all other forms of hyperpyrexia. The quantity needed as an antipyretic varies: for an adult, from 8 to 15 grains; for children, proportionate doses should be used.

Although it is capable of reducing temperature in these fevers, it is not comparable in value to the use of *cold* in hyperpyrexia. The temperature under its influence falls, but after such reduction, the patient is apparently prostrated and languid. In the last stages of fevers, where the nervous system is exhausted from the constant high temperature and from the toxin of the infection, antipyrin, and likewise the rest of this group of antipyretics, have produced subnormal temperature with collapse, and in not a few cases death followed.

It is believed by some physicians, that in these cases, the antipyretics exercise a direct depressant action upon the heart, and that the subnormal temperature and collapse are a sequence of this depression. But this view of it is improbable, and appears to be contrary to facts. These conditions of collapse have only occurred where temperature fall took place first, and collapse followed. They have likewise occurred only where antipyretics were used for the purpose of reducing high temperatures in the late and exhausted stages of low fevers, and not when used to meet other indications; and since antipyrin is not known to

depress the circulation, but rather stimulate it, in any medicinal doses; it would seem more probable and more reasonable that all these antipyretics are alike prone to reduce the temperature subnormal in low fever, where the thermogenic centres have been exhausted; and the failing heart, cold sweat, and collapse are the necessary consequences.

If this be correct, it would then follow that antipyretic drugs are all equally dangerous to use in the late stages of any low fever with exhaustion, and *should be avoided.* They are not only prone to reduce temperature to a subnormal degree, but their continued influence upon the heat centres holds the temperature down, so that heat applied externally will not elevate it, and this adds to the danger.

As an Analgesic. Antipyrin, like the other members of this group, is a most *valuable* drug to *relieve neuralgic pains;* and it is possible that it does this by its influence upon the sensory nerves. It has, however, no controlling power over pains due to inflammation.

It relieves the pains of hemicranic headaches, where it should always be given in 1 or 2 full doses; it is also used in cardiac neuralgia, in gastralgia, in angina pectoris, in the neuralgias of locomotor ataxia, in ovarian and renal neuralgia, in the headaches and bone pains of influenza, and in painful menstruation, when it is not due to mechanical obstruction. In most if not all of these indications, it is far better to combine the antipyretic with a full dose of one of the bromides; viz., 10 to 15 grains of antipyrin, combined with 1 dram of bromide of sodium or ammonium, and this can be repeated in three hours, if necessary

In *hemicranic headaches* the dose should be given as soon as the earliest symptoms of the headache appear; for it is less efficient to control the attack after the headache is under way than if given earlier in the attack.

In *painful menstruation,* which is of neuralgic origin, a single dose is often sufficient to control the suffering of a single menstrual period; and here again it should be given as soon as the menstrual pains begin. It is not of any service in those menstrual pains which are due to stenosis, or obstruction to the menstrual flow, but only in a dysmenorrhœa in which the pains begin before the flow, and usually stop as soon as the menstrual discharge is fully established.

As an Antispasmodic. As antispasmodics, these antipyretics are valuable in *chorea*, *whooping-cough*, *epilepsy*, *hysterical nervousness*, and in *asthma*.

In *chorea* they are inferior to arsenic, but can be combined with it to increase its effectiveness.

In *epilepsy* they are used as adjuvants to the bromides, and diminish the amount of the bromides required to control the attacks.

In *hysteria* they are almost as valuable as the bromides, but it is better that the two should be combined to get the conjoined action of both at the same time.

In *nervous asthma*, antipyrin is sometimes effective when other remedies have failed; but to secure the best effects, it must be given in full doses.

In *whooping-cough* in children it is the most valuable remedy we possess, and is most effective when combined with belladonna and the bromides.

These antipyretics have some value in acute rheumatism, though they are inferior to the salicylates; but where the rheumatic pains are severe, antipyrin or phenacetin, in combination with the salicylates, often aids in the relief of the suffering.

Antipyrin has been used and highly recommended in true diabetes, but its practical service, like that of other remedies in this disease, more often fails than succeeds.

ACETANILID (Antifebrin).

This drug differs primarily from antipyrin in the fact that it is almost insoluble, and has to be given either in pills, powders or capsules; dose, 3, 5 to 10 grains, depending on the purpose for which it is to be used.

Toxic Symptoms. When Acetanilid is given in toxic doses, it produces symptoms like antipyrin: cerebral depression, stupor, nausea, vomiting, pain, cyanosis, depression of heart and respiration, lessening of reflexes, and death by asphyxia.

Physiology. The physiological effects produced by acetanilid, so far as investigations indicate, are probably due to the same causes as those producing like symptoms in antipyrin. In excessive doses it acts as a direct depressant to all the vital functions, while in smaller quantities, it is slightly

stimulant to the reflexes, to the respiration, and to the circulation. In some cases, like antipyrin, it produces a cutaneous rash.

It reduces body temperature by its direct influence on the heat producing centres, when the system is suffering from an elevated temperature; in ordinary doses it does not affect normal temperature. The lessened reflexes are the result of its depressant action upon the peripheral sensory and motor nerves. The cyanosis is due to the production of *met-hæmoglobin.*

Elimination. Acetanilid, when it is ingested, probably decomposes in the circulation into *aniline* and *acetic acid.* The aniline ultimately undergoes advanced oxidation, and is eliminated as a *paramidophenol sulphate.* The setting free of the aniline in the circulation, may render the acetanilid to a slight degree more poisonous than the rest of this group, for aniline itself is a violent poison.

Therapeutic uses: Acetanilid meets all the indications set down for antipyrin; namely, as an *antipyretic,* to reduce temperature in fever; as an *analgesic,* to relieve neuralgic pains of all kinds; and as an *antispasmodic,* to allay certain mild spasms, like whooping-cough and asthma. In all of these indications it is probably just as valuable as antipyrin, except that it has the disadvantage of its insolubility.

Acetanilid is also a very excellent and useful local application, externally. Its local effect is that of an active *antiseptic* and somewhat *anæsthetic.* It is, therefore, very useful in skin diseases, employed in the strength of 30 to 60 grains of acetanilid to the ounce of ointment. Its value here can still further be enhanced by combining calomel with it. As a dusting powder over weeping ulcers, burns, scalds and local septic infections, the combination of powdered acetanilid, calomel, and precipitated carbonate of zinc, is a most valuable one.

PHENACETIN.

Phenacetin, like acetanilid, is almost insoluble; dose, 5 to 15 grains.

Like antipyrin and all the rest of this group, in toxic doses it produces depression of the brain, spinal cord, loss of reflexes, vomiting, cyanosis, finally convulsions, and death from asphyxia. In small quantities it has no appreciable influence upon a healthy adult.

Therapeutic uses: In practical medicine, it is used to meet the same indications as antipyrin; namely, to reduce temperature, to relieve neuralgic pains, and to allay local spasms. In its practical usefulness, it is probably co-equal with antipyrin in all of these indications. The differences of efficiency and usefulness of the various drugs in this group of antipyretics, claimed by clinicians, are more due to prejudice and habit, than to any real facts.

PHENOCOLL HYDROCHLORATE.

Phenocoll itself is insoluble, but its hydrochlorate is freely soluble in water. The fact that it is soluble, puts it more nearly on a par with antipyrin in its practical usefulness; dose, 5, 10 to 15 grains.

This substance, like the preceding three, when given in large quantities, acts as a depressant to the entire nervous system and to the circulation, and produces cyanosis by a formation of *met-hæmoglobin* in the blood. It differs from the rest in the fact that it is probably a trifle less poisonous, and to that degree it may be preferable; while, in power and certainty of action, it is fully equal to the rest.

Therapeutic uses: It is used in neuralgias, to reduce temperature in fevers, and in local nervous spasms, in exactly the same way, and with fully as much certainty of good effect, as antipyrin or any of the rest. It is also said to be of decided value in acute rheumatism.

LACTOPHENIN.

Lactophenin is more closely related to phenacetin than to antipyrin. It is no more soluble than phenacetin, and is probably about as safe in large doses. It produces all the effects peculiar to this class of drugs, and is similar in its influence on the nervous system, the circulation, the respiration, the temperature, and on the blood itself.

Its therapeutic uses are identical with the rest, and probably answers them quite as well. It differs, however, in this one striking respect: that, given in full doses, it has very distinct and decided hypnotic power, probably equal to that of Urethane.

Thallin and Kairin. Thallin and Kairin are two substances which were introduced into medicine to reduce temperature, before antipyrin and the rest of this group were discovered; but they are decidedly more poisonous, more dangerous, and less reliable to reduce temperature than the foregoing drugs, and are therefore justly abandoned by the profession.

CHAPTER XVII.

STOMACHICS.

This is a class of remedies whose chief physiological action is that of a *stimulant tonic* to the digestive tract, increasing the secretions of the digestive fluids, and promoting intestinal peristalsis by a stimulant action on the muscular coats of the intestines.

Their one great *indication* is a *loss of appetite due to atony* of the stomach and intestines. Their one great *contra-indication* is the presence of *irritation* or *inflammation* of the gastro-intestinal canal, because they are all locally irritant.

For convenience of study, they can be divided into three groups:

First, The *Simple Bitters,* which depend for their activity upon the *bitter principles* they contain.

Second, The *Aromatics,* which are grouped together, because they depend for their activity upon *volatile oils;* while a few of them, like Pepper, Ginger and Capsicum, contain *oleo-resins.*

Third, The *Aromatic Bitters,* which contain both *bitter principles* and *aromatic oils.*

The *simple bitters* differ, therapeutically, from the group of *aromatics,* principally in the fact that the bitters are *permanent* in their action, while the aromatics are *more powerful* but *less lasting* in their effects.

SIMPLE BITTERS.

The simple bitters are: **Quassia, Gentian, Chirata, Hydrastis, Columba** and **Prunus Virginiana.**

Quassia. Quassia is used in medicine as an *Extract;* dose, ½ to 1 grain.

As a *Tincture;* dose, ½ to 1 fluidram.

An *Infusion,* which is rarely used internally, but is employed more as an anthelmintic in *seat worms,* where it is injected into the bowel. This infusion, made of the strength of 1 to 2 ounces of quassia chips to the pint of water, should be injected into the bowel and retained as long as comfortable. This is probably one of the most efficient and best treatments for the relief of seat worms.

But this local injection of quassia into the bowel for seat worms, is not an absolutely safe procedure. An infusion of the strength of 2 ounces of quassia to the pint, injected into the lower bowel of a young child, has produced, in a very short time after the injection, a condition of relaxation, the face becoming livid, the surface cold, the breathing labored, the pulse thready and almost imperceptible, unconsciousness, complete paralysis and death. Cases of poisoning in this way by quassia are very rare, but yet it cannot be looked upon as entirely free from danger.

The active principle of quassia is *Quassin,* a neutral, crystalline and extremely bitter principle.

Quassia itself is used in internal medicine as a simple bitter and stomachic, in loss of appetite, the outcome of a want of tone in the digestive tract. It is a very nauseous bitter, so that it should always be given in solid form, either in pill or capsule, to avoid its taste.

Gentian. Gentian depends for its activity upon the neutral crystalline principle, *Gentio-pikrin,* and contains besides this, *gentesic acid.* It is used in medicine as an *Extract,* dose, 1 to 2 grains; as a *Tincture,* dose, ½ to 1 fluidram; and as a *Compound Tincture,* dose, 1 to 2 fluidrams.

The Compound Tincture is the most elegant of these preparations, and is the one almost exclusively used by the profession.

Like quassia, gentian is useful in atonic indigestion, or in failing appetite during convalescence from acute disease. It is not as unpleasant a bitter as quassia, and therefore is more generally used in medicine.

Chirata. Of this substance we use in medicine, principally, an *Extract*, the dose of which is from 1 to 2 grains. It is an active simple bitter in atonic dyspepsia, but differs from the other simple bitters in the fact that it is probably a *stimulant to the liver*, and therefore is especially useful in loss of appetite associated with, or dependent upon, *hepatic torpor* or biliousness.

HYDRASTIS.

Preparations. Tincture; dose, ½ to 2 fluidrams.
Fluid Extract; dose, ½ a fluidram.
The Glyceride (glyceritum hydrastis); dose, ½ to 1 fluidram.
The Extract (not official); dose, ½ to 3 grains.

The alkaloids of hydrastis are *hydrastine*, *berberine*, *canadine* and *xanthopuccine*. Of these, the *dominant alkaloid*, and the one that characterizes the drug, is *Hydrastine*. The other alkaloids are present in small proportions, and have little influence in the general action of this drug. Hydrastine itself is used in medicine as *hydrastine sulphate* (not official); dose, 1/6 to ½ grain.

Out of the alkaloid hydrastine there is made a synthetic or derived alkaloid, *Hydrastinine*, and this is official as a *hydrochlorate*, the dose of which is from 1/6 to ½ grain.

(The hydrastinine hydrochlorate, having a very pronounced action upon the uterus, will be studied in detail under the head of Ecbolics, in association with ergot.)

The commercial "*hydrastin*," which is probably no more than a concentrated extract, contains most, if not all, of the active principles of hydrastis, and produces physiological effects which are in no respect different from those of the crude drug. It has no advantage in medicine over the extract, except that it is more concentrated, and is given in doses of 1 to 3 grains.

Toxic Symptoms. When hydrastis is given in toxic doses, the symptoms are those of pain in the stomach, repeated vomiting, salivation, pupils slightly dilated, purging, pulse and respiration slightly increased at first, but later become depressed, reflexes are lost, there is unconsciousness, with tremors and rigidity of the muscles.

The symptoms produced by an overdose of its chief alkaloid, *hydrastine*, are very similar to the above, except in so far as the alkaloid, *berberine*, may produce slight modifications. The symp-

toms are, some nausea, vomiting, sometimes purging, increased intestinal peristalsis, pupils are dilated, salivation, the pulse increased in rate, the blood pressure slightly elevated at first, but later falls and the entire circulation yields; respiration becomes depressed; the reflexes are markedly increased, finally convulsions develop, associated with muscular rigidity, which may be followed by paralysis, and death from arrest of respiration.

This arrest of respiration may be from "*cramp-asphyxia*," like strychnine, if it occurs during a convulsion before the paralytic stage comes on; or the asphyxia may be *paralytic*, if it occurs after the stage of depression comes on. This paralytic asphyxia is probably in part due to depression of the peripheral motor and sensory nerves, and in part to depression of the respiratory centres.

Physiology. Hydrastis, or its chief alkaloid, hydrastine, produces increased blood pressure, by stimulating the heart muscle and the bloodvessel walls, and there may be slight stimulation to the vasomotor centres. In toxic doses, it is depressant to the entire circulation.

The muscular rigidity, associated with convulsions, and the production of increased intestinal peristalsis, are probably the direct outcome of its influence upon the muscle structures, independently of their nerve supply, and it is, therefore, a true *muscle poison.*

To the spinal cord it acts as a direct stimulant, increasing the activity of the motor cells, and thereby producing tetanic convulsions. This is probably the *dominant action* of the alkaloid hydrastine.

In large toxic doses, however, it becomes depressant and paralyzant, especially to the peripheral nerves; first, the motor, and finally the sensory nerves.

On gastro-intestinal secretions, hydrastis or its alkaloid has a marked influence. It increases the secretions of saliva, the gastric glands, the intestinal glands, and the bile secretion. It is, therefore, a valuable gastro-intestinal tonic, besides having this cholagogue influence on the liver.

This drug has also peculiar alterative relations to mucous membranes, which render it of great service in the treatment of acute and chronic catarrhs.

Therapeutic uses: Hydrastis, and the alkaloid hydrastine, are principally used in medicine for their action on the gastro-intestinal canal, being employed as stomachics, or simple bitters, in the different forms of dyspepsia. In loss of appetite due to atony, hydrastis is an excellent bitter. In acid dyspepsia, due to gastric catarrh of acute or chronic type, this substance, combined with nitrate of silver in pill form, has no superior. In intestinal catarrhs of acute or chronic type, associated with constipation, this substance is of great value, because it combines in itself the use of a bitter, and the alterative influence on the catarrhal mucous membranes, besides increasing peristalsis, which aids in the relief of the constipation. In biliousness or indigestion associated with hepatic torpor, it is of great service as a *cholagogue stomachic.*

Hydrastis has also been employed locally in catarrh of the middle ear, in catarrh of the nose, in leucorrhœal catarrhs of the vagina, and even in the late stages of gonorrhœa. In all of these conditions its value is recognized.

The alkaloid hydrastine has distinct and decided stimulant influence upon the motor spinal cord; and it is not improbable that it might be of service as a spinal stimulant, or as a general nerve tonic, in cases where strychnine and cocaine are generally used. It is less powerful than either of those, but it can be used as an adjuvant to them.

(For Hydrastinine Hydrochlorate, see Oxytocics.)

Columba. Columba is used in the preparations of a Tincture; dose, ½ to 1 fluidram.

Fluid Extract; dose, 15 to 30 drops.

The active principles are *columbin,* a bitter neutral principle, and the alkaloid *berberine.*

It is a good simple bitter and stomachic tonic, but its taste is rather nauseous, and therefore it is less used in practical medicine.

Prunus Virginiana. Prunus Virginiana, or wild cherry bark, is official as a *Syrup,* which is used as a vehicle for expectorant mixtures; and a *Fluid Extract,* which can be given in ½ to 1 fluidram doses.

The activity of wild cherry depends upon its *tannic acid* and a *bitter extractive.* It also contains the two principles, *amygdalin*

and *emulsin*, which, when they meet in a watery solution, combine and form *hydrocyanic acid;* so that the syrup of wild cherry, contains sufficient traces of hydrocyanic acid to give it a pleasant flavor, and fit it all the better for a vehicle.

Therapeutic uses: The preparations of wild cherry have very little practical use in medicine, save that of a pleasant vehicle. The bitter extractives which it contains, are not sufficient to give it stomachic value, nor is the hydrocyanic acid present in quantities sufficient to have any physiological or therapeutic effect; and therefore the drug is at present used almost exclusively as a flavoring vehicle for cough mixtures.

Eupatorium. Eupatorium, or the ordinary Thoroughwort, has been employed in medicine, not so much as a stomachic, as it has been used to break up colds, and sometimes in muscular rheumatism. For this purpose it is often used as a domestic remedy, in the form of an infusion or tea, and is administered hot, in the chilliness of the early stages of a cold. When taken in large quantites, it produces a free perspiration; but its taste is so extremely nauseous and bitter, that one such dose in a lifetime is sufficiently lasting to have the memory of it produce a free sweat at any time.

AROMATICS.

The Aromatics depend for their activity in part or wholly upon the presence of a *volatile* or *essential oil.* A few of them contain *oleo-resins;* namely, Pepper, Ginger and Capsicum.

Locally, they are more irritant and more stimulant than the simple bitters, but are at the same time more fugacious in their action. Their local influences are stimulant tonic, and stomachic, and a few of them are locally anæsthetic. They are all carminative, and increase intestinal peristalsis.

They are *contra-indicated* in all conditions of inflammation in the stomach or intestines, because they are irritant.

When any of these volatile oils are thrown into the general circulation, they act as powerful depressant poisons to the heart directly, and to the nervous system.

When they are ingested in toxic doses, they produce violent gastro-enteritis, with its concomitant symptoms of pain, nausea, vomiting, purging and collapse.

The principal aromatics are: **Cinnamon, Cloves, Nutmeg, Allspice, Cardamon, Cajuput, Ginger, Pepper, Capsicum, Lavender, Spearmint** and **Peppermint.**

To this list may be added such aromatics as Rosemary, Sassafras, Orange Flower, Orange Peel, Fennel, Caraway, Anise, Coriander, Sage, Rose, and the like; but these have no medicinal virtues of sufficient power to give them a place in medicine, except for the purpose of preparing flavoring vehicles.

Cinnamomum or Cinnamon. Of Cinnamon the preparations used in medicine are, the Oil itself; dose, 1 to 3 drops.

Aqua Cinnamomi, used as a flavoring vehicle.

Aromatic Powder; dose, 5 to 15 grains.

Tincture; dose, ½ to 1 fluidram.

Cinnamon depends for its activity upon the presence of its *volatile oil* and *tannic acid.* It is used in medicine as a stomachic and carminative, in atonic dyspepsia and in summer diarrhœas. The tincture of cinnamon is sometimes useful in menorrhagia, in doses of 1 to 2 fluidrams.

Caryophyllus or Cloves. The *Oil* of Cloves is the preparation generally employed in medicine, in doses of 1 to 3 drops. It is probably the most active of the volatile aromatic oils, and has distinct local *anæsthetic* properties.

It is employed as a stimulant tonic and carminative to the intestinal canal in atonic conditions. It is also employed for its anæsthetic property, in combination with purgative pills, to prevent griping. Locally, it can be used to allay toothache, by dropping it into the cavity of an aching tooth.

Myristica or Nutmeg. In medicine, the volative oil of nutmeg is used in 1 to 3 drop doses, and is a pleasant carminative. When it is given in large doses, it differs materially from the other aromatics in the symptoms it produces. The effect is that of a distinct *narcotic,* producing drowsiness and sleep, somewhat resembling the symptoms of opium, and may be called a "*narcotic aromatic.*"

Piminta or Allspice. This is a native of the West Indies, and contains a fixed and a volatile oil. The volatile oil alone is used in medicine, in doses of 2 to 5 drops. It is a pleasant stimulant carminative to relieve flatus.

Cardamomum or Cardamon. The preparation of this substance, which is of value, is its *Compound Tincture;* dose, 1 to 2 fluidrams. It is an extremely mild stomachic tonic, and a pleasant vehicle in which to exhibit and disguise other remedies.

Cajuputum or Cajuput. The Oil of Cajuput is given in 3 to 5 drop doses, and is generally employed in colics, in serous diarrhœas, or in diarrhœas of fermentation, in conjunction with paregoric and chloroform, which combination is often an effective mixture.

Zingiber or Ginger. Ginger depends for its activity upon an *Oleo-resin,* the dose of which is ½ to 2 minims. The Syrup is used as a vehicle; dose, 2 to 3 fluidrams.

An Infusion is often used to break up colds.

Tincture of Ginger; dose, ½ to 1 fluidram.

Ginger, in its different preparations, is often used as a stomachic, in combination with other substances, and is a pleasant carminative to expel flatus in colic.

In domestic medicine, the infusion of ginger, or hot "ginger tea," is often employed as an emmenagogue, in suppressed menstruation, when this is due to the taking of cold. It is possible that the hot drink has as much to do with its virtue in such cases as the ginger itself.

Piper or Black Pepper. Pepper is used in tonic pills as an *Oleo-resin;* dose, 1 to 2 drops.

It contains, besides the oleo-resin, a neutral acrid principle, *piperin,* which gives edge to this substance.

Capsicum. This contains an *oleo-resin* and the neutral principle, *capsicin.*

It is used in medicine as a Tincture; dose, from 10 minims to ½ a fluidram.

The Oleo-resin; dose, from ½ to 2 minims.

In toxic doses, Capsicum is a violent local irritant poison, producing intense pain, nausea, continued vomiting, purging, pain in the back and loins, bloody urine, and later suppression of urine with stranguary and collapse.

It is a useful stomachic tonic, but is especially serviceable in *adynamic dyspepsia* of drunkards; where it should be combined with tincture of nux vomica, and given in full doses.

Lavandula or Lavender. Lavender is used principally in the form of its *Compound Spirits;* the dose of which is 1 to 2 fluidrams. This is an elegant mild stomachic tonic and cordial, and is very much employed as a flavoring vehicle.

Spearmint and Peppermint. Spearmint and Peppermint are pleasant flavors and valuable carminatives. They are frequently employed in the nursery in colicky children to expel flatus.

AROMATIC BITTERS.

Of these we have, *Anthemis* or Chamomile, *Serpentaria* or Virginia Snakeroot, and *Cascarilla.* These three substances contain both *volatile oils* and *bitter principles,* in small quantities. They are mild stomachic tonics, and are generally employed in domestic medicine as infusions or "teas." In practical medicine they are rarely used by themselves, but often enter into other and more efficient official preparations as vehicles and flavors.

CHAPTER XVIII.

EMETICS.

Emetics are a class of remedies used for their local influence to produce vomiting. Some of them produce emesis by their *local irritant* action upon the stomach; others produce it *by stimulating* the *vomiting centres* in the medulla; while again others act both by local irritation and by stimulating the vomiting centres.

For convenience of study, they can be divided into two classes: **Sedative Emetics** and **Stimulant or Mechanical Emetics**; this classification being based upon their therapeutic effects.

A *Sedative Emetic* produces intense and prolonged nausea, repeated vomiting, and is followed by great relaxation and sedation. These sedative emetics act principally by their stimulant influence on the vomiting centres, yet they also have some local influence on the stomach.

The *Stimulant Emetics* stand in contrast with the sedative emetics in the fact that they act promptly, producing little nausea, the vomiting not frequently repeated, and the after-relaxation slight. They produce emesis principally by their irritant influence upon the stomach.

The *general indications* for emetics are:

To unload the stomach; as in cases of poisoning, or to remove irritating and indigestible food from the stomach.

To dislodge foreign bodies; either from the air passages, from the œsophagus, or from the stomach itself.

To produce revulsion or shock; as in cases of violent hysteria or in alcoholic mania, where the revulsive influence of an emetic aids in producing quietude.

To produce relaxation in convulsions in children, in violent attacks of nervous asthma, and in spasmodic croup of children.

The emetics were formerly also employed to rouse up the liver and increase the biliary secretions, in hepatic torpor and biliousness; but this use of them is happily obsolete.

The emetics are *contra-indicated* in congestion or inflammation of the brain, in gastritis, in advanced pregnancy, in hernia, and in

conditions of great prostration from disease or advanced old age. The harm that may come from their use in these conditions, is probably produced by the mere straining or mechanical efforts at vomiting.

Treatment of Hyper-emesis. In a condition of hyper-emesis, produced by an overdose of an emetic, or in an individual excessively susceptible to emetics, the treatment consists in promptly washing out the stomach, applying counter-irritation or ice over the epigastrium, and giving opium. The opium can be given in suppositories, when a prolonged influence is desired, or morphine can be given hypodermically, when prompt action is necessary.

SEDATIVE EMETICS.

The Sedative Emetics in practical use are: **Tartar Emetic, Ipecac** and **Apomorphine Hydrochlorate.**

Tartar Emetic. The emetic dose of Tartar Emetic is from ½ to 1 grain. This is a powerful, intensely nauseating emetic. It produces emesis partly by stimulating the vomiting centres in the medulla, and partly by irritating the stomach itself. As a practical emetic, for general purposes, it is not often employed, because it is too distressing in its effects and is not entirely free from danger. In cases, however, where it is desirable to produce *shock* or *revulsion*, this is the best emetic we have.

Ipecacuana. *Preparations:* Powdered Ipecac, as an emetic; dose, 20 grains to a dram.

Fluid Extract of Ipecac, as an emetic; dose, 20 to 30 minims.

Wine of Ipecac, as an emetic; dose, ½ ounce.

Syrup of Ipecac, which is the preparation mostly used as an emetic in children; dose, ½ to 2 fluidrams.

The active principle of Ipecac is the alkaloid, *Emetine.*

Physiology. When Ipecac is given in emetic doses, it produces nausea and vomiting, probably several times repeated. Associated with this emesis, there is a marked increase in the glandular secretions of the gastro-intestinal canal, of the bronchial mucous membrane, increased secretion of bile and increased secretions of the glands of the skin.

The vomiting from ipecac is produced in part by its stimulant action on the vomiting centres, and in part from its local irritation. This is probably the safest of the sedative emetics; for even in the largest doses, it cannot produce symptoms that can be called truly dangerous.

By virtue of its stimulating the gastro-intestinal and hepatic secretions, it becomes useful in medicine as a *cholagogue* or stimulant to the liver, in hepatic torpor, biliousness, and catarrhal jaundice. It is also useful, and probably for the same reason, in the treatment of dysentery, especially sporadic dysentery of Camps or Barracks. Here it is given in full emetic doses, until vomiting is established; thereafter it is given in small doses, combined with opium to prevent the vomiting. It is said that this treatment is followed by the evacuation of *tarry black stools*, which are probably due to bile coloring matter from increased biliary secretions which disinfect the lower bowel.

Ipecac is also serviceable as a *sedative expectorant* by reason of its increasing the bronchial secretion. It is used as a sudorific or diaphoretic, in the form of Dover's Powder, to break up colds, because it increases cutaneous secretions.

Ipecac is occasionally serviceable to allay vomiting, when this is due to depression. Here it should be given in very small doses, one or two drops of the wine of ipecac every few minutes, until it has stimulated the stomach to its natural tone, and the vomiting ceases. It is of no service to allay any other form of vomiting.

Apomorphine Hydrochlorate. The emetic dose of this alkaloid is $\frac{1}{10}$ to $\frac{1}{6}$ of a grain, given hypodermically. As a sedative expectorant it is sometimes used in doses of $\frac{1}{20}$ to $\frac{1}{12}$ of a grain.

Apomorphine Hydrochlorate is a synthetic or artificial alkaloid, prepared from morphine by the action of hydrochloric acid. It is a very unstable alkaloid, and readily undergoes decomposition. In watery solution, it decomposes in a very few minutes, producing a *green color* reaction. In *triturate* or tablet form, it ultimately undergoes decomposition, and the triturate becomes green. After such decomposition has taken place, the alkaloid should not be used, for it is claimed that the product of this decomposition is highly poisonous.

Toxic Symptoms. Although this alkaloid is prepared from the alkaloid morphine, it has absolutely no physiological or toxic relations to morphine or opium, but produces entirely different effects.

In toxic doses, apomorphine produces excitement, delirium, hurried but shallow respiration, muscular weakness, weak and rapid pulse, unconsciousness, violent convulsions, and death from paralytic asphyxia.

Physiology. It is noteworthy that in toxic doses apomorphine does not produce vomiting. This is explained by the fact that it is a purely *centric emetic*. In small doses the vomiting centres are actively stimulated, producing prompt emesis; while in toxic doses these same centres become paralyzed, and vomiting is entirely absent. As a practical matter, this would suggest that apomorphine should never be given in any larger doses, hypodermically, than ¼ of a grain, for fear of depressing the vomiting centres, and thereby defeating the very purpose for which the drug may be administered. Of all the emetics, apomorphine is the most prompt and probably the most certain in its action. The promptness of the emesis depends somewhat on the size of the dose; ⅒ of a grain usually does not produce vomiting sooner than from seven to ten minutes; whereas ¼ or ⅕ of a grain, given hypodermically, usually produces vomiting within three minutes.

To the respiration and the circulation apomorphine, in small doses, acts probably as a slight stimulant, but the toxic doses become active depressants to both functions.

The general spinal system also appears to be stimulated by this drug; since in poisoning by it, there is a period of heightened reflexes with convulsions which are at least in part spinal; but this is followed by depression and paralysis.

Therapeutic uses: Apomorphine is almost exclusively used as an emetic. In cases of poisoning, where it is essential to empty the stomach immediately, it is, of all the emetics, the most reliable and the quickest in action, if administered hypodermically. As an emetic it should never be given in any other way than hypodermically; for if it be given by the mouth, especially on a full stomach, it is not only slow, but very uncertain in its effect.

Apomorphine is often used as an *expectorant* in acute and chronic bronchitis, especially in such cases where the secretions

are scanty and the cough severe. Here it should be given in doses sufficiently small so as not to provoke nausea.

Sanguinaria, or *Bloodroot,* and **Squill,** are two substances which have, in times gone by, been used as emetics; but both of them are harsh in their effects, unpleasant to the taste, and, when given in very large doses, they are not entirely free from danger of producing poisoning. They are at present very little used as emetics, except in domestic medicine.

Sanguinaria is a very complex body, containing probably four alkaloids: Chelerythrine, Homochelidonine, Sanguinarine and Protopine. None of these alkaloids are of any practical service in medicine, nor is there any certainty as to which one is responsible for the production of emesis.

STIMULANT EMETICS.

The Stimulant or Mechanical Emetics are: **Mustard, Zinc Sulphate, Copper Sulphate, Alum** and **Common Salt.**

These Stimulant Emetics produce emesis principally by their irritant action upon the gastric mucous membrane.

Mustard. Mustard is probably one of the most certain of the stimulant emetics. The dose is from ½ to a tablespoonful of powdered mustard, mixed in a tumblerful of water and exhibited. It is prompt in its action, and acts with great force; but it has the disadvantage that, when ejected, part of it is forced into the nasal passages, and there sets up a catarrhal inflammation which is sometimes troublesome to relieve. This emetic can be repeated twice or thrice, if necessary.

Zinc Sulphate. The emetic dose of Zinc Sulphate is from 10 to 30 grains. It is about as certain in its action as is mustard, but is probably more pleasant to take, and for that reason more generally employed. It is used to empty the stomach in cases of poisoning, or to get rid of indigestible articles of food. It can be repeated twice with entire safety.

Copper Sulphate. The dose of copper sulphate is from 5 to 8 grains. It is an active but a dangerous emetic, and is rarely employed when other emetics are available. One good use for it is, as an emetic in phosphorus

poisoning, because it is at the same time also an antidote. This emetic should not be repeated more than once.

Alum. Alum, as an emetic, is generally given in the form of *dried alum*, as this is more irritant and consequently more certain to act. The dose to a child is generally half a teaspoonful of the powdered alum; to an adult, a tablespoonful can be given. Alum is an emetic which is powerful when it acts, but it is somewhat uncertain in its effect, and is therefore not a favorite.

Chloride of Sodium. Sodium Chloride, or Common Salt, is an emetic which can be used where no other emetic can be obtained. It is less certain than the rest of this class, but if it does not produce emesis, no harm can come from its ingestion. A tablespoonful should be administered in a half pint of luke warm water and the whole be taken at one draught. What commends this emetic most, is the fact that it is available in every household, and can be used to meet emergency cases.

CHAPTER XIX.

CATHARTICS.

All cathartics produce *catharsis*, both by increasing *intestinal peristalsis* and by increasing *intestinal secretions*. Some act more prominently upon peristalsis, like castor oil, while others act more upon the secretions; but all of them affect the secretions to some degree.

One of the greatest uses for cathartics is *to relieve constipation*, which may be *acute* or *chronic*.

Acute Constipation. In acute constipation of moderate severity the cathartics are entirely safe, and are the best means to relieve it. But when the constipation is a very obstinate one, cathartics should be used with a great deal of caution, and an examination into the nature and cause of it should be made with great care. In addition to the ordinary causes, it may be produced by *impaction*, *inter-intussusception*, *hernia*, *external pressure* upon the bowel, violent acute *inflammation*, *paralysis* of the bowel, or *organic growths* in the bowel. In all such serious conditions as these, cathartics are not only inefficient, but their too bold use may prove dangerous to life.

Chronic Constipation. Chronic constipation is by all means the more frequent in its occurrence, and calls more often for the use of the cathartics. A chronic constipation may come from mere carlessness on the part of the individual in not attending regularly to stool; it may be dependent upon dyspepsia or indigestion; or it may be due to atony of the large intestines.

Chronic constipation can often be relieved without resorting to drugs, by means of careful *dietetics*, *exercise*, *regular time for stool*, the use of free *draughts of water*, *rectal injections* and *glycerin suppositories*.

Diet. The diet should be properly regulated, and the free use of laxative articles of food be employed as a part of the diet. Of these we have the *green vegetables*, *green fruits*,

dried fruits, oat-meal, bran bread, corn meal, etc. These articles of diet yield a large amount of indigestible material to increase the bulk of the intestinal contents, and the mere presence of this residue, becomes a stimulus to peristalsis, and hence are laxative. It is, however, necessary that in selecting such articles of food as yield an indigestible bulk, the substance which is not digested must be of a kind which at the same time does not undergo fermentation in the intestines. Such a substance we have in *cellulose,* which forms the frame-work of all fruits and vegetables, and undergoes no change in the human intestinal canal.

