

Lectures on materia medica and therapeutics / delivered by C. Harrington to second year class Harvard Medical School.

Contributors

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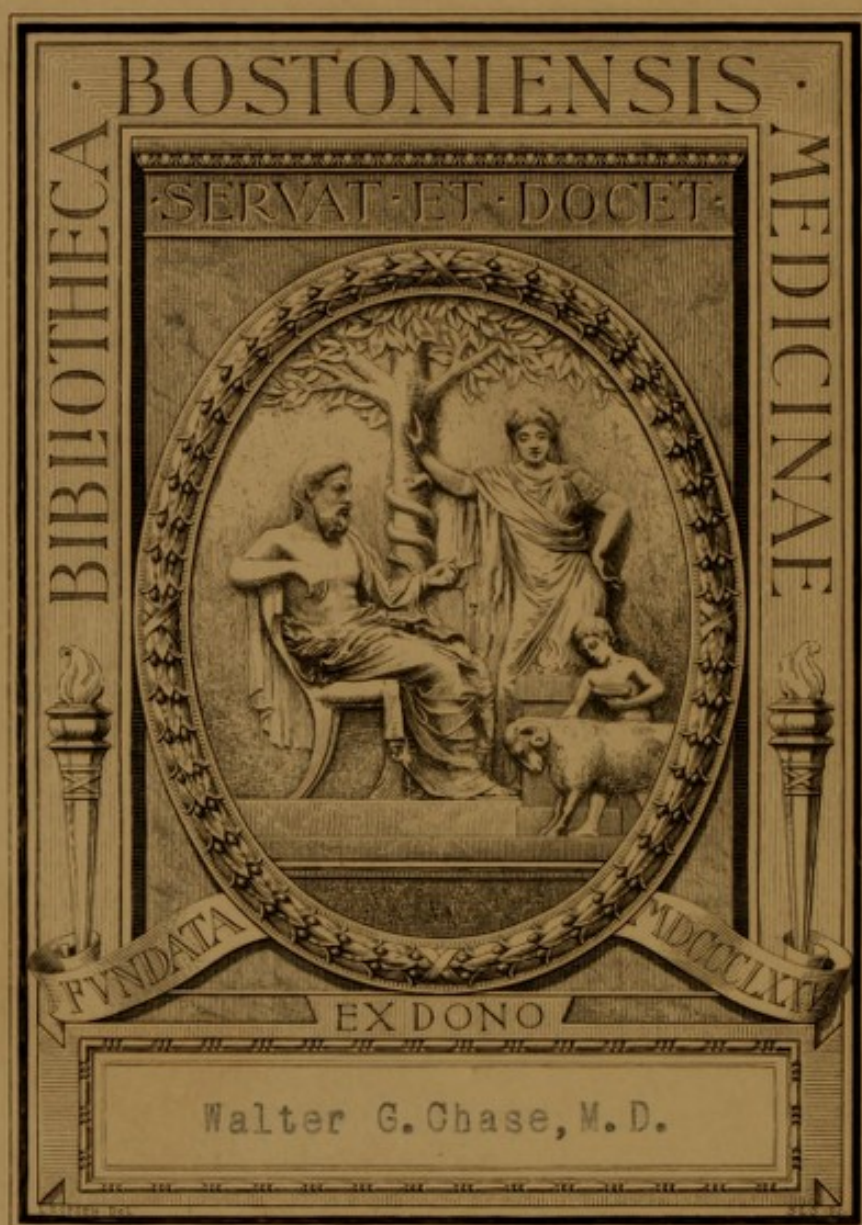
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WATERBURY, CONNECTICUT

THE RAILROADS

LECTURES
ON
MATERIA MEDICA
AND
THERAPEUTICS

DELIVERED BY
DR. C. HARRINGTON

TO SECOND YEAR CLASS HARVARD MEDICAL SCHOOL

PRINTED AT
THE CO-OPERATIVE PRESS
CAMBRIDGE, MASS.
1897.

Sulphonal

Troscil

Chloralamid.

V Excit: Motors.

VI Bromide Potass.

Sodium

Ammonium.

Calabar Bean

Amyl Nitrite

Polemoni. "

Nitro glycerine

Lobelia

Esocerin.