It is also necessary to bear in mind, that where the constipation is dependent upon a catarrh of the stomach or intestines, these articles of diet, although acting as laxatives, are very apt to increase the indigestion, and must often be withheld.

Exercise. People who are troubled with constipation due to *sedentary habits* or occupation, often find great relief in resorting to open air exercise, like walking, horseback riding, and bicycle riding.

Regular Time for Stool. The establishment of regular hours for stool is often itself efficacious. At first this attempt may be without effect, but the *intestinal habit* may become educated to regularity by perseverance, just as readily as the habit of irregularity can be established by neglect and carelessness. A regular hour for stool, therefore, is an important factor in preventing and in relieving constipation.

Use of Water. Liberal draughts of hot or cold water, taken in the morning on rising, act with many people as an effective laxative. The quantity of water taken should be from 1 to 2 tumblerfuls. The reason why this should act as a laxative when taken on an empty stomach, is not far to seek; for we know that water is not absorbed from the stomach, but is at once expelled from an empty stomach into the intestinal canal, and there, by its mere bulk and presence, produces a reflex peristalsis. This also explains why a free draught of water on a full stomach has no such effect, because then the water is retained with the food until gastric digestion is complete.

Enemata. Rectal injections are of three general kinds: *First,* Injections which are used for *feeding* or for general medication. They should always be small in quantity and given at body temperature, so that the bowel will retain them.

Second, Injections which are used for the purpose of *emptying the lower bowel* in constipation. Their usual bulk is about a pint. They can consist of plain hot or cold water; or they can be made with soap and water; and if it be desirable that they should be more stimulant, a fluidram of Turpentine, or two fluidounces of Emulsion of Assafœtida, or Common Salt can be added to it to provoke peristalsis. These are used in chronic constipation, and it is chiefly due to the presence of the bulk of the liquid in the lower bowel, which sets up a reflex peristalsis, that a stool follows.

These injections are very serviceable so long as they are not abused; but to use them constantly to bring about a daily stool, is capable of no little mischief. In the first place, the bowel forms a *habit*, so that no attempt at stool will occur unless this stimulus is furnished; in the second place, the daily injection of a pint or more of liquid into the lower bowel, which is already over-distended with fœcal matter, may over-stretch the bowel to such an extent as to become permanently dilated, and may finally result in *sacculation* of the rectum. It is often more effective to use a glycerin suppository into the bowel instead of an injection of water; and when there is obstinate constipation, this may be alternated with a water injection, with benefit to the patient.

Enteroclysis or Forced Enemata. For *enteroclysis* or *forced enemata* the quantity of water employed is usually from 1 to 4 quarts, or even more. They are best administered with a fountain syringe having a long flexible nozzle, placing the patient on his back, with knees flexed and hips elevated, or the *knee-chest* position is still more effective but less comfortable to the patient; this favors the free flow of the liquid into the higher bowel.

These large injections are indicated in *fœcal impactions*, to *reduce concealed hernia*, in *dysentery*, in *intussusception* of the intestines, sometimes as an anthelmintic, and to wash out the lower bowel and render it aseptic in summer diarrhœas of both children and adults.

In dysentery, of both acute and chronic type, and in diarrhœa due to intestinal fermentation, rectal injections to wash out the bowel are of the most valuable methods of treatment. This can be done with cold or hot water, or the water may be medicated with an antiseptic.

In chronic dysentery, 30 to 60 grains of nitrate of silver can be added to a half gallon of water and injected into the large intestine with great advantage; but this must be followed by an injection of common salt solution to reduce the silver, in case it should not be expelled in due time.

Classification. For the sake of convenience of study, the cathartics may be grouped into five classes. This classification is not supposed to be strictly scientific, but it is therapeutically very convenient, since it is based upon special therapeutic advantages which the different drugs coming under each class have, rather than upon any physiological relations they possess.

These groups are: *Laxatives, Purgatives, Hydragogues, Cholagogues* and *Drastics.*

The Laxatives are such cathartic remedies as are incapable of producing active purgation, and are therefore employed more in chronic constipation, simply to maintain regularity of the bowels.

The Purgatives are more active cathartics, and are capable of producing active purgation, and the character of the stools is soft and mushy. They are used chiefly to sweep out the intestinal canal.

The Hydragogue Cathartics can be used for general cathartic purposes, but they have the special advantage of producing *large watery stools*, and are therefore useful to *deplete inflammations* or to *remove dropsical effusions.*

The Cholagogue Cathartics have the special function of influencing the liver and *increasing the flow of bile*, besides being general active cathartics.

The Drastic Cathartics are the most active and the most poisonous of this class. They can be used as powerful cathartics for all general purposes, but they have the special advantage of being able to produce *revulsion* or shock.

General Indications. The general indications for cathartics are:

To overcome chronic constipation.
To empty the intestinal canal.
To get rid of dropsical effusions.
To deplete inflammations.
To stimulate the liver.
To increase pelvic circulation in amenorrhœa.
To produce shock or revulsion.

LAXATIVES.

The drugs coming under this class are used chiefly to relieve chronic constipation, but it must be borne in mind that any one of the cathartics can be used for this same purpose, if it be given in proper dose.

The laxatives are: **Tamarinds, Manna, Cassia Fistula, Magnesia, Sulphur, Cascara Sagrada, "A. B. S." Pill.**

Tamarinds. The pulp of the fruit of Tamarinds is used in medicine as a laxative. It contains traces of citric, tartaric and malic acids, but its laxative properties depend entirely upon its indigestible bulk. It is, therefore, a very inefficient and rarely used laxative.

Manna. Manna depends for its laxative property upon a sugar, *mannite*, which it contains, and the rest of the bulk is made up of cellulose, so that it is laxative partly because of its bulk and partly because of its sugar, since all sugars are somewhat laxative. It is pleasant to take, but by itself it is not very efficient.

Cassia Fistula. Cassia Fistula, or *Purging Cassia*, can be used in medicine for laxative purposes; but it is rarely, if ever, employed by itself, but is one of the ingredients of the official Confection of Senna.

Magnesia. Of Magnesia we have the *Calcined* and the *Magnesia Carbonate*. Magnesia occurs in two forms, the *heavy* and the *light*. The heavy magnesia is the one used as a laxative. It is to be remembered that magnesia acts as

a laxative only when there is acidity in the stomach or intestines to convert it into a soluble salt. In such cases it likewise acts as an *ant-acid.*

Sulphur. Of Sulphur we have *Sublimed Sulphur* or Sulphur Sublimatum; the *Washed Sulphur* or Sulphur Lotum; and the *Precipitated Sulphur* or Sulphur Præcipitatum.

The *sublimed* sulphur differs, medicinally, from the *washed* and *precipitated* sulphur in that the former is contaminated with *sulphurous* and *sulphuric acids,* which are produced in the manufacture of sulphur. These acids are washed out of the other two preparations. We therefore employ the washed or precipitated sulphur for *internal purposes,* and the sublimed sulphur for *external local* applications.

Physiology. When sulphur is given internally, even in large doses, it is incapable of producing any symptoms, except in so far as it may be irritant through the acids it contains. The sulphur itself is only very slightly dissolved by the intestinal juices, and the quantity absorbed and entering the circulation is not sufficient to give rise to any marked symptoms.

Therapeutic uses: Internally, sulphur can be used as a laxative, and is sometimes given in cases of old rheumatism, in chronic gout, and in chronic syphilis; but it is of little practical value.

Externally, locally, it is of some value in skin diseases, especially in *acne* and *scabies.* Here it should be employed as an ointment, and it is better to use the sublimed sulphur, since the acids present in it are themselves antiseptic.

In the treatment of *scabies,* the sulphur ointment should be applied for five successive days to all the parts affected, without the change of personal attire or bed clothing. At the end of this period the patient should be directed to take a bath, change the underwear and change the bed clothing. After this treatment, usually no further trouble is experienced.

Sulphide of Potassium. Sulphide of Potassium is a soluble salt of sulphur, and is locally very irritant. In overdoses it is capable of producing a fatal gastro-enteritis. It has been used internally in ¼ to ½ grain doses as an alterative in various skin diseases, but its best use in medicine is to prepare sulphur baths.

Sulphide of Calcium. Sulphide of Calcium is occasionally used internally in pill form, in doses of $\frac{1}{5}$ to $\frac{1}{2}$ grain. It is highly recommended as an alterative in boils, carbuncles, and scrofulous enlarged glands. It should always be given on a full stomach to prevent local irritation.

Cascara Sagrada. This substance is derived from the California buckthorn.

It is official as an Extract; dose, $\frac{1}{2}$ to 2 grains.

Fluid Extract; dose, 10 to 20 minims.

Elixir; dose, 1 to 2 fluidrams.

Cascara Sagrada is probably the best single vegetable laxative we have for the relief of chronic constipation. Different from the other cathartics for this special purpose, it does not need a constant increase in the dose, but can slowly be diminished in quantity, and the constipation under its influence often wholly disappears. It should, however, never be administered in full purgative doses, for it is capable, in large quantities, of producing an inflammation of the small intestines and a mucus purging with intense griping, which may last for many days.

A. B. S. Pill. The so-called "A. B. S." Pill consists of strychnine, $\frac{1}{60}$ to $\frac{1}{30}$ grain; extract of belladonna, $\frac{1}{8}$ to $\frac{1}{4}$ grain, and aloin, $\frac{1}{5}$ grain. The efficiency of this pill can be increased by adding thereto, $\frac{1}{3}$ to $\frac{1}{2}$ grain of extract of cascara. This combination is probably superior to any now in general use, to relieve chronic constipation. It should be administered one pill at bedtime. If this is insufficient, a pill can be taken after supper, and a second one at bedtime. If, on the contrary, one pill is too effective, it is often practicable to advise that one pill be taken every other night. This treatment should be kept up until the constipation yields.

PURGATIVES.

The purgatives are principally used where it is desirable to sweep out the intestinal canal, or simply open the bowels. They do not produce large watery stools, but simply a soft mushy stool, and act promptly.

They are: **Castor Oil, Rhubarb, Aloes, Senna,** and the **Compound Cathartic Pill.**

Castor Oil. The dose of Castor Oil (Oleum Ricini), to a child is from ½ to 1 fluidram; to an adult, from ½ to 1 fluidounce.

Castor oil is derived from the Castor Oil Bean by expression. The *Bean* itself contains a very irritant and poisonous principle, *ricinic acid,* which is itself violently poisonous, producing fatal gastro-intestinal irritation.

The Oil itself is entirely free from irritant properties, and is, on the contrary, rather soothing to inflamed mucous membranes. It depends for its cathartic activity upon the acid radical, *ricinolein* or *ricinoleic acid.*

Castor oil is a good cathartic for all purposes where it is desirable to empty the bowel; but it is of special value where there are irritant and indigestible substances in the intestinal canal, producing irritation and diarrhœa. It does not only clean out the intestinal canal of such substances, but at the same time soothes the inflamed surfaces.

It can be administered as the plain oil, in emulsion, in capsules, or suspended in soda water; and in case of children, an excellent way of administration is to combine the oil with equal parts of glycerin and administer this in 1 to 2 fluidram doses.

Rhubarb (Rheum). Rhubarb contains *tannic* and *chrysophanic* acids, but its purgative action possibly depends upon a complex body, *Rhein.*

Rhubarb is a slowly acting cathartic, producing catharsis in from 4 to 6 hours; and because of the presence of its tannic acid, the purging is apt to be followed by slight constipation. It also contains a bitter principle which is slightly *stomachic* in its influence, so that rhubarb is an excellent laxative for old people with chronic constipation due to lack of digestive power, because it combines both stomachic and laxative qualities.

There is an unnecessarily large number of official preparations of rhubarb, but the best ones for practical use are:

The *Extract;* dose, 5 to 8 grains.

The *Aromatic Syrup* of Rhubarb; dose, ½ to 1 fluidram for a child.

The *Aromatic Tincture* of Rhubarb; dose, ½ to 1 fluidram.

The *Aromatic Syrup of Rhubarb* is oftentimes serviceable *in summer diarrhœas,* probably because it contains aromatics, which are themselves disinfectant and stimulant to the intestinal canal.

Aloes. Aloes we have official as *Socotrine* Aloes, *Barbadoes* Aloes and *Cape* Aloes.

The active purgative principle of aloes is *Aloin*, a crystalline neutral principle, the dose of which is from 1/5 to 1 grain. Aloes, like rhubarb, has a host of official preparations, none of which, however, are as useful and certain as the active principle itself, and it is best for all purposes to use the *Aloin*.

Aloes is a slowly acting but certain cathartic; and if the dose be a full one, it is apt to be followed by rather severe griping and repeated stools. It is a cathartic, therefore, that is more fitted for combination with milder cathartics when active catharsis is desired, than to be given by itself; but as a laxative in chronic constipation, it is one of the best we have. Since it is so slow in action, it combines very happily with either Rhubarb, Calomel, or Podophyllum, all four of which are remarkable for their slowness of purgative effect.

Aloes is peculiar among the cathartics in that its principle action is upon the *lower bowel*, and at the same time increases the pelvic circulation. It is for this reason often used as an *emmenagogue cathartic* to overcome constipation associated with ammenorrhœa.

It is *contra-indicated*, in very large doses, in all conditions of pelvic inflammation; such as inflammation of the womb, of the ovaries, inflamed hemorrhoids and in acute cystitis.

Senna. *Preparations:* Fluid Extract; dose, 1 to 2 fluidrams The Confection; dose, ½ to 2 drams.

The Compound Infusion, or "Black Draught," being made up of senna, manna, and Epsom salt; dose, ½ to 1 fluidounce.

The Syrup; dose, ½ to 1 fluidram—an excellent preparation for children.

The Compound Licorice Powder, containing powdered licorice, senna and sulphur; dose 1 to 4 drams.

Of all these preparations the most elegant and desirable are the *Confection*, the *Syrup* and the *Compound Licorice Powder*.

Senna depends for its activity upon *Cathartic Acid*. It is a very prompt and certain cathartic, acting with briskness and yet without much griping. The stools are large and watery, and it could be classed physiologically as a hydragogue cathartic; but in its application it is exclusively used as a purgative to sweep

out the bowels. Besides being useful for general cathartic purposes, it is the most desirable to empty the bowels before and after confinements.

Compound Cathartic Pill. The Compound Cathartic Pill contains 1⅓ grains of compound extract of colocynth, 1 grain of extract of jalap, 1 grain of calomel, and ¼ grain of gamboge. The calomel in this pill is reduced to a *black oxide of mercury* by the soap which enters into the compound extract of colocynth.

This pill is a very active hydragogue cathartic; but in practical medicine it is used only as a purgative to secure a stool or to relieve constipation. The dose is from 1 to 3 pills as a laxative, and from 3 to 5 pills as a brisk purgative. It is not a fit cathartic to use constantly for chronic constipation, because it contains mercury.

HYDRAGOGUE CATHARTICS.

The Hydragogue Cathartics are characterized by the production of *large watery stools,* indicating that their dominant action is an increase of intestinal secretion more than peristalsis. They can be used as common cathartics for all intents and purposes, but because of the large watery stools they produce, they have two special uses which none of the other cathartics can fulfil. These are: first, to *deplete local inflammations;* second, to *eliminate dropsical effusions.*

They are: **Elaterium, Jalap** and the **Salines.**

The Salines are: *Magnesium Sulphate, Sodium Sulphate, Sodium* and *Potassium Tartrate* (Rochelle salt), *Magnesium Citrate, Seidlitz Powder, Carlsbad Salt* and the *Saline Waters.*

Elaterium and the Compound Jalap Powder are far more active as hydragogue cathartics than the salines; but they are at the same time more irritant to the intestinal canal, and are not to be used to deplete inflammations of the abdominal cavity; but they are especially useful to remove *dropsical effusions.*

The *Salines,* on the contrary, are all free from local irritant properties, and are therefore the ones to be selected to *deplete abdominal inflammations,* such as peritonitis, appendicitis and inflammations of the pelvic organs.

Elaterium. The dose of Elaterium is from 1/6 to 1/4 of a grain, and is best combined with extract of belladonna and oil of cloves, to prevent griping. It should always be administered in pill form. Its active principle is the neutral crystalline substance, *Elaterin*, the dose of which is 1/20 to 1/12 of a grain.

Given in over-doses, Elaterium is capable of producing violent and even fatal hypercatharsis, with copious bloody stools, vomiting and collapse.

In the dog it does not seem to have any purgative effects, but produces systemic depression with salivation, depressed heart and respiration, convulsions and death in collapse from asphyxia.

It is principally used in medicine as a hydragogue cathartic to relieve dropsies. It can be employed in cardiac dropsies, in renal dropsies, in pleural effusions, and in pericardial effusions. It is probably the most active of the hydragogue cathartics.

In a dropsy from Bright's disease it is probably of special value, since it has been claimed that the stools from elaterium contain large quantities of urea; and if this be true, the drug is certainly of some value to relieve the system in cases of uræmia by eliminating urinary solids.

Jalap. The preparations of Jalap are:
The Extract; dose, 5 to 10 grains.

The Resin; dose, 1/2 to 2 grains.

The Compound Powder of Jalap; dose, 10 to 20 grains as a laxative, and 1/2 to 1 dram as a hydragogue cathartic.

Of these preparations, the *Compound Powder* is the most elegant and the most useful. It contains about 1 part powdered jalap to 2 parts of cream of tartar. As a hydragogue cathartic it may be made still more efficient by adding more cream of tartar. The active principle of jalap is a *resin*, which is itself used in medicine.

Jalap is a very efficient and very elegant hydragogue cathartic to get rid of local effusions; and for this purpose it should always be given in 1/2 to 1 dram doses, in the morning an hour before breakfast, so that the purgative may have left the stomach before food is taken. This produces one, two and sometimes three large watery stools. Only one such dose should be administered in the twenty-four hours.

Magnesium Sulphate or Epsom Salt. Magnesium Sulphate is a brisk, non-irritant hydragogue cathartic in doses of ½ to 1 ounce. This is a good cathartic to empty the bowels, or to get rid of fœcal impactions; and is especially well fitted as a cathartic in peritonitis or appendicitis. For this use it should, however, be given in divided doses rapidly repeated; say, a teaspoonful every half hour until purgation follows. Along with this, a rectal injection should always be administered to empty the lower bowel.

As a general cathartic, merely to open the bowels, Epsom salt is one of the best. It is certain and prompt in effect, and usually purges without much griping.

When a solution of Epsom salt is injected into the circulation of one of the lower animals, it acts as a fatal poison, producing rapid depression of the heart, failing circulation and paralysis. But no such symptoms ever follow its administration by the mouth, if it be given in reasonable quantities.

Sodium Sulphate. Sodium Sulphate, or "Glauber's Salt," is closely related in its efficiency and mode of action to Epsom salt. The dose is about the same, viz.: from 1 to 2 teaspoonfuls as a laxative, and from ½ ounce to an ounce as a brisk cathartic. It acts promptly and without much griping. For either general cathartic purposes or as a hydragogue to eliminate dropsical effusions, it stands co-equal with Epsom salt in the same doses.

Sodium and Potassium Tartrate (Rochelle Salt). This is very much milder in its effects and more pleasant to take, than either Epsom or Glauber's salt, and has to be given in very much larger doses to produce brisk catharsis. It is better fitted for a gentle saline laxative, where not much effect is needed to open the bowels. It is, like all the rest of the salines, free from irritant properties, but its mildness of action unfits it for a certain and effective hydragogue purge in peritonitis and other inflammations of the abdominal cavity.

Magnesium Citrate. Magnesium Citrate can be used either as an *effervescent powder*, or as an *effervescent solution*. The solution is by all means the most frequently used. It is a very gentle, but yet certain cathartic to open the bowels, and at the same time pleasant to take

and agreeable to the stomach. It is, of all saline cathartics, the most used in domestic medicine for laxative purposes.

Seidlitz Powder. "Seidlitz Powder" is composed of two papers, a *white* and a *blue*. The *white paper* contains 35 grains of tartaric acid; the *blue paper* contains 40 grains of bicarbonate of soda and 2 drams of Rochelle salt. When it is administered, these two powders are at the same time put into a half glass of water, and the whole draught is taken while it is effervescing.

Seidlitz powder is a very mild saline laxative, and often insufficient to open the bowels in constipation; but it is especially well fitted to follow a mercurial when the mercury has been taken in divided doses and has failed to open the bowels.

Carlsbad Salt. Carlsbad Salt is derived by evaporating Carlsbad water, and contains the same ingredients as the water itself. It is at ordinary temperature rather insoluble, so that it is better taken in hot water before breakfast, in doses of 1 to 2 teaspoonfuls. This salt is not only cathartic, but also depurant, and aids to eliminate waste matter in cases of gout and rheumatism.

Saline Waters. The different saline cathartic waters in the market are all of some value, and most of them are very pleasant to take. They are of use not only as a cathartic or laxative, but they as well very materially aid in getting rid of effete matter from the system, and in enhancing the action of the kidneys when there is a disposition to sluggishness of action and the formation of gravel.

CHOLAGOGUE CATHARTICS.

The cholagogue cathartics are grouped together because they have special usefulness in *stimulating the liver* and *increasing the flow of bile*, and are especially employed in all conditions of constipation associated with biliousness, congestion of the liver or hepatic torpor, besides being good general cathartics.

They are: **Mercury, Podophyllum, Euonymus, Leptandra** and **Sodium Phosphate.**

Mercury. Mercury is used as a cholagogue laxative or cathartic principally in the form of *Calomel*, although Blue Mass and "Gray Powder" can be used for the

same purposes. Calomel is especially useful in cases of hepatic torpor or mild hepatitis associated with either constipation or diarrhœa. Whenever the stools are of a light *clay color*, a mercurial is indicated, where there be diarrhœa or constipation. Where it is desirable to have more of its action on the liver than of its purgative effect, it is best to give calomel in fractional doses; say, ⅛ grain repeated every two hours until the bowels are opened. In this way all the calomel becomes absorbed and increases its cholagogue effect.

Podophyllum. Podophyllum or *may-apple*, depends for its activity upon a *Resin*. It also contains a crystalline purgative principle, *podophyllotoxin*, and the alkaloid, *berberine*.

The preparations are:

An Extract; dose, ½ to 1 grain.

A Fluid Extract; dose, 5 to 10 drops.

The Resin; dose, 1/12 to ½ grain.

Podophyllum is a cathartic which is remarkably slow in its effect, but it is very certain and very powerful when its action appears. The resin is the most certain of its preparations, and is the one which should always be employed. Being slow in action like calomel, the two combine very happily as a cholagogue laxative or cathartic in biliousness or hepatic torpor and like conditions.

Podophyllum is an active poison when it is taken in overdoses, producing prolonged catharsis with mucous and bloody purging, and intense griping. If the dose be large enough, it can take life by producing a fatal gastro-enteritis. It should therefore never be given in purgative doses by itself, but simply be employed in combination with milder cathartics, to which it gives certainty and briskness.

Euonymus. Euonymus, or *Wahoo*, is a mild cholagogue laxative, and depends for its activity upon the resin *Euonymin*, the dose of which is from 1 to 4 grains. It is not to be relied on for certainty of action where there is stubborn constipation, but rather where a mild laxative influence is desired along with hepatic stimulation in cases of biliousness or torpor of the liver.

Leptandra. Leptandra contains a resin, *Leptandrin*, which is mildly laxative and somewhat stomachic. It is cholagogue in its influence, and can be used in combination with more active cathartics as a stimulant to the hepatic functions. The dose is from 1 to 3 grains of the resin.

Sodium Phosphate. Sodium Phosphate is an excellent saline cholagogue laxative. In its purgative power it is far less efficient than the other salines, and can only be looked upon as a mild laxative. It is therefore useful where there is hepatic torpor with sluggishness of the bowels; also in cases where there is a tendency to the formation of *gall stones* and biliary colic.

In the diarrhœas of bottle-fed children during the hot seasons, phosphate of sodium, in doses of 3 to 5 grains at each feeding, is often capable of arresting such diarrhœa and fermentation. Its value here probably entirely depends upon the biliary secretion it provokes, and thus disinfects the intestinal canal.

A very useful saline cholagogue laxative, for chronic constipation with hepatic torpor, is the combination of Sodium Phosphate, 1 dram; Sodium Sulphate, 2 drams; Potassium Iodide, 5 grains. This quantity, as a single dose, is to be dissolved in half a glass of water and taken in the morning on rising. This is often a very efficient laxative in gouty and plethoric people.

DRASTICS.

This group constitutes the most active of the cathartics. They are all capable of producing fatal hypercatharsis when taken in over-doses. Their special usefulness lies in the fact that they can be employed to produce *shock* or *revulsion* when such an effect is desired, and for this purpose croton oil is the most active and the most desirable. They are all powerful general cathartics and are useful in obstinate constipation.

They are: **Colocynth, Scammony, Gamboge** and **Croton Oil.**

Colocynth. *Preparations:* Extract; dose, 1 to 3 grains. Compound Extract, containing colocynth, aloes, scammony, cardamon and soap; dose, 1 to 5 grains.

The Compound Extract is by all means the more desirable

and the more frequently used preparation. It is the principal ingredient of the official compound cathartic pill.

Colocynth depends for its purgative activity upon the glucoside, *colocynthin.*

It is itself an active and reliable cathartic for general purgative and laxative purposes, and empties the bowel without much griping; but it is generally used by the profession in combination with milder cathartics, to give them certainty of action.

Scammony. Scammony depends for its activity upon a *Resin,* which alone is official; dose, ½ to 2 grains.

Scammony is such an active drastic cathartic that it is rarely used alone in medicine, but is usually combined with mild cathartics in fractional doses to give them briskness.

In toxic doses this resin produces excessive purgation, with vomiting and collapse.

Gamboge. Gamboge has official a *Gum Resin* which contains about 70 per cent. of *gambogic acid;* dose, as a purgative, 1 to 3 grains; as a laxative, combined with milder cathartic, ½ to 1 grain.

This substance, like scammony, can produce fatal hypercatharsis, with vomiting and collapse.

Oleum Tiglii, or Croton Oil. This oil is obtained by expression from the seeds of the *Croton Tiglium;* dose, 1 to 2 drops.

Croton oil depends for its purgative and irritant effects upon its fatty acid radical, *Crotonolein* and *Croton-resin,* both of which are probably active.

Locally, croton oil is extremely irritant, producing redness, vesication, and even ulceration of any vital part with which it comes in contact. Because of these properties it is sometimes used externally locally as a *counter-irritant* in sore throat, and over the chest in chronic bronchitis. It is very severe in its action, and the counter-irritation very prolonged.

When croton oil is given internally in doses of 1 to 2 drops, it produces brisk purgation in from ten to twenty minutes. Of

all the cathartics it is the most prompt, the most powerful, the most irritant, and the most poisonous.

Toxic Symptoms. When croton oil is taken in toxic doses, there is intense pain throughout the entire gastro-intestinal canal, with continuous vomiting, and purging of mucous and bloody stools, pain in the back and loins, bloody urine, finally the urine become suppressed, and death in collapse from toxic gastro-enteritis.

Therapeutic uses: Croton oil is especially selected as a cathartic when very quick and certain action must be obtained, as in apoplexy, in obstinate constipation where other cathartics are ineffective, in acute congestion of the brain, or in maniacal insanity where it is desired to produce shock and quietude.

Croton oil stands in striking contrast with castor oil (the only two cathartic oils), in that it is the most active and the most poisonous of all the cathartics; whereas *castor oil* is the mildest and most soothing of all the cathartics.

CHAPTER XX.

DIURETICS.

The diuretics are used in practical medicine for the purpose of *increasing* or *modifying* the renal secretions.

For convenience, they can be divided into three classes:

First—The *Hydragogues*, whose main function is to increase the *watery constituents* of the urine. They are stimulant to the renal secreting structures directly.

Second—The *Depurant* or *Refrigerant* diuretics, whose main purpose is to increase the oxidation and elimination of the solid *waste constituents* of the urine. Their action is more upon the cell metabolism of the entire system than upon the kidneys themselves.

Third—The *Alterative* or *Stimulant* diuretics, whose principal uses are to *medicate the genito-urinary tract* in catarrhs and irritations.

General Indications. The general indications for these diuretics are:

To maintain the action of the kidneys in acute diseases.

To relieve dropsical effusions in serous cavities, and general dropsies.

To aid in the elimination of the urinary waste products and other poisons from the system.

To modify the renal secretions, and allay catarrhal irritations of the urinary canal.

HYDRAGOGUE DIURETICS.

The Hydragogue Diuretics increase the watery constituents of the urine, and are therefore the ones to be employed to get rid of dropsical effusions, to dilute the urine when it is too con-

centrated in cystic irritation, and in cases of inactivity of the kidneys due to local congestion, to re-establish their full functions.

They are: **Water, Bitartrate of Potassium, Digitalis, Strophanthus, Caffeine, Theobromine, Diuretin, Jaborandi, Calomel, Spirits of Nitrous Ether, Sugar of Milk, Scoparius, Squill** and **Blatta.**

They are comparatively free from irritant properties to the genito-urinary tract, except *Scoparius, Squill* and *Blatta,* all three of which are active local irritants, and should not be employed in acute irritation or inflammation of the kidneys or bladder.

Water. Water acts mechanically as a hydragogue diuretic by increasing the volume of the circulating fluids, and increasing the blood supply to the kidneys. Although it is physiologically inactive, it increases the elimination of the urinary solids or waste products when they are in readiness for elimination from the system, and simply need be flushed out; but it does not act as a depurant by increasing the oxidation of tissue waste.

It is to be remembered that there is a *reciprocal relation* between the action of the skin, the kidneys and the bowels. When either one of these functions is excessively active, as a *free perspiration,* there is lessened activity of the kidneys and of the bowels. On the contrary, when there is a free *liquid purgation,* the kidneys and skin are apt to be inactive and the urine concentrated. Again, when the skin becomes very inactive, as it does in cold weather, the kidneys assume part of its action and secrete all the more freely.

From this physiological relation it is easily seen how free draughts of water can be made to act at will, either as a *diuretic* or as a *diaphoretic.* When a *diuretic* action is desired, it is necessary that the patient should remain in cool surroundings, so that the skin remains inactive. When, on the contrary, a *diaphoretic* action is desired, the patient, after taking free draughts of water or hot tea, should be kept in warm surroundings, or in a room of a high temperature to promote perspiration.

Of all the diuretics employed in medicine, *Water* is the most extensively used, and in many cases the most serviceable. In acute fevers, where the urine is scanty and highly concentrated,

putting a heavy strain upon the kidneys, the free use of water is our constant and most reliable diuretic to maintain their action. The free use of cold water should always be encouraged in all fevers, for it aids in the elimination of poisons and helps to reduce temperature.

Water is also serviceable in irritation of the bladder or cystitis, in irritation of the ureters or urethra, and for the purpose of diluting the urine so as to lessen its irritant properties.

In gout and rheumatism the liberal daily use of water is a most essential diuretic to keep the system flushed out and kept free from the poisonous products present in those conditions.

Water can be used with great effectiveness and value in acute Bright's disease, with sudden suppression of urine. Here it should be given in large quantities by *draught, hypodermically,* and by the *bowel.*

Hypodermically, or so-called *Hypodermoclysis,* it should be injected in quantities of ½ to 1 pint, at body temperature, with common salt added to the amount of one per cent. This is said to act promptly and vigorously upon the kidneys, probably simply by increasing the bulk of the circulation. Less efficient, but yet very helpful, is a process called *Entero-clysis,* in which a solution of luke-warm water, at body temperature, is thrown into the large bowel, and allowed to remain and be absorbed. Either of those two methods is sometimes very efficient and helpful, especially in cases of Bright's disease, where the stomach is too irritable to retain water.

Milk is likewise used as a diuretic, and as a food, in acute Bright's disease. It acts very much as does water, except that it has food value associated with it. The food value depends entirely upon the solid constituents of the milk; while the diuretic effect depends in part upon the watery constituents of the milk, and in part upon the *sugar of milk* contained in it, which is itself diuretic. In *sour milk* or *buttermilk* the sugar of milk is fermented into lactic acid, and this lactic acid itself has diuretic properties. Therefore, a milk diet in Bright's disease has more than one advantage, and is deservedly a popular diet in this disease.

Bitartrate of Potassium. Bitartrate of Potassium, or Cream of Tartar, differs from the other vegetable potassium salts in the fact that it is *hydragogue* in its effects on the kidneys, whereas the rest are *depurant.* It is a

mild, non-irritant hydragogue diuretic, in doses of ½ to 1 dram three or four times a day.

It can be administered with Infusion of Juniper; or, in cases of acute congestion of the kidneys, it can be combined with Infusion of Digitalis. Cream of tartar circulates in the system, and is eliminated by the kidneys unchanged.

It is a diuretic of value in acute congestion of the kidneys with scanty urine, and acute nephritis with urinary suppression, because it is bland in its effects. In very large doses it is capable of acting as a mild laxative.

Digitalis. Digitalis is a non-irritant diuretic, but is somewhat uncertain in its effects. It is therefore more frequently used where it subserves the double purpose of stimulating both heart and kidneys, in cases of organic heart disease, with dropsy. It can be used as the Infusion or the Tincture, in combination with other diuretics. In heart disease, with dropsy, a very effective and valuable *diuretic pill* can be employed, consisting of a grain each of powdered digitalis, powdered squill and calomel. This pill can be given three or four times a day.

Digitalis produces diuresis more through its constricting effect on the arterial system than by stimulating the kidneys directly, though it probably has some direct effect, and hence it is more certain in action in lessened flow of urine associated with relaxation of the bloodvessels than elsewhere.

Strophanthus. Strophanthus is a diuretic of more certainty and probably more power than digitalis. It is a direct stimulant to the kidneys, besides influencing the circulation, and is very useful in cardiac dropsies, or scanty secretion of urine from congestion of the kidneys themselves. The dose of the tincture is from 5 to 10 drops.

Caffeine. Caffeine, the alkaloid of coffee, is still more active and more certain than is either strophanthus or digitalis, in those who are not addicted to the daily use of coffee as a beverage. It is comparatively free from irritant properties, and produces diuresis by directly stimulating the kidneys. It can be used in medicine both in renal and cardiac dropsy. The dose is 1, 3 to 5 grains of the citrate of caffeine.

Theobromine. Theobromine is the alkaloid of *Cacao* or *Chocolate Nut*, and can be used in doses of 5 to 15 grains. This alkaloid is physiologically very closely related to caffeine; and its employment as a hydragogue diuretic has given great satisfaction to many clinicians. It is useful, like the rest of this class, to relieve dropsical effusions, to stimulate the kidneys to greater action during the course of acute fevers, and in acute nephritis when the amount of urine voided becomes scanty.

Diuretin. "Diuretin" is the name under which the double salt of Salicylate of Sodium and Theobromine is put upon the market. This double salt is more freely soluble than theobromine itself, but its diuretic virtues probably depend principally, if not entirely, upon the presence of theobromine. It is said to be an active and very harmless diuretic in dropsies and acute suppression of urine. It should be given in doses of 10 to 15 grains every two or three hours, until 1 to 2 drams have been taken. In these doses it has never yet been known to produce any decided constitutional symptoms, and is said to be a trustworthy diuretic.

Jaborandi. Jaborandi, or its alkaloid Pilocarpine, can be made to act either as a *diuretic* or as a *diaphoretic*, depending entirely upon the amount of the drug administered, and the temperature of the surroundings. If the dose be a very small one often repeated, and the surrounding temperature be low, a free action of the kidneys can be expected. If, on the contrary, the surrounding temperature is high and the dose is large, a free sweating will occur.

To use it as a diuretic, therefore, it must be given in small doses, 5 to 8 drops of the Fluid Extract every four or five hours, or $\frac{1}{20}$ of a grain of Pilocarpine Hydrochlorate every three or four hours, and the patient meanwhile be kept in a cool room. Jaborandi is not only an active and reliable diuretic, but it is absolutely free from local irritant properties, and can be employed in acute congestion of the kidneys, or to increase the flow of urine in nephritis.

Calomel. Calomel has been introduced as a hydragogue diuretic, and is recommended principally in scanty or diminished urine from cardiac lesions or in renal disease. It

is recommended that it should be given in doses of 3 to 5 grains every three hours, until 20 to 30 grains have been administered. Under these circumstances, it often brings about full action of the kidneys when the other diuretics have failed.

Why the doses should be given in short succession to produce diuresis is very clear; it is because we know that calomel or mercury acts upon the kidneys as a stimulant for a very short time, and then it rather lessens the renal secretions, then accumulates in the system and produces ptyalism. It is therefore the first effect of calomel that must produce the diuresis, or else diuresis will not at all follow its use. This makes it an *emergency diuretic* in cases of obstinate cardiac or renal dropsy.

Spirits of Nitrous Ether. Sweet Spirits of Nitre is a very mild and unreliable diuretic, and is principally used for this purpose during the course of acute fevers, to maintain the action of the kidneys. It can be given in doses of 10 minims to a fluidram.

Saccharum Lactis. Sugar of Milk has recently been introduced into medicine as a diuretic. It may be said that all the sugars have a slight diuretic action, but that sugar of milk has the advantage of being less irritant to the gastro-intestinal canal, and probably slightly more diuretic than other sugars; yet it is probable that it is more of a confection than it is efficient and reliable to bring about increased activity of the kidneys. It is given by those who recommend it in quantities of 1 to 3 ounces per day.

Scoparius. Scoparius depends for its activity upon the neutral principle *Scoparin* and the liquid alkaloid *Sparteine*. It is used in medicine as a Decoction, made of the strength of an ounce to the pint, and given in doses of ½ to 1 fluidounce. Sparteine sulphate can be used in doses of ⅕ to ½ grain.

Scoparius, in toxic doses, produces vomiting and liquid purging, irritation of the kidneys, bloody urine, and finally suppression of urine.

In medicine, it is a good diuretic to get rid of dropsical effusions when the kidneys are intact; but it is not a safe drug to use in a dropsy where the kidneys are damaged, for fear of producing increased irritation by the drug itself.

Scilla. Scilla, or Squill, is probably the most irritant of the hydragogue diuretics, and in over-doses it produces a slow full pulse, intense nausea, vomiting, purging, pain in the stomach and back, scanty and bloody urine, and finally collapse. It is, therefore, not a diuretic to be used in damaged kidneys, but is active and reliable in dropsies from heart disease.

Squill contains the active principles *scillin, scillitin, scillain, sculein, scillipicrin* and *scillitoxin.* Its active principles are of little importance to the practical physician, because none of them are used in medicine, except in the preparations of the crude drug; nor do we know how they severally become responsible for the emesis, diuresis, cardiac stimulation or expectorant effects which follow ingestions of this drug.

The preparations employed are:

The Tincture; dose, 10 to 20 drops.
The Vinegar of Squill; dose, 10 to 15 drops.
The Syrup of Squill; dose ½ to 1 fluidram.
The Fluid Extract; dose, 1 to 3 drops.

Of these preparations, the Syrup and the Vinegar are the ones most employed.

Physiology. When squill is given internally in moderate doses, it produces a slow full pulse, resembling that of digitalis, except that it lacks in force. This cardiac stimulation is probably direct, but it is not very marked.

Its diuretic action depends upon its direct stimulating effect upon the kidney structures themselves, and is rather an active and reliable diuretic; but it is apt to produce irritation in the kidneys when given in large doses. In toxic doses there is always irritation of the gastro-intestinal canal and irritation of the kidneys. It is, therefore, *contra-indicated* in all conditions in which the kidneys are diseased.

Occasionally syrup of squill is used in domestic medicine as an *emetic* and as an *expectorant.* As an emetic, it is somewhat uncertain in its action, and is very harsh in its effects.

Blatta. Blatta is prepared from the dried bodies of the *Blatta Orientalis,* or the common *cockroach.* It contains a crystalline principle, *antihydropin,* upon which its diuretic action depends. In large doses it is actively irritant to all mucous membranes, and in toxic doses it produces albuminous and bloody urine, together with gastro-intestinal irritation and collapse.

It is a very harsh and unsatisfactory diuretic, and is not very safe to use where the kidneys are not healthy. It is employed in medicine in Europe, but in this country it has never yet found favor.

DEPURANT OR REFRIGERANT DIURETICS.

The *Depurant* or *Refrigerant Diuretics* do not materially increase the quantity of urine, but rather increase the oxidation and elimination of the *nitrogenous waste constituents* of the urine. Their action is not so much upon the kidneys and their functions, as it is the influence upon cell metabolism of the entire system, increasing the destruction and elimination of waste products.

They are indicated in all cases of rheumatism or gout, in cases of debauch or over-feeding without proper exercise, and where the system is filled with uneliminated waste matter, as in lithæmia and uric acid gravel.

These depurants are: **The Mineral Salts of Potassium,**—the *Chlorate, Nitrate, Sulphate, Carbonate and Bicarbonate.*

The Vegetable Salts of Potassium,—the *Citrate, Tartrate* and *Acetate.*

The Vegetable Salts of Lithium,—the *Citrate, Tartrate* and *Benzoate.*

Lactate of Strontium and **Piperazine.**

Mineral Salts of Potassium. All the potassium salts, when taken in large doses and long continued, produce universal depression to all the higher functions, being poisonous to all tissues directly. The mineral salts, however, are far more depressant than the vegetable salts in their constitutional effects, besides being more active local irritants to all the tissues with which they come in contact.

The symptoms produced by the mineral potassium salts are about the same when any one of them is given, creating violent local irritation, besides general depression of the nervous system and circulation; and as an index of their action, the Chlorate of Potassium can be selected as a type of the entire group.

Toxic Symptoms. The symptoms produced by a toxic dose of the chlorate of potassium are those of intense local irritation, with nausea, vomiting, bloody purging, pain in the back and loins, bloody urine and later suppression of urine; cyanotic appearance of the face and hands, cold perspiration, fall of body temperature, yielding of the heart and respiration, and finally death, in part from the general depression, and in part from the local irritation of the gastro-intestinal canal and the kidneys.

Physiology. Chlorate of Potassium, in common with the other mineral potassium salts, is locally very irritant, and in its general effect depressant to all functions.

The *cyanosis* of the face and hands that occurs in poisoning is due to the formation of *methæmoglobin* in the blood. This blood lesion probably does not occur in poisoning by the other potash salts.

Elimination. Chlorate of potassium and all the mineral potash salts are absorbed, circulate, and are eliminated *unchanged:* The chlorate is eliminated as a chlorate, the nitrate as a nitrate, the sulphate as a sulphate, the carbonate as a carbonate, and the bicarbonate as a bicarbonate. None of them, therefore, yield oxygen in the general circulation to hasten oxidation of effete matters, and hence their depurant effects must be looked upon as doubtful.

From these facts it would appear that the mineral potassium salts are of very little service as depurant diuretics, because they do not undergo decomposition in the system or increase oxidation of tissue waste; and in this respect they strikingly differ from the vegetable salts in practical usefulness.

The potassium salts are *eliminated* by *all excretions* and *secretions;* chiefly, however, through the skin, the kidneys, the bowels and the salivary glands.

Therapeutic uses: The mineral potassium salts are at present very little used in practical medicine, except for their local influence. The chlorate of potassium is the one usually selected, and is used as a gargle in sore throat, in follicular tonsilitis and in aphthous stomatitis. In these conditions it has the double advantage of being a local disinfectant or antiseptic, and when administered internally it again influences these local lesions through its liberal elimination by the salivary glands.

It was formerly used a great deal in combination with the Tincture of the Chloride of Iron, in the treatment of diphtheria and scarlet fever. This combination is excellent as a local application to the throat; but as an internal remedy in these two diseases, it is to be condemned. It not only fails to do good, for it does not undergo oxidation in the system; but it is capable of doing a great deal of harm by way of elimination through the kidneys, which in these diseases are already irritated by the toxins, with a tendency to Bright's disease; and the additional irritation of chlorate of potassium may be sufficient to convert a mild albuminuria in diphtheria or scarlet fever, into a serious or possibly fatal case of nephritis.

Vegetable Salts of Potassium and Lithium. The Vegetable Salts of Potassium and Lithium are alike in their constitutional effects, and are of about the same degree of activity and value in medicine as depurant diuretics. They can be given in doses of 10 to 30 grains. They probably undergo decomposition in the system, yielding their *acid-radical* to form soluble compounds with the waste products, and the *bases* themselves being ultimately eliminated by the kidneys as *alkaline carbonates.* It is very probable that their depurant value and influence depends upon this decomposition, and hence the difference of action between the vegetable and the mineral salts of potassium as diuretics.

It matters very little which of the vegetable potassium or lithium salts are employed, so far as their effects are concerned; but because the citrate of potassium is probably the more pleasant to take, and yields itself to combination with lemon juice to disguise it, it is the one usually selected by physicians.

It should be mentioned here that the bitartrate of potassium, though a vegetable salt, is eliminated unchanged, and is not a *depurant*, but a *hydragogue* diuretic.

Therapeutic uses: These vegetable salts of potassium and lithium are used in *lumbago, muscular rheumatism, lithemia, uric acid gravel,* and in *gout.* They are also useful, and especially the citrate, as an expectorant to break up colds or bronchitis in the early or formative stage. For this purpose, when given in full doses, it has no superior in medicine.

Citrate of Potassium is also used as a stimulant to the liver or as a cholagogue in catarrhal jaundice and mild hepatitis, in which case it should be combined with bicarbonate of sodium and phosphate of sodium.

Strontium Lactate. Lactate of Strontium is freely soluble, and can be given in doses of 15 to 30 grains. In its therapeutic effect it produces depurant influence upon the general system, and aids in the elimination of uric acid and other poisonous urinary compounds; but besides these effects, it somewhat increases the watery constituents of the urine and causes the kidneys to act more freely. It is also used in gout, muscular rheumatism, and in uric acid gravel.

There is some clinical evidence to show that strontium lactate probably has some *alterative* influence upon the kidneys themselves. Indeed it has been used in catarrhal nephritis with a claim that the kidneys acted more freely under its influence, the albumen having been markedly lessened in quantity and in some cases wholly disappeared. This fact should be recorded as "important, if true."

Piperazine. Piperazine is freely soluble in water. It can be given in doses of 5 to 10 grains, three or four times a day. It is especially useful in medicine for its solvent power to uric acid. It is said that it is twelve times as solvent to uric acid as are the lithium salts, and therefore twelve times as useful in uric acid gravel.

If piperazine be administered where there is uric acid in the system, it combines with the uric acid and forms a soluble *piperazine urate*, and is thus eliminated in solution with the urine. When it is administered in the absence of uric acid, it partly escapes from the kidneys unchanged, and partly as a *piperazine carbonate*.

Therapeutic uses: Piperazine has been highly recommended in uric acid gravel, in uric acid diathesis, in the formation of cystic calculi, and in rheumatism and gout. The urine, after its administration, sometimes becomes *reddish brown* in color. This is probably due to organic combinations with the piperazine.

ALTERATIVE OR STIMULANT DIURETICS.

This last group are not, in a true sense, diuretics, for they do not materially affect the normal constituents of the urine, nor do they increase its quantity. But they are substances which are freely eliminated by the kidneys, and in that manner medicate and produce alterative and stimulant influence upon catarrhs in the genito-urinary tract; such as cystitis, pyelitis, urethritis, irritability of the bladder, and in passive congestion of the kidneys.

For practical therapeutics it is well to divide this class into two groups:

First—Those which are less stimulant and less irritant in their local effect, and therefore can be used in acute and sub-acute catarrhs of the genito-urinary tract.

Second—Those that are more stimulant, and which in overdoses can produce violent inflammation of the genito-urinary tract, and are therefore useful in medicine only in more chronic catarrhs.

First Group. In the first group we have: **Buchu, Uva Ursi, Pareira Brava, Chimaphila, Triticum Repens** and **Benzoic Acid.**

Buchu. Buchu is official as a Fluid Extract; dose, ½ to 1 fluidram, and as an extract; dose, 5 to 10 grains.

It can also be used as an Infusion, of the strength of an ounce to the pint; dose, 1 to 2 fluidounces.

Buchu depends for its activity upon a *volatile oil*, a *resin*, a *bitter extractive* and *tannic acid.*

It is one of the most useful of this group of diuretics in the treatment of cystitis, sub-acute and chronic pyelitis, and irritability of the bladder. In ordinary cystic irritation or in congestion of the kidneys, with highly acid urine, a happy combination consists of the fluid extract of buchu, potassium citrate and sweet spirits of nitre.

Uva Ursi. Uva Ursi, or the ordinary bearberry, has official a Fluid Extract; dose, ½ to 1 fluidram, and an Extract; dose, 10 to 15 grains.

Uva Ursi depends for its diuretic action almost entirely upon a crystalline principle, *Arbutin.* It also contains *gallic acid* and a trace of *volatile oil.*

Its active principle, Arbutin, probably circulates in the system unchanged, but is ultimately converted *in the kidneys* into *hydrochinone*, and is eliminated as such. It is upon this hydrochinone elimination that the diuretic value of Uva Ursi depends, for hydrochinone is an active antiseptic, and acts as a disinfectant to the bladder. Sometimes it imparts to the urine a peculiar *greenish-brown color*, which, on standing, deepens.

Uva Ursi is probably co-equal with Buchu as a diuretic, and can be used in congestion of the kidneys or sub-acute and chronic catarrhs of the ureters and bladder.

Pareira Brava. Pareira Brava is inferior to either Buchu or Uva Ursi, and is used in medicine principally as an Infusion, of the strength of one ounce to the pint, of which the dose is ½ to 1 fluidounce, and as a Fluid Extract; the dose of which is ½ to 1 fluidram.

It is useful in cystitis and mild irritability of the bladder due to fermentation.

Chimaphila. Chimaphila contains *tannic acid*, a *bitter extractive*, and a crystalline principle, *Chimaphilin*.

It is used in medicine as a Fluid Extract—dose, ½ to 1 fluidram, and as a Decoction, the dose of which is ½ to 1 fluidounce.

Chimaphila, like the rest of this group, is useful in different forms of catarrh of the genito-urinary tract; in cystitis, cystic irritation and pyelitis.

Triticum Repens. Triticum Repens contains *tannic acid*, a trace of *volatile oil*, and the crystalline principle, *Triticin*.

It is used in medicine as a Fluid Extract—dose, 1 to 2 fluidrams; as an Infusion—dose, ½ to 1 fluidounce.

It is a mild stimulant diuretic, useful in irritability of the bladder and cystitis. It is probably not quite as effective as Buchu.

Benzoic Acid. Official Benzoic Acid is derived from Gum Benzoin. For commercial purposes it is often derived from hyppuric acid, but the Pharmacopœia directs that, for medicinal purposes, gum benzoin shall be its source.

The dose can vary from 5 to 20 grains.

Gum Benzoin itself contains a *resin, benzoic acid, cinamic acid* and a *volatile oil.*

It has been used in medicine as a Tincture of Benzoin and as a Compound Tincture of Benzoin. The Compound Tincture, given in doses of ½ to 1 fluidram, has been used as an *expectorant,* but it is an inferior remedy for this purpose.

Locally, the Compound Tincture of Benzoin was formerly much used as a local antiseptic application in the dressing of wounds; and certain it is, that it has antiseptic virtues on account of the presence of the benzoic acid and the volatile oil it contains, but is not now much used on account of its inelegance.

Benzoic Acid itself is used in medicine almost exclusively as a *diuretic,* though it has local antiseptic and irritant properties. When given in over-doses, it produces depression of the respiration and the circulation, together with nausea and vomiting, and has the power of reducing body temperature, but is never employed in medicine for this purpose.

When given internally, it circulates in the system probably as a *benzoate,* but is ultimately eliminated by the kidneys as *hyppuric acid.* This conversion of the benzoic acid into hyppuric acid probably takes place in *the kidneys,* and it is upon this elimination that its diuretic value depends. Hyppuric acid is of acid reaction, and is actively antiseptic to the urine. Benzoic acid therefore is used in practical medicine as a diuretic in cases where there is alkalinity of the urine with ammoniacal fermentation and cystitis. By its elimination it renders the urine acid and disinfects the genito-urinary tract. It is one of four acids used for the purpose of acidulating the urine, namely: *Benzoic Acid, Boric Acid, Agaric Acid* and *Camphoric Acid,* all four of which are eliminated and found in the urine as acids.

Second Group. This group consists of volatile oils which are more stimulant and more irritant, and which, in toxic doses, are capable of producing gastro-intestinal irritation, irritation of the genito-urinary tract and strangury.

They are: **Oil of Juniper, Oil of Erigeron, Oil of Santal, Cubebs, Copaiba, Turpentine** and **Cantharides.**

Of this group the most irritant, the most poisonous and the least useful is *Cantharis;* Turpentine stands next in order of irritation.

Oil of Juniper. Juniper is official as the Oil; dose, 5 to 15 drops, and the Spirits of Juniper; dose, ½ to 1 fluidram. The Spirits of Juniper is about equal to a good quality of Gin, and can be used as a diuretic in chronic congestion of the kidneys not due to organic disease, and in chronic catarrhs of the bladder with irritability.

The Oil of Juniper is more stimulant, and is used in more chronic forms of genito-urinary catarrhs.

Oil of Erigeron. The Oil of Erigeron is used in from 5 to 20 minim doses, more for the purpose of arresting internal hemorrhages than as a genito-urinary stimulant. It is often of value in hemorrhage from the kidneys, hemorrhage from the bladder, and in excessive menstruation; in all of which indications it has been employed with asserted good results.

Oil of Santal. Oleum Santali, or the Oil of Santal, is extensively used in irritation and inflammation of the bladder and urethra. It is highly stimulant to the urinary organs, and in toxic doses it is capable of producing not only gastro-intestinal irritation with vomiting and purging, but scanty and bloody urine with violent irritation of the bladder.

In practical medicine it is most frequently used in the treatment of sub-acute and chronic gonorrhœa, where it can be given either in emulsion or in capsules, in doses of 5 to 15 drops.

It is also one of our most valuable stimulant expectorants in the later stages of bronchitis.

Cubebs. *Preparations:* Oil of Cubebs; dose, 10 to 15 drops. Oleo-resin of Cubebs (Balsam); dose, 5 to 15 drops.

Tincture of Cubebs; dose, ½ to 1 fluidram.

Fluid Extract of Cubebs; dose, 10 to 20 minims.

The Oil and the Oleo-resin are the two most eligible preparations, and either one or the other should be employed.

In large doses, taken internally, Cubebs is capable of producing an active gastro-intestinal irritation, with nausea, vomiting and purging; genito-urinary irritation, bloody urine, probably suppression of urine, irritation of the bladder and strangury. Its volatile oil is freely eliminated by the kidneys and lungs, and in

this manner it becomes a stimulant to the mucous membranes of both organs. It is, therefore, valuable and useful both as a *diuretic* and as an *expectorant*, and is employed in medicine in very chronic cystitis, but more frequently in the treatment of gonorrhœa. It is sometimes useful in chronic bronchitis and in chronic catarrh of the stomach and intestines.

When the Oleo-resin of Cubebs or Copaiba is freely administered, it produces a urine which throws down a *white floculent precipitate* on the addition of nitric acid, resembling the presence of albumen, and may be mistaken for it. The distinction however can be made by heat test for albumen, to which it will not respond.

Copaiba. Copaiba depends for its diuretic action upon a *volatile oil* which it contains. The dose of it is from 5 to 15 drops. It has also official a *Mass* of Copaiba (Massa Copaibæ), which can be given in pill or capsule in doses of 5 to 10 grains.

When the Oil of Copaiba is given internally in toxic doses, it acts as a violent irritant to the gastro-intestinal and genito-urinary canals, producing nausea, vomiting, purging and pain, on the one hand, and scanty and bloody urine, with irritation of the bladder and urethra on the other, often followed by suppression of urine and strangury.

It is freely eliminated by the kidneys and bronchial mucous membrane, and to the urine itself it may impart the peculiarity of responding to the *copper test* for sugar, producing a red precipitate, and may be mistaken for a diabetic urine. It does however not answer to any other sugar test, and thereby may be distinguished.

In medicine it is used in cystitis and in gonorrhœa of acute and chronic character. It is freely eliminated with the urine, and like all volatile oils, is a disinfectant to the genito-urinary tract.

Both copaiba and cubebs have been used in different forms of chronic diarrhœa, and they no doubt have some value, but not any more than there is attributable to the class of aromatic or essential oils generally.

Turpentine. The Oil of Turpentine is used in internal medicine in doses of from 5 to 20 drops, best given in capsules or emulsion.

Toxic Symptoms. When turpentine is taken in toxic doses, it produces irritation of the gastro-intestinal canal, with nausea, vomiting, pain and purging, pain in the back, scanty and probably bloody urine, and strangury. Associated with these symptoms, there is some mental excitement, a species of intoxication and increased rapidity of the heart and respiration. If the quantity be sufficient, collapse and death finally occur from depression of respiration.

Physiology. Turpentine is probably slightly stimulant to the respiration and to the circulation, but at the present day it is not used for any but local purposes, and hence its general physiology is of very secondary importance save as a toxic agent.

Therapeutic uses: The oil of turpentine, being locally stimulant, is a useful diuretic in very chronic cystitis, and in chronic gonorrhœa or gleet.

By virtue of its local properties it becomes a remedy of usefulness in expelling intestinal worms and in certain forms of chronic diarrhœa, especially in chronic dysentery with ulcers.

It has also been recommended in typhoid fever in two distinct conditions: First, during the course of the low stages of the fever, where it can be given in 10-drop doses, three or four times a day, as an intestinal disinfectant. During the course of this fever the intestinal tube is usually distended with gas, and the turpentine, being volatile at the temperature of the body, will permeate all parts of the intestinal canal and aid to disinfect it. In the second place, it is recommended in *post-typhoid diarrhœa* delaying convalescence, which diarrhœa is probably due to unhealed ulcers in the intestines.

Turpentine is also used in bronchitis of chronic type, or in bronchitis of old people, as an expectorant. Here it is of great service wherever the stomach bears it.

Externally locally it can be used as a rubefacient to produce mild counter-irritation in superficial inflammations or irritations.

To Recapitulate. Turpentine is useful as an *alterative diuretic*, as an *anthelmintic*, in *typhoid fever* both during the course of the disease and in post-typhoid diarrhœa, as an *expectorant*, and as a *counter-irritant*.

Cantharides. Cantharides has been used as a diuretic in the form of a Tincture, and it was formerly recommended to be employed in very chronic cystic catarrhs in the hope of converting them into an acute type, and then attempting to relieve the acute catarrh. This appears to be a relic of mediæval medicine, and it does not seem probable that cantharides has any legitimate place in medicine as a diuretic.

Zea. Under the name of "Zea" is official the ordinary silk of Indian corn. It is claimed to have diuretic value and to be useful in uric acid gravel or gravel from phosphatic deposits. It is official as a Fluid Extract; dose, 1 to 2 teaspoonfuls, and as an Infusion, taken *ad libitum.*

Matico. Matico contains a *volatile oil,* a *resin* and a crystalline principle, *Maticin.* It is used as a Fluid Extract in doses of 5 to 20 minims, and as a Tincture; dose, 1 to 2 fluidrams.

This substance has been used in cystic irritation, gonorrhœa, and for the purpose of controlling internal hemorrhages. Its medicinal virtue is problematical.

Kawa. This is a root containing a *resin,* a *volatile oil,* and a crystalline principle, *Methysticin.*

It was at one time used in gonorrhœa and cystitis, but is a very inferior remedy. It is not now official and deserves to be abandoned.

CHAPTER XXI.

DIAPHORETICS.

This is a class of remedies especially intended for the purpose of increasing the activity of the skin and thereby producing free perspiration.

General Indications. The diaphoretics are employed for various purposes, but their most important uses in medicine are:

First—To get rid of dropsical effusions, dropsies from heart disease, and dropsies from renal disease.

Second—To eliminate poisons or excrementitious matter from the system in cases of *gout*, *rheumatism*, and *uræmia*.

Third—For the purpose of breaking up acute colds, and thereby arresting forming diseases, as bronchitis, catarrhs, rheumatism, and such other conditions as may follow a cold.

Fourth—For the purpose of depleting local inflammations, either internal or external; inflammation of the lungs, kidneys, brain or spinal cord.

It is to be remembered that there is a reciprocal relation between the *skin*, *kidneys* and *bowels;* that when either one of these is very active, the other two are sluggish, and their secretions scanty. Because of this mutual interdependence of these three functions, it is possible that when one is arrested by disease process, as Bright's disease, to have the other two to subserve the purpose of the three.

We have two diaphoretic measures: **Baths** and **Medicinal Means.**

BATHS.

Turkish or *hot-air bath*, Russian or *hot-vapor bath*, and *hot-water bath.*

Hot-air Bath. The hot-air or Turkish bath is probably the most efficient to bring about free, continued perspiration. The hot chamber can vary in temperature from 130 to 160 degrees ordinarily, and sometimes it can be as

high as 180. After the sweating is complete, the patient should be allowed to take a cold shower bath, to produce contraction of the skin and prevent the taking of cold from after exposure.

Hot-vapor Bath. In the hot-vapor or Russian bath, the temperature of the hot chamber may vary from 110 to 120 degrees. In the hot-vapor bath the temperature of the chamber should not rise as high as in the dry-air bath, for there is not the amount of evaporation of the perspiration to reduce body temperature as there is in a dry chamber.

Hot-water Bath. In the hot-water bath, the water should be from 105 to 115 degrees, and the patient be immersed from ten to twenty minutes, then be removed and wrapped in hot blankets. The sweating takes place after the removal from the bath. This can only be considered a substitute for the hot-air or hot-vapor bath, for it is a great deal less efficient.

A substitution for either the hot-air or the hot-vapor bath can easily be extemporized in the sick room by putting the patient on a stool, covering him over with a mackintosh that reaches to the floor, and under the stool placing one or several alcohol lamps. This process, if continued from thirty minutes to an hour, will produce the most profuse sweating. To convert this into a Russian or hot-vapor bath it is only necessary to put a vessel filled with water under the stool and keep it boiling with the alcohol lamp; so that both heat and moisture are furnished.

Therapeutic uses: For therapeutic purposes these baths are used to meet any of the indications for which diaphoretics are serviceable. In dropsical effusions; in chronic gout or rheumatism the frequent use of them prevents attacks; for breaking up colds to prevent forming catarrhs; to deplete local congestions, and in acute nephritis with threatening uræmia, or chronic disease of the kidneys with lessened flow of urine, these baths are amongst the most efficient means for prompt relief.

Contra-indications. The hot baths are contra-indicated in a weak heart, in œdema of the lungs, in chronic meningitis, especially if it be a sequel to a former sunstroke, and on the development of *thermic fever* while the patient is in the hot chamber.

Should thermic fever or symptoms of sunstroke arise while the patient is in the hot chamber, with headache, excessively rapid pulse and no sweating, it is imperative that he should at once be removed into a cold shower bath, and his temperature be reduced.

DIAPHORETIC DRUGS.

The diaphoretic drugs are usually divided into three classes:

The *Nauseant* or *Sedative Diaphoretics*, which probably produce diaphoresis by causing cutaneous relaxation.

The *Refrigerant Diaphoretics*, which produce sweating principally by lessening the force of the circulation.

The *Stimulant Diaphoretics*, or those that produce sweating by directly stimulating the secreting glands of the skin. This last group constitutes the most practical and valuable diaphoretics.

NAUSEANT DIAPHORETICS.

These are: **Tartar Emetic, Ipecac** and **Dover's Powder.**

Tartar Emetic. Tartar Emetic produces slight sweating, which is probably in part due to the nauseant effect it produces, and partly to direct glandular stimulation. It is a diaphoretic that is rarely now used in medicine, unless it be to arrest severe colds in robust adults.

Ipecac. Ipecac is now rarely used as a diaphoretic, except in the form of Dover's Powder, which contains in every 10 grains, 1 grain of opium, 1 grain of ipecac, and 8 grains sugar of milk. This preparation is often administered in conjunction with hot drinks in the evening before retiring, for the purpose of aborting or breaking up a forming cold.

REFRIGERANT DIAPHORETICS.

Under this group may be named: **Citrate of Potassium, Aconite** and **Veratrum Viride.**

Of these three drugs, Citrate of Potassium and Aconite are the more used. On physiological grounds Veratrum Viride could probably have some effect, but in practical medicine it is never used for this purpose.

When Aconite is given in drop doses every hour until the circulation shows distinctly its effects, it is capable of bringing about increased action of the skin, and great improvement in a recent cold may follow; but in point of safety and efficiency in this condition, Citrate of Potassium takes first place. When a cold is to be arrested at once, the potash salt is most effective, but it should be given in ½ to 1 dram doses, freely diluted, about four hours apart, until ½ an ounce is taken.

STIMULANT DIAPHORETICS.

Of these we have **Jaborandi, Spirits of Nitrous Ether,** and **Liquor Ammonii Acetatis.**

JABORANDI.

Preparations. Fluid Extract; dose, 10 minims to ½ a fluidram.

The active principle is the alkaloid *Pilocarpine,* which is official as a *hydrochlorate;* the dose of it as a *diaphoretic* is from ⅛ to ¼ of a grain; as a *diuretic,* smaller doses are employed. This alkaloid is more prompt and more efficient when given hypodermically than when administered by the mouth. It is superior to the fluid extract, because it is less apt to produce sickness at the stomach and vomiting.

Toxic Symptoms. When a full diaphoretic dose of pilocarpine is given, it is followed by a slight rise of temperature, free sweating, free flow of saliva, nausea, and at times followed by vomiting.

When a toxic dose of this drug is taken, there is at once excitement, contraction of the pupils, the pulse becoming strong and slow, rise of temperature, respiration increased, a profuse continued sweating, nausea, vomiting, occasionally liquid purging, and collapse.

Physiology. The sweating from Pilocarpine is due probably to direct stimulation of the perspiratory gland cells themselves. This sweating, when it becomes too profuse or too prolonged, can be arrested by the hypodermic administration of atropine, which is an antagonist to pilocarpine. The sweating usually begins from fifteen to twenty minutes after administration, and may last from three to four hours. The amount of liquid lost in this sweat may vary from 1 to 3 pints. The reac-

tion of the perspiration is at first acid, then neutral, and later alkaline. The early acidity is probably due to the admixture of waste products from the sebaceous follicles, which are always of acid reaction.

Jaborandi does not always produce sweating, but instead it occasionally produces excessive secretion of the internal glandular organs; the gastro-intestinal glands and the kidneys, with liquid stools and copious voiding of urine. It does therefore not only increase the functional activity of the cutaneous glands, but is a stimulant to all glandular structures; increasing the secretion of bile, pancreatic secretion, intestinal secretion, gastric secretion, with their natural proportion of digestive ferments, and is said to increase or stimulate the flow of milk in nursing females.

But these internal and external secretions under pilocarpine, are produced in inverse ratio. When the sweating is very free, the internal secretions are scanty; if on the contrary the internal secretions are profuse, the perspiration is scanty. This relation is purely physiological and is not due to any peculiarity in the effect of the drug.

The tense, slow pulse is probably due to direct stimulant action to the heart and the bloodvessels and is not very marked unless the quantity given is large.

The contracted pupils are of peripheral origin, probably stimulating the oculo-motor nerves and depressing the sympathetic nerves. It is an antagonist in this respect to Atropine, but is parallel to Ezerine in its pupilary action.

To the kidneys it is a direct and very valuable stimulant; and when it is given in small doses, and the patient kept in a cool room, it is one of the most certain and most serviceable diuretics we have. The dose as a diuretic should however not exceed $\frac{1}{20}$ of a grain of the alkaloid, repeated every three or four hours. Larger doses are apt to produce nausea and sweating, and thus would defeat the original purpose.

Therapeutic uses: Pilocarpine is at present most frequently used in medicine either for its action on the skin or on the kidneys, and is employed to abort colds or forming bronchial inflammations and other catarrhs. It is also useful in pulmonary œdema, to eliminate dropsical effusions, and in uræmia where the skin has to assume the function of the kidneys.

It is sometimes used for the purpose of promoting the growth of hair in scalp Seborrhœa. That jaborandi has some influence and direct relation to the growth of hair is undoubted. Under its prolonged use it has been noticed that the growth of hair is more profuse, and the hair usually becoming darker in color and coarser in fibre. If these facts be true, it may be of some service in alopecia and in the loss of hair after acute disease, like influenza and typhoid fever, both by internal administration and by its local application to the scalp.

Sweet Spirits of Nitrous Ether. Sweet Spirits of Nitre can be given as a diaphoretic in doses of ½ to 2 fluidrams to adults, and to children in proportionate doses. It is incapable of producing very much sweating, and is not to be relied upon when there is urgent need of cutaneous action.

Toxic Symptoms. In toxic doses, Nitre is capable of producing all the symptoms peculiar to the *nitrites*, for it is the *Nitrite of Ethyl* dissolved in alcohol. The early symptoms are chiefly those of alcoholic excitement, with delirium and intoxication; but the later symptoms from large doses are accompanied by rapidity of the pulse, cyanosis of the face, labored respiration, muscular weakness and finally motor paralysis.

Therapeutic uses: In its practical application, Nitre is a much used and much abused substance. It is harmless in its effects, both to children and to adults, and is equally useless for most of the indications for which it is employed. It is given to children in colds, in mild fevers, and as a diuretic, in any of which indications it can be looked upon as an agent of probable value.

Liquor Ammonii Acetatis. The solution of the Acetate of Ammonia, or "Spirits of Mindererus," is prepared by neutralizing dilute acetic acid with carbonate of ammonia. It is usually employed when of slightly acid reaction to prevent its decomposition.

In practical therapeutics this substance certainly has no place of value or importance. It has been used in all kinds of fevers, and as a diaphoretic and febrifuge, but in no case must it be expected to do much if any good.

Probably the best use for this solution is in combination with the tincture of the chloride of iron and glycerin to disguise the iron and give the solution a beautiful color. The color is a deep mahogany brown, and an absolutely clear solution. Care should be taken however that the solution is kept slightly acid by adding a little hydrochloric acid, to prevent the iron from being precipitated.

CHAPTER XXII.

EXPECTORANTS.

The expectorants are a class of drugs employed for the purpose of treating bronchial catarrhs. A bronchitis may be of an *acute* or *chromic type*, and the various substances used in its treatment can be classified to co-adjust themselves to these stages of a catarrhal inflammation.

Classes. The expectorants may therefore be divided into *Sedative* and *Stimulant*, according to the stage of the bronchial catarrh.

The *Sedative Expectorants* are those used in the early formation of a cold when there are present the constitutional symptoms of aches and pains with fever, headache and general malaise, before it has centered itself definitely upon the respiratory tract.

The *Stimulant Expectorants* are more applicable after the acute symptoms of a cold have disappeared, and it has centered itself upon the bronchial mucous membrane with the usual symptoms of an acute bronchitis with cough and expectoration.