Valerian

Cannabior

Hoffmann's Anydrous

Ammonium salts

Alcohol

Digitalis

Caffeine

Thophranthus

5025

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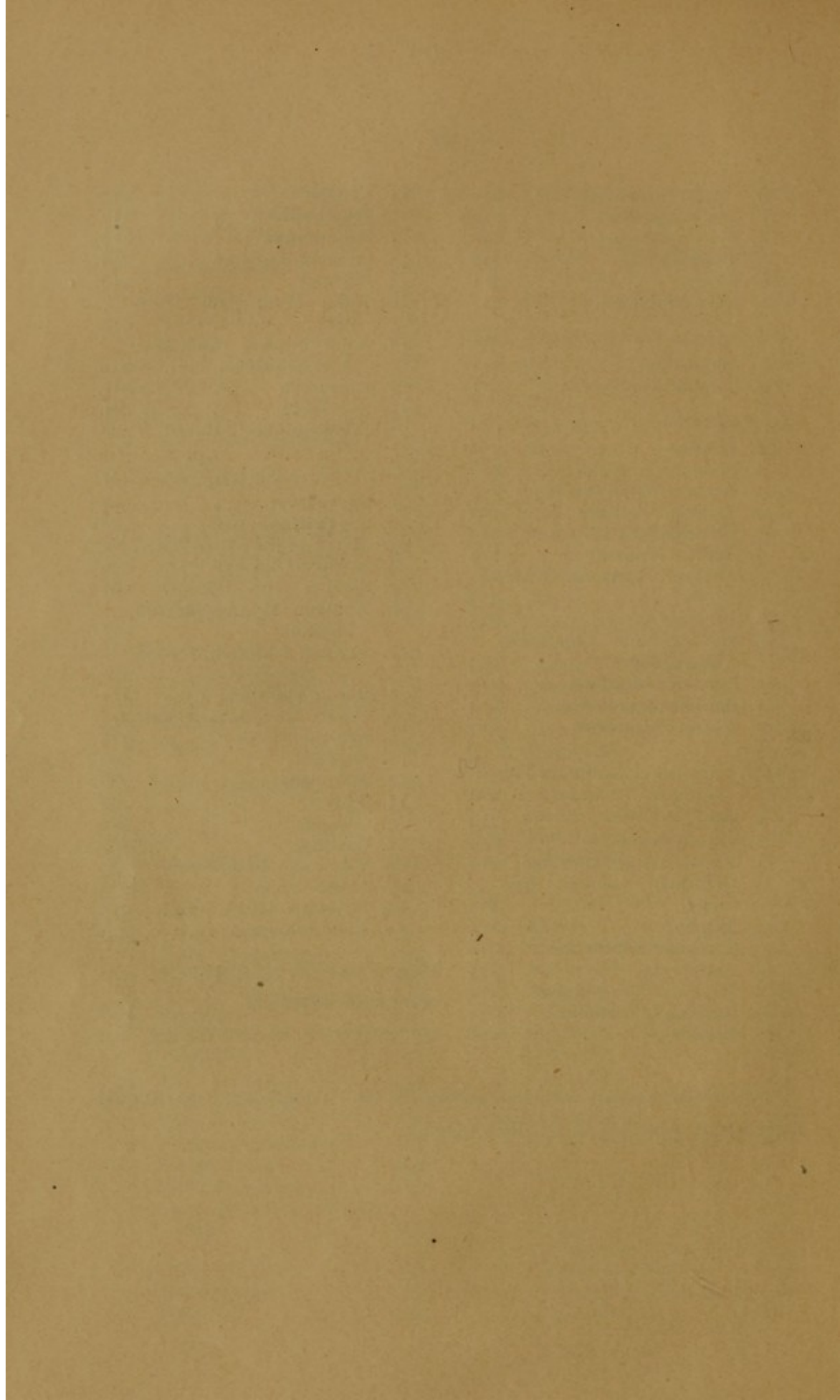
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All words marked with an asterisk [*] are unimportant, for Annual Examination according to Dr. Harrington.



MATERIA MEDICA AND THERAPEUTICS.

Materia Medica, Pharmacology, and Therapeutics form the subject-matter of the course, which is devoted to a consideration of the nature and properties of agents or remedies employed in the treatment of disease, their action on the normal and diseased body, and their therapeutical value. These remedies are of three sorts: (1) **MECHANICAL**, such as bleeding, bandaging, aspiration, etc., properly treated in surgery; (2) the **IMPONDERABLES**, including light, heat, cold, electricity, and massage; (3) and the **PHARMACEUTICAL REMEDIES**. Of the latter a list is made and published in the U. S. Pharmacopoeia. Besides the crude drugs themselves there are numerous preparations, and there are also many non-official drugs which are in common use. In this course the important medicinal agents, their doses, physiological, therapeutic and toxic actions will be considered.

IMPONDERABLES.

1. **HEAT.** *Physiological Action.* Applied to the body it causes general or local increased vascularity of the superficial blood-vessels and increased action of the heart and lungs. In moderate amounts it acts, locally and generally, as a stimulant.

Administration. Solar heat is utilized by exposing the body to the direct action of the sun. Artificial heat may be divided into dry and moist. **DRY** heat is applied locally by hot bricks, hot-water bags and bottles, hot salt bags, and rubber tubes containing hot water. It may be applied generally by raising the temperature of a room by a hot-air bath or a Turkish bath. The hot-air bath may be applied to a person sitting in a chair or in bed. The patient is placed in a chair with blankets about him and hot air is introduced. If he is in bed, the heat may be applied by means of a stove-pipe elbow, one end of which passes beneath the blankets, the other having an alcohol lamp beneath it. — **MOIST** heat is applied locally by means of moist flannels, poultices, and hop-bags dipped in hot water. Materials which retain heat and moisture longest are preferred. Moist heat is applied generally by vapor-baths, warm-water baths, 92–98° F., and hot-water

baths, 98–112° F. 104° F. is high enough to begin with, and if necessary the temperature may be raised to 112° F.

Therapeutics. In abdominal pain the local application of heat is very useful. With pain without fever or inflammation warm or hot applications are useful, but when there is inflammation, as in Peritonitis, cold may be better. Loss of body-heat is caused by Vaso-motor Paralysis, the outer layer of partially cooled tissue losing its power to contract the superficial vessels, thereby causing the surface temperature to rise to that of the interior; heat is then rapidly lost and the temperature of the whole body is uniformly cooled. This occurs in certain forms of Poisoning, and in various forms of Collapse, as shock from operations. In such cases it is important to apply heat directly rather than to apply a means to prevent the simple loss of heat. For example, wrapping the patient in blankets may prevent loss of heat but it imparts none. In general, wherever the body temperature falls materially below the normal, heat should be applied.

A warm bath is useful as a relaxant in Dislocations, Hernia, Spasms, Infantile Convulsions, etc., and in certain Chronic Cutaneous Diseases. Hot baths are useful in Exhaustion, Asphyxia, Collapse, Rheumatism and General Dropsy. In Chronic Rheumatism the hot bath assists in the elimination of uric acid; and in General Dropsy it aids the elimination of water through the skin. Hot air is good in Depression of the Vital Forces with feeble action of the heart and coldness of the surface; in Internal Congestion to produce vicarious action of the skin; in handling the feeble new-born, and in Rheumatic, Neuralgic, and certain of the Cutaneous diseases. Hot baths may be dangerous in old subjects and others with degenerated vessels. All high temperatures are contra-indicated in cases of Fatty Degeneration of the Heart, and in cases of Carditis and Valvular Obstruction.

Hot water injections are useful in Uterine Hemorrhage, and before Operations on the Perineum and Cervix. Hot water is often useful as an application to wounds during an operation, to prevent bleeding. Hot, dry applications are often useful in Neuralgias and Spinal Irritation. The stupor and coma are often relieved in the case of Uraemia by hot applications to the neck. The hot vapor bath has a more marked diaphoretic and relaxing influence than hot-water baths.

2. COLD. *Physiological Action.* The application of cold causes contraction of the blood-vessels and tissues, suspension of the secretions, and the reduction of the temperature and volume of the parts. Like heat, it has its local and general effects and uses. It acts as a direct and powerful depressant according to its

intensity, and in excess it may go so far as to cause death of the parts. In moderate amounts it brings about a return and even an increase of temperature, volume and sensibility. Locally applied, it causes contraction of cutaneous vessels, local reduction of temperature and volume, and benumbing of nerve-filaments with consequent relief of pain. The general effect of cold is to decrease the body-temperature and to cause a general stimulation. In a state of health, the effect of cold is to cause a shock, irregularity of respiration, increased pulse, and goose-flesh or roughened skin. The external temperature is lowered, since the blood is driven inward, and the nerves of the skin are depressed. There then follows a sense of exhilaration, but if cold be carried too far a period of depression comes on with weakened pulse and muscular debility due to the continued abstraction of heat. There is also an accumulation of blood in the great venous trunks, and a resulting interference with tissue metamorphosis. If cold is not applied too long it causes increased oxidation of the tissues, leading to a rise of temperature after the cessation of application.

Therapeutics. Cold is used both for its primary and secondary effects: primary, to lessen vascular and nervous excitement, and abnormal heat; secondary, to invigorate and arouse the system. It is used to check Inflammations, Hemorrhages, and to reduce Strangulated Hernia. Very often ice or a spray of ether is used in surgery to produce local anaesthesia. In Tonsillitis and Diphtheria it is often of benefit applied in the form of a wet-pack to the neck. In Sunstroke with no depression, ice is good applied to the head as a cold bath or wet-pack. In Wakefulness, where the head is hot and the circulation active, cold should be applied to the head and a hot bath to the rest of the body. The balance of circulation is thus restored and relief afforded. In Hemorrhages cold is good, since it causes a contraction of the blood-vessels, and in Hemorrhoids, etc., cold is very useful. By far the most important therapeutic use of cold is the use of the cold-bath in Fevers, especially Scarlet and Typhoid. In such cases it must be remembered that often the temperature continues to fall after the withdrawal of the bath.