Cough and *Asthma* frequently accompany and complicate a bronchitis, and often need separate attention to relieve the patient's distress.

To Control Cough. The drugs used in combination with expectorant mixtures to relieve cough are: *Opium, Morphine, Chloroform, Tincture of Hyoscyamus* and the *Cyanides.*

Opium. Opium and morphine are the best drugs at our command and the most generally employed for the purpose of relieving cough. It is however a common belief that they should only be used to relieve cough, when there is a disproportion between the amount of cough necessary to expel the expectorations, and the unnecessary cough which is harassing the patient. It is believed that when there is merely sufficient cough to expel the secretions from the lungs, that cough should not be arrested, because opium is known to lessen the secretions of the bronchial tubes, and thus may defeat the secretions necessary to bring about resolution in the inflamed bronchial mucous membrane.

This general belief does not seem to be well founded. The cough itself is simply an attempt to relieve an irritation in the bronchial tubes, and by its own rasping of the bronchial mucous membrane, it will in turn increase the irritation and inflammation; and as a consequence, a greater amount of secretion is thrown out for which the cough itself is directly responsible. If it be borne in mind that the secretions from the bronchial tubes are chiefly mucus or mucus mixed with pus, it is readily seen that this secretion will not relieve the congestion of the bloodvessels in the bronchial mucous membrane, for it is the direct product of the inflamed mucous glands, and not of the congested bloodvessels in the mucous membrane. Besides this, it is a clinical fact that the more completely the cough in a bronchitis is controlled and lessened at all times, the more rapidly the irritation subsides and recovery follows.

Chloroform. Chloroform is of less value to allay bronchial irritation and lessen the symptom of cough than opium; but next to opium, it is the best drug we have for this purpose, and has the advantage of not interfering with the digestive organs and producing constipation. It is therefore a drug to be employed in cough mixtures when for any reason opium cannot be given.

Hyoscyamus. The Tincture of Hyoscyamus is of some value to allay bronchial irritation and relieve cough; but to do this, it must be administered in full doses, and even then it can only be looked upon as a substitute for the better drugs.

Cyanides. The Cyanides and Hydrocyanic acid have been used in the past to relieve cough, but it is doubtful whether these drugs are of any practical value for this purpose; because they are in the first place very fugacious in their effects, and in the second place, they can only be given in such small doses that even their transient effects cannot be very marked. Personally, I have never seen any beneficial effects to come from their use in allaying cough.

To Allay Asthma. Asthma, like cough, is a mere symptom, but sometimes it is so distressing that it needs separate attention. Some forms of asthma are symptoms of organic diseases, as renal or cardiac asthma, and have no relation to bronchitis, and must be treated accordingly.

The substances used to relieve asthma are: **Opium, Belladonna, Lobelia, Chloroform, Nitrite of Amyl, Antipyrin, Grindelia, Iodides** and **Arsenic.**

Opium. Opium, or its alkaloid morphine, is as valuable in relieving asthma depending upon a bronchitis as it is to relieve cough depending upon the same condition; but where asthmatic spasms are very sudden and severe, and occur in paroxysms, it is better to give morphine combined with atropine hypodermically, than to administer them by the mouth or combined with an expectorant.

Belladonna. Belladonna is of some service in expectorant mixtures to relieve mild asthma, on account of its depressant influence upon the non-striated muscles of the bronchial tubes. It is however more efficient as an anti-asthmatic if equal parts of the leaves of belladonna, stramonium, and tobacco, are made into a cigarette, and the smoke inhaled; or where this is undesirable, the belladonna and strontium leaves can be ignited on a dish and the fumes of the burning leaves inhaled by the patient.

Lobelia. The Tincture of Lobelia is oftentimes used in expectorant mixtures to relieve asthma; and when given in full doses, it is capable of doing much good in an asthma which is persistent throughout the entire course of a bronchitis. The dose can vary from 5 to 20 drops. This is probably the only legitimate use for lobelia in practical medicine.

Chloroform. Chloroform is only available in very violent forms of asthma, where it is given by inhalation, and continued until the asthmatic spasm is relieved. This should never be entrusted to the patient himself, but should always be given either by the physician himself, or by a competent nurse under specific instructions from the physician.

Amyl Nitrite. Nitrite of Amyl is one of the most serviceable remedies we have in nervous or spasmodic asthma, and should always be given by inhalation when the attacks come on. This drug is comparatively safe, so that it can be entrusted to a patient, giving him directions to drop 5 to 8 drops on a handkerchief when the attacks come on and inhale it freely until he is relieved. It is not a substance that is of practical service in an asthma which is continuous, because it is too fugacious in its effects.

Antipyrin. Antipyrin, in attacks of nervous asthma in hysterical persons, is probably the most useful remedy we have; but to get its best service, it should be given in single full doses, combined with one of the bromides; 15 grains of antipyrin with a dram of the bromide of ammonia should be administered in a single dose, and this can be repeated in four hours if the attack has not entirely ceased. I have seen this combination arrest asthmatic attacks which have been unaffected by other remedies.

Grindelia. Grindelia is used in medicine in the form of a *Fluid Extract,* in doses of 10 to 30 minims. For its activity it depends upon an *oleo-resin* and an *alkaloid.*

Physiological Effects. When Grindelia is given in large doses internally, it produces depression; first, of the sensory nerves, then the sensory cord, and later

the motor nerves and motor cord. It also produces some drowsiness with dilatation of the pupils. The circulation seems to be increased, due to its stimulant action on the vasomotor centres, but finally it becomes depressant to the heart and vasomotors.

Therapeutic uses: Grindelia is not now employed for its constitutional effect either on the circulation or the nervous system; but its chief employment is for its local influence upon the respiratory tract to allay asthma associated with bronchitis. It has been recommended in whooping-cough and in catarrh of the bladder, in both of which conditions it is an inferior remedy.

The best use for Grindelia is as a local application in Sumac or Ivy poisoning. To treat these poisons it is probably one of the best remedies we possess. It should be employed in the form of the fluid extract combined with menthol, thus: fluid extract of grindelia, 1 fluidounce; menthol, 1 dram; and 2 fluidounces of alcohol. This mixture can be applied to the affected parts once or twice a day with a brush.

Potassium Iodide and *Arsenic* are often of great service in hereditary asthma to ward off the attacks; and sometimes their combined use in full doses and continued over a long period of time may relieve the patient permanently. In such cases the iodide and arsenic should be commenced in small doses, and be increased as they can be borne to the largest doses the stomach can take without interfering with digestion.

Suffocative Catarrhs. The "Suffocative Catarrhs" which occur in infants are probably a condition of œdematous swelling of the bronchial tubes, and are sometimes dangerous to life by producing mechanical asphyxia.

To relieve such catarrhs it is well to apply a hot poultice to the chest of the infant and at the same time administer an emetic of Ipecac. Sometimes it is advisable, instead of applying heat to the chest, to apply mild counter-irritation, such as a spice poultice or a turpentine stupe, to bring about reaction. When these measures fail, as a last resort an alternate hot and cold douche will sometimes bring relief by producing a reflex forced respiration.

SEDATIVE EXPECTORANTS.

The drugs of this group of remedies are used for the purpose of breaking up a cold before it is reduced to a bronchitis, rather than to relieve the bronchial catarrh after it exists.

They are: **Citrate of Potassium, Ipecac, Apomorphine** and **Tartar Emetic.**

Citrate of Potassium. Citrate of Potassium, when properly used, is probably the best substance at our command to break up an acute cold, and usually without the slightest inconvenience to the patient. It is of more value than all the rest of this class of remedies combined.

There are two ways in which this can be administered with equally good results: First, where the stomach will bear it and the patient can take it, it can be administered in dram doses, freely diluted with water, three hours apart, until 3 drams are taken; or second, it can be given in 10-grain doses every half hour until 3 or 4 drams are taken. Its effects are not measured by the quantity taken at a single ingestion, but by the sum total of what is taken within a specified number of hours; so that persons with a weak stomach had better take it in small doses rapidly repeated than in large single doses.

When the smaller doses are used, it should always be administered in equal parts of pure lemon juice and simple syrup; the lemon juice covering the taste of the potassium very completely. How a cold is relieved by this drug cannot readily be explained, because the pathology of a "cold" is not fully understood.

Ipecac. Ipecac is usually given as an expectorant either in the form of the Syrup or the Wine of Ipecac. It can be given by itself and pushed to a point where distinct nausea appears, or in smaller doses combined with potassium citrate. It acts as an expectorant by increasing the bronchial secretions, and is most effective in the early stage of a bronchitis.

Apomorphine. Apomorphine, in doses of $\frac{1}{20}$ to $\frac{1}{12}$ of a grain, is a useful expectorant in any stage of bronchitis where the secretions are scanty. This can be given by itself, or administered in combination with other remedies.

The dose must always be small enough so as not to produce vomiting. Its one great drawback as an expectorant is the fact that it rapidly decomposes in solution.

Tartar Emetic. Tartar Emetic itself can be used in acute colds of adults, in doses of $\frac{1}{15}$ to $\frac{1}{12}$ of a grain, or the Wine of Antimony, which contains 2 grains of tartar emetic to the fluidounce, can be employed.

This is a harsh and unpleasant expectorant to use, and is at present very rarely employed. It is however not without power to break up an acute cold when it is taken in sufficient dose to produce distinct nausea and relaxation.

STIMUMANT EXPECTORANTS.

The *stimulant expectorants* are used in the more advanced stages of bronchitis, when the secretions and expectorations have set in.

They can be divided into two groups: Those that are of great *practical usefulness*, and those that are of *secondary importance.*

The most serviceable ones are: **Ammonium Chloride, Oil of Eucalyptus, Oil of Santal, Turpentine, Terebene, Creosote, Guaiacol, Syrup of Tar** and **Massa Petrolii.**

Those that are of less service are: **Allium, Squill, Seneca, Mistura Glycyrrhizæ Comp., Balsam of Peru, Balsam of Tolu, Turpentine, Ammoniac** and **Sulphuretted Hydrogen.**

Some of this last group can be used to advantage as flavors and vehicles for expectorant mixtures. The rest of them belong to the "has beens," and are retained more out of respect for our ancestors than on account of their usefulness in medicine.

Ammonium Chloride. Ammonium Chloride is used in doses of 5 to 10 grains. It is best administered in "Brown Mixture," which itself contains a little paregoric, antimony and licorice, and is slightly expectorant, but its greater value lies in the fact that the licorice covers the unpleasant taste of the chloride of ammonia very successfully.

Of all the expectorants, chloride of ammonia is probably used more than any other; and deservedly so, because it is probably the most generally reliable and efficacious. The dose should be repeated at intervals of about two hours, so as to get a continuous or conjoined effect of it. It should always be administered freely diluted in water, else the stomach will reject it.

It is also useful as a stimulant to the liver in hepatitis, hepatic torpor, catarrhal jaundice and in the early stages of hepatic cirrhosis.

There is clinical evidence to show that chloride of ammonia has constitutional alterative influence in lessening fibrous tissue formation; and for this purpose it has been employed where there is a disposition to the formation of fibrous growth or fibrous tumors.

The Carbonate of Ammonia has also been employed as an expectorant; but is inferior to the chloride in its influence upon the bronchial mucous membrane. It acts as a general systemic stimulant in so far as it liberates ammonia, and for this reason it is occasionally employed as a stimulant in croupous pneumonia.

Eucalyptus. The Oil of Eucalyptus, being a volatile oil, is freely eliminated by the bronchial mucous membrane and affecting it as a stimulant; and it is upon this fact that its virtues as an expectorant depend.

It can be given in emulsion or in capsules, in doses of 10 to 15 drops, every two or three hours. It is more apt to disturb digestion and produce nausea than chloride of ammonia, but yet is a valuable expectorant in advanced bronchitis.

Oil of Santal. The Oil of Sandalwood, like oil of eucalyptus, is a stimulant expectorant by virtue of its elimination by the respiratory mucous membrane. It can be combined with the oil of eucalyptus, or be given by itself in capsules in doses of 5 to 15 drops.

Copaiba and Cubebs, though classed with the stimulant diuretics, are sometines very useful expectorants in chronic bronchitis. Their volatile oils are active stimulants to the bronchial mucous membranes.

Turpentine. The Oil of Turpentine has been used in times past as a stimulant expectorant, but it is less employed now since its derivative, Terebene, has taken its place. It can however be given in emulsion in 10-drop doses, in the advanced stages of chronic bronchitis, and sometimes gives relief when other expectorants fail.

Terebene. Terebene is a volatile liquid derived from turpentine by the action of sulphuric acid. It is more pleasant to take, and less irritant to the stomach than turpentine, and can be given in doses of 5 to 15 drops in capsules.

It is an excellent stimulant expectorant, more fitted for the later stages of an acute bronchitis and in chronic bronchitis with asthma. It has also been employed in genito-urinary catarrh as a diuretic, because it is in part eliminated by the kidneys.

Creosote. Creosote has been introduced as an expectorant to be employed in cases of bronchitis associated with pulmonary phthisis. It was at first supposed that by its elimination through the lungs it would not only relieve the catarrh, but have some antiseptic influence upon the bacilli of tuberculosis directly. This is, however, not the case. It has no appreciable influence upon the progress of the disease itself, but simply relieves the catarrh and the cough associated with it, as would any other expectorant.

It is also useful in all forms of chronic bronchitis where there is no phthisical infection. The dose of it is from 3, 5 to 10 minims, increased as the patient's stomach will bear it.

Guaiacol. Guaicol is one of the component derivatives of Creosote, and can be used as an expectorant to meet the same indications for which creosote is employed. It is probably more desirable than the former, because it is less apt to disturb digestion, and can be given in larger doses.

The dose of guaiacol can be put down from 5 to 15 minims administered in capsules, and increased to a point of intolerance. It is best fitted for the chronic forms of bronchial catarrhs, and bronchitis dependent upon phthisis.

Tar. Syrup of Tar is a very powerful and a very certain expectorant in chronic bronchitis which is stubborn in yielding to ordinary expectorant treatment. The dose of it is

from ½ to 1 fluidram. To avoid the unpleasantness of the taste of tar, the liquid tar itself can be employed, administered in capsules. It should only be employed in chronic bronchitis where the more common expectorants have failed.

Tar is a very complex body, containing creosote, guaiacol and a great many other amorphous but very active tar products, all of which have expectorant properties. The one great drawback to its more general use as an expectorant is its unpleasantness to the taste and the odor about the person to whom it is administered. It is eliminated by the lungs, skin and kidneys, and the odor of tar remains about the person for many hours after the cessation of its administration.

Massa Petrolii. Petroleum Mass is a jelly-like substance obtained from the deposits of crude petroleum. In its composition and effectiveness it is very closely related to tar, and contains all the tar products. It has, however, the advantage of being comparatively free from odor and less irritant to the stomach, besides being a good expectorant. It should always be given in capsules, in doses of 3, 5 to 8 grains.

Strychnine is sometimes an expectorant of great value in persons with chronic bronchitis, who are suffering from general debility and respiratory weakness with lack of strength to expectorate. In such cases the use of strychnine or the tincture of nux vomica, put into an expectorant mixture, will aid in producing relief when otherwise the bronchitis is unyielding to treatment. This use of strychnine or nux vomica can with advantage be made a routine practice in chronic bronchitis of old people.

Allium. The English Garlic is official under the name of *Allium*, and contains a volatile oil which is rapidly eliminated by the bronchial mucous membrane. It can be used as an expectorant in the form of Syrup of Garlic in teaspoonful doses. This is an efficient expectorant, but so unpleasant and socially so objectionable on account of the odor that it is rarely employed.

The *American Garlic*, and even the ordinary Onion, contain volatile oils which are somewhat expectorant in their influence, but less powerful and certain than the English garlic. In young

children with bronchitis it sometimes proves of great benefit to apply to the chest a poultice made of onions and garlic.

Squill. The Syrup of Squill is still used as a stimulant expectorant in doses of ½ to 1 fluidram, but is of little practical value. The Compound Syrup of Squill, known as Cox's Hive Syrup, contains antimony, and is rather a sedative expectorant. It is sometimes used in domestic medicine as an emetic.

Seneca. The Syrup of Seneca is an old-fashioned expectorant of little or no use, but is rather pleasant to the taste, so that it can occasionally be employed as a vehicle for more powerful expectorant remedies. It contains *polygalic acid,* which substance has however little influence upon the animal organism.

Mistura Glycyrrhizæ Comp. Compound Licorice Mixture, or "Brown Mixture," contains half a fluidounce each of extract of licorice and spirits of nitrous ether, half ounce each of powdered acacia and sugar, one fluidounce wine of antimony, and two fluidounces of camphorated tincture of opium, in every pint of the mixture.

In domestic medicine it is often employed as an expectorant, but is by itself incapable of coping with a bronchitis. It is however a very excellent vehicle in which to exhibit ammonia salts and disguise their nauseous taste.

Balsams. The *Balsam of Peru* and the *Balsam of Tolu* are two substances that have slight expectorant value, but are so inferior to other remedies that they are at present more used as vehicles, because they have a rather pleasant aromatic taste. Whatever little expectorant value they may have, probably depends upon the presence of a trace of *benzoic* and *cinnamic acids,* and some *volatile oil.*

Ammoniac. Ammoniac is a resinous substance containing a trace of *volatile oil,* and has been employed as an expectorant, but is now rarely if ever used. It is occasionally employed locally over swellings and enlarged joints as an antiphlogistic application.

Sulphuretted Hydrogen. Sulphuretted Hydrogen Gas was introduced in 1880 as a "sure cure" for consumption. The gas was administered by the rectum, and in that manner was supposed to find its way to the lungs in the attempt at elimination from the system. This, like other fads, had a short course to run; but, during that brief period, it was not only learned that it had no effect upon tuberculosis, but that its employment was not wholly without danger to life; for a number of cases of alarming collapse have occurred in the course of administration.

CHAPTER XXIII.

EMMENAGOGUES.

The Emmenagogues are a class of remedies which are employed for the purpose of *regulating menstruation* or re-establishing *an arrested menstruation.*

They are of necessity a very disappointing class of remedies; because an arrested menstruation is in most cases a mere symptom of some other disease or disordered condition of the system.

A menstruation may be irregular, especially in the young, for mere want of development. A menstruation may be irregular or be arrested, because there is constitutional disease. A menstruation may be irregular, because there is local pelvic disease. But it is in very rare cases, that without any other ailing, menstruation itself is irregular, unless it be in individuals in whom it is an idiosyncrasy and is entirely compatible with good health, and should therefore not be interfered with.

In any disturbance of menstruation which is dependent upon either acute disease, chronic organic disease, constitutional mal-

nutrition, or pregnancy, it is plainly to be seen that no emmenagogue, or substance supposed to be emmenagogue, can be of any permanent avail. The recurrence of menstruation entirely depends upon the treatment of such diseased conditions upon which its arrest may depend, and not upon any emmenagogue treatment.

The emmenagogues are usually spoken of as being of three classes: The *Tonic, Purgative* and *Stimulant Emmenagogues;* but it is only the last group which can be spoken of as true emmenagogues.

Tonic Emmenagogues. Under Tonic Emmenagogues the substances usually employed are *Myrrh* and *Iron.* They are to be employed in amenorrhœa which *depends upon anæmia.* It is however not fair to consider them emmenagogues, for it is the constitutional effect of the Iron upon the anæmia which brings about recurrence and regularity of menstruation, and not any action upon the uterus directly.

Myrrh is sometimes combined with iron as a uterine stimulant in atonic amenorrhœa. How much value this substance may have as an emmenagogue is not clinically established.

Purgative Emmenagogues. *Aloes* is a cathartic which is often employed as a *purgative emmenagogue,* because its chief influence is upon the large intestines and upon the pelvic organs, including the uterus, ovaries and bladder; and because it increases the flow of blood to these parts, it probably has some power in aiding to re-establish an arrested menstruation. It is therefore a drug to be used for this purpose when there is constipation associated with the amenorrhœa, and when the amenorrhœa may in part depend upon this constipation.

Black Hellebore has at times been used along with aloes as a laxative emmenagogue. The fluid extract is generally employed in doses of 10 to 15 drops.

STIMULANT EMMENAGOGUES.

This is the class which may truly be called emmenagogues, if there be such a remedy. They likely have some direct stimulant influence upon the uterine functions, and may probably aid a menstruation which has been arrested by reason of atony of the womb and its functions.

They are: **Sabina** *or Savine,* **Ruta** *or Rue,* **Tanacetum** *or Tansy,* **Petroselinum** *or Parsley,* **Cantharides, Guaiacum, Potassium Permanganate, Oxalic Acid** and **Pennyroyal.**

Of this class, Savine, Rue, Tansy and Oxalic Acid, are the most poisonous and the most dangerous. When they are given in large enough doses they are rapidly acting fatal poisons, and if pregnancy exists they usually bring on abortion with dangerous hemorrhages.

Oleum Sabina. The Oil of Savine is used as an emmenagogue in doses of 3 to 5 drops. It can be given in combination with the *Oil of Rue* and administered in capsules.

Toxic Symptoms. The Oil of Savine, like all the volatile oils, is a violent local irritant, and in toxic doses produces fatal gastro-intestinal and genito-urinary irritation. The symptoms are those of intense pain in the stomach, nausea, vomiting and bloody purging, pain in the back and loins, scanty and bloody urine, which after a time become suppressed, and if pregnancy exists, usually abortion with hemorrhages follows. The respiration becomes diminished, unconsciousness, and sometimes convulsions occur, followed by collapse, and death from gastro-intestinal and genito-urinary irritation.

Therapeutic uses: The Oil of Savine is at present only used as an emmenagogue, but given in large doses it is capable of producing abortion. It is unsafe and unwarranted to use this or any other drug to bring about miscarriage when such a step is a necessity; for no medicinal agent known is without grave danger to life in doses sufficiently large to bring about a miscarriage. In all cases where abortion must be induced, it should always be done by operative procedure.

Oleum Ruta. Rue depends for its emmenagogue activity upon a *volatile oil*, but it contains besides this, a neutral principle, *Rutin.*

Rue, like Savine, produces in over-doses violent gastro-intestinal symptoms with pain, nausea, vomiting, sometimes profuse salivation and swelling of the tongue, and in pregnant women, abortion and collapse follow, and death from local irritation or hemorrhage.

In practical medicine the oil of rue can be used as an emmenagogue in doses of from 3 to 5 drops. It has been given as a carminative to stimulate intestinal peristalsis, but is an unsafe drug to use for this purpose.

Oleum Tanaceti. Tansy has been used as an emmenagogue in the form of a Decoction, but by the physician it is always used as the *Oil*, the dose of which is from 3 to 5 drops.

Toxic Symptoms. A toxic dose of the Oil of Tansy produces intense pain, nausea, vomiting, violent and bloody purging, suppression of urine, and later unconsciousness, with very violent and repeated *epileptiform convulsions*, followed by collapse and death.

Tansy poisoning differs slightly in its symptoms from those produced by Rue and Savine, All three produce the same gastro-intestinal and genito-urinary irritation, with abortion if pregnancy exists; but in tansy poisoning there are apt to be violent epileptiform convulsions in addition to this irritation, which are never marked and often not present in poisoning by Rue or Savine.

Petroselinum. Parsley contains a *volatile oil*, the glucoside, *Apiin*, and *Apiol;* but for its emmenagogue action it depends entirely upon the liquid neutral principle, *Apiol.*

Physiology. When Apiol is given in large enough doses or its use long continued, it finally produces a series of symptoms resembling those of quinine or *cinchonism.* There is some mental excitement, ringing in the ears, dizziness, sometimes a frontal headache, and disturbed vision; but even in very large doses this substance does not produce violent or dangerous poison symptoms.

Therapeutic uses: Apiol is probably the best and the most reliable of all the so-called emmenagogues to aid in the regulation of menstruation. It is not a substance that should be used continuously during the entire menstrual period, but its use should be commenced two or three days before the expected menstruation, and be discontinued so soon as the menstrual flow is fully established.

It can be given in doses of 5 to 10 drops three or four times a day in capsules. The Apiol which is usually dispensed in drug stores is a greenish dark liquid, and is rather a complex body containing a number of ingredients.

There is also in the market a more purified apiol, under the name of *Apioline*, which is ready put up in capsules, each containing about four minims. These are very expensive, and have no advantage over the ordinary official apiol of the Shops.

Dewee's Mixture. "Dewee's Emmenagogue Mixture" is probably as reliable as most emmenagogues, in amenorrhœa due to atony of the uterus. It consists of the tincture of the chloride of iron, tincture of cantharides, tincture of aloes, the ammoniated tincture of guaiac and syrup. It is probable that in this combination alone *guaiac* and *cantharides* are used with any degree of frequency as emmenagogues.

This mixture combines the tonic, the purgative and the stimulant emmenagogue elements, and is probably more comprehensive in scope than it is effective in practice.

Cantharides has been used by itself as an emmenagogue in the form of a tincture; dose, 1, 3 to 5 drops.

Potassinm Permanganate. This salt was introduced some years ago as a valuable emmenagogue in amenorrhœa due to a cold, to fright, or to shock. The dose of it is from ½ to 2 grains in pill form.

This substance has had the endorsement of some of the greatest authorities in the country, but yet the clinical facts seem to indicate that menstruation returns as often in spite of the drug as because of it.

There is now physiological evidence to show that permanganate of potassium is reduced into an insoluble oxide of manganese

as soon as it enters the stomach, and it is probable that this oxide of manganese is not at all absorbed. If this be so, permanganate of potassium can have no constitutional influence whatever either on the uterus or any other organs, but can at best only produce local irritation. It is a safe *placebo* for an arrested menstruation due to pregnancy in women who attempt to mislead the doctor.

Oxalic Acid. Oxalic Acid is sometimes used as an emmenagogue in doses of ¼ to ½ grain, in pill or capsule form. This acid is a violent poison, and produces symptoms almost identical with the poisoning from the oil of tansy: The same gastro-intestinal and genito-urinary irritation, and later unconsciousness with violent epileptiform convulsions. Like tansy and rue, it is capable of producing abortion; and it has been used to commit criminal abortion with occasionally fatal termination.

Pennyroyal. The Oil of Pennyroyal is sometimes used as a mild stimulant to the uterus where menstruation is delayed from a cold or from atony. It is a weak, harmless substance, and is not apt to do any mischief or prove dangerous even though it may be incapable of doing any good. When taken in large enough doses, it produces vertigo, a feeling of faintness, lessening of spinal reflexes, a cold skin, and the pulse and respiration slightly depressed. The usual dose of it is about 3 to 5 drops.

CHAPTER XXIV.

OXYTOCICS OR ECBOLICS.

This is a class of remedies whose important function in medicine is to produce uterine contraction in labor and to arrest uterine hemorrhage.

They are: **Ergot, Hydrastinine Hydrochlorate, Quinine** and **Gossypium.**

ERGOT.

Preparations. Wine of Ergot; dose, ½ to 2 fluidrams. Fluid Extract of Ergot; dose, 10 drops to 1 fluidram.

Extract of Ergot; dose 5 to 30 grains.

The extract of ergot is about five times as strong as the crude drug itself or as the Fluid Extract; and should be given in one-fifth of the dose for equivalent effects.

For hypodermic use the extract of ergot dissolved in glycerin and water is probably the best preparation; the Fluid Extract, being an alcoholic preparation and not entirely free from the oil of ergot, is not as useful, because it is more apt to produce local irritation at the point of infection.

"*Ergotin*" of the market is about an equivalent in strength to the extract, and can also be used hypodermically in like doses.

"*Ergotol*" is a liquid preparation of ergot, which is claimed to be one-half the strength of the solid extract, and is a preparation which admits of hypodermic use.

The *active principle* or principles of ergot are not yet made out definitely, and we do not even know with certainty as to whether there is one or several active principles or alkaloids in this substance. None of the substances now sold in the market for the active principle of ergot can be relied upon or should at all be used.

Ecboline, Ergotine, Ergotinine, Sclerontinic Acid, Ergotic Acid and a number of other substances have been brought forward as representing the active principle or the activity of ergot, but neither of them is a representative of the crude drug.

Toxic Symptoms. When ergot is given in doses of half to a teaspoonful several times repeated, it develops a peculiar coldness of the skin, a slow full pulse, pallor of the face, and probably nausea.

When given in large toxic doses, there is developed dizziness, nausea, pain in the stomach followed by vomiting, dilatation of the pupils, numbness in the extremities, development of thirst, pulse becoming slow and full, but finally increases in rapidity and becomes weak. The skin, especially over the extremities, becomes cold and clammy, followed by fall of body temperature, and later unconsciousness, convulsions, and death from asphyxia.

Ergot is however a drug of so little toxic action, that it is probable no single dose could take the life of a healthy adult; and therefore it can be given in very bold doses when needed to control hemorrhages.

Physiology. The dizziness, nausea and vomiting, may in part be due to slight irritation of the stomach and probably in part to some effect on the vomiting centres in the brain. The numbness in the extremities, although never very marked, is probably due to depression of the sensory nerves and sensory cord.

The two important effects of ergot are its action on the circulation from *centric vasomotor stimulation*, and its action on the uterus due to *stimulating the parturient centres.*

Circulation. The slow, full and strong pulse from the influence of ergot is probably entirely produced by its stimulant action upon the vasomotor centres. Ergot does not seem to have any effect upon the heart muscle or the pneumogastric in moderate doses, but in toxic amounts it becomes a direct depressant to the heart and bloodvessels.

The *diminished rate* of the ergot pulse is directly the outcome of the increased arterial resistance produced by the contraction of the bloodvessels through its *centric vasomotor stimulation*, and the blood pressure elevation is produced in the same way; so that ergot, though it increases the blood pressure and gives the general impression of an increased circulation, in truth lessens the

circulatory power, and can not be given in the hope of stimulating a failing heart, because the increased arterial resistance rather embarasses than assists a weak heart.

Uterine Contraction. It is probable that ergot produces uterine contraction by a direct stimulant effect upon the *Parturient Centres in the lower spinal cord.* It therefore does not increase the natural or intermittent uterine contractions, but tends to produce a *continuous spasm* of the womb. In this respect it differs very materially from the uterine contractions produced by quinine, which simply increases the natural or *intermittent contractions* without changing their character.

Chronic Ergot Poisoning. Chronic poisoning by ergot has rarely been known in this country; but cases of such poisoning have occured and are reported from European countries, principally that of Germany, where the ergot of rye contaminates the grain and flour which the peasantry of that country so universally use for bread, and which forms their chief article of diet. Here the constant ingestion of ergot or its principles is said to have produced chronic poisoning of various types.

One of its forms of poisoning is said to be *gangrene of the lower extremities.* It may possibly be due to interfered circulation through the influence of ergot upon the vasomotor system and starving the part.

Sometimes it manifests itself in *aching pains* like rheumatism, with a general feeling of wretchedness, chilliness and nausea. In this form of poisoning probably the principal effects are the interference with the circulation.

In the third form of poisoning there is itching, numbness and anæsthesia, some gastro-intestinal irritation, occasionally muscular cramps, disturbed vision, and sometimes mental delusions; an evidence that ergot in its prolonged effects has a deleterious influence upon the nervous system.

All these cases of chronic ergot poisoning, so far as we know in this country, have only text book existence, and are in no sense important to either student or practitioner.

Therapeutic uses: Ergot has two general indications in medicine: To *produce uterine contractions*, and *as a vasomotor stimulant.*

Its use in labor. Ergot should not be used in labor to produce uterine contraction, except during the latter part of the *second stage* and during the *third stage* of labor, to prevent post-partum hemorrhages.

It is not without danger or risk that ergot is used in the first stage of labor, especially in primipara, or in any case where there is not an abundance of pelvic room. To give it early in labor may endanger the life of both mother and child. The life of the mother may be endangered by producing a precipitate labor which may result in inversion of the womb and hemorrhage, or in lacerations both internally and externally; or if there be obstruction in the birth-canal, it may produce impaction of the child in the pelvis with subsequent sloughing of the parts.

It may be dangerous to the child by producing a fatal asphyxia; the ergot bringing on a continuous uterine contraction, arresting the circulation in the uterus, and thus take the life of the child by asphyxia. In the early stages of labor with uterine inertia, it is probably safer to use quinine, which does not bring about uterine spasms.

As a vasomotor stimulant. As a vasomotor stimulant it is useful:

First—*To arrest hemorrhages;* as bleeding from the nose, hemorrhage from the stomach, hemorrhage from the kidneys, and in post-partum hemorrhages; in all of which the ergot gives assistance by its stimulant action on the vasomotor centres.

Second—*To overcome vascular relaxation with excessive secretions;* like night sweats of phthisis, in colliquative diarrhœa, and in polyuria, or excessive flow of urine, in which case it can be combined to advantage with opium and gallic acid.

Third—*To relieve passive congestions,* like congestion of the lungs, congestion of the liver, congestion of the meninges of the brain, congestion of the spinal cord and congestion of the spleen; in all of which ergot should be given in the fullest doses the patient's stomach will bear;—2 or 3 drams every five hours if the patient can take it.

Fourth—Ergot is often used in tumorous enlargements, as in uterine fibroids, where the fibroids are small and within the cavity of the womb. Here ergot, by producing uterine contraction and lessening the blood supply to the uterus, may check the growth of a small fibroid by starvation.

It is useful in enlargement of the spleen when due to chronic malaria, probably entirely through its influence on the circulation. It has been used in goitre and varicose veins, but with doubtful results.

HYDRASTININE HYDROCHLORATE.

Hydrastinine is a synthetic alkaloid produced by the oxidation of the alkaloid *Hydrastine*. Hydrastine itself is one of the alkaloids of *Hydrastis Canadensis*.

Hydrastinine is official as a *hydrochlorate*, and is given in doses of ½ to 1 grain.

Toxic Symptoms. When Hydrastinine is given in full doses it produces general muscular tremors, pupils dilated, respiration at first increased in rapidity, but later becomes weak and shallow; the reflexes become lessened and finally absolutely lost; the pulse is increased in rapidity and strength, and the blood pressure elevated, until late in the poisoning, when there is a blood pressure yielding; and finally death occurs from paralytic asphyxia. But if artificial respiration be kept up, death usually occurs from *cystolic arrest of the heart*, like digitalis.

Physiology. It is evident from the symptoms which this alkaloid produces that its most pronounced effect is *a stimulant to the circulation*, while the depressant action upon the motor apparatus is only slightly less prominent.

The lessening of reflexes and final complete paralysis are directly produced by its depressant and *paralyzant influence upon the entire motor cord and the psycho-motor region of the brain.* In this respect it is in direct antagonism to the natural alkaloid *Hydrastine*, which is a *stimulant to the motor cord*, producing spinal convulsions, and may even take life by *cramp asphyxia*, like Strychnine.

To the circulation this alkaloid is a direct and powerful stimulant. It stimulates the heart muscle, the bloodvessel walls, and the vasomotor centres. To the vasomotor centres, it is a stimulant of such power and persistence that it can be used in medicine as a *practical vasomotor stimulant.* To the heart itself it is a stimulant of such activity that it usually arrests the heart in cystole like digitalis. In this respect it is antagonistic to the natural alkaloid hydrastine, which is a depressant to the general circulation in all but the very smallest doses.

The muscle tremors and muscular rigidity are probably due to direct stimulation of the muscle substance, regardless of any nerve supply, and in large quantities it becomes a *muscle poison.* The increased intestinal peristalsis, the uterine contraction, the contraction of the bloodvessel walls, and the increased cardiac contraction itself are all a part of this general muscle stimulant action.

The dilatation of the pupils is of peripheral origin, probably affecting both the oculomotor and the sympathetic nerves, somewhat like atropine. The drug has been used by oculists as a practical mydriatic.