Administration. Cold is applied locally by cold water, ice, spraying with ether, etc. Cold water is applied directly; ice, directly or by ice-poultices and ice-bags, made by sewing up ice and saw-dust in bags and quilting them. Spray of ether is applied by an atomizer, and the cold is produced by rapid evaporation. Cold may be applied generally by wrapping the patient in wet sheets or by cold-water baths.

PHARMACEUTICAL REMEDIES OR DRUGS.

Drugs occur in three forms : solids, liquids, and gases. There are very many classes of preparations of which the following are the principal ones : —

An **EXTRACTUM** is a solid or semi-solid made either by evaporating the fresh juice, or an aqueous, alcoholic, or acetic acid extract of the crude drug. There are thirty-two. In many cases glycerine is added to them.

An **ABSTRACTUM** is a powdered extract, so prepared that one part by weight represents two parts by weight of the crude drug.

An **EXTRACTUM FLUIDUM** is a fluid preparation so made that one minim represents one grain of the crude drug. Fluid extracts ought to be stable, but many deposit glucose and saccharine products. They contain more or less tannin and cannot be given with emulsions nor metallic salts. There are seventy-nine officinal fluid extracts.

FIXED OIL : (1) liquid fat, (2) marks paper, (3) makes soap, (4) does not distil.

VOLATILE OIL : (1) does ~~not~~ distil, (2) not fat, (3) contains aromatic substances, (4) lighter than water, (5) does not mark paper, (6) does not make soap.

A **PULVIS** is a powder of any drug reduced to a state of minute subdivision by pulverization. Of these there are nine.

TRITURATIO is made by rubbing up one part of the drug with nine parts of sugar of milk. There is only one officinal.

A **PILULA** or **PILL** is a small spherical body containing one or more medicinal agents. Many pills are compound. There are fifteen officinal and very many non-officinal.

A **MASSA** or pill-mass is a combination of medicinal agents of a proper consistency for making into pills of any desired weight.

A **TROCHISCUS** or troche or lozenge is made by mixing medicinal agents with sugar and mucilage, and is intended for slow action in the mouth. There are sixteen officinal.

A **DISCUS** or disk is a small rounded scale of gelatine impregnated with some drug, for application to the eye.

A **RESINA** or resin is obtained by precipitation from alcoholic extracts by means of water.

An **OLEORESINA** or oleoresin is an extract made from the crude drug by ether, the ether being then evaporated. An oil holding a resin and sometimes other matter in solution is left behind.

An **AQUA** or water is a solution of a volatile principle in water. There are thirteen officinal aquae.

A **SPIRITUS** or spirit is an alcoholic solution of volatile principles, made by direct solution or by distillation.

A **LIQUOR** is an aqueous solution of non-volatile principles.

A **VINUM** is a preparation made with stronger white wine.

An **ACETUM** is a preparation in which vinegar or dilute acetic acid is used as the menstruum.

An **INFUSION** or infusum is a preparation made from a vegetable drug with water either hot or cold, but without boiling.

A **DECOCTUM** or decoction differs from an infusion in that the crude drug is boiled in water for a varying length of time in a closed vessel.

A **TINCTURA** or tincture is an alcoholic solution of a non-volatile form prepared by maceration, digestion, or percolation.

A **SYRUPUS** is a concentrated solution of sugar in watery fluids, either simple or combined with some medicinal substance.

A **CONFECTIO** is a preparation in which one or more medicinal substances are incorporated with sugar or honey.

A **MEL** is a preparation of which the basis is honey. There are but two, both of which are unimportant.

An **ELIXIR** is a preparation made with dilute alcohol as a menstruum, rendered agreeable to the taste by the addition of aromatics and very generally of sugar.

A **GLYCERITUM** is a solution of a medicinal substance in glycerine. There are only two officinal.

A **MUCILAGO** is a solution of a gum or of substances closely allied to the gums.

A **MISTURA** is a preparation in which one or more insoluble substances are held in suspension in water by means of mucilage, sugar, yolk of eggs, etc. An **EMULSION** is a mistura in which oily matters are held suspended in water in a state of minute subdivision by the aid of a gum or some albuminous material.

An **UNGUENTUM** or ointment is a preparation made of various combinations of medicinal agents with lard, vaseline, and wax, or lard alone. They are of the consistency of soft butter and are intended for external application only.

A **CERATUM** or cerate is like an ointment, but is of a firmer consistency.

An **EMPLASTRUM** or plaster is a solid substance spread by the aid of heat on muslin, leather or other suitable material, and of such a nature as to be adhesive at the temperature of the body. Most plasters have olive oil and litharge as a basis.

A **CHARTA** is a medicated sheet of paper for external use. There are only three officinal, mustard, potassic nitrate and cantharides.

A **LINIMENTUM** is a liquid preparation generally soapy or oily, intended only for external use.

An **OLEATUM** or oleate is a solution of medicinal principles in oleic acid.

A **COLLODIUM** is a solution of gun-cotton in ether and alcohol, with or without medicinal drugs.

SUPPOSITORIA or suppositories are conical bodies prepared for introduction into the rectum, where they melt with the heat of the body. Their basis is generally oil of Theobroma or cacao-butter. There are no officinal formulae, but the U. S. Pharmacopoeia directs that they shall weigh 15 gr.

An **OLEUM DESTILLATUM** is one of the volatile, distilled or essential oils obtained from plants by distillation.

In addition to the above defined officinal forms, there are a few non-official preparations.

An **ENEMA** or clyster is a liquid for injection into the rectum, for alimentary or medicinal purposes.

A **BOUGIE** is a small cylinder of cacao-butter impregnated with some drug, for introduction into the male urethra or uterine cavity.

PESSARIA or pessaries are vaginal suppositories.

A **POULTICE** or cataplasm is a soft moist preparation for external application to relieve pain and inflammation, made usually with hot or boiling water and bread or flax-seed meal as a basis, and applied warm or hot.

ADMINISTRATION OF DRUGS.

There are five paths whereby drugs can gain an entrance into the circulation: the skin, mucous membranes other than those of the alimentary canal, mucous membranes of the alimentary canal, serous membranes, and cellular tissue.

1. *Skin.* Drugs are administered by way of the skin in four ways: the epidermic, enepidermic, endermic and hypodermic methods.

(a) In the Epidermic method the remedy is brought into contact with the skin, and absorption takes place by means of friction. Most drugs cannot permeate the cuticle, so that this method is of limited utility. The sebaceous matter of the skin is an obstacle to cutaneous absorption, and solutions in water will not enter. If the medium of solution be chloroform or ether, which are solvents of fat, absorption takes place more rapidly. Hg. is generally administered by the epidermic method, being forced by friction between the cells of the cuticle.

(b) In the Enepidermic method the drug is simply brought in contact with the skin, and absorption takes place without friction.

(c) In the Endermic method, which is a quicker method of absorption, the cuticle is first blistered by ammonia or cantharides and then removed. The medicine is next brought into direct contact with the exposed cutis in the form of powder, gelatine, or cerate if irritating. The disadvantages of this method are the pain and smarting produced, and the tendency to ulceration which is induced. It is used when rapid absorption is desired in cases where the stomach is irritable or when there is inability to swallow, or when local action is wanted.

(d) Drugs are administered by the Hypodermic method when rapid action is desired, when swallowing is painful and difficult, or when the patient refuses to take medicine. This method is especially adapted for drugs to be given in small bulk, as the alkaloids, and for speedy relief of pain where the action of the anodyne is wanted immediately. It is very efficient when absorption cannot go on in the stomach or bowels, as in the black vomit of yellow-fever, or in the second stage of cholera. A syringe with a very sharp needle is used for making the injection. They must both be perfectly clean, the substance to be injected must be in perfect solution, and be fresh, else abscesses or ulcers may be caused, or an undissolved particle may plug the needle. It is best to make the solution as it is needed, and a little borax or cherry laurel may be added to make it asptic. Run the needle under the skin about an inch, press slowly and withdraw the needle, holding the finger over the point of insertion. The favorite places for making hypodermic injections are the arm, abdomen, calf, thigh, buttocks and back. If the alkaloid causes irritation, the back is the best place since the patient cannot touch it. Avoid all bony prominences and inflamed spots, and especially the veins, lest you should introduce air or cause too rapid an action of the drug. Sometimes, as in snake bite, direct injection into the veins may be valuable, and in poisoning from prussic acid (HCN), ammonia may be so given.

2. Drugs are very often introduced into the system by absorption from mucous membranes other than those of the alimentary canal, as by the Conjunctiva or the Mucous membrane of the Nose. In the latter case the drug may be administered in a liquid form by means of the nasal douche, consisting of a reservoir to hold the solution of the drug, and a rubber tube through which it flows. The patient breathes through his mouth, and the liquid is allowed to run in one nostril and escape by the other. Some find it hard to take, others impossible. Some swallow the fluid. The

first application should be warm, bland and unirritating, followed later by the drugs themselves. Care must be taken that the fluid does not flow into the Eustachian tubes nor the middle ears. This method of administration is of only limited utility for cleansing the nares and as a deodorizing method.