It produces contraction of the uterus, probably through its direct stimulant influence on the muscle structure itself, and has practical ecbolic effects. The contraction or uterine spasm thus produced is usually very strong and very continuous, closely resembling in character the ecbolic action of ergot, except that it is less powerful.

Therapeutic uses: The general therapeutic uses are, to *arrest uterine hemorrhages,* as a *circulatory stimulant,* to *control spasms,* and it may be used as a *practical mydriatic.*

To arrest hemorrhages from the womb it is of practical usefulness in menorrhagia, metrorrhagia, and in the hemorrhages accompanying or following miscarriages. It can be used in the post-partum hemorrhage of childbirth in conjunction with ergot. It is probably not as powerful in its effect as ergot, but it can be used hypodermically with more prompt action than ergot would produce.

It has been suggested as a cardiac stimulant in organic heart disease, or lesions of the cardiac valves with loss of compensation, and it seems to deserve more extensive clinical trial in cardiac weakness than it has hitherto received.

As a stimulant to the vasomotor system it is so effective that it might be used in conjunction with strychnine, without hesitation in conditions of shock and collapse, where it is important to overcome the vasomotor relaxation to maintain body temperature.

By virtue of its depressant action on the psycho-motor region of the brain, it has been suggested and tried with asserted good results, in epilepsy. Its depressant action on the spinal cord

would likewise suggest its probable usefulness in controlling mild spinal spasms.

Quinine. Quinine is sometimes used as an ecbolic in uterine inertia, in the early stages of labor when it is not safe to use the more powerful drug ergot. It is not powerful, nor is it very reliable in its production of increased uterine contraction in labor; but its great advantage lies in the fact that it does not change their character, but simply increases in strength the normal or *intermittent contractions*. The increased activity of the uterus is probably not due to any specific action on its muscle structure or its nerve supply; but is more likely its tonic influence upon the entire system which the parturient organ shares.

To get any desirable effect from it, it is necessary to give it in doses of 15 to 20 grains. The smaller doses do not seem to have any appreciable influence.

Gossypium. The pharmacopœia recognizes the root of the ordinary cotton plant as an ecbolic. It can be used as a Fluid Extract in doses of ½ to 1 fluidram, or as an Extract in doses of 5 to 8 grains.

It has been used in practical medicine as an oxytocic to produce uterine contractions in excessive menstruation, or in bleeding from the womb due to organic disease, and in the later stages of labor. Its effects are very closely allied to those of ergot, with the difference that it is probably not as certain nor as powerful in action.

CHAPTER XXV.

COUNTER-IRRITANTS.

The counter-irritants are substances or agents used for the purpose of *counteracting irritations, congestions* and *inflammations.*

They influence local inflammation or congestion in two ways: First, by producing a *counter-congestion* or *counter-inflammation* at the point at which they are applied, and thus modify the circulation of the original inflammation by drawing blood to the *counter-inflammation.*

Second, they influence an inflammation or congestion by a reflex influence through the nervous system; and it is in this manner that their greatest effects are produced. So much so is this true, that a counter-irritant can be applied at a distant point from the original inflammation, over the exit of the nerves which supply the inflamed part, and has the same effect as if placed directly over the inflammation. How this reflex nerve influence impresses an inflammation is not very clear, but it is probably chiefly through its influence on the vasomotor and trophic nerve supply of the affected part.

Place of Application. In localized inflammations, congestions, or irritations, the counter-irritant should always be applied *directly over the affected part* in all cases, except where the inflammation is so superficial that the skin itself is involved; in which case the counter-irritant should be placed on the immediately surrounding healthy surface.

Over a painful nerve or *neuralgia,* a counter-irritant should be placed over the *exit of the nerve* instead of placing it over the surface of its distribution. If, however, this nerve pain is a *neuritis* instead of a neuralgia, the counter-irritant should be placed over the course of the nerve trunk, as in any other inflammation.

Contra-indications. Active counter-irritants are harmful and sometimes dangerous in *very young children,* in *very old and feeble persons,* and in conditions of *collapse.* Cantharides should also be used with caution in cases

of chronic Bright's disease; for sufficient of its active principle may be absorbed to irritate the kidneys and produce suppression of urine.

Classes. These counter-irritants are of two classes:

First, *Rubefacients*, or those that produce merely a *redness* or congestion of the skin, and are used to counteract *congestions* and *irritations*.

Second, the *Epispastics*, or those which produce a *blister* with inflammation of the part, and are employed to counteract *inflammations*.

Rubefacients produce a mere congestion or redness of the skin *without structural change;* are very prompt in action, take effect in from ten to thirty minutes, and their effect is not lasting. They are therefore used to counteract congestion and irritation; conditions which are themselves of short duration.

Blisters, on the other hand, are produced slowly, acting in from four to eight hours; act permanently, and *produce structural change* or inflammation of the part. They are therefore used against inflammations, to act as a *counter-inflammation*.

RUBEFACIENTS.

The Rubefacients are: **Mustard, Turpentine, Capsicum, Cupping, Iodine, Spice Plasters, Pitch Plasters** and **Liniments.**

Mustard. For counter-irritant purposes both the *yellow* and the *brown mustard* are used. The Brown Mustard is probably the more active and certain, and depends for its activity upon a *volatile oil*, which is developed in the presence of water. A mustard plaster should therefore always be made with water as a menstruum. If it be desired to have it very active, the pure mustard can be used; for less activity, it can be mixed with flax-seed meal in any proportions desirable. Brown mustard itself does not contain a volatile oil, but it contains *Myronic Acid* and *Emulsin;* and these two principles in the presence of the water used in making the plaster, produce this volatile oil.

The *Yellow Mustard* contains a *fixed acrid principle*, upon which it depends for its rubefacient effect, but it is less powerful than the brown mustard.

A mustard plaster should be kept in place until a distinct redness is produced; which effect usually follows in from ten to thirty minutes after its application. If mustard be kept in contact

with the skin for too long a time, it is capable of producing a slough and destruction of the skin surface with which it is in contact.

Turpentine. Turpentine is used in the form of a *stupe* over a wide-spread irritation or inflammation. A turpentine stupe should be made by wringing a piece of flannel out of turpentine and applying it to the part. It is about as prompt in effect as mustard, but is not as active. It is more used over congested lungs and abdominal irritations, where large surfaces have to be covered.

Capsicum. Capsicum is used like mustard for preparing plasters. It is fully as effective as mustard, but is not as desirable, because it is so unpleasant to handle. It can fulfil any of the uses for a mustard plaster, but has no special advantages of its own.

Cupping. Cups are spoken of as *Dry* and *Wet* cups. Wet cupping is done by scarifying the skin and then applying the cup to draw blood; so that it is not in any sense a counter-irritant, but is a method of local *blood-letting*, and is in effect about equivalent to leeching.

Dry Cups are applied over congestions and irritations where it is desirable to have very prompt but fugacious effects, though they do not produce an impression as intense as that of mustard. They can be used over spinal or pulmonic congestions.

Iodine. Iodine is used as a local counter-irritant. The *Tincture* or the *Iodine ointment* is applied over inflamed lymphatic glands and sprained joints. It is sometimes applied externally over the tonsils in sore throat; but in all these uses it appears to act more as a "cerebral splint" than as a truly helpful agent.

Spice Plasters. Spice Plasters are a very mild form of counter-irritation, and are principally used in children for diarrhœa and irritations of the intestines, where it is desirable to cover the entire abdominal surface. But care should be taken in not having the application too prolonged in infants, for I have seen constitutional symptoms arise from their absorption.

Pitch Plasters. Of the Pitch Plasters we have two: *Burgundy pitch plaster* (Emplastrum burgundicum), and the plaster of *Pitch* and *Cantharides* (Emplastrum picis cum cantharidis).

Both of these are very slow and mild but persistent counter-irritants; and can be used over the chest in chronic bronchitis, or applied to the affected parts in chronic muscular rheumatism, where it is desirable to have a mild but continuous effect.

Liniments. The substances which are most frequently used for the preparation of liniments are: *Ammonia, Chloroform, Camphor* and *Turpentine.* These are all of about equal value.

The Liniments are very mild local stimulants, to be applied in rheumatism and sore joints. Their effect is more moral than physical, and entertains the patient while his ailments are spontaneously disappearing.

Sometimes slight value can be obtained from a liniment in old muscular rheumatism, by directing the patient to apply the liniment and then "rub it in well." This amount of kneading and rubbing of the part acts as a *crude massage,* and from it some influence may be brought to bear upon the rheumatism.

EPISPASTICS.

The Epispastics are counter-irritants which produce a blister and inflammation, and are therefore more slow and more permanent in their influence.

The Epispastics are: **Cantharides, Ammonia** and the **Cautery**.

CANTHARIDES.

Preparations. The Cerate of Cantharides (Ceratum Cantharidis) is almost exclusively used for blistering.

Cantharidal Collodion, is sometimes used for blistering in localities where another blister would not stay in place.

Tincture of Cantharides; dose, 3 to 5 drops, is only employed for internal purposes.

The active principle of cantharides is a neutral, crystalline substance, *Cantharidin.*

Toxic Symptoms. In toxic doses cantharides produces intense inflammation of all the mucous membranes with which it comes in contact; pain, nausea, intense and persistent vomiting, purging of bloody and mucous stools, with persistent tenesmus, like acute dysentery.

Later in the poisoning, genito-urinary symptoms arise; with pain in the back and loins, the urine becomes scanty, then bloody and albuminous with frequent micturition and strangury. Sexual excitement and priapism supervene, fall of body temperature, collapse and finally death occurs from gastro-intestinal and genito-urinary irritation.

Cantharides probably inflicts more severe suffering in the event of poisoning by it, than any other known irritant poison; because it does not destroy any part, but simply produces an excessive and persistent inflammation.

The treatment consists in cleaning out the stomach and intestines, washing out the bladder, applying heat to the perineum, and administering opium and belladonna in suppositories by the bowel to relieve the suffering.

Therapeutic uses: The best and most frequent use for cantharides is as a blistering agent or counter-irritant in localized inflammations; like pleurisy, pericarditis, meningitis, inflamed or sprained joints, neuritis, and in superficial neuralgia.

A cantharides blister should always be applied right over the affected or inflamed part, unless the inflammation is too superficial. It should be kept in contact with the part for four to eight hours. If at the end of that period the blister is not complete, a hot poultice should be applied to complete it.

After the blister is fully drawn, it should be punctured and the serum removed and then be dressed. If the counter-irritation is not to be prolonged, the dressing should be a bland oil or fat dressing to prevent further irritation. If the counter-irritation is to be prolonged, it should be dressed with a little *Compound Resin ointment* or Mezerion ointment to maintain the irritation. These are sufficiently irritant to maintain and prolong the action of a blister.

Cantharides has also been used as a stimulant emmenagogue, and sometimes as a diuretic. It has been suggested as an *aphrodisiac;* but there is much doubt existing as to whether this

drug has any such effect, unless it be given in doses sufficiently large to become irritant to the genito-urinary apparatus.

Ammonia. Ammonia will produce a blister in a very few minutes, if it be applied as the *stronger water* of ammonia and covered with a watch crystal to prevent evaporation. Under circumstances where it is absolutely essential to have counter-irritation without delay, this substance can be used in place of cantharides.

Cautery. The "*Actual Cautery*" is the most powerful of all counter-irritants; but it does not properly belong either to the rubefacients or the epispastics, because it does not produce a blister nor a mere redness, but is vastly more severe than either.

The Cautery is especially useful in very chronic inflammations of joints or in chronic meningitis. In chronic meningitis the cautery should never be applied over the scalp, because it destroys the hair follicles and produces bald spots, but should always be applied to the nape of the neck.

It is much used as an escharotic to destroy growths of malignant nature, and in gangrene. It is an effective hæmostat to arrest hemorrhages in localities where a ligature cannot be applied.

CHAPTER XXVI.

ESCHAROTICS.

The Escharotics are a class of substances used wholly for the purpose of destroying tissue. They are employed for the destruction of *gangrene, epithelial growths, cancers, chancres, venereal warts, exuberant granulations,* and to cauterize *poisoned wounds.*

The most active among these agents are: **The Cautery, Liquor Potassa, Arsenic, Bromine, Chromic Acid, Nitrate of Mercury, Nitric Acid, Sulphuric Acid and Silver Nitrate.**

The Cautery. The Cautery is by all means the most effective to destroy morbid growths of any kind, and is preferable in all cases where it is practical to use it. It is also a very effective *hæmostat* to control bleeding from small vessels where they cannot be reached by pressure or ligation; but for this use, the cautery should not be at a white heat, but simply a *dull red heat.*

Liquor Potassa. Caustic Potash acts as an escharotic by dehydrating the part and dissolving the fats and albumens. It is not very rapid in action, but is capable of doing a great deal of damage when kept in contact with a part too long. Whenever it is employed, there should be at hand some dilute acid to arrest its action when it is so desired.

Arsenic. Arsenic is extremely destructive and immediate in its effects when it comes in contact with animal tissue. It destroys all known organic substances.

In practical use it is only employed to destroy epithelial growths. When so used it should be made into a paste and applied freely; but care should be taken that not sufficient is absorbed into the general circulation to produce constitutional poisoning.

Bromine. Bromine is also a very powerful and rapidly acting escharotic. During the late Civil War it was used very extensively in military hospitals to destroy *hospital gangrene* in the wounds of soldiers, to whom it was best known as "liquid hell fire."

Chromic Acid. Chromic Acid is used a great deal, even at this day, to destroy venereal warts and venereal growths of any kind. It is a powerful oxidizant and destroys the tissues rapidly, but too liberal or too frequent application is not entirely safe; for in many cases it has produced constitutional poisoning, some resulting fatally.

Acid Nitrate of Mercury, *Nitric Acid* and *Sulphuric Acid* are all alike useful in destroying warts, corns and chancres.

Silver Nitrate. Silver Nitrate differs from the rest of this class, in the fact that it is more superficial in its effect. It produces a hard, impervious coagulum of albuminate of silver, and thereby limits its own caustic action.

It is useful as a caustic for superficial effect, but should never be used in attempting to cauterize deep-seated or punctured poisoned wounds, like animal bites; for its action is too superficial on account of coagulation of albumen it produces, sealing the wound and imprisoning the poison instead of destroying it.

CHAPTER XXVII.

DEMULCENTS.

The *Demulcents* are a class of substances principally containing *gums, mucilages,* and some of them *bitter principles.* They have been used in medicine, in days gone by, for the purpose of "soothing inflamed surfaces."

Their actual value in medicine consists a great deal more in the soothing impression they may have upon the doctor's brain than the influence which they bring to bear upon any inflammation or irritation. They were used frequently in irritations and inflammations of the stomach and intestines, and sometimes in irritation of the urinary tract,—the bladder, the kidneys and the urethra.

It is however a well-known fact that these mucilages are neither digested nor absorbed, and are absolutely bland in their local influence. They can do no more good than plain water to any inflamed surface with which they come in contact.

The principal demulcents are: **Acacia, Tragacanth, Ulmus, Iceland Moss, Irish Moss, Licorice, Linum, Sassafras Pith, Sago, Arrow Root, Tapicoa, Water, etc.**

Acacia. Acacia, or *Gum Arabic,* is wholly dependent upon its *mucilage,* and is at present almost exclusively used by the druggist for the preparation of emulsions. It is occasionally still employed in domestic medicine, in sore throats and gastric irritation.

Tragacanth. Gum Tragacanth depends exclusively upon its gummy principle, *Basorin,* and is inelligible for any purpose except to make mucilages and pastes.

Ulmus. Ulmus, or *Slippery Elm,* is made from the inner bark of the Elm Tree. It contains, besides other inert substances, a large quantity of *mucilage,* and is used principally in the preparation of poultices.

Iceland Moss. Iceland Moss (Cetraria) is a *Lichen* or moss growing on rocks in the northern or cold regions. It contains a large quantity of *mucilage, lichen starch,* and the bitter principle, *Cetraric Acid.*

In so far as it contains a bitter principle, it is slightly stomachic in its effect, while the small quantity of starch it contains is digestible, and to that degree is nourishing.

The mucilage it contains is supposed to be soothing to irritated surfaces, so that it is an old-fashioned domestic remedy for irritation of the stomach and intestines, or in mild cystitis; sometimes it is given in chronic bronchitis. The best which can be said of it, is that it is a pleasant, absolutely harmless "placebo" to entertain the sick.

Irish Moss. Irish Moss (Chontrus) is very similar to Iceland moss in its constituents; containing a large amount of mucilage or gummy principles, and in effect is an absolutely harmless and practically inert substance.

Licorice. Licorice contains, besides its gummy constituent, some starch, and the active principle, *Glycyrrhizin.* As a demulcent it is usually used either in the form of the *Extract,* or the *Fluid Extract.* The fluid extract is often used as a vehicle for the exhibition of other drugs.

Compound Licorice Mixture (Mistura Glycyrrhizæ Compositus), or "Brown Mixture," is oftentimes used as a mild expectorant; because it contains Paregoric, a little Tartar Emetic, and Sweet Spirits of Nitre. It is itself very inefficient, but is probably the best vehicle we have in which to exhibit and disguise Chloride of Ammonia.

The *Compound Licorice Powder* (Pulvis Glycyrrhizæ Compositus), is a pleasant and effective cathartic. Its activity depends upon the presence of Senna and Sulphur, and the Licorice it contains subserves the purpose of a vehicle.

Linum. Linum, or *Flax Seed,* contains a great deal of mucilage, besides an oil and some starch. It is commonly used in the form of an Infusion or Tea; and is employed in domestic medicine in catarrhs, enteric and dysenteric inflammations.

Sassafras Pith. This substance depends exclusively upon the small quantity of mucilage it contains, and was formerly used as an *eye-wash* in an irritated conjunctiva.

Sago. Sago contains a peculiar form of starch, and a mucilage. It is far more an article of food than a medicine. It can however be used for its food value and its soothing effect in an irritated digestive tract.

Arrow Root. Arrow Root (Maronta) is almost a pure starch, and is readily digested. It is sometimes used as an Infusion for children who suffer from gastro-intestinal catarrh with diarrhœa.

Tapioca. Tapioca, like Sago, contains both mucilage and starch, and is more used as an article of food in dyspeptic children than for its medicinal properties.

Water. Plain water is probably, of all the demulcents, the most effective and the most generally employed to soothe irritations. Its effectiveness depends not so much upon the contact of the water with the irritated parts, as upon the diluent influence it has in attenuating and washing away the acrid secretions which are the product of inflamed mucous membranes. It is in this way that it becomes especially useful in irritations of the urinary tract,—the bladder, the kidneys and the urethra. It is also serviceable in the stomach when there is irritating matter present, keeping up a continued nausea, as often happens in cholera morbus and gastritis.

CHAPTER XXVIII.

EMOLLIENTS.

The Emollients are bland substances used for the purpose of protecting inflamed surfaces, wounds or ulcers, and to protect the cutaneous structures and keep the skin soft and pliable.

The Emollients are: The **Oils** and **Fats**, which are used as *protectives;* and the **Poultices**, which are used as *antiphlogistics.*

OILS AND FATS.

Of the *Oils* and *Fats* we have: The **Mineral Oils**, the **Vegetable Oils**, and the **Animal Fats.**

Mineral Oils. Of the Mineral Oils, the principal ones are the official *Petrolatum, Cosmoline* and *Vaseline.* Cosmoline and Vaseline are petroleum fats which are legally protected by *trademarks,* and are therefore very much more expensive than the official *Petrolatum;* whereas Petrolatum is more useful and more valuable than either of the former, because it contains more of the crude coal-tar constituents, and is the one that should always be employed.

Petrolatum is not an absolutely bland substance and free from activity like other fats, but it contains many of the amorphous coal-tar ingredients, whose activity renders it useful as a local application in skin diseases of all kinds, to ulcers and other sores, either by itself or as an ointment base; because it is free from irritant properties. It does not become rancid and unpleasant in odor after long standing, as do the animal and vegetable fats, because its coal-tar constituents are antiseptic.

Vegetable Oils. The more important vegetable oils and fats are: **Cacao Butter** (Oleum Theobroma), **Cold Cream** (Unguentum Aquæ Rosæ), **Linseed Oil**, **Cotton-seed Oil** and **Olive Oil.**

These vegetable oils are absolutely bland substances, and are of no use externally except as protectives and bland dressings to blisters and raw surfaces.

When they are internally taken, they all subserve the purposes of a food. They are digested and absorbed; and in low conditions of nutrition are capable of increasing body weight.

Cacao Butter and *Cold Cream* are very elegant substances, and are frequently used for the purpose of softening the skin of the hands and face when there is a disposition to scaliness and unnatural dryness.

Cacao Butter (Oleum Theobroma) is prepared by expressing the oil or fat from the seeds of the Cacao or "Chocolate nut." The yield is about forty per cent. This fat is the basis for the making of all rectal suppositories, and is an excellent ointment base for use about the face.

Animal Fats. All the animal fats, like *lard*, *mutton-suet*, *tallow*, and other fats from lower animals, are absolutely bland and free from all activity when locally applied; and internally they have no effect save that as a food.

They are chiefly used as bases for ointments. They have an advantage over the mineral oils in the fact that they are more readily and more rapidly absorbed by the skin, and are therefore useful ointment bases where absorption is desired; but unless they are mixed with some disinfectant, like boric acid, benzoic acid, or carbolic acid, they are apt to become rancid and unpleasant in a very short time.

The wonderful curative effects for different diseases and local injuries in domestic medicine which are often ascribed to such substances as *goose grease*, *skunk fat*, *rattlesnake oil*, *dog's fat*, etc., have no bases of fact; but are simply the ordinary bland animal oils, made up of a fatty acid radical combined with glycerin as all other fats are; and all the importance and value attached to them by the laity is purely a matter of faith and reports.

Glycerin and *Lanolin* are two substances slightly different from the ordinary animal fats, though they are derivatives from the same source; but need individual consideration.

Glycerin. Glycerin is derived from fats and oils. An oil or a fat consists of a *fatty acid radical* combined with *glycerin*. The glycerin is always the same, whether it be a mineral, animal, or vegetable fat; but the fats themselves differ in their physical peculiarities, directly as their acid radicals differ. The glycerin itself is truly one of the lower alcohols, and belongs to the *Propenylic* alcohol series.

When glycerin is applied locally, it forms an admirable protective for the skin, and is used for chapped hands, chapped face, or chapped lips. It has the advantage of not being volatile, therefore remaining on the skin; nor is it irritant to cutaneous surfaces, of whatever length the application may be.

When glycerin is taken internally in single large quantities, it acts as a laxative or mild cathartic; and can be used in combination with equal parts of Castor Oil as a mild laxative for children.

When glycerin is continuously applied to mucous membranes for a length of time, it will ultimately produce local irritation by dehydrating the mucous membrane. It is very hydroscopic, and consequently dehydrates or removes water from the mucous membrane, and in this mechanical way becomes irritating.

When it is thrown into the circulation directly, it produces remarkable symptoms: There are nausea and vomiting, marked thirst, muscular weakness, occasionally bloody urine, and may finally produce convulsions and coma.

How this series of symptoms are produced by this substance is by no means clear. Whether it has any direct action upon the nerve centres and other vital structures, or whether it is due to mechanical interference with the circulation in the nerve centres, is not understood. Certain it is that none of these symptoms can be produced by glycerin when taken into the stomach, however large the quantity ingested may be.

Glycerin is often used as a vehicle for the administration of general medicines. It must however be remembered that it will *precipitate alkaloids* and the *salts of the alkaloids* on long standing, and should be avoided as a vehicle in prescriptions containing alkaloids.

The *glycerin suppository* is a most admirable means to open the bowels in chronic or habitual constipation. It is administered at the time stool is desired, and will set up a reflex peristalsis in a very few minutes and a full stool follows.

Lanolin. Lanolin is an oily or fatty substance extracted from sheep's wool. It is not a true oil or fat, but *a sebaceous oily secretion* from the sebaceous follicles of the skin, for the purpose of keeping the wool soft and pliable. It contains a large proportion of *Cholesterin* and other fatty acid educts.

Owing to the fact that it is an excretion or waste product of the skin, it is probable that this substance is not readily absorbed, and is not a fit ointment base with which to combine substances that are intended to be absorbed; but on the contrary, it is an excellent protective where it is simply used as a bland external application to maintain softness of the skin; because it neither turns rancid nor evaporates, but remains permanently on the surface over which it is placed.

Plasters. It should be mentioned here that there are certain plasters which are used purely as protectives over tender surfaces, and for the purpose of fixing dressings over sores, ulcers, and abrasions. Very important amongst these are, *Soap Plasters*, *Adhesive Plasters*, *Lead Plasters* and *Collodion*.

POULTICES.

Poultices are emollient substances which are applied to *inflammations*, *abscesses*, *sloughs* and *gangrene*.

They depend entirely and absolutely for their activity upon the *heat* and *moisture* they contain. In inflammations, when in the early stages, the prolonged application of a hot poultice will produce local vasomotor spasm and constriction of the local bloodvessels, forcing the excess of blood out of the inflamed part, and replacing the redness of the inflammation by palor, with relaxation of the skin. So much so in fact that by applying a poultice for too long a time to a part, it is possible to devitalize it to such an extent as to produce a slough.

To get the proper effect of a poultice, it should be applied as hot as the patient can bear it, and be changed as often as the temperature of the poultice falls to the temperature of the body. In this way it is possible to arrest an early inflammation and bring about resolution.

In the late stages of an inflammation or abscess formation, when the suppurating process has already begun, the application

of a hot poultice will hasten the suppuration, and shorten the course of suffering. It probably hastens the pus-formation by the additional heat which is supplied to the part. In abscesses or pus-formation there is chemical change going on in the tissues, and we know that heat exhilarates and hastens the chemical changes.

Objections are often made to the use of poultices, especially when they are to be applied to open wounds. These objections are principally urged on the ground that poultices may become fruitful sources of carrying bacteritic poisons to a wound, and act as a culture medium for bacteritic growth and infection. This objection is valid when poultices are not properly made; but when a poultice is made with carefulness, and with a view to render it aseptic, they are as safe applications as any other aseptic substances applied to wounds.

To make a poultice properly, the poulticing material should be brought to a boiling point, and be kept boiling for fifteen to twenty minutes, before it is applied to surfaces where the skin is broken. After such preparation they are absolutely aseptic, and are often of great service to reduce inflammations and swellings. They not only reduce the congestion of the part, but at the same time produce relaxation of the skin, and thus relieve the pressure which gives rise to the throbbing pain.

Kinds of Poultices. Poultices are usually spoken of as *Stimulant* or *Fermentative poultices* and *Sedative poultices.*

A *Stimulant* or *Fermentative* poultice is made by taking a poulticing substance, like *flaxseed* or *cornmeal*, mixing it with some *yeast* or *porter*, and setting it in a warm place until fermentation has taken place. This form of poultice was formerly used in the attempt to separate sloughs and gangrene, and for the purpose of stimulating sluggish ulcers of low vitality.

The *Sedative poultices* are the ordinary poulticing materials heated with water and applied to the part as hot as can be borne. They are used over inflammations and abscesses, and are sometimes useful over inflamed nerve trunks, local neuralgia, and inflammations in the chest or abdominal cavities.

Substances used. The most common poulticing materials are: **Flaxseed meal, Indian or cornmeal, bread and milk, Onion poultice** and **Slippery elm.**

There is no particular advantage in any one of these poulticing materials over the rest, except that the one which *holds heat longest* is to be preferred; and in selecting them on this basis the ordinary cornmeal poultice is perhaps the preferable one. A flaxseed poultice is likewise a pleasant and smooth poultice, but is more expensive and does not retain heat as well as cornmeal.

Onion poultices, though they have a very unpleasant odor, are very frequently used in domestic medicine over the chests of children with heavy colds and bronchitis. It is possible that besides the heat and moisture they contain, the votatile oil of the onion itself may in part be absorbed and have direct effect upon the catarrhal inflammation.

The "*Jacket poultice*" has formerly been used a great deal, both in children and adults, in pneumonia, pleurisy, congestion of the lungs and bronchitis. They are very useful and commendable in any of these conditions, when there is no general body temperature rise or fever. In suffocative catarrhs of children, in capillary bronchitis and in very acute general bronchitis, these jacket poultices may be capable of much good. But when there is high fever as in croupous pneumonia, a jacket poultice, or a "cotton jacket" as is often used, is an abomination which must be condemned. It not only fails to do good in these infectious fevers, but is capable of great harm, and may make the difference of life or death in a patient, by further raising the temperature in the region of heart and lungs, both of which organs show the effects of fever very quickly. Hot poultices or cotton jackets will raise the temperature of the chest and its contained organs, the heart and lungs, several degrees higher than the general body temperature will register with the thermometer, and to that degree they are more apt to embarass the heart, and assist rather than prevent a fatal termination.

CHAPTER XXIX.

ANT-ACIDS.

This class of drugs constitutes alkalies and alkaline carbonates employed for the purpose of overcoming or neutralizing excessive acidity in the *stomach*, the *intestines*, and over acidity of the *urine*.

The practical ant-acids are: **Ammonia, Sodium Bicarbonate, Magnesia, Lime** and **Potassium Bicarbonate.**

Ammonia. Ammonia is ant-acid only to the stomach; but for this purpose it is the quickest in action and the most desirable of all the ant-acids. It should be given in the form of Aromatic Spirits of Ammonia, in ½-dram doses, freely diluted, immediately before a meal. It is especially useful in gastric dyspepsia with distress after eating.

Sodium Bicarbonate. Bicarbonate of Soda is the most desirable of all the soda salts as an ant-acid. It can be used to overcome acidity both in the stomach and intestines. It is a *simple ant-acid*, because it has no constitutional influence; it being the natural alkali of the circulation. It can be given in doses of 20 grains to a dram; in all cases of acid dyspepsia with fermentation and discomfort after meals. As a gastric ant-acid it stands next to ammonia, though its effect is not as prompt.

Magnesia. Magnesia is a *laxative ant-acid*, being ant-acid to both stomach and intestines, and at the same time acting as a laxative. It is therefore an admirable ant-acid in over acidity of the alimentary tract associated with constipation. It can be given in doses of ½ to 1 dram. The Calcined Magnesia or the carbonate can be employed with equally good results.

Lime. Lime is an *astringent ant-acid*, and is particularly appropriate in intestinal acidity with diarrhœa, where it neutralizes the acid and at the same time aids in checking the diarrhœa by virtue of its astringent influence.

We have lime for use in two forms: *Lime Water*, and the *Carbonate of Lime* or common Chalk.

Carbonate of Lime, or common chalk in the form of powdered chalk or Chalk Mixture, is an excellent preparation to combine with more efficient remedies in diarrhœa with acidity and fermentation in the small intestines. Especially is it useful in the summer diarrhœas of children and diarrhœas of adults during hot seasons.

Lime Water, which is no more than the *oxide of lime* in solution, is used more particularly for the stomach to allay vomiting, especially when it is due to fermentation and acidity. It is also used to precede a meal in acid dyspepsia, or to mix with milk to prevent the formation of large curds in an irritable stomach.

Potassium. The best preparation of Potassium as an ant-acid is the *Bicarbonate.* This is a *depurant ant-acid.* It differs from the sodium bicarbonate in the fact that, besides neutralizing acidity in the gastro-intestinal canal or excessive acidity of the urine, it has constitutional effects by increasing the oxidation and elimination of effete products from the system. It is therefore an ant-acid that can be used in acidity of the stomach or acidity of the intestines; but is especially fitted for excessive acidity of the urine when such is due to rheumatism or gout, or when there is a disposition to uric acid gravel.

CHAPTER XXX.

ANTHELMINTICS.

The Anthelmintics are a class of remedies used for the purpose of destroying and expelling intestinal worms.

These intestinal parasites are of three classes: the *Seat-worm*, the *Round-worm* or lumbricoid worm, and the *Tape-worm*.

It is to be remembered that the substances used for the purpose of expelling these intestinal parasites are at the same time poisonous to the higher animals and to man. They are usually given in as large quantities as is safe for the individual to take without endangering life; because their effectiveness depends upon the happy medium of being fatal or destructive to the parasite, and at the same time not taking the risk of human life. Because they are always given in large quantities, they must be guarded with greater care and watchfulness than the ordinary medicinal means employed in disease.

In the general application of these anthelmintics, it is necessary that a certain amount of preparation on the part of the patient should precede the administration of the anthelmintic.

In the case of *Seat-worms* it should be a general rule to wash out the lower bowel before the local treatment is begun.

In *Round-worms* or *Tape-worms*, it is good practice to empty the entire intestinal canal with a cathartic before the anthelmintic is administered, so that the parasites will get the full effect of the drug employed. A few hours after the administration of an anthelmintic, a purgative should again be administered to aid in the expulsion of the worm, and to sweep out from the intestines such portion of the anthelmintic as may not have been absorbed, and by this precaution lessen the chances of producing a general poisoning.

Against Seat-worms. Seat-worms or *Ascarides* usually inhabit the lower part of the large bowel or Rectum, and can best be reached by local injections. These injections may consist of *Turpentine*, *Thymol* or *Quassia*.

Of these three, *Quassia* is the one most frequently used, and is probably the safest and most effective. It is employed in the form of an *Infusion*, of the strength of 1 to 2 ounces of quassia wood to the pint of infusion. The quassia should be put in a pint and a half of water and be allowed to boil until it is reduced to a pint; then the infusion strained, the bowel be washed out with a warm salt solution, and the infusion of quassia injected and retained as long as is comfortable. This injection can be repeated two or three times a week until all the parasites are killed and expelled.

In the use of *Turpentine* it is best that ½ to an ounce of turpentine be made up into an emulsion, and then sufficient water added to make a pint. This is likewise to be injected into the bowel and retained for a time before it is expelled.

Thymol is a very efficient vermicide, but is so slightly soluble in water, that if it be employed it is first to be dissolved in alcohol and then diluted with water.

It is more poisonous and more dangerous than either turpentine or quassia, and cannot be retained in the bowel for a long time with entire safety.

AGAINST ROUND-WORMS.

The principal and most useful substances employed for the destruction of round-worms are: **Santonin, Spigelia, Chenopodium, Turpentine** and **Thymol.**

Santonin. Santonin, or *Santonic Acid*, is the most efficient of this group. The dose for children is from ¼ to ½ a grain; to adults, the dose is from 2 to 4 grains.

When it is given to children for the expulsion of intestinal worms, it should always be combined with *Calomel*, thus: ¼ of a grain of Santonin with ¼ of a grain of Calomel to each triturate, and four of these triturates should be given in succession at intervals of two hours apart. If purging fails to follow, a dose of castor oil may be administered.

Another pleasant and efficient way of administering it, is to combine in powder form, ¼ of a grain of Santonin, ¼ of a grain of Calomel, and 3 grains of sugar of milk to each powder; and four of these powders be given at intervals of two hours. The

calomel is especially advisable because it is itself an anthelmintic, and when given in large doses is a very efficient one, besides acting as a purgative.

Toxic Symptoms. Santonin is a very poisonous substance. If it be absorbed in large enough quantities it produces very alarming symptoms. The only safeguard against the production of more frequent poisoning from this anthelmintic is the fact that it is very insoluble, so that most of it remains unabsorbed in the intestinal canal.

The first and *characteristic symptom* of Santonin poisoning usually is color-vision, or *chromatopsia;* followed by a *yellow-colored urine,* free flow of saliva, rapid and weak pulse, muscular cramps and tremors, dilated pupils, unconsciousness, followed by violent *epileptiform* and *spinal convulsions,* and death from paralytic asphyxia.