Remedies may be introduced into the Lungs, where they are absorbed by the mucous membrane of the bronchi and bronchioles, by means of a hand or steam atomizer. Remedies so introduced reach only the upper part of the air passages, and there is the further disadvantage that the mucous membrane must go through a preliminary training before the drug can be administered. Strong applications cannot be thus used, and before any drug is given the mucous membrane should first become accustomed to it by small doses.

Gases and vapors are introduced into the lungs by Inhalation as in the case of all the Anaesthetics. The remedy may be used on a cloth or sponge or in an inhaling apparatus, from which it evaporates, or the vapor may be inhaled directly.

The only other mucous membrane of this group is that of the Genito-urinary apparatus. Here medicines are applied for purely local effects; upon the uterus and vagina as pessaries, upon the urethra as bougies, or as injections in Gonorrhoea. The absorptive power of these membranes is slight, especially that of the bladder. Nevertheless, Atropine may be absorbed from the bladder; and As. and Hg. have been absorbed from the mucous membrane of the vagina, just as from the conjunctiva, in sufficient amounts to cause symptoms of poisoning. Intra-uterine injections are sometimes made in inflammation and disease of the uterus, but there is some danger of causing Peritonitis.

3. Drugs are almost always introduced into the system by absorption from the mucous membranes of the alimentary canal, especially of the stomach and rectum. Medicines may be applied to the throat, fauces, larynx and glottis as Gargles, or by the Insufflation method. A tube of glass, a quill, or a tube of writing paper can be filled with powder, which is then blown into the throat. The remedy must be small in amount, unirritating, since the glottis is very intolerant of foreign bodies, and which should be mixed with something which will insure an even distribution.

The great majority of drugs are absorbed by the stomach.

The rate of absorption varies with the drug, with the individual, and with the time of administration. It depends somewhat upon the blood-pressure, upon the contents of the stomach, its chemical re-action and the condition of its membranes. If it be empty, healthy, and the veins not turgid, absorption is very rapid.

If the drugs are given in solution, absorption is still more rapid ; if after a meal, when the stomach is full of food, absorption is delayed. Drugs which are not irritating should therefore be given on an empty stomach ; and the irritants, during digestion. Drugs which interfere with digestion should be given from 2 to 3 hours after a meal. The only disadvantages of this method of administration arise from the bad tastes of drugs, and these may be avoided by pills, capsules, confections, syrups, etc. Another disadvantage is the danger of spoiling an appetite or of injuring digestion in the case of some drugs.

The Rectum is inferior to the stomach, but is often used when there is inability to swallow, and when the mucous membrane of the stomach is diseased. If the rectum be in a state of irritation, absorption will not take place. No bulky drugs can be introduced, therefore, since the bulkiness causes irritation and spasmodic contraction. Since the rectum is alkaline, acids will not be absorbed. Solid substances are best given as suppositories weighing 15 gr., or in solution, when they are termed enemata or clysters. If an enema is to be retained for any length of time, it should weigh 3 oz., but if it is to produce evacuation it may weigh 10 or 16 oz. The amounts for children are proportionately less. The substances when administered should be of the same temperature as the rectum, and be preceded by ordinary enemata to remove any faecal matter. If the rectum is irritable or intolerant a few drops of laudanum may be added. If laudanum is to be given alone, the dose should be two or three times as large as when taken by the stomach ; but the salts of Morphine, Atropine and Strychnine are absorbed as rapidly by the rectum as by the stomach, and therefore the rectal doses of those drugs are the same as those by the mouth. The alkaloids themselves are not quickly absorbed unless in acid solution. Mineral salts enter the blood only in small quantities when injected into the rectum.

4. Occasionally absorption of drugs takes place from Serous Membranes. Injections of irritating substances are often made into hernial sacs in hernia, into the pleural cavity in pleurisy, and into the tunica vaginalis in hydrocele, to produce inflammations with subsequent adhesions. Absorption is rapid, and when carbolic acid is used, it should be with some degree of caution.

5. Drugs are sometimes applied directly to cellular tissue in the case of ulcers, wounds and abscesses. These prove very good absorbing surfaces and care must be taken in the administration of toxic drugs. Iodiform, carbolic acid and corrosive sublimate thus absorbed have caused several cases of poisoning. So much for the administration of drugs.

The rapidity of absorption depends among other things upon the state of the circulation, being slow with depression, and rapid with exhilaration. The rate of absorption is determined by analysis of blood remote from the place of the introduction of the drug. A drug taken into the mouth may be here absorbed if there be ulcerations or abrasions; but ordinarily it passes on to the stomach where the rate of absorption depends upon its condition, whether empty or full. The rate is further influenced by the capillaries, lymphatics and lacteals. If very rapid absorption is desired, the drugs should be given in solution; if slow, use powders or hard pills. The absorption of some drugs is aided by giving them as emulsions. Those drugs not absorbed in the stomach are absorbed in the small intestine, and very few escape action in the alimentary canal at some point or another.

When the medicine reaches the blood, it produces the desired effect and is then eliminated. Some drugs produce their effects only on the blood, others upon the various organs, and others in the process of elimination. Some are eliminated completely decomposed as alcohol, some partially as salicylic acid and quinine, and some not at all as potassic iodide. In most cases it is very difficult to recover them from the excreta. Different drugs have different exits. Alkalies, alkaline salts, alkaline earths, alkaloids, metals, volatile oils, and resins are eliminated by the urine; volatile substances such as ether and chloroform by the lungs; salines, by the rectum.

The Effects of drugs are variously modified. (1) By the extremes of age. As a rule the very old and the very young are more susceptible than young adults or the middle-aged. For example, children are very susceptible to opium. There are exceptions to the rule, however, for children are less susceptible to calomel and castor-oil. Several rules for dosing children have been invented; (a) that of Young:—Divide the age by the age plus 12. (b) that of Dr. Cowling:—Divide the number of the following birthday by 24. (2) By the size of the dose. Thus by varying the size of the dose Ipecacuanha may be given to cause or to restrain vomiting. Potassic salts in small doses are diuretics, but in large doses, cathartics. Opium in small doses excites, in large doses, soothes. (3) By the method of administration. Less laudanum is needed to produce a given effect when absorbed by the stomach than when absorbed by the rectum. (4) By the condition of the stomach, if thus administered. Insoluble iron compounds require gastric juice to become soluble, and they therefore will produce quite an effect during digestion and very little effect after digestion has ceased. For rapid absorption the

stomach should be empty. (5) By the sex. Women need smaller doses than men. Avoid the use of drugs during menstruation, pregnancy and lactation as much as possible. (6) By the temperament. Brunettes yield to drugs less readily than blondes. (7) By the imagination, which very often exerts a strong controlling influence. Water has often been a sufficient remedy. (8) By tolerance for a drug often produced in disease, as opium in tetanus and alcohol in typhoid fever, or Ipecacuanha. As in diseases of the skin. Thus very large doses of Digitalis may be borne by those having heart diseases; and doses of Ipecacuanha which ordinarily cause vomiting may be borne in dysentery. (9) By habit. The continued use of drugs as of opium, arsenic or tobacco, greatly reduces the susceptibility. (10) By the idiosyncrasy of the patient. This influence, which at times may be very great, is not at all understood. One person may be very much affected by a small dose, another only by a very large dose. Opium may soothe one and irritate another. It is well before administering opium, morphine, quinine, the bromides, phosphorous, etc., to understand if the patient has ever taken them before, and if so with what effects.

There is a Proper Time for the Administration of Drugs. If they be given untimely, the cure may be delayed or prevented. In general, if the drug is not an irritant, it should be given on an empty stomach. If very prompt action is desired, give the drug just before a meal; if slow action or action on the intestines is desired, give some time after a meal, during digestion. If local action on the stomach be wished for, give directly after a meal in order to avoid too strong an action. Strychnine is not well borne on an empty stomach, but is, on a full one. Castor-oil and oily substances are best given during digestion when the lacteals are actively absorbing and the biliary and pancreatic juices are at their maximum flow.

During digestion the stomach is acid in reaction. If, therefore, alkalies are given, salts are formed. Acids check acid secretions; and alkalies alkaline. Therefore, acids before a meal prevent the secretion of gastric juice, and so interfere with digestion. Alkalies before a meal stimulates acid secretion and so aid digestion. However, during the process of digestion acids may be given, since the gastric juice is already secreted; and alkalies must be interdicted, lest the acidity of the stomach be neutralized and digestion stopped. Hg. should be given when the stomach is empty or nearly so. Sulphates, nitrates, bromides, chlorides and salicylates retard digestion. Alcohol in small amounts stimulates the formation of pepsin, but large amounts

impair and even prevent digestion. In general, the time of administration depends much upon the physician's judgment. If opium be given to cause sleep, it is best to give it just before natural sleep comes on, this is at night. Purgatives act best in the morning, and when giving them always bear in mind the condition of the stomach. Pills are best given on a full stomach, and saline cathartics on an empty one.

Duration of action. This varies very much with the different drugs, their rate of decomposition, and of elimination. Anaesthetics act for a very brief time, but some drugs have a very long action. Certain drugs of slow action and elimination frequently given, may be stored up in the system, and lead to serious symptoms as in strychnine, digitalis, KBr., Pb., and many other drugs.