Physiology. The most pronounced effect of Santonin is upon the brain and spinal cord, producing excitation and convulsions; but is later followed by complete paralysis, and depression of the heart and respiration.

The color vision, or *yellow vision,* is probably due to the Santonin circulating in the refractive humors of the eye, having the same effect upon the retina as looking through yellow stained glass; and hence it is not due to any direct influence on the nerve centres themselves.

The urine, after the ingestion of toxic doses of Santonin, is usually *yellow* in color when first voided; but on standing, this color changes to a *reddish brown,* somewhat resembling hæmatin, and has probably been mistaken for a hæmatinuria.

Spigelia. Spigelia, or *Pink Root,* contains *tannic acid,* a *fixed oil,* a *volatile oil,* a *resin* and a *bitter principle.* Upon which one of these principles it depends for its usefulness in destroying intestinal worms is not definitely known.

The preparations are: A Fluid Extract; dose, ½ to 1 fluidram for children, and ½ a fluidounce for adults.

Compound Fluid Extract of Spigelia and Senna (not official), given to children in doses of ½ to 1 fluidram, repeated every three hours until purging follows. This preparation, though not official, is preferable, because it is more pleasant to take, and contains sufficient Senna to act as a cathartic.

Spigelia is probably not quite as certain and active in its effect against worms as Santonin; but it is at the same time less poisonous, and can be given with less risk to life.

Toxic Symptoms. Spigelia is not truly a poisonous substance unless taken in very excessive doses. It produces symptoms of discomfort of the stomach, some rapidity of the pulse, dilatation of the pupils, dryness of the skin, puffiness of the face, delirium, and muscular weakness.

Chenopodium. Chenopodium, or the *Oil of Wormseed*, is an oil obtained from the seeds of the "Jerusalem Oak." It is employed in doses of 10 to 20 drops, combined with ½ a fluidram of castor oil, and can be repeated every three hours until purgation follows. This oil is more safe but less effective against round-worms than either Spigelia or Santonin.

Turpentine. Turpentine is very efficient but a very unpleasant anthelmintic; and can be used with equal effectiveness against the Round-worm or the Tape-worm.

When it is given to children it can be administered in doses of ½ a fluidram, combined with 2 fluidrams of castor oil. This should be given in a single dose, and should not be repeated more than once a day or once every two days, and be continued until there is evidence that all the parasites have been expelled.

Thymol. Thymol is an effective but at the same time a poisonous anthelmintic. The safety of the patient depends to a great degree upon the insolubility of this drug; for the bulk of it stays in the intestines and poisoning the parasites instead of being absorbed and entering into the general circulation. In children over six years old, 5 grains can be given and repeated in two hours; and this be followed by a dose of 3 grains of calomel. This is a very effective treatment, but it needs the watchfulness of the physician more than the other anthelmintics.

AGAINST THE TAPE-WORM.

The drugs which are most effective and most generally used against the Tape-worm are: **Pepo**, **Aspidium**, **Granatum**, **Cusso**, **Turpentine** and **Thymol**.

Pepo. Pepo, (pumpkin seeds) is absolutely free from toxic properties so far as the higher animals or the human being are concerned, though it is an active poison to intestinal parasites. Its activity against worms is believed to depend upon a *resin* which it contains.

Pepo can be given in almost any dose, but the usual quantity is from 1 to 2 ounces of the hulled seeds, mixed with sugar and spices and beaten up into an *electuary*, and the whole mass be taken at once.

In treating a patient for a tape-worm, whether the anthelmintic used be Pepo, Pomegranate, Aspidium or any of the rest, there is a certain routine of preparation necessary for the patient before and after the anthelmintic is administered. The patient should retire in the evening without supper, the anthelmintic should be administered on rising in the morning, and three hours thereafter it should be followed by a purgative, consisting either of a fluidounce of *castor oil* with 2 drams of *oil of turpentine* in it; or instead of that, a dose of 10 to 15 grains of calomel in a single ingestion be given. After the bowels have opened, there should be injected into the rectum 1 or 2 quarts of solution of common salt, to wash out the lower bowel and aid mechanically in bringing away the worm, if it has not already passed with the stool. The stools should then be carefully washed and examined, to determine whether the animal has passed.

Aspidium. Aspidium, or Male Fern, depends for its anthelmintic activity upon an *Oleo-resin;* and this oleo-resin contains *Filicic Acid*, which itself is very active.

The dose of the Oleo-resin of Male Fern is from ½ to 1 fluidram, and should always be followed by a brisk purgative, either of castor oil and turpentine, or a single large dose of calomel.

Toxic Symptoms. In toxic doses, Male Fern produces a very violent gastro-enteritis, with nausea, vomiting and excessive purging. These symptoms may later be followed by weakness, muscular cramps and tremors, amaurosis, and occasionally spinal convulsions, followed by stupor, coma, and collapse. The *dominant* toxic symptoms are however *gastro-intestinal*, and the action on the nervous system is secondary in importance.

Granatum. Granatum or *Pomegranate,* contains several alkaloids, the more important of which are *Pelletierine* and *Isopelletierine.* Both these alkaloids are active tæniacides, and are used in doses of 4 to 5 grains.

Pomegranate bark can be used in an *Infusion* of the strength of 2 ounces of the bark to a pint of water. This should be taken in three doses, each an hour apart.

Toxic Symptoms. In toxic doses pomegranate or its alkaloids produce rapid general paralysis with absolute loss of reflexes, and death from asphyxia. This general paralysis is due to depression of the *peripheral motor nerves,* and in this respect it has close physiological relations to Curare.

Pomegranate is one of the most effective and reliable anthelmintics against the *tape-worm* at our command. The alkaloid *Pelletierine* is usually administered in prepared capsules, each containing from 4 to 6 grains, and should be followed by a brisk purgative the same as any other anthelmintic.

Cusso. Cusso, or Brayera, contains a *volatile oil, tannic acid,* and the resin, *Cussin.* It is probable that its anthelmintic effects depend upon the presence of its resin.

Cusso is used as a Fluid Extract in doses of ½ a fluidounce, or it can be given in the form of the *Resin,* in doses of 20 to 30 grains, each followed by a brisk purgative.

In over-doses it is capable of producing nausea, abdominal pains and some purging, followed by general weakness, but is not a dangerous poison.

Turpentine. Turpentine is as effective against the tape-worm as it is against the round-worm. The dose for an adult is from ½ ounce to an ounce of the oil of turpentine given with twice the quantity of castor oil. It should be given on an empty stomach, and no food allowed until purgation has taken place.

Thymol. This is also effective against the tape-worm, and in adults it can be given in 15 to 20 grain doses repeated in two hours; and an hour later be followed by 15 grains of calomel. In this way it becomes both effective and comparatively safe.

Calomel. Calomel is not often mentioned in the class of anthelmintics, but yet it remains true that it is not only a very effective anthelmintic, both against the round-worm and the tape-worm, but is at the same time a very safe substance to use. When given in doses of 15 to 20 grains or more, it acts with a great deal of certainty against intestinal parasites. The small doses, however, have little or no effect upon them. But even if it be not much used as an anthelmintic by itself, it certainly remains the best cathartic that can be employed to follow any of the ordinary anthelmintics, because it adds to the anthelmintic effects, and is a non-irritant and certain cathartic.

CHAPTER XXXI.

DIGESTANTS.

The substances used as *Digestants* are a class of ferments of both animal and vegetable origin. Their purpose in practical medicine is not to produce any constitutional effects but wholly for the purpose of aiding the digestion and solution of the food materials in the stomach and intestines.

They are: **Pepsin, Pancreatin, Diastase, Papain, Papoid, Caroid** and **Pineapple Juice.**

Pepsin. Pepsin is a ferment secreted by the peptic glands of the stomach, and is concerned directly in gastric digestion. This ferment acts principally upon proteids or nitrogenous food materials.

The Pepsin of the market is this identical ferment extracted from the gastric mucous membrane of the lower animals, and should be of the strength of 1 to 3000; i. e., 1 grain of pepsin should be capable of dissolving 3000 grains of albuminous or proteid food material.

Saccharated Pepsin is a scale pepsin mixed with ninety per cent. of sugar of milk, and is therefore only one-ninth as active as the ordinary pure pepsin.

Pepsin is usually employed to aid digestion when there is insufficient digestive ferment secreted. It is especially needed in old people who have a lack of digestive power by reason of years; or in the dyspeptic and debilitated, in whom the digestive ferments are dimished in quantity, and the deficiency is in this way supplied. When used in this manner it should be given shortly after the food is taken or with the food.

In indigestion due to gastric catarrh, pepsin or any other digestive ferments do not seem to have any value or afford relief. This is probably due to the fact that this form of dyspepsia is caused more by the interference of the morbid organic acids secreted by the inflamed gastric mucous membranes which promote bacteritic fermentation, than the want of pepsin secreted. Hence the proper treatment for gastric catarrh is the removal of the catarrhal condition by appropriate treatment, rather than the administration of digestive ferments.

A very good use for pepsin is to have it taken some time before the meal, to stimulate by its presence the gastric mucous membrane and increase the appetite or sense of hunger. This application of it is well adapted to such cases who have not only a lack of digestive power, but where there is a degree of atony of the stomach, so that no appetite or desire for food occurs.

Pepsin is also employed for the purpose of preparing peptonized or artifically digested food, to be used in the sick room in acute diseases and in cases of diarrhœa. Care should be taken in preparing peptonized or artificially digested food, so as not to allow digestion to go on to a point where the *peptones* develop and give the food a nauseous bitter taste. The fermentation or digestion should always be arrested by heat before this point is reached.

Pancreatin. Pancreatin contains the different ferments secreted by the Pancreas which are concerned in intestinal digestion. These ferments act upon *proteids*, *fats* and *carbo-hydrates* or starchy foods.

It is at present a mooted question as to whether Pancreatin can be taken into the stomach and run the gauntlet of the acid gastric juice without being damaged or destroyed; but may

again become active when it reaches the alkaline secretions of the intestines. Pancreatin does not act in an acid medium; and whether it is wholly destroyed in the stomach before it reaches the intestines is a matter which has been affirmed and denied. Pancreatin is a very uncertain digestive ferment when given by the mouth. It does not in any sense assist gastric digestion, and whether it assists intestinal digestion is doubtful.

The best use for pancreatin is in the preparation of predigested foods for *rectal feeding* in acute sickness. A rectal food injection may consist of two raw eggs beaten up and ½ pint of milk, with about 15 grains of pancreatin and 10 grains of sodium bicarbonate added to it. This should be put on a warm stove where the temperature does not rise above 100 degrees, and keep stirring it until the mass is practically dissolved and converted into *peptones*. Such a rectal injection should be repeated twice in the twenty-four hours.

Diastase. Diastase is a ferment found in all seeds or grains, and is located in regularly arranged cells, lining the inner side of the rind or bran of the grain. Its direct purpose is to convert the starch in the grain into glucose and other invert sugars, and thus aid in the growth and development or germination of the seed or grain.

When this *diastase* is taken into the stomach by eating the grain, before it has been *rendered active* by germination or growth of the grain, it will have no influence upon starchy foods present in the stomach, nor will it itself be affected by the gastric ferments; but can be recovered with a bran or covering of the grain from the stools without having undergone any change or digestion. If on the contrary, the diastase is *first rendered active* and set free from its cell walls, by exposing the grain to sufficient moisture and heat to cause germination or growth, the ferment can then be extracted and be made to aid in the conversion of starch into sugar in the stomach.

To this purpose a *Malt Extract* is prepared from grain, which contains this *diastatic ferment* in solution; and the official Extract of Malt is used as an aid to digestion in cases of weak stomachs. It is prepared by exposing grain (usually Barley), to heat and moisture sufficient to cause growth or germination and liberate the diastase. After germinination has progressed sufficiently it

is arrested by exposing the grain to enough heat to dry it. From this grain or *malt* is then prepared an *infusion*, which is afterwards evaporated to a more consistent liquid or "Extract."

Malt Extract as prepared according to the pharmacopœia, does not and should not contain any trace of alcohol; for there is no fermentation allowed to occur.

A great many of the malt extracts, or so-called "malts" of the market, belong to the fermented beverages, and are no more nor less than a *porter* or a *beer*. They may contain some diastatic ferment, but their principal effect is that of a stimulant by virtue of the alcohol they contain.

Papain, Papoid and Caroid. These three extractive substances are derived from the fruit of the *Carica Papaya* or the common *Papaw* of the South. The ferment contained in the *Papaw* fruit dissolves or digests both *proteids* and *carbo-hydrates*, It is active in alkaline, neutral, and acid solutions, and is therefore of service in gastric and intestinal indigestion, being an aid to gastric and pancreatic ferments.

The difference between Papain, Papoid, and Caroid seems to be one of activity only. All three are derived from the same fruit, and all three are supposed to contain the same ferment or ferments. But the experimental results arrived at by Chittenden, seem to indicate that of the three, *Caroid* is both the most active and the most certain; for he states that Caroid is far superior to Papoid and Papain in its digestive power on proteid foods in neutral, acid, or alkaline solution; also that two parts of Caroid will digest as much proteid matter in a neutral solution as five parts of Papoid or Papain.

He further states that, in starch digestion, the solvent power of Caroid is far greater than that of Papoid and Papain. The same amount of starch solution with Caroid, will reach an *acromic point* to iodine test in five minutes, which will take Papoid two hours, and Papain three hours to digest to a point where the iodine blue does not appear from the reaction of the starch. This shows plainly that Caroid is far more active in the same quantity than Papoid or Papain. Why these three substances should be so at variance, though derived from the same fruit, can only be

explained by the fact that probably Caroid is a more concentrated extract, and therefore contains a greater proportion of the ferment of the fruit than the other two substances.

Pineapple Juice. It has recently been discovered that the ripe Pineapple contains a very active ferment which has digestive influence upon meats, blood, fibrine and egg albumin; besides converting starch into glucose. This ferment is very readily destroyed or killed by exposure to heat. A temperature of 110 and 115 usually destroys its activity.

The only practical suggestion in this would seem to be that raw Pineapple, being a favorite fruit in its season, should be a valuable and commendable dessert at regular meals, and be eaten after a full meal. After the Pineapple or its juice has been exposed to heat, this ferment at once becomes inert.

CHAPTER XXXII.

DISINFECTANTS.

The Disinfectants are substances used for the purpose of preventing and arresting bacteritic growth and the development of disease-producing poisons.

They are of two classes: The **Oxidizants** (or Antiseptic) and the **Germicides.**

The *Oxidizants* or Antiseptics are used for the purpose of destroying, and oxidizing organic waste product, *to prevent the development and growth of disease germs.*

The *Germicides* are used for the purpose of *killing germs and spores* in infected organic matter, and thus preventing the dispersion of disease-producing bacteria.

The disease-producing poisons are: **Bacteritic Infection, Miasmatic Infection,** and **Poisonous Gases** emanating from decomposing filth.

Nature disposes of organic waste matter on a large scale *by bacteritic decomposition, by oxidation,* and *by dispersion.*

The Bacteria of fermentation and putrefaction, are the most powerful agents Nature has to dispose of organic waste or *filth.* These bacteria are not disease-producing, but *health-producing* bacteria. They not only destroy filth and aid in the decomposition of organic waste to prevent the development of *disease-producing bacteria,* but many of them are *phagocytic* or bacteria of prey, and directly aid in the destruction of the toxine-producing bacteria.

This is especially significant and true in the purification of drinking water taken from large streams, where there is an abundance of organic matter getting into the water supply. Here the safety of the people against infection almost entirely depends upon the activity of these bacteria, in decomposing and destroying the poisonous filth which may be polluting the water supply.

OXIDIZANTS.

These Oxidizants or Antiseptics are principally used to destroy filth, and not to kill germs; yet some of them have both properties, and are used for both purposes.

They are: **Actual Combustion** or *Fire,* **Putrefactive Bacteria, Unslacked Lime, Sulphate of Iron, Permanganate of Potassium** and **Peroxide of Hydrogen.**

Fire. Oxidation by rapid combustion or fire is of all processes the most efficient, but it is not always practicable. This method of oxidation is of course also germicidal, and destroys both disease germs and waste material equally. It

is practicable to resort to this plan of rapid destruction of all substances in which disease germs may develop, if they are in a state of dryness, and are without any further usefulness.

Bacteria. The *Bacteria* directly concerned in the decomposition of organic matter, are by all means the most extensive and powerful oxidizing agents. It is Nature's way of disposing of organic waste on a larger scale; but this process of destruction of filth in domestic hygiene is in most cases too slow to be practical for masses of filth which immediately endanger the surroundings.

Lime. Ordinary *unslacked lime* is an oxidizant of power and rapidity of action. It oxidizes a mass of filth by appropriating the oxygen of the surrounding atmosphere, and not yielding its own. It is therefore very persistent and prolonged in its oxidizing effects.

It has the one disadvantage, in that it is apt to set free ammoniacal and other volatile poisonous gases, which, for the time being, will contaminate the atmosphere of the surroundings.

Lime can be used for the oxidation of filth in cess-pools or water-closets in which the contents are not infected by disease germs; but it is incapable of killing germs and hence is worthless in infected filth.

Iron Sulphate. The ordinary *Sulphate of Iron* or "Copperas" is sometimes used as an oxidizant to destroy small masses of filth in cess-pools and water-closets. This substances is probably not as active an oxidizant as lime, but it does not set free any noxious gases to pollute the atmosphere, but precipates them in the mass as new compounds.

Potassium Permanganate. Potassium Permanganate is a very powerful and rapidly acting oxidizant, and is at the same time a *Germicide;* but both its oxidizing and germicidal properties are very fugacious; because so soon as it comes in contact with organic matter it immediately yields its own oxygen and is decomposed. It is therefore not a practical substance to oxidize large masses of filth; but is an excellent application to foul ulcers, sloughing wounds, and suppurating surfaces to clean and disinfect the part.

Hydrogen Peroxide. Peroxide of Hydrogen (Aqua Hydrogenii Dioxidi) is one of the most rapidly acting oxidizing agents in this group. It produces oxidation by yielding a part of its own oxygen, and thus destroying all organic substances with which it comes in contact. But it can of necessity be only transient in effect, because it is itself destroyed in the attempt of oxidizing other substances. It is quite as active a *germicide* as it is an oxidizant.

Peroxide of Hydrogen is only serviceable where the amount to be oxidized is small, such as wound dressings, to cleanse ulcerative and suppurating surfaces; to wash out abscesses; to clean out the urethral canal in gonorrhœa; and in all forms of ulcerative sore throat.

Wherever it is practical to do so, the Peroxide of Hydrogen should be used with an atomizer or spray. Especially is this true in affections of the throat, like follicular tonsillitis, and in true diphtheria. In diphtheria itself, it is the best local application known, and by a frequent and careful spraying of the throat, it is often possible to remove the membrane several days earlier than it would otherwise be shed. It acts as an active germicide to disinfect the mouth and throat, and at the same time produces rapid oxidation of the diphtheretic membrane itself. The spray used for this purpose should never be entrusted to the members of the family, or even to the nurse unless she is very skilled; but should at all times be done by the physician himself.

Peroxide of Hydrogen should be used in its purity. For the presence of water, even though it be distilled, aids in the rapid decomposition of the peroxide. Nor is there any possible harm to come from its use in concentrated or full strength, except possibly in the conjunctiva sack, where it might produce irritation.

Taken into the stomach, peroxide of hydrogen is decomposed by the gastric contents present, and leaves behind nothing but plain water. It therefore cannot produce any local effects other than possibly slight irritation; nor is it capable of producing any constitutional influence or symptoms in whatever quantities it is given, because none of it is absorbed or enters the general circulation as a peroxide.

GERMICIDES.

Germicides are agents used for the purpose of killing disease germs and their spores.

They are: **Heat, Formaldehyde Gas, Corrosive Sublimate, Hypochlorite of Lime, Carbolic Acid, Oxalic Acid, Sulphurous Oxide, Boric Acid, Acetanilid, Creosol Compounds** and **Naphtol.**

Of these, the most powerful and the most useful are *Heat* (dry and moist), *Formaldehyde, Corrosive Sublimate, Hypochlorite of Lime* and *Carbolic Acid.*

Heat. Heat as a disinfectant can be used as *actual combustion* or fire; as *dry heat* at lower temperature, but not less than 300 degrees; as *moist heat* at the boiling point, and *super-heated steam* the temperature of which is higher.

Actual combustion or fire, is both germicidal and oxidizant; but is only practicable as a germicide where the substances or articles infected, have no commercial value and can be destroyed.

Dry heat is not as certain and valuable as a disinfectant, especially of clothing, because it does not penetrate effectively to the interior of the mass at a temperature of less than 250 degrees. It will not destroy spores except on very prolonged exposure.

Moist heat is the most convenient, the most easily applied and the most reliable to disinfect garments, bed-clothing, and other materials used in the sick-room which will admit of exposure to boiling water.

In disinfecting bed-clothing and personal attire, the water should be at a boiling point when the clothes are put in, and be kept boiling from half an hour to an hour. The germs will yield to boiling temperature in less time than an hour, but the *spores* of some disease germs will resist boiling temperature for a longer period than the bacteria themselves.

Formaldehyde Gas. Formaldehyde Gas is prepared by decomposing *Methylic Alcohol* by heat. The gas is extremely penetrating, and in contact with mucous membranes or raw surfaces is violently irritant.

This gas is used as a *germicide* and disinfectant in fumigating and disinfecting rooms and apartments which have been exposed to contagious diseases. It penetrates all parts of the room; the crevices, walls, and closets; and is probably the most efficient and most useful fumigating disinfectant we now possess.

Formaldehyde Gas, dissolved in water of the strength of ten to thirty per cent. is a very useful antiseptic solution to wash out abscesses, and to cleanse ulcers and suppurating surfaces. A ten per cent. solution is germicidal to all known germs, and the secretions of a wound or ulcer will not decompose it. It has even been used, though in weaker solutions, to treat gonorrhœa and leucorrhœa by local injections.

Corrosive Sublimate. Corrosive Sublimate is a powerful germicide to use in places where it is not decomposed; but it is not a germicide to be used to disinfect a mass of filth like a cess-pool, because the ammoniacal gases resulting from the decomposing filth, and the albumens present in all organic matter, will decompose corrosive sublimate into an insoluble *albuminate of mercury* and *yellow oxide of mercury*, both of which are practically inert as germicides.

It should be borne in mind that corrosive sublimate is also decomposed when it is used in a wound, an abscess or an ulcer, by the secretions and albumens of the tissues present, and is therefore only antiseptic momentarily.

Chlorinated Lime. Chlorinated Lime, or *hypochlorite of lime*, is an active germicide as well as an oxidizant. It is an oxidizant by virtue of the free chlorine it liberates, and is a germicide both by virtue of its chlorine and by virtue of its *hypochlorite*. All the hypochlorites of the alkalies are poisonous to disease germs; but the hypochlorite of lime being so much cheaper, is the one usually preferred for disinfection in the sick-room. Of all the germicides it is probably the most practical and the most employed in the sick-room, as well as to disinfect masses of filth which contain disease germs. It is not decomposed by any putrefactive matter except in so far as it liberates its chlorine.

Carbolic Acid. Carbolic Acid is at present used chiefly to disinfect surgical instruments, and in the sick-room to disinfect stools, urine, and expectorations. As an

antiseptic in the dressing of wounds, it is not now so much employed, because there are other antiseptics more effective and less liable to produce general poisoning from absorption. To be an effective germicide it should be of five per cent. strength.

Oxalic Acid. Oxalic Acid is an active germicide, but is itself so poisonous to higher animal life, that its use is very limited. It is at present almost exclusively employed to disinfect the hands for surgical work.

Sulphurous Oxide (SO_2). Sulphurous Oxide gas is produced by burning sulphur, and is an active germicide. It can be used for the purpose of disinfecting sick-rooms after the patient has been removed; but it is now almost completely replaced by the better gaseous disinfectant, *farmaldehyde*, and is therefore very little employed.

Boric Acid. Boric Acid is a comparatively feeble germicide but is in other respects so innocent that it becomes a valuable substance to apply to wounds and ulcers. It is especially useful in the eye, for inflammation of the conjunctiva; as a dessicant powder in suppurating middle ear disease, and as a douche into the nose to relieve catarrh.

Externally in skin diseases, it is a very valuable ingredient of dessicant powders when there is a great deal of itching and weeping of the part affected, as in eczema and psoriasis.

Internally it is of some value as a gastro-intestinal disinfectant, but is especially useful *to render an alkaline urine acid*, and at the same time arresting fermentation in the bladder. For this particular purpose, Boric Acid and Benzoic Acid are the two most useful substances we have.

If boric acid be taken internally in excessive quantities, it is capable of producing general toxic symptoms; nausea, vomiting, hiccough, depression of respiration, fall of body temperature and collapse; but to produce such marked symptoms, it takes enormous quantities.

Acetanilid. Acetanilid is particularly useful in suppurating ulcers, in skin diseases, and suppurating middle ear. It is distinctly antiseptic to suppurating sores.

It can be used in skin diseases, in an ointment of the strength

of 30 to 40 grains to the ounce. As a dusting powder for the ear, or as a dessicant powder over weeping eczema, it is one of the best. When mixed with equal parts of Boric Acid and Precipitated Carbonate of Zinc, it is probably as efficient an application as could be suggested for local purposes where dessicant and disinfectant properties are required.

Cresol Compounds. The Cresol Compounds that can be used as local disinfectants are *Creolin*, *Cresalol*, *Lysol* and *Lasophan*.

Creolin is said to be a *cresol emulsion* obtained from *resin soap*. When mixed with water it produces a milk-white emulsion; with Chloroform or Alcohol it mixes in all proportions. It can be used in practical medicine as a disinfectant mouth wash, but is too inactive and unreliable to be classed as a valuable wound disinfectant.

Cresalol or *Cresol Salicylate*, can be used externally; but at present is more used as a disinfectant to the intestinal canal where it undergoes decomposition into its elements, *Creosol* and *Salicylic Acid*. It is less poisonous than Salol, and can therefore be used in larger doses for intestinal disinfection.

Lysol is a liquid compound containing about fifty per cent. of *Cresol*, and is miscible with water, alcohol or glycerin. It is a trifle more antiseptic than Creolin, but is relatively of so little importance as a germicide that it is hardly employed by the practicing profession.

Losophon, or *Cresol Iodide*, is a powder which is soluble in oils but insoluble in water. It has probably some local alterative influence in nasal catarrh, and can be used for this purpose.

Naphtol. Naphtol is derived from Coal-tar, and is very insoluble in water, but freely soluble in alcohol. It can be used externally locally in alcoholic solution as a wash to cleanse ulcers, and in itchy skin diseases, like Eczema or Psoriasis.

Its best use, however, is internally as a disinfectant to the gastro-intestinal canal; in gastric or intestinal fermentation with

or without diarrhœa, It is not poisonous to human life unless it be taken in very large quantities; and therefore can be used with safety in full doses, and may be combined with Sub-nitrate of Bismuth, Calomel and Opium. It is claimed to be a valuable disinfectant to the intestines in Typhoid Fever, where it can be given in capsules in doses of 5 to 10 grains.

Sick-room Disinfection. In the sick-room where there is contagious disease, the principal things to observe are: *Isolation*, the *disinfection of the excreta*, the *disinfection of the clothes*, and the *disinfection of the room* itself.

Isolation. In the onset of an acute specific disease, the first and most important thing is to isolate the patient from the rest of the family, in a room by himself; and this room is best selected on the top floor of the house. The attendant to the sick should be instructed not to communicate with the rest of the house more than is absolutely necessary. The outer garment worn in the sick-room should be exchanged at the door, before going into any other part of the house.

It is likewise necessary that the utensils in the sick-room, like spoons, forks, knives and dishes in which food and drink are brought to the patient, should always be washed in Carbolic Acid or Bichloride solution before they are allowed to leave the sick-room and enter the rest of the house. All unnecessary articles in the sick-room, as drapery, bric-a-brac, pictures, curtains, rugs and the like, should be removed before the patient enters.

Excreta. The *urine*, *stools*, and *expectorations* of a patient with infectious disease, should always be disinfected before they are allowed to be removed. The disinfectant here most useful is *Chlorinated Lime*. A saturate solution of this should be made and kept in vessels preparatory to receive the *excreta*. When receiving a stool, it should be allowed to stand for at least half an hour in the disinfectant solution before it is removed, so that all parts of it may be disinfected. Where the odor of the Chlorine set free by the Chlorinated Lime is objectionable to the patient, Carbolic Acid or Bichloride of Mercury may be substituted; but both of these articles are more expensive and not any more efficient than the Chlorinated Lime.

Infected Clothes. The Infected Clothes of the sick-room, consisting of bed clothing, personal attire, towels, napkins and the like, should all be gathered up and wrapped into an *aseptic sheet;* and without being opened, should be put into a boiler filled with *boiling water* and allowed to boil for half an hour to an hour. After this they are entirely safe to be washed and handled like any other uninfected article.

All woolens and silks that may be in the sick-room, but which are ruined by exposing them to a boiling temperature, should be disinfected by putting them into a Corrosive Sublimate solution of the strength of 1 to 1000 or 1 to 2000, and allowed to stand for several hours. After that they should be washed in plain water to remove the corrosive sublimate, and then dried.

Furniture. The *furniture, fixtures,* and the *walls* of the sick-room should be wiped down with a Bichloride solution of the strength of 1 to 1000. Corrosive Sublimate is preferable for this purpose, because it does not attack the woodwork or paints, and can be used with absolute harmlessness. After this is done the room should be disinfected with Formaldehyde Gas, and thereafter freely ventilated, and subjected to soap and the scrubbing brush.

It is absolutely necessary that a physician gives these directions in the minutest details to the responsible members of the family, in every case of infectious disease; and thereafter sees to it that they are carried out as explicitly as they were given. If he does anything less than this, and through any carelessness on his part the disease is communicated, he becomes responsible for any misfortune that may follow.

CHAPTER XXXIII.

HEAT AND COLD.

Heat and *Cold* are conditions identical in their ultimate effects. Extreme heat and extreme cold are alike capable of arresting all vital activity, ending in *destruction and death;* and the effects *of a moderate degree,* of either are again identical, producing *stimulation, and increased functional activity.* These temperatures or conditions are of different degrees of intensity for different living organisms.

A temperature which is extreme in the case of one may not be of sufficient intensity to be extreme for other organisms, and likewise the moderate heat or cold just sufficient to cause stimulation and increased functional activity varies somewhat in the degree required for different organisms.

The temperature of some lower animals, reptiles and fish, varies with the temperature of their environments, and is at all times a few degrees higher than the medium in which they exist. In these animals the application of heat or cold has less effect than in animals whose normal body temperatures under all circumstances remain on the same plane.

In warm-blooded animals, like the human being, the body temperature is constantly on the same plane (about 98½ degrees Fahrenheit for man), and this temperature cannot vary more than 2 or 3 degrees without being intensely felt. If the temperature falls below 98 degrees Fahrenheit the effect is felt; and when it falls to 96 or 95 degrees, the condition is dangerous to life unless supported by external heat. On the contrary, if the temperature rises above the normal line to 103 degrees, the various functions will begin to suffer.

Heat and cold, when applied locally, will act *as stimulants* to the part in contact, if the application be only *momentary.* If however the application be of *prolonged* duration or very intense, they both act *as sedatives.*

To determine whether the effect is sedative or stimulant, it is only necessary to watch for *reaction.* If the reaction follows *at once,* such application is a *stimulant;* if the *reaction* is *delayed* or absent, the effect is *sedative.*

LOCAL USES OF HEAT AND COLD.

Local applications of Heat and Cold are used to combat *congestions* and *inflammations*. Their effects depend upon the contraction of bloodvessels in the part inflamed.

Their contact produces reflexly a vasomotor spasm, contracting the bloodvessels, thus causing depletion which relieves the inflammation or congestion. It is probable also that some of the effects on the local circulation are caused by change of temperature in the inflamed part, from direct contact of the heat or cold.

The effects of heat and cold for local antiphlogistic purposes are alike, so long as they are of equal intensity.

Cold is preferable for vigorous patients, because by the use of the ice bag the temperature will remain the same during the application; whereas if *Heat* be applied, the temperature of the substance used rapidly falls to the temperature of the body.

In small children who have not as yet developed their heat producing apparatus, or in old people who have, by reason of years, lost the power of generating heat, the application of *heat* to an inflamed part is always preferable; because in such cases, the local application of cold may be sufficient to reduce general body temperature, and do a great deal of mischief.

Methods of Applying Heat. Heat can be applied, for local purposes in inflammations, **as a poultice, hot water bag, hot stupes or fomentation,** and **hot water irrigation.**

Poultices. The hot poultice made of *flaxseed meal* or *corn-meal* is probably the most efficient and desirable way of applying heat to an inflammation for the purpose of reducing hyperæmia. It combines the effects of *heat* and *moisture*, or what is often called "moist heat," to the part; and is more prompt in giving relief than any form of dry heat.

The poultice should always be made by bringing the poulticing material to a boiling point, so as to render it aseptic, then apply and be covered to retain the heat. It should be kept in contact for half to three-quarters of an hour and then be exchanged for another like poultice without allowing the part to be exposed in the interval. This should be kept up for four to eight hours, or until the part begins to lose its redness.

Poulticing is capable of driving the blood out of the part to such an extent as to cause it to become devitalized and slough for want of circulation if continued too long.

Hot Water Bag. The hot water bag consists of an India rubber bag containing from a pint to two quarts of hot water. It can be applied to a part and the water changed as often as required; and in this way heat can be maintained and made very effective. It has however the disadvantage of being dry heat.

To allay a mere irritation or a neuralgic pain, abdominal cramps or colics, and in neuralgias of the face, the hot water bag is a very useful local application to give prompt relief.

Hot Water Stupes. *Hot Water Stupes or Fomentations* are made by dipping a piece of cloth or flannel into hot water, wringing it out, and applying it to the part. This lacks the effectiveness of a poultice because it loses heat rapidly. It must be changed every few minutes, so as to maintain the heat. It is not as useful as the foregoing methods except in parts where neither poultice nor hot water bag can be applied.

Hot Water Irrigation. This consists of allowing the constant flow of water of as high temperature as can be borne on the part which is inflamed. This application, when rightly applied, is very effective; but its proper use requires so much paraphernalia and inconvenience that it is rarely used.

The application of heat is indicated in *inflamed joints, forming abscesses, bruises*, and other injuries where there is no open wound; and in inflammation of thoracic and *abdominal organs;* congestion of the *Liver*, local or general *Peritonitis, Pleurisy*, and *Bronchitis*, especially in children where the chest walls are thin.

The local application of heat is not advisable in any diseases accompanied by high fever, unless the general temperature first be reduced; for it has a tendency to increase the fever.

Local Application of Cold. The local applications of Cold are: **Ice-bag, Ice Poultice, Cold Water Irrigation, Ice Water Compress, and Coiled Tubing**

Ice-bag. Of all the methods for applying cold locally, the *ice-bag* holds the first place. It is not only the most effective and most convenient, but is superior to heat in its power of relieving congestions and inflammations. It is superior because the same temperature is maintained so long as there is ice in the *bag*.

The *Ice-bag* is simply a thin, flexible rubber bag in which the crushed ice is placed, closed by a cork or string, and applied.

The ice-bag should never remain on any part more than an hour at a time, for the extreme reduction of local nutrition may devitalize superficial structures and result in the destruction of tissue.

The application should be made for an hour, then removed for an hour; in this manner the application can be made on alternate hours for twelve to twenty hours.

In local injuries where there is no break in the tissues, in injuries of joints, as the Wrist, Elbow, Shoulder, Knee, Hip, or Ankle, and in abscesses which are about to form, in acute Lumbago or acute Sciatica, the ice-bag is capable of doing much good.

Ice Poultice. The *Ice Poultice* is a nearly obsolete method of applying cold. It was made by mixing crushed ice with saw dust and applied as a poultice, and as often as the ice melted a new poultice was applied. It is unpleasant, soiling and wetting everything about the patient, and is no more effective than the ice-bag.

Irrigation. Cold water irrigation was formerly used very much in injuries and wounds, and after operations, to irrigate the wound and reduce the local inflammation, but is not at all now used for this purpose; for such irrigation is not necessary in a wound antiseptically treated.

In the local treatment of Dysentery and Summer Diarrhœa ice water irrigation is of great usefulness, and should be used a great deal more than it is. The bowel should be washed out once or twice in the twenty-four hours with ice cold water,

medicated or plain, as required. It should always be administered with a fountain syringe and the entire large bowel filled, so that the whole of it is washed and cleaned out.

Ice-Water Compress. Ice water *stupes* or *compresses* are used for exactly the same purpose as the hot water fomentations are applicable; in injuries to the eyes or ears, or in any other locality where other methods of application are not convenient. These may be made effective in the treatment of inflammations in direct proportion to the frequency with which they are changed, so as to keep the temperature of the part reduced to normal.

Coiled Tubing. Coiled Tubing through which cold water is constantly flowing, is made to fit the part to which it is applied. This is effective where it is practicable to apply it.

CONSTITUTIONAL EFFECTS OF HEAT AND COLD.

The human organism is so constructed that functional activities are best performed at about 98½ degrees Fahrenheit. Any variation from this temperature, either increase or diminution, always depresses and deranges functional activity; and if the variation be as much as 4 degrees, there is a decided change in the organic fuctions.

If the body temperature lowers to 95 or 94 degrees, as it often does in shock, death will rapidly ensue, unless the temperature be quickly elevated by artificial means. If, on the contrary, the temperature rises to 106 degrees, or above, as it does in sunstroke, the vital functions are seriously affected, unless such temperature be lowered promptly.

Here are practical indications for the use of Heat and Cold. When a temperature is elevated, it is readily controlled by the application of cold, and when a temperature falls below normal, the application of external heat will give relief.

HEAT AS A PYRETIC.

We employ the external application of heat for the purpose of elevating a sub-normal body temperature, and for the purpose of sustaining a temperature which constantly tends to fall below normal, as in **Shock, Collapse** and **Insanity.**

Shock. Shock and Collapse are very closely allied, if not identical. In both conditions there is a sudden abeyance of functional activity; in which the heart fails, the respiration weakens, consciousness may disappear, complete relaxation, and a very marked and rapid fall of body temperature. The rapid loss of heat is the most dangerous of all the conditions present in either *Shock* or *Collapse.*

It is absolutely essential in the treatment of these conditions, to supply external heat. Elevation of temperature at once influences the circulation, respiration, and consciousness; and a condition of reaction occurs. The rapid loss of temperature is evidently in part due to diminished functional activity of the entire organism, including *depression* of the *heat-producing centres* in the brain; also in part to the *complete vasomotor paralysis* which occurs simultaneously, allowing a sluggish circulation in the peripheral bloodvessels, and rapid loss of heat from radiation.

It should therefore be borne in mind that in the treatment of shock or collapse, aside from the fact that body temperature must be elevated by external heat, it is equally necessary to use *active vasomotor stimulants;* such as Strychnine, Atropine, Cocaine, Ergot, etc., to bring about contraction of the bloodvessels and prevent further dissipation of heat.

Collapse. Collapse is a systemic condition in which all functional activities are in abeyance, the failing heart, respiration, unconsciousness and fall of body temperature are identical with those seen in *Shock.* But this condition is spoken of as *Collapse,* when it occurs in the course of a disease or a diseased condition, while the same condition is spoken of as *Shock,* when it occurs from violence or injury which may be of *mental, moral or physical character.* Sometimes the term *collapse* is used to indicate an extreme degree of shock, without reference to its cause.

The conditions being the same in these respective systemic states, the same treatment must be followed. The cause of collapse must be removed if it can be reached; and thereafter the application of external heat, combined with stimulants for the lost functions; cardiac, respiratory, and above all, vasomotor.

Insanity. In some forms of insanity there is a constant tendency to sub-normal temperature, which at

times falls to a point of danger, and at other times needs little attention. Typical amongst these is the so-called "*Confusional Insanity;*" in which there is an extreme degree of brain exhaustion, with the functions of the thermogenic apparatus so reduced, that sufficient heat cannot be manufactured to maintain the body temperature at normal, even when the external temperature is moderate.

This is the form of insanity which follows acute diseases of severe type, and occurs after septic infections; after Typhoid, after severe Influenza and after childbirth, or so-called *puerperal insanity.*

Sub-normal temperature is also of frequent occurrence in Paralytic Dementia, in which the constant tendency of body temperature to fall is probably the outcome of injury to the heat-producing centres in the medulla.

In these cases the body temperature must be maintained temporarily by the use of external heat; but any permanent relief wholly depends upon the curability of the disease.

Mode of Applying Heat. The different methods by which heat may be applied to combat sub-normal temperature are: **Superheated room or chamber, hot water bath, hot water bed, the hot pack, hot air, hot blankets, bottles filled with hot water, heated bricks,** etc.

Hot Chamber. *The Hot Chamber or Room* heated to a temperature of 90 to 110 degrees Fahrenheit, is probably the most efficient way of elevating a sub-normal temperature, if the facilities can be commanded.

Hot Water Bath. *The Hot Water Bath* is very prompt and efficient. The temperature of the water may vary from 100 to 110 degrees, and the patient be allowed to remain in it until the body temperature reaches normal. Along with this use of heat there should be a free use of such stimulants as Strychnine, Cocaine and Digitalis given hypodermically.

The use of alcohol is of no avail, because it is *not a vasomotor stimulant,* and vasomotor paralysis or relaxation is the condition which needs most attention.

Hot Water Bed. *The Hot Water Bed* consists of an India rubber mattress partially filled with hot

water. This should not be too full, to allow the patient to sink down, and as it were, become half enwrapped; so that there is an application of heat to as large a surface as possible. This is effective, but such conveniences are not often at hand when needed.

Hot Pack. *The Hot Pack* consists of blankets or sheets wrung out of the hottest water that can be applied without harm to the skin. Outside of these blankets, dry blankets are applied to retain the moist heat of the interior. The patient is allowed to remain in this pack until the body temperature becomes normal and reaction occurs. This is a very efficient way to deal with a condition of shock or collapse.

Hot Air. *Hot Air* conducted through a tube under the bedclothes is often a very convenient and effective measure for patients who are too sick to be moved. A rubber tube is attached to a funnel, adjusted over an alcohol lamp or a gas jet, the air entering the funnel and tube is heated and conducted to the patient covered with blankets to retain the heat, which are held away from the patient by a wire canopy or other device, to allow the hot air to gain access to all parts of the patient's body.

Heated blankets, bottles filled with hot water, heated bricks, hot flat-irons, etc., are often the only means at hand to get heat quickly. These are less convenient, but when properly applied they are capable of elevating the temperature.

The blankets should be heated as high as possible without injuring them, and wrapped around the patient, and over these, other blankets be placed, to retain the heat.

Alongside the patient, to the feet and arms, and along the legs, bottles filled with hot water, hot bricks, hot water bags, or whatever else may be at command which yields heat should be placed.

COLD AS AN ANTIPYRETIC.

All elevated temperatures above normal will do harm in direct proportion to the degree of elevation. Slight elevation of temperature produces little inconvenience unless too long continued; whereas a high temperature cannot be endured for a long time without producing serious injury or death, such being the

direct result of *heat*. Where such temperature is produced by specific infection, as *infectious fevers* or *septic fevers*, there is the additional injury from the bacteritic toxin added to the elevated temperature; patients suffering from specific infections cannot endure as high temperature for the same length of time as an individual who is suffering from Sunstroke or *Thermic fever;* for, in the latter the system has not the additional depression of the bacteritic toxins. But in both cases the high temperature must be reduced.

It does not matter what the nature of the infection is or what the cause of the rise of temperature; the treatment is always the same. *Get rid of the superfluous amount of heat*, and the most natural and most effective way to do this is by the application of *cold* in one way or another. *The cold must always be proportionate to the amount of heat and the stubbornness of the fever.* If the fever is mild, the plan of dealing with it can be proportionately moderate; if the temperature is very high and yields but stubbornly, it must be dealt with in a manner sufficiently vigorous to subdue it.

In specific diseases with bacteritic infection there are always three conditions present, each of which is dangerous to life: The *bacteritic toxin*, the *elevated temperature* or *fever*, and the *underfeeding or starvation.*

In most diseases the bacteritic toxin is not under our control, and the diseases will run their regular course; so that as this element is practically outside of our control, the *patient*, not the disease, is to be treated and supported.

The high temperature or fever is a condition which is absolutely under our control, and this evil can be barred from the course of the illness, and the patient's chances for life to that degree be increased. In a great many cases the additional amount of injury which a high temperature will do, is just sufficient to exhaust the patient to a degree where in the later stages he may die from exhaustion, where otherwise he might have lived through this stage and recovered.

But this is not all. If it should not make the difference of life and death, it is after all inexcusable for a physician to allow a patient to endure the suffering which an elevated temperature causes throughout the course of an illness. Besides this physical suffering, and the loss of sleep and rest induced by high temperature, it influences the general nutrition and digestion to such a

degree that the patient cannot take a sufficient amount of food to maintain strength; this again may not only produce an extreme exhaustion and permanent harm to the nervous system, but in many cases may make the difference of life and death.

The controlling of temperature therefore in fevers is very important and far reaching. It not only prevents harm to the tissues, especially the nervous system which is so susceptible to fever, but it affects the nutrition, more food can be taken by the patient, and auguments his comfort, rest, and sleep; and these in turn come to assistance in resisting the deleterious influence of the bacteritic toxin.

The use of *Cold* is superior in safety and efficiency to antipyretic drugs. When the temperature or fever promises a course prolonged over may days, *Cold* should always be selected; for it is always at hand in one form or another. The antipyretic remedies will reduce temperature, but their after-effects are always those of general depression. This depression may be so mild in some instances, that it is barely noticeable until repeated doses have been used; in other cases, and especially so in the late stages of low fevers, a single dose sometimes produces depression which is alarming and has occasionally proved fatal.

Cold, on the contrary, has no depressant influence *so long as body temperature is above normal.* It has even been claimed that its effect is rather that of a stimulant. This is however doubtful. The apparent stimulant effect is due more to relief from the depression of the fever than to positive stimulation of the cold.

Methods of Using Cold. **Cold Baths, Tepid Baths, Sponge Baths, Cold Pack,** and **Air Baths,** are the practical methods.

Cold Baths. The so-called *Cold Water Bath* is employed at the temperature of about 60 to 70 degrees Fahrenheit. A bath of a temperature as low as this is only warranted in conditions where the temperature is so elevated that it becomes a matter of great importance to reduce it promptly. In *Sunstroke* the temperature often ranges as high as 107 to 109 and even 112 degrees Fahrenheit. In such cases it is imperative that the temperature be reduced at once to save life, for no human being will endure this temperature for very many minutes without becoming unconscious, and death following in a short time.

In Sunstroke, with a temperature sufficiently high to threaten life, the patient should be immersed in a cold bath, and at the same time an ice cap applied to the head, and be kept there until the temperature is lowered to 102 degrees Fahrenheit. If the shock of cold water embarrasses the heart it is important that the temperature of the bath be at once elevated to 80 degrees. After the temperature is reduced to about 102 degrees, the patient can be removed from the bath and be fanned or allowed to remain in a draught of air without being wiped, to prevent the temperature from rising again, which it is apt to do in sunstroke. This secondary elevation can further be prevented by giving a 10-grain dose of antipyrin hypodermically.

Should the heart be weak and rapid, the hypodermic use of Strychnine and Digitalis are indicated.

In Sunstroke, as in all other elevated temperatures, structural changes, both in the nervous system and muscle fibres, may prove to be a fatal sequel. This being the case, it is readily understood why it is so imperative to reduce the temperature without delay.

In milder forms of Sunstroke, which are commonly spoken of as *heat exhaustion*, where the temperature rarely reaches above 105 degrees, the tepid or cool bath is sufficient.

In cases of sunstroke where you do not have the convenience of a bath, the individual should at once be removed to a shady place, and the clothes be stripped off if the surroundings will allow it, and water poured over the person to keep him wet and be fanned constantly till the temperature is reduced.

In patients who suffer from *organic cardiac lesion*, where the cooling of the surface of the body is apt to embarrass the heart partly through reflex nerve impulses, and partly by driving the blood from the surface into the deeper vessels, thus increasing the resistance to the blood current, the temperature must be reduced by sponging with tepid water and fanning. However in many cases the weakness of the heart is directly due to the excessive temperature or fever, and in such cases the heart cannot be helped any better than by reducing the temperature at once; for the cardiac muscle and its innervation are seriously affected by elevated temperature. This is demonstrated by the fact that the pulse rate and pulse character are an index of body temperature. Even if the heart be weak from organic disease, the use of a bath as an antipyretic is not wholly contra-indicated; but the reduction of

temperature should be brought about slowly and by such means as will not produce shock, and a bath of 85 to 90 degrees is in all cases safe to use.

Tepid Baths. A *tepid bath* as usually given from 75 to 85 degrees Fahrenheit is the bath which is most employed in the treatment of ordinary acute fevers; such as Typhoid, Typhus, Influenza, Pneumonia, etc. The patient is wrapped in a sheet, immersed in the bath, and allowed to remain until the temperature is lowered to 101 degrees; then he is removed from the bath and put to bed with a light cover over him.

To reduce a temperature from 104 to 101 degrees, requires from fifteen to twenty-five minutes of immersion; but the length of time is of secondary importance; the thermometer should determine when the patient is to be taken out. In all the specific fevers, it is a common rule that the patient be put into the bath when a temperature of 102½ to 103 degrees is reached, and reduced to 101 degrees. In some cases it is necessary to bathe a patient four or more times in the twenty-four hours; in other cases two baths a day answer the purpose.

Sponge Baths. The so-called *sponge bath* is not as prompt and effective in its action as the tub-bath, but is often more convenient.

The sponge bath is usually applied by first stripping the patient, and sponging with cold water continuously until the temperature is reduced. The temperature falls very slowly, and in many cases it becomes necessary to keep up the bathing almost continuously.

The sponge bath can be made very much more effective by fanning, so as to produce rapid evaporation of the water. Very cold water is unpleasant to the patient, and apt to make him rebellious, and it does not reduce the temperature as readily as luke-warm water with fanning, because the contact of cold water to the skin produces reflex contraction, and will not allow of as much heat radiation, so that the heat is retained in the body while the skin resists the cold.

In the employment of luke-warm water the skin remains relaxed, allowing liberal heat radiation, and the evaporation of the water by the use of an air current will remove the heat rapidly.

Cold Pack. The *cold pack* is applied by wringing a sheet out of ice water and wrapping it around the patient. This method is less efficient and more unpleasant than any of the other methods now in vogue. The reduction of temperature, it is readily seen, depends entirely upon the temperature of the water contained in the wet sheet; and to elevate the temperature of such a small quantity of water to the body temperature, can certainly not consume very many heat units in proportion to the amount of heat which it is necessary to dissipate.

Air Baths. I have for the past ten years employed *cold air* when it could be obtained; or in Summer season, an air current combined with moisture, to reduce temperature in all kinds of fevers: Scarlet, Diphtheria, Measles, Mumps, Typhoid, Influenza, Septic fevers, Pneumonia, etc. It is an antipyretic which requires no apparatus and is always at hand.

In Winter, cold air from an open window or simply allowing the temperature of the sick-room to be low and cold, is safe and effective.

If the fever is not very high, it is often sufficient merely to exclude fire or heat from the room in which the patient is kept, with thin covers over the patient himself. If this be insufficient, all the covers should be removed as low down as the pelvis, and a little air may be admitted from a window.

If the fever is higher and not disposed to yield, the antipyretic must be kept in proportion, and it may become necessary to keep two windows well opened. When the out-door temperature is very low, it is often sufficient to allow a window to be open for a quarter to half an hour at a time, until the fever is reduced to 101 degrees, and then be closed until it rises, when the window may be opened again.

In some cases however it is necessary to keep the windows open, and a full blast blowing over the patient for the greater part of the day, in order to hold the temperature at the desirable point. In other cases again such severe measures may only be necessary during parts of the day when the fever naturally runs high, and the balance of the twenty-four hours the windows may be kept closed.

Several important conditions must be kept in view: In the first place, the severity of your antipyretic measure, or the amount of cold air you admit, and the amount of exposure of your patient,

is entirely determined by the height and stubbornness of the fever. Never should more exposure be allowed than is necessary to reduce the temperature to a desired point. The thermometer must be the guide, and there should never be any less exposure than is required to do this work.

Second, the patient should not be exposed below the pelvis, and the legs and feet should remain well protected, and if the feet show any disposition to become cold, no matter how high the general temperature may be, a local application of heat to the feet should always be made. A free circulation in the lower extremities is of importance, and cold feet always mean a scanty circulation in the extremities.

In the later or weak stages of low fevers, especially where the patient is much emaciated, it is well to keep the arms and hands covered, especially if they show a disposition to become cold. The elevated temperature does harm only to the organs of the *Cranium*, *Chest* and *Abdomen*, and those are the parts to which the air should be admitted freely.

There are a great many people in and out of the profession who still have some scruples about this exposure to cold air, for fear of the patient "taking cold." It however takes only a second thought to see that there is no such danger except through carelessness. *It is physiologically impossible that a cold can be taken when body temperature is above normal;* so that the taking of cold on the part of a patient can only be the outcome of negligence on the part of the nurse, by allowing the patient to remain unprotected after the temperature has become normal. This is easily guarded against; it is readily determined what degree of exposure is necessary to control the temperature.

It is important to remember during what hours of the day the temperature, by its natural course, is most apt to approach normal, and to give directions to lessen the exposure during such periods. At no time should the patient be exposed in a cold draught when asleep; for the very possibility of sleep is evidence that body temperature has fallen; sleep is not possible when the fever is high.

This method of controlling fever is so easily managed, that directions can be given to any member of the family, and carried out effectively without any danger of taking cold. After a long experience in using this method, I have never yet had a patient contract a cold.

In warm weather it is necessary that moisture be used in conjunction with the air current. The proper way to do this is to expose the stomach and chest of the patient and then keep him moist with luke-warm water in front of an open window with a good draught. In some cases, like typhoid fever, it is necessary to keep the patient moist the whole day, in order to maintain a comfortable temperature. Where the temperature is disposed to rise very high, it may be necessary to use a fan to increase the evaporation, directed alternately to chest, abdomen, back and always including the head and face. This moistening of the skin in the presence of an air current, will control any temperature if it be persistently applied; and for private practice is superior in its conveniences, to any method of tub bathing that could be instituted. It not only reduces the temperature as well as a tub-bath would, but keeps it down if the patient is properly watched, so that a case of severe typhoid can be brought under such control that the patient suffers no more from the fever during the entire course, than ordinarily he would from a mild infection. The patient's general behavior throughout the course is as you would expect in a case of mild typhoid, where the temperature naturally does not rise above 102 degrees. Patients are always bright, take their food well, the pulse remains good, sleep is natural, and emaciation and prostration are less marked than in cases where the temperature is allowed to rise to 103 or 104 degrees before it is reduced. The means are always at hand, be your patient rich or poor. Any one can carry it out after proper directions are given, and can readily be modified to suit the mildest or severest fever. It does not produce the shock and discomfort to the patient which follow the water bath or even a sponging with cold water.

Cholera Infantum. It has now become a recognized fact that the disease called *Cholera Infantum* in children, is nothing more than a form of *Sunstroke* or *heat exhaustion;* and the treatment is therefore the application of cold to reduce the temperature.

If the child is seen during the period of elevated temperature before collapse occurs, the temperature should be reduced promptly. If however the case is not seen until the condition of collapse is present and the body temperature has fallen below normal, the

application of heat to the child and the internal use of stimulants should be resorted to at once.

The diarrhœa which accompanies the collapse is probably the outcome of vasomotor paralysis and a leakage of serum from the bloodvessels into the intestines, which accounts for the fact that the stools are like water or serum, without much mucous or fœcal matter. It is also easily understood why Cholera Infantum should be so fatal after it has been allowed to go on to the stage of collapse in which the diarrhœa occurs; because by this time changes have taken place, not only in the digestive tract, but in the nervous system, which in many cases are irreparable, and will result fatally.

This subject is of far more importance however if the prophylactic side of the question be considered, than the mere treatment of the condition after it has occurred. The occurrence of *heat stroke* (Cholera Infantum) in an infant can be prevented as readily as sunstroke in the adult. Keep the child in a cool, shaded place with plenty of air, and as little clothing as is possible. If this be insufficient, the child should be bathed twice a day in front of an open window to keep the temperature normal. In this manner a healthy child can be kept throughout an entire summer without danger of Cholera Infantum, just as readily as during the cooler seasons. During a period of heat, the child should not be allowed to have anything but a thin slip over its body, and then be kept in front of an open window on the shady side of the house, with air blowing over it the entire period of the heat of the day.

It is curious enough, but true, that during three or four successive hot summer days, the temperature of babies less than a year old, is often found to be 102 or 103 degrees, and the children appear to be perfectly well, probably they may be a little languid, or at times fretful; but the mother never suspecting that anything is wrong. I have made a series of observations during the last four years to determine this fact, by taking the temperature on hot days, of as many infants as I could get access to, and it was to my surprise that I often found in apparently healthy babies a temperature of 102 to 103 degrees.

Cases of Cholera Infantum are much more frequent after a period of four or five hot days than they are after one or two days of higher temperature. The body temperature is com-

monly elevated through the entire period; but it is only after the fourth or fifth day of excessive heat that the imperfectly developed *heat regulating centres* of the infant become paralyzed, the body temperature rapidly rises, and a heat stroke or Cholera Infantum occurs. Infants, and even children less than five years old, perspire very little; and in an infant less than a year old, there is practically no perspiration, except a very little about the face and neck. The secreting glands of the skin are not sufficiently developed to become functional, and infants are therefore deprived of this means of regulating body temperature.

In the adult, perspiration and its evaporation are one of the great means of maintaining a normal temperature when exposed to great heat. The *heat producing centres* and the *heat inhibitory centres* in an infant are not developed, and consequently the thermic nervous system is not as capable of maintaining an even body temperature when the temperature of its environments is fluctuating either below or above the normal. That means, that the *infant cannot endure as much cold as the adult, and must be kept warmer in cold weather.* It also means, *that the infant cannot endure as much heat as the adult, and must therefore be kept cooler in hot weather.*

CHAPTER XXXIV.

ELECTRICITY.

Galvanic Cell. A Galvanic cell consists of a vessel containing fluid, in which two metals, *electrically dissimilar*, are placed. The metals may be *Copper* and *Zinc*, or *Carbon* and *Zinc*.

The fluid could be plain water; but to make it a better conductor, water containing a *saline* like Chloride of Ammonia or Bichromate of Potassium is used, or an acidulated liquid may be employed.

The *electric current* inside of the cell, starts from the softer metal or *Zinc*, to the harder metal or *Carbon;* outside of the cell it flows from carbon to zinc. This would make the Carbon plate the *Anode* or *positive pole* and the Zinc plate the *cathode* or *negative pole.*

Ohm's Law. The law of electrical currents discovered by Ohm is, *that the strength of an electric current, or the electric pressure, is equal to the Electro-motive force, divided by the Resistance;* or $\text{Current} = \frac{\text{Electro-motive force}}{\text{Resistance}}$ or $C = \frac{E}{R}$, in which last expression the C, E and R, are the initial letters of the forces they represent.

Electro-motive Force. The *Electro-motive force*, or "E," is entirely dependent upon, and caused by the *contact of the two dissimilar metals*, and no current can exist, and no electro-motive force can generate without this contact. It is the *electric pressure*, or the force which overcomes the resistance.

The *Electro-motive force* can be increased or diminished in two ways: First, by increasing or diminishing the electrical dissimilarity of the two metals in contact. If the dissimilarity be increased, the Electro-motive force increases in proportion; if the dissimilarity be diminished, the force diminishes.

Second, electro-motive force can be increased or diminished by increasing or diminishing the number of Galvanic cells or contacts.

Current Strength. The *Current Strength*, or "C," is the direct resultant of the *Electro-motive* force divided by the *Resistance*, and naturally varies as either or both of those two elements increase or diminish.

The *Current strength* in a battery can be increased or diminished in two ways: First by increasing or diminishing the Resistance. Second, it can be increased or diminished by increasing or diminishing the number of *cells* or *contacts;* that is, by increasing or diminishing the *electro-motive force.* In the practical use of electricity in medicine, an insufficient current is usually increased by multiplying *contacts* or *cells.*

Resistance. The *Resistance* in a battery consists of the two elements: The *Internal Resistance* and the *External Resistance.*

The *Internal Resistance* is the resistance inside the cell, offered by the *metal plates* and the *liquid* in the cell.

The *Internal Resistance* can be diminished in three ways:

By approximating the metal plates.

By enlarging the surface of the metal plates.

And by making the liquid a better conductor, by the addition of either a *saline* or an acid.

The *approximation* of the metal plates diminishes the resistance by lessening the distance of the liquid through which the electricity has to pass from one metal to another; the liquid itself offering greater resistance to electricity than the metals.

To *enlarge the metal plates* themselves or increase their exposed surfaces, diminishes resistance according to the law that the resistance of a conductor is increased or diminished directly as the square of its diameter; that is, the larger the conductor for the same current, the less resistance there is to the passing of electricity.

The *External Resistance* is all the resistance which an electric current meets outside the cell, viz: The *conducting wires*, the *Electrodes*, and the part of the human body or other substance through which the electricity is to pass. It is evident therefore that in a Galvanic battery the *external resistance* is many times greater than the *internal resistance.*

The *External Resistance* can be lessened by shortening the conducting wires, by having the wires as heavy as is practicable, and by moistening with a saline solution the skin at the point where the Electrodes are to be applied.

In a Galvanic battery, the difference between the internal and external resistance is so great that the diminution of the internal resistance has little practical influence upon increasing a current, and the current is therefore usually increased by adding more cells.

In the *Galvano-cautery* or the "Electro-cautery," the external resistance is much diminished because the conductor is short and thick; and in this application of electricity, the lessening of the *internal resistance* is of some practical consequence to increase the current.

Units of Measure. In the practical application of electricity in medicine or elsewhere, it is necessary to have definitely established *units of measure* or quantity, in the equation of Ohm's law or $C = \frac{E}{R}$. These elements C, E and R, expressed in their units, may be represented thus: Ampere $= \frac{\text{Volt}}{\text{Ohm}}$.

The *Ampere* here is the unit of *Current-strength.*

The *Volt* is the unit of the *Electro-motive* force.

The *Ohm* is the unit of *Resistance.*

These units are necessary to measure or calculate definite quantities of electricity, just as we calculate money in the unit of a *dollar*, or broadcloth in the unit of a *yard*, and estimate distances in *units of miles.* They are arbitrary units, signifying definitely known quantities of what they measure.

The *Milliampere* is $^1/_{1000}$ part of an Ampere, and is the established unit for an electric current used in medicine.

Currents used. In practical medicine we use the *Primary* or Galvanic current, and the *Induced* or Faradic current.

The *Primary* or Galvanic current, sometimes spoken of as the *chemical current,* is the one which proceeds directly from the cell elements in contact.

The *Induced* or Faradic current is an induction current coming from a *secondary coil,* and is directly produced by the direct or *primary* current. In this secondary coil the Induced current is not constant, but is a to-and-fro current, controlled in its alternations by an "*interrupter.*"

Divided Conductors. When an electric current is split up to flow along a number of conductors, the current sub-divides as follows:

First—*In direct ratio* as the square of the diameters of the different conductors, provided the conductors consist of the same substances, and are of the same length.

Second—If the conductors are of the same thickness and are homogeneous, but of different length, the current will split up in direct ratio as the distance or length, the shorter conductors partaking of a larger quantity of the current.

Third—If the distance be the same, the conducting wires of the same diameter, but the different wires being made of different metals, the current will split up in direct ratio as the conducting power of the several metals. These are laws of mechanics which are, however, not practicable in the use of electricity in medicine.

In a *heterogeneous conductor,* such as the human body, consisting of muscles, nerves, bloodvessels, bone, skin, etc., all of which offer different degrees of resistance to the passage of electricity, an electric current passed through any part of the human body, naturally divides, and is carried along the different structures, *in direct proportion as the conducting power of the different structures;* muscles, nerves, bone, bloodvessels, etc.; or, which is the same thing, *in inverse ratio as their resistance.* The skin, especially when it is dry, offers very great resistance to the passage of an electric current. It is therefore necessary that it should be moistened with a saline solution at the points where the electrodes or poles are to be applied.

When it is desired to pass an electric current along some particular structure like a nerve, the positive pole or electrode should be small, so that the current can enter as concentrated as possible.

Physiology. When an electric current is applied to a muscle, contraction occurs only *at the interruption of the current,* or when the circuit is made and broken. So long as the current is passing through the muscle constantly, it produces absolutely no change in its contractility; but the moment the current is broken, muscular contraction occurs.

When these interruptions of a circuit are at moderately long intervals, there is alternate contraction and relaxation of the muscle at the points of making and breaking of the circuit. When however the interruptions are very rapid, the muscle will go into a *tetanic spasm,* simply because there is not sufficient time between the interruptions to allow the muscle to relax.

The *Motor Point* of a muscle is the place where the motor nerve enters the muscle; and if an electrode be applied at that point, it will produce greater contraction than if applied anywhere else over the body of the muscle. The motor points of the different muscles are always to be selected when electricity is applied for curative purposes in palsies or for muscular exercise. When, on the contrary, the electric current is used for the purpose of testing a muscle for reactions of degeneration, it is better that the electrode be placed over the body of the muscle instead of the motor point; because the condition of the muscle, and not the sensibility of the nerve to that muscle, is to be determined.

ELECTRICITY IN MEDICINE.

Electricity is used in medicine *to diagnose* or locate lesions in the nervous system, and for the purpose of *treating palsies* and other conditions.

Diagnosis. Here we use electricity for the purpose of determining whether the lesion in a palsy is located in the Brain or *higher Neurons,* or whether the lesion is in the *Spinal system* or *lower Neurons.*

Lesions are located, first, by testing the electrical reaction of the muscles to determine the presence or absence of muscular degeneration in the paralyzed region; and second, by determining the condition of spinal reflexes.

Muscular contraction, in response to an electric current, takes place only at the interruptions, or the making and breaking of the current. There is a definite relation in a normal muscle as to the amount of contraction which takes place at the opening and closing of the circuit by positive or negative pole; and from this relation or relative reaction, normal muscles can be distinguished from muscles in process of degeneration.

In the electric reaction of a normal muscle, the *Anodal* or positive *closing contraction* is less than (<) the *Cathodal* or negative *closing contraction*, and the *Anodal* or positive *opening contraction* is greater than (>) the *Cathodal* or negative *opening contraction;* that is, when the circuit is closed with the positive pole, the contraction is less than when the circuit is closed with the negative pole; and when the circuit is broken or opened with the positive pole, the contraction is greater than the current broken or opened with the negative pole. This can be expressed in a convenient formula, thus:

$$\left.\begin{array}{l} \text{An Cl C} < \text{Ca Cl C} \\ \text{An O C} > \text{Ca O C} \end{array}\right\} \text{Normal Muscle.}$$

When a muscle undergoes degeneration, these inequalities between the *anodal* and *cathodal* closing contractions, and the *anodal* and *cathodal* opening contractions, slowly approach equality, so that the above formula will soon assume the following relation:

$$\left.\begin{array}{l} \text{An Cl C} = \text{Ca Cl C} \\ \text{An O C} = \text{Ca O C} \end{array}\right\} \text{A condition of early degeneration.}$$

If this degeneration of a muscle or group of muscles be progressive and continuous, there comes a time when on closing the circuit with the positive pole, the contraction is greater than on closing the circuit with the negative pole; and the opening of the circuit with the positive pole is less than the opening of the circuit with the negative pole; that is, the order of relative degree

of contraction of a normal muscle is exactly reversed, and can be expressed by the following formula:

$$\left.\begin{array}{l} \text{An Cl C} > \text{Ca Cl C} \\ \text{An O C} < \text{Ca O C} \end{array}\right\} \text{A condition of muscles in advanced degeneration.}$$

By these formulæ it can be determined whether a muscle is undergoing degeneration in consequence of a nerve lesion, and at the same time learn how rapid the progress of this degeneration may be. If the degeneration be very rapid and progressive, it is probable that the lesion is located either in the *Spinal Cord* or in the motor nerves. If the degeneration be very slow and not marked in degree or altogether absent, it is probable that the lesion is in the *Brain.*

Lesions of the Spinal Cord or the nerves themselves are accompanied by progressive and more or less rapid degeneration of the muscles, because the *trophic centres* are located in the spinal apparatus, and the destruction of these centres necessitates the degeneration of the muscles which they supply, because their nutrition becomes impaired. If, on the contrary, the lesion be in the Brain, these trophic centres are not interfered with, and consequently the muscular degeneration can only go on in so far as the muscles waste *from disuse* or want of exercise.

There is another way, which is less scientific, but far more practical and convenient, to discover muscular degenerations, than by the above equations or formulæ. This is done by using the *different electric currents*, and employing them with different degrees of rapidity of interruptions, thus: A degenerating muscle will cease to contract to a rapidly interrupted Faradic current when it still responds to a slowly interrupted current; and as the degeneration goes on, the muscle will entirely cease to respond to the Faradic current, when it still contracts to the making and breaking of a slowly interrupted Galvanic current. This is probably the most practical way of determining the presence of degenerating muscles.

In *practical diagnosis*, to discover the location of lesions, these reactions will only assist in determining as to whether the lesion is located in the Brain or in the Spinal apparatus; but to learn in what part of the spinal or peripheral apparatus, is a matter of mere probability and clinical experience.

If, in a case suffering from palsy of recent occurrence, there be marked degeneration of muscles, and the reflexes impaired, the probabilities are that the lesion is in the nerve trunks, either from pressure, section, or other injury; because in degenerative diseases of the Spinal Cord, the muscle degeneration is not as rapid as it is in lesions of the nerve trunks, unless it be in a child, in whom there may be an acute Anterior Poliomyelitis.

On the other hand, in a case where the muscular degeneration is slow but progressive, and the reflexes are impaired, the probabilities are that the lesion is in the Spinal Cord; because in lesions of the cord the muscles degenerate only as fast as the corresponding trophic centres in the cord, tributary to those muscles, undergo degeneration.

Again, if there be a case of palsy in which muscular degeneration is not marked or almost absent and the reflexes may or may not be impaired, the probabilities are that the lesion is in the higher brain centres, because evidence of trophic interference is absent.

THERAPEUTIC USES.

Electricity is used in practical medicine in *Palsies, Anæsthesia, Neuralgias, Muscular Rheumatism,* and as a *Tonic to Muscles.*

Palsies. Palsies may be *functional,* or they may be of *organic origin.*

Functional palsies are conditions in which the nerve centres or nerve structures are suffering rather from a depression of function than from any organic change in the structure itself. In some functional palsies there may be structural change, together with functional depression. This is especially true in diphtheritic paralysis. In others, there is a purely temporary depression of function.

The functional palsies are almost exclusively of *toxic origin,* among which the most common are: Palsies from Lead, Mercury, Arsenic, Alcohol and Tobacco; and palsies following toxins, like Influenza, Diphtheria, Typhoid and other infectious diseases. The most common functional palsy which is not of toxic origin is *hysterical paralysis,* often associated with hysterical anæsthesia.

In these functional palsies, with little or no structural change, the electric current is of enormous value. It not only stimulates

and exercises the muscles, but it reaches the depressed nerve centres themselves and arouses them to functional activity.

Organic Palsies are conditions of local or general paralysis, in which there is a lesion of organic character, either a structural change or injury in the *nerve trunks*, the *Spinal Cord* or in the *Brain*. Where the lesion is of a progressive and incurable character, it is readily seen why electricity is of little or no value, except in so far as it may give temporary relief.

Where the lesion, though organic in origin, is of a character which may be curable or its progress be arrested, and the destroyed structures or nerve centres be replaced, electricity becomes of distinctly more value in bringing up the lost functions and tone of the muscles themselves. But in no case of organic palsy can the application of electricity be of any more benefit than simply to exercise the muscles, and increase their nutrition and growth to a full capacity. Injury to the nerve centres themselves cannot be changed or improved by an electric current; but will only improve in so far as nature's process may repair the damage.

Contra-indications. Electricity is *contra-indicated* and capable of doing harm in all palsies with organic lesions, either in the Brain, Cord or nerve trunks, at a time when there is active inflammation at the seat of lesion; for the electric current tends to excite functional activity and increased blood supply in the surrounding tissues, which increases the existing inflammation. Electricity should therefore never be employed in case of apoplexy or in palsies of spinal origin, until all active inflammation has disappeared, and until there is a natural disposition to improvement. It is only then that the electric current is capable of doing good by toning up the muscles themselves.

The current selected in the treatment of palsies, should always be the one *which produces the greatest amount of muscular contraction with the least inconvenience or pain to the patient.* This most frequently is the Faradic current. Sometimes better results are derived from the interrupted Galvanic current; and to determine which to use, can only be done by testing or trying the two currents.

In the application of the current, the electrode should always be applied to the *motor point* of the muscle which is to be exer-

cised; and both the electrodes and skin be moistened with a saline solution to overcome the resistance of the dry skin.

Anæsthesia. In peripheral anæsthesia, which may be of hysterical or toxic origin, the rapidly interrupted Faradic current should be employed, and the *dry electric or wire brush* be used as the electrode over the affected surface. This brush produces intense peripheral irritation and rouses up the peripheral sensory nerves to natural sensibility.

Neuralgias. In peripheral neuralgias, such as *facial neuralgia, neuralgic* or *rheumatic sciatica*, the electric current is often of very great service. In these cases the *constant mild Galvanic current* is usually the one which gives the best satisfaction; and the current should be passed toward the periphery, with the positive electrode over the exit of the nerve, and the negative pole over its peripheral distribution. If, during the time that the current passes, and after the application is complete, the pain of a sciatica or other neuralgia is lessened, it is evident that the further application may aid in improving the patient's condition. If, on the contrary, there is an increase of pain at the time the current passes and afterwards, it is evident that there is active inflammation in the nerve trunk, and that the condition is made worse by the application of electricity, and should be discontinued.

Muscular Rheumatism. In old cases of muscular rheumatism, it is often beneficial to apply the Faradic current to the region of the rheumatic pains. It sometimes gives great relief temporarily and appears to improve the condition permanently. Whether this improvement be in consequence of any change which the electric current may bring about in the nutrition of the part, or whether it modifies and accelerates the circulation in the part affected, is not clear; but that there is practical benefit coming from it in many cases of chronic rheumatism, is matter of clinical experience.

As a Tonic. Electricity is used in conjunction with *massage* in the so-called *Rest Cure* for neurasthenia. The object of its use here is to bring about muscular exercise of a passive character, and thereby save the central nervous system from taking share in this exercise, the electricity replacing nerve

impulses. It replaces voluntary movements for the purpose of keeping up general nutrition of the muscles, and allows the nervous system a complete rest.

For tonic purpose the Faradic current is usually employed. The current is applied to each part or member of the body, beginning with the arm of the one side, and applying it to every muscle separately, then the muscles of the abdomen and back of the same side, and finally the muscles of the lower limb, including every large muscle of the leg and thigh. After this, the muscles of the corresponding members of the opposite side should be exercised in like manner. When this is accomplished, the so-called "electric bath" may be administered; in which there are large electrodes or sponges, one placed at the nape of the neck, and the other at the buttock or between the knees, and a very strong rapidly interrupted Faradic current allowed to pass. The time consumed for a single *electric seance* may be from forty minutes to an hour. Thus electricity applied daily in a case of "rest treatment," will keep up muscle nutrition and muscle tone for weeks, while the patient himself is not making a single exertion.

CHAPTER XXXIII.

PRESCRIPTION WRITING.

The question often arises as to the property-rights or ownership of a prescription, after it is written by a physician, for a patient, and compounded by a druggist. The physician could claim it, from the fact that it is his professional knowledge which is dispensed on it; the druggist could claim it on the ground that he needs it as a matter of protection against errors which might occur in its administration by the patient; and the patient could claim it because he has paid a fee for it, in return for which it was given to him by the physician.

It is the popular impression that the prescription should be the property of the one who pays for it, and the Courts of Justice in many States in this country have so decided; while in Europe it is a universal legal definition, that a prescription is the property of the person who pays for it.

It is a mistake to question ownership or *property-rights* of any prescription after it has been filled by the druggist or fully executed; for, after that is accomplished, it truly has no property-value, unless its privileges be abused either by the patient or druggist. The misleading language used in reference to the obtaining of prescriptions is what gives rise to the opinion and even conviction that it has property-value. The patient says: "I have paid the doctor a dollar or two dollars, in lieu of which he has given me this prescription, and it is therefore so much property to me." The doctor often says: "My charges for prescriptions are so much and so much," when he truly refers to his fee for a *visit* or *consultation*. But the physician in point of fact never charges, or bases any part of his charges for consultation on the prescription or prescriptions which he writes. The fee is always the same, whether he writes no prescription, or three or four of them. The physician's fee, like an attorney's fee, is wholly based upon the value of his time for examination or study of the case, and his professional advice. The prescription which

is written is simply a necessary *communication or note* to the druggist, directing him what medicine or medicines he shall dispense, and how he shall direct the patient to take them. The fact that the prescription is handed to the patient, and the patient takes it and carries it to the druggist, is simply using the patient as a messenger to carry this communication. If the physician had his medicine in his office, he would dispense it and give the directions, and then add to his charge for advice the price of the medicine; and the patient would pay the same amount of money as he now pays to both druggist and physician, without ever getting a prescription; and the fulfilment of the transaction or the satisfaction of the fee would be the same.

A glance at the history of prescription writing will make this clearer. Many years ago, when physicians had to gather their plants, prepare their own decoctions and infusions, and dispense in every respect their own medicines, no prescriptions were used. But when the druggist appeared on the scene, the preparing and dispensing of medicines were delegated to him, and thus relieved the doctor of this task. In those early days it was the practice that the physician would write a personal note to the druggist and give him detailed instructions what medicines to prepare, how to prepare them, and what instructions to give to the patient for taking them, and sign his own name. This was sealed and sent to the druggist, who executed the order as given. This personal note of necessity, as all letters or communications do, belonged to the druggist, who filed it as he would file any other business letter; and it was only in the course of time, and as a matter of convenience and uniformity, that this personal note was ultimately reduced into a technic form, which constitutes our present prescription. But its purpose and relation to the parties concerned, are not in the least changed. It remains as much to-day a communication from the doctor to the druggist as it did then, and rightfully belongs to the druggist, not as a part property, but as a source of reference for his own purposes, and for his own safety to protect himself against any errors for which he may not be responsible.

There is furthermore a reason why a prescription should be on file with the druggist instead of being held by the patient: It is the doctor's technic information which it contains, and it should be so placed that he at all times can be privileged to refer to it if he chooses. It is also necessary to do this, to prevent the

public from abusing privileges which they could probably otherwise not resist, in using the prescription according to their own judgment amongst their friends. That the druggist may occasionally abuse these same privileges is true, but such abuse can only be found to occur by the few and not by the many.

A physician's prescription holds the same relation to the patient as a "Law-brief" of an attorney holds to his client. A client can as reasonably lay claim to a "Brief" which has been prepared for a certain civil case in which he is a party in Court, as a patient can claim the ownership of a physician's prescription calling for a compound or medicine needed in the treatment of his ailment. In the first instance, the Brief is a concise statement of law bearing on the case in hand, and is intended to serve as a convenience to both attorney and Court, and so soon as the case is settled, the Brief is not returned to the client, but is filed as a part record of the Court. The physician's prescription is in like manner a concise statement of instructions to his druggist for the convenience of both, and so soon as it is executed and the patient has the medicine called for, it ceases to have property value, and should go on the druggist's file as a source of reference or *business record.*

Prescription Technique. Practical prescription writing is both an art and a science; an art in so far as the technique of its form, order and language are concerned; a science in so far as the combination of its elements or ingredients will meet exact therapeutic indications. The variety of combinations of the same ingredients or drugs, with but a change in their proportions to meet different diseased conditions, is the highest kind of test for a physician's therapeutic skill. The doctor who can take the same remedies or drugs and can so vary their proportions in prescriptions that every new combination will have a resultant action which will produce the effect of a new remedy and will meet an entirely different therapeutic indication, possesses far higher therapeutic skill than the physician who needs a new drug for every new symptom he meets, or the surgeon who needs a different instrument for every turn of his hand. It is the development, of this kind of tact in a physician which counts in the aggregate of his therapeutic intelligence to meet shaded conditions of disease in the sick room.

In the art of prescription writing, it is necessary to follow a difinite order or form in which to write the component elements

or ingredients, so that there may be a logical succession of steps from start to finish. Thus:

First.—The *names* of the drugs or ingredients which are to be employed should be written, as the first step. These names should succeed one another *in the order of their importance in that particular prescription*, regardless of the toxicity or activity of such drug. The drug or ingredient which bears the greatest part of the burden in such prescription, should be written first; the one next in importance should be placed second; the one of third-rate importance, if there be such, should occupy third place; and last of all the vehicle, which should always be written, if the prescription be a liquid, in sufficient quantity to make the entire bulk of the prescription, or its Latin equivalent, "q.s. ad" (quantum sufficiat ad).

Second.—After the ingredients are placed, the directions to the druggist how to compound or prepare the medicine should follow, whether it be pills, powders, capsules, or solution, and what number or quantity is wanted, which likewise indicates the number of doses in the whole prescription.

Third.—The directions to the patient or family should follow next. These should be written in plain and explicit English without abbreviations, and in as brief wording as can be done with clearness. In this step the size of each dose, and frequency of repetition of doses, is considered, both of which are necessary conditions from which to estimate the quantity of each ingredient in the prescription.

Fourth.—The last step is the estimating and putting down the quantity of each drug. These quantities are obtained *by multiplying the individual dose of each drug by the number of doses in the whole prescription*, and such quantity should always be expressed in Roman characters, and be reduced to its highest denomination without a remainder; thus, 30 grains should be written ½ dram; 4 fluidrams should be written ½ fluidounce, etc.

Endings. Prescriptions should be written in Latin, so as to conform with professional customs and have them uniform for all countries and localities. The case-ending, employed in prescriptions, is the *genitive singular* following the word "recipe" or its character "℞," which stands at the head of every prescription. These genitive endings follow the ordinary Latin order, so that the names of drugs whose nominatives end in *um*, as Acidum, take the ending i; names ending in *ium*, as Opium,

end in ii; those ending in *us*, as Spiritus, end in i; those ending in *a*, as Belladonna, take the ending *æ*, and so on.

A few drugs, as Buchu, Catechu or Chloral, are indeclinable, and take the same endings throughout.

Abbreviations. Abbreviations in prescription writing are at all times inelegant; but their universal employment by physicians has made the custom an unwritten law, so that they are not only allowable but in truth desirable. The origin of these abbreviations may have been to save time, which is naturally required to write out long Latin terms; more probable is it however that their general adoption was the outcome of avoiding technical endings, which are at all times, to say the least, inconvenient, and to the beginner often embarrassing. Such abbreviations must however at all times be intelligible, so that under no circumstances can they be mistaken for names of other drugs and make errors on the part of the druggist probable. There are some fixed and continuously used abbreviations which can always be employed with propriety, such as Tr. for Tinctura; Ext. for Extractum; Syr. for Syrupus; Pil. for Pilula, etc. The phrase "q. s. ad" is constantly employed to indicate the quantity of a vehicle; or the phrase "q. s." (quantum sufficiat) is employed to indicate the quantity not known to the physician, but to be determined by the druggist; as in indicating a pill-mass, or the mucilage for an emulsion, or the vehicle in a suppository, all of which are to be determined by the druggist.

Signs of Quantities. The following signs are used to indicate measure and kind of substances: gr. for grains, m. for minim, gtt. (gutta) for drops, ʒ for dram, fʒ for fluidram, ℥ for ounce, f℥ for fluidounce, O for pint, lb. for pound.

The character "$\overline{aa}$," a corruption of the Greek preposition "*ana*," is used to indicate equal quantities of two or more ingredients. Such ingredients thus indicated must however either be all liquids or all solids, as Ext. Belladonna, Ext. Nucis Vom., $\overline{aa}$ gr. v, which means, of each five grains; or Tr. Cinchonæ Comp., Tr. Gentianæ Comp., $\overline{aa}$ fʒj, which means of each one fluidounce, etc.

It is necessary to become familiar with all of these characters and symbols and the technic form of prescription writing, and to acquire them *not by memory, but by practice*, before a per-

son can expect to write prescriptions which will meet medicinal indications; for the abbreviations, forms, spelling, order of ingredients, estimation of quantities and individual doses, must become *automatic*, so that no part of the physician's attention shall be attracted or divided when he is writing a prescription, but his entire force be concentrated upon the purpose at which he is aiming. To closely meet the therapeutic indications of the sick, it is necessary that prescription writing as an exercise, be practiced with great frequency by the beginner, so that the characters, arrangement, etc., become not so much a part of his memory as a part of the muscular education of his right hand.

In writing for solutions of certain per-cent. strength, it is probably simplest to multiply the number of grains in an ounce or the number of minims in a fluidounce, either of which is 480, by the per-cent. strength which is desired, and the result gives you the number of grains or minims in each fluidounce of the solution; thus: you wish an 8-per-cent. solution of cocaine, you multiply 480 by .08, or $480 \times .08 = 38.40$, or the number of grains of cocaine in each fluidounce.

In the every-day routine prescription writing of a physician, it is bad practice to order large quantities at a time, the bulk of which is vehicle, and then order the dose a dessert or tablespoonful for administration. The charges for prescriptions by druggists are generally in proportion to the amount or quantity, and a six-ounce mixture costs about twice as much as a three-ounce mixture, even if the same quantity of medicine is in both, with a difference only in quantity of vehicle. It is better and more fair to your patient to order his medicine in a more concentrated form, and have him dilute it freely at the time of administration.

In prescribing medicines, it is important that every effort should be made to disguise their taste by exhibiting them in pleasant vehicles, or by the use of capsules and pills. A good part of the success or failure of a physician often depends upon this fact. Advertising doctors and homœopaths overcome this evil by leaving out the medicine and a regular physician has to compete with this as far as possible by disguising it.

PRESCRIPTIONS.

The following prescriptions are appended, which, properly modified to suit the requirements of individual cases, may be

helpful to students and recent graduates in medicine until formulas of their own may be developed from personal bed-side experience.

Lumbago in old people with uric acid in the urine:

℞ Potass. Citratis . ʒiij
Sodii Salicyl. . . ʒj
Tr. Gentian. Comp. . fʒj
Elix. Aromat. q.s. ad fʒiij

M. Sig. A teaspoonful in water every three hours.

For acute or sub-acute articular rheumatism:

℞ Ammon. Salicylatis . ʒiij
Strontii Salicylatis . ʒij
Tr. Cardamomi Comp. fʒiss
Aquæ q.s. ad . . fʒiv

M. Sig. A teaspoonful in water every two or three hours;

or,

℞ Ammon. Salicylatis . ʒij
Phenocoll Hydrochloratis ʒj

M. Ft. Cap. No. xxiv.

Sig. One every two or three hours.

For chronic muscular rheumatism

℞ Ammon. Salicylatis . ʒiij
Ammon. Iodidi . . ʒij
Inf. Gentianæ q.s. ad fʒiij

M. Sig. A teaspoonful in water after meals and before retiring;

or,

If a gouty element be present:

℞ Sodii Salicylatis . ʒij
Antipyrini . . ʒj
Vin. Colchici. . . fʒss
Aq. Menth. Pip. q.s. ad . . . fʒiij

M. Sig. A teaspoonful in water every four hours.

For cystitis, acute or sub-acute:

℞ Ext. Buchu Fl'd
Ext. Uva Ursa Fl'd āā fʒvj
Tr. Belladonnæ . fʒij
Tr. Gentianæ Comp. q.s. ad . . fʒiij

M. Sig. A teaspoonful in water every four hours.

For cystic irritation, with highly acid urine:

℞ Potassii Citratis . ʒij
Ext. Buchu Fl'd
Ext. Uva Ursa Fl'd āā fʒiij
Spts. Ætheris Nitrosi fʒss
Aq. Menth. Pip. q.s. ad fʒiij

M. Sig. A teaspoonful in water every three or four hours.

For cystic irritability and incontinence of urine, due to nervousness, in women and children. To be given in doses according to age of patient:

℞ Sodii Bromidii . ʒiss
Atropinæ Sulphatis gr. 1/8
Aquæ q.s. ad . fʒij

M. Sig. A teaspoonful in water every five hours.

Mouthwash for stomatitis:

℞ Listerinæ
Aq. Rosæ āā . fʒij

M. Sig. Use twice daily;

or,

℞ Potassii Chloratis . ʒj
Thymol . . . ʒss
Alcoholis . . . fʒss
Aquæ q.s. ad . . fʒiij

M. Sig. Use three times a day.

For a pharyngitis:

℞ Potassii Chloratis . ʒij
Ext. Rhois Glabræ .
Ext. Hydrastis Fl'd āā fʒss
Aquæ q.s. ad . fʒiv

M. Sig. A teaspoonful in sufficient water to gargle. Use every two hours;

or,

℞ Argentii Nitratis gr. xx
Aquæ q.s. ad . . fʒss

M. Sig. Apply to pharynx with brush once daily.

To arrest vomiting:

℞ Cocainæ Hydrochloratis gr. ij
Morphiæ Sulphatis gr. ss
Aquæ q.s. ad . . fʒj

M. Sig. A teaspoonful every half hour;

or,

℞ Bismuthi Subnitratis ʒj
Pulv. Opii . . gr. iij
Acidi Carbolici . gtt. v
Hydrarg. cum Cretæ gr. ij

M. Ft. Chart. No. vi.

Sig. One every half hour.

For acid dyspepsia:

℞ Argent. Nit.
Ext. Hydrastis
Ext. Nucis Vom. aa gr. x
Manna . . q.s.

Ft. Pil. No. xxx.

Sig. One an hour before each meal;

and

℞ Spts. Ammon. Aromat. fʒss
Tr. Gentian. Comp. fʒj
Aq. Menth. Pip. q.s ad fʒiij

M. Sig. A teaspoonful in water five minutes before eating.

Suppository for heart disease, with restlessness and insomnia:

℞ Ext. Digitalis . gr. xij
Ext. Opii . . gr. vj
Trional . . . ʒj
Chloralose . . gr. xxiv
Ol. Theabrom. q.s.

M. Ft. Suppos. No. xii.

Sig. One at bedtime.

For chronic bronchitis in debilitated old people:

℞ Ammon. Chlor. . ʒv
Tr. Opii Deod. . fʒj
Tr. Nucis Vom. . fʒj
Syr. Prun. Virgin. q.s. ad . . . fʒiv

M. Sig. A teaspoonful in water every three or four hours.

For heat diarrhœa in summer:

℞ Tr. Catechu Comp. fʒij
Acid. Carbol. . gtt. xij
Tr. Opii Deod. . . fʒiss
Elix. Aromat. q.s. ad fʒiij

M. Sig. Two teaspoonfuls every two hours until relieved;

or,

℞ Bismuth Subnit. . ʒj
Salol . . . . ʒss
Pulv. Opii . . gr. iv

M. Ft. Cap. No. viii.

Sig. One every two hours.

For hepatic congestion:

℞ Hydrarg. Chlorid. Mit. gr. ij
Pulv. Ipecac. . gr. vj
Sod. Bicarb. . . ʒj

M. Ft. Chart. No. xii.

Sig. One every three hours;

or,

℞ Acid. Nitrohydrochlor. fʒij

Sig. Five drops in water every three hours.

For hepatic torpor, with constipation:

℞ Sod. Sulph.
Sod. Phosphat. āā ʒiss
Potass. Iodid. . . ʒj
M. Ft. Chart. No. xii.

Sig. One in a glass of water, in the morning on rising.

For lienteric diarrhœa:

℞ Acid. Carbol. . gtt. xij
Bismuth. Subgal. . ʒj
Hydrarg. Cum Cretæ gr. iij
Pulv. Opii . . gr. vj
M. Ft. Cap. No. xii.

Sig. One before each meal.

Suppository for inflamed hemorrhoids:

℞ Cocaine Hydrochlor. gr. iij
Iodoformi . gr. xxiv
Ext. Opii . . gr. iij
Ol. Theabrom. q.s.
M. Ft. Suppos. No. vi.

Sig. One every four or five hours.

For an irritable stomach, after a debauch:

℞ Tr. Capsici . . fʒiij
Tr. Nucis Vom. . fʒij
Aq. Menth. Pip. q.s. ad fʒij
M. Sig. A teaspoonful, in water, every three hours.

For cystic irritability due to alkalinity of the urine:

℞ Acidi Boraci
Acidi Benzoici
Salol . . . . āā ʒj
M. Ft. Cap. No. xxx.
Sig. One every two hours.

For cardiac valvular disease, with failing compensation:

℞ Tr. Digitalis
Tr. Nucis Vom. . āā fʒj
Tr. Strophanth. . fʒss
M. Sig. Twenty-five drops in water every four hours.

For an acute bronchitis in the early stage:

℞ Potass. Citrat. . ʒv
Suc. Lemonis . . fʒiss
Syr. q.s. ad . . fʒiv
M. Sig. Two teaspoonfuls in water every hour;

or,

℞ Potass. Citrat. . ʒiij
Syr. Ipecac. . . fʒiij
Vin. Antimonii . fʒij
Syr. q.s. ad . . fʒiij
M. Sig. A teaspoonful every two hours.

Expectorant for later stages of bronchitis:

℞ Ammon. Chlor. . ʒv
Tr. Opii Deod. . fʒj
Mist. Glycyrrhizæ Comp. q.s. ad . . fʒiv
M. Sig. A teaspoonful, freely diluted, every two or three hours;

or,

℞ Ol. Eucalypti
Ol. Santali
Terebini . . āā fʒj
M. Div. in Cap. No. xxiv.
Sig. One every three hours.

For nervous asthma:

℞ Sodii Bromidi . . ʒss
Tr. Lobeliæ . . fʒij
Tr. Opii Deod. . fʒiss
Tr. Belladonnæ . fʒij
Syr. Yerb. Sant. q.s. ad fʒiv
M. Sig. Two teaspoonfuls in water every two or three hours.

For bronchitis, with asthma:

℞ Ammon. Chlor. . ℥ss
Tr. Lobeliæ . . f℥j
Codinæ Sulph. . gr. ij
Aq. Menth. Piper. q.s. ad . . . f℥iij

M. Sig. A teaspoonful every two hours;

or,

℞ Belladon. Foliæ . .
Stramonii Foliæ . .
Tobaci (tobacco) . āā ℥j

M. Sig. Make into cigarettes and inhale smoke.

For bronchitis, asthma and cough in early phthisis:

℞ Creosoti . . . f℥ij
Tr. Opii . . . f℥iss
Tr. Nucis Vom. . f℥j
Spts. Frumenti q.s. ad f℥viij

M. Sig. A teaspoonful, in water, four times a day.

For a scrofulous child, with chronic catarrh and enlarged glands:

℞ Ol. Morrhuæ . f℥iiss
Calcii Lactophosphat. ℥j
Liq. Potass. Arsenitis f℥j
Pulv. Acaciæ q.s.
Syr. Prun. Virgin. q.s. ad. . . . f℥vi

Ft. Emulsio.

Sig. Two teaspoonfuls after each meal.

For fever from local irritation in children:

℞ Antipyrini . . gr. x
Sodii Bromidi . gr. xx
Tr. Aconit. . . gtt. x
Syr. . . . f℥j
Aq. q.s. ad . . f℥ij

M. Sig. Half teaspoonful every three or four hours.

For whooping cough in children:

℞ Sodii Bromidi . . ℥j
Antipyrini . . ℥ss
Chloralis . . . gr. xij
Tr. Belladon . . f℥iss
Syr. . . . . f℥j
Aq. Rosæ q.s. ad . f℥iij

M. Sig. Half to one teaspoonful every three or four hours according to age of child.

For summer diarrhœa in children:

℞ Bismuthi Subnit . ℥ss
Hydrarg. Cum Cretæ. gr. j
Salol. . . . gr. vj
Pulv. Opii. . . gr. iij
Pulv. Pepsini . . gr. x
Sacchari. Lactis . gr. xij

M. Ft. Chart. No. xii.

Sig. One every four hours;

or,

℞ Pulv. Pepini . . ℥ss
Bismuthi Subgal. . gr. xx
Tr. Opii Camph. . f℥j
Glycerini . . . f℥ss
Aq. q.s. ad . . f℥ij

M. Sig. A teaspoonful every four hours.

A tonic pill for a neurasthenic, with anæmia and constipation:

℞ Acid. Arseniosi . gr. iij
Ext. Nucis Vom.
Ext. Hydrastis āā gr. xxv
Ext. Cascaræ . . ℥ss
Ferri Carbonatis . ℥iiss

M. Ft. Cap. No. lx.

Sig. One after each meal.

For a stomachic bitter in a case of convalescence:

℞ Strych. Sulph. . . gr. j
Tr. Gentianæ Comp.
Tr. Cinchonæ Comp. āā f℥j
Acid. Nitrohydrochlor. f℥j
Aq. q.s. ad . . f℥iv

M. Sig. Two teaspoonfuls, in water, four times a day.

For nervous headache, with insomnia:

℞ Sodii Bromidi . . ʒss
Antipyrini . .
Trional . . āā ʒss
M. Ft. Chart. No. v.
Sig. One in water at bedtime.

An active hypnotic for alcoholic or other marked insomnia:

℞ Morph. Sulph. . gr. ij
Chloralis . . ʒij
Hyoscini Hydrobromatis gr. 1/6
Aq. q.s. ad . . fʒij
M. Sig. A teaspoonful in water every hour until sleep occurs;

or,

℞ Sodii Bromidi . . ʒss
Trional . . . ʒj
Chloralose . . gr. xv
M. Ft. Chart. No. iv.
Sig. One in water every half hour.

For seborrhœa of the scalp, with scaliness and falling of the hair:

℞ Resorcin. . . ʒiss
Menthol. . . ʒss
Ol. Ricini . . fʒj
Spts. Lavand. Comp. fʒss
Alcoholis q.s. ad . fʒv
M. Sig. Apply to scalp twice a week.

For ivy poisoning or other severe itching:

℞ Menthol. . . . ʒij
Ext. Grindeliæ Fl'd fʒj
Alcoholis q.s. ad . fʒiij
M. Sig. Apply to part with a brush.

For eczema in babies:

℞ Resorcin . . . ʒss
Glycerini . . fʒss
Aq. Rosæ q.s. ad . fʒiij
M. Sig. Apply twice daily.

Ointment for eczema or acne:

℞ Hydrarg. Chlor. Mitis ʒiss
Pulv. Acetanilid . ʒj
Acid. Carbol. (crude) gtt. xv
Petrolati . . . ʒss
M. Ft. Ung.
Sig. Apply locally at night;

or,

℞ Ichthyol.
Resorcini
Ung. Hydrarg. āā ʒj
Petrolati q.s. ad . ʒj
M. Ft. Ung.
Sig. Apply morning and night.

Dusting powder for heat scalds or abrasions:

℞ Pulv. Acetanilid . ʒj
Hydrarg. Cum Cretæ ʒiss
Zinc. Carbonat. Precip. ʒij
Amyli . . . ʒss
M. Sig. Apply to part twice daily.

Laxative pill for chronic constipation:

℞ Strych. Sulph. . . gr. iij
Physostigminæ Sulph. gr. ij
Ext. Belladonnæ gr. viij
Ext. Cascaræ . . ʒss
Aloin . . gr. xij
M. Ft. Pil. No. lx.
Sig. One at bedtime.

To produce free sweating:

℞ Pilocarpinæ hydrochlor. gr. j
Antipyrini . . gr. xv
Tr. Aconiti . gtt. xx
Aq. q.s. ad . fʒj
M. Sig. A teaspoonful every hour until free sweating occurs.

For a hydragogue cathartic to relieve dropsy.

℞ Elaterini . . gr. ss
Ext. Colocynth. Comp gr. vj
Ext. Belladonnæ . gr. j
Ol. Caryophylli . gtt. vj
M. Ft. Pil. No. vi.
Sig. One an hour before breakfast.

Tonic pill for cerebral or sexual exhaustion:

℞ Strych. Sulph. . gr. vj
Phosphori . . gr. ss
Auri et Sodii Chloridi gr. v
Acid. Arseniosi . gr. iij
M. Ft. Pil. No. lx.
Sig. One three times a day, after meals.

For "mixed treatment" in old syphilis:

℞ Potass. Iodidi . ʒss
Hydrarg. Corrosivi gr. iij
Syr. Sarsaparillæ Comp. fʒiv
Aq. q.s. ad . . fʒvi
M. Sig. A dessertspoonful, in water, four times a day.

For chronic hepatic torpor, with constipation:

℞ Sodii Phosphat.
Sodii Sulphat. . āā ʒj
Strontii Iodidi . ʒj
M. Ft. Chart. No. xii.
Sig. One in a glass of water in the morning on rising.

Suppository for inflamed hemorrhoids:

℞ Cocain. Hydrochloratis gr. iij
Iodoformi . gr. xxiv
Ext. Opii . gr. iij
Ol. Theabrom. q.s.
Ft. Suppos. No. vi.
Sig. One morning and night.

For a low stage in pneumonia, with respiratory and cardiac weakness.

℞ Strych. Sulph. . gr. j
Cocainæ Hydrochlor. gr. iv
Tr. Digitalis . fʒiss
Aq. q.s. ad . . fʒij
M. Sig. A teaspoonful, in water, every two hours.

A useful mixture in scarlet fever or diphtheria; to be given according to age of child:

℞ Tr. Ferri Chlorid. fʒij
Acid. Hydrochlor. Dil. fʒss
Liq. Ammon. Acetat. fʒiss
Glycerini q.s. ad . fʒiij
M. Sig. Half to one teaspoonful, in water, every two or three hours.

To arrest hemorrhage from the kidneys or lungs.

℞ Ext. Ergotæ Fl'd fʒiij
Tr. Opii Deod. . fʒij
Acid. Gallici . ʒj
Glycerini . . fʒj
Aq. q.s. ad . . fʒiij
M. Sig. Two teaspoonfuls, in water, every two or three hours.

A blister for counter-irritation:

℞ Cerali Cantharidis q.s.
Ft. Emplast. . iii-x-v unc.
Sig. Apply as directed.

For syphilitic gumma.

℞ Potass. Iodidi. . ʒj
Aq. Menth. Piper. q.s. ad. fʒii
M. Sig. 15 to 30 minims four times a day.

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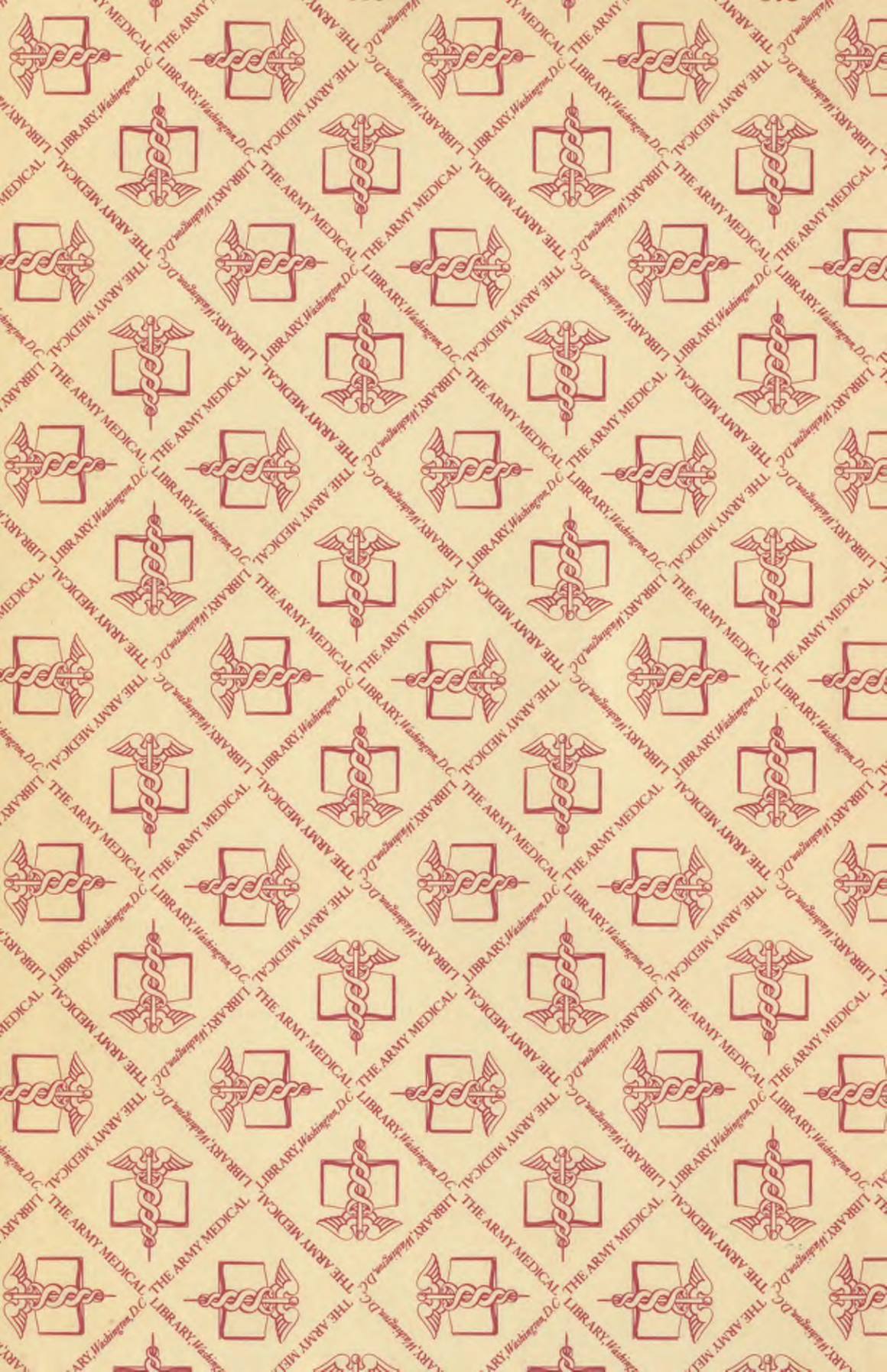
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