When giving drugs which are eliminated slowly, allow intervals of a day or two at times. The next dose will then be more efficient, and any excess stored up will be eliminated in the meanwhile.

As for the Size of the Dose in the administration of drugs, it is always well to consider the question of the relative efficiency of repeated small or single large doses. In cathartics one large dose is better than several small ones, but in other cases the repeated action of small doses is better, as of aconite in fever. Purgatives and emetics are best given in single large doses; diuretics, tonics, etc., in small repeated doses.

Prescription Writing is an art in which certain rules must be observed. Certain effects only are desired, and any other actions must be avoided if possible. The following are good rules:—

(1) Avoid all nauseating and irritating mixtures.

(2) Make the prescription as simple as possible. Mixtures are often necessary, as in cough medicines and diuretics; and these afford somewhat of an exception to the general rule. There are also other exceptions. Jalap and cream of tartar in a mixture are better than either alone. Chloral in combination with morphine or K Br. is much more efficient in insomnia than either alone.

(3) In selecting a drug consider whether any symptoms of the case will be aggravated by its use. Thus, in meningitis, though quinine might reduce the fever, its use could not be pardoned; and tonics are good in systemic disturbances, but harmful in others.

(4) The FORM of the drug is important. Some drugs should be prescribed dilute, some concentrated. Metals are best prescribed in the form of pills; salts, especially purgatives, dissolved in water. In prescribing for children, remember that they object to acids and bitters, but they take oils readily.

(5) Above all, carefully consider the size of the dose. As a rule women and children require smaller doses than adults, as arsenic, strychnine, and chloride of iron. On the other hand, children cannot bear potassic iodide and bromide and opium. Chloral is well borne. In prescribing for children, make the doses as small and agreeable as possible. In general with everybody, begin with small doses and increase them if necessary.

(6) Avoid Incompatibles. These are both chemical and physiological. Substances chemically incompatible form new compounds when brought together; and physiological incompatibles are mutually antagonistic in their physiological actions, as morphine and atropine. As a rule, a drug is incompatible with its antidote, and its chemical tests where these form precipitates.

Alkalies precipitate metallic salts and alkaloids.

Mineral Acids decompose salts, vegetable acids, form ethers with alcohol, and decompose glucosides.

Silver nitrate should always be prescribed alone, or in combination with opium only. Most vegetable extracts decompose it, and with some it forms explosive compounds. It is incompatible with almost everything.

Tannic Acid, Iodine, and the Iodides are incompatible with alkaloids and any drugs containing them, as well as with most metallic salts. The Iodide of Potassium should always be prescribed alone, or with corrosive sublimate, with which it forms a double salt, or with iodine itself.

CLASSIFICATION OF DRUGS.

There is no satisfactory classification of drugs, and in fact a perfect one is impossible. A division into chemical and vegetable drugs is unsatisfactory and useless. The classification according to therapeutics is better, but each author has his own. H. C. Wood's is the best, though not ideal, and will be followed in the main but not rigorously. Many drugs of little practical importance will be omitted and only the very useful ones considered, many of these being non-officinal.

Therapeutically medicines are divided into two great classes:—

1. Systemic Remedies, acting upon the solid or fluid tissues of the body only after absorption into the system.
2. Extraneous Remedies, used to act upon secretions, excretions, or other liquid and solid bodies which are not human tissues.

Systemic Remedies are of two classes: (1) General, and (2)

Local. General Remedies are such as reach all portions of the body after absorption into the system, and affect the tissues of the body generally. They comprise three orders: (1) Nervines, drugs affecting the nervous system; (2) Cardiants, drugs affecting the circulation; (3) Nutriants, drugs affecting the nutrition of the body. Of Nervines there are six great families:—

1. Antispasmodics, feeble cerebral stimulants which are employed for the relief of minor spasms and other nervous symptoms, the result of insufficient nerve-power.
2. Anaesthetics, drugs used to produce anaesthesia.
3. Somnifacients, drugs which when in sufficient doses produce deep sleep without delirium.
4. Delirifacients, drugs which when in sufficient doses produce delirium, followed by stupor.
5. Excito-Motors, drugs which produce violent tetanic spasms.
6. Depresso-Motors, drugs which cause paralysis.

NERVINES.

I. Antispasmodics.

Antispasmodics are feeble cerebral stimulants employed for the relief of minor spasms which are the results of insufficient nerve-power. They have little effect on the healthy body, but are useful in certain deranged conditions of the nervous system, especially in spasms, idiopathic or due to lack of nerve-force, hysteria, nervousness, hypochondriasis, and even insanity. They are useful in other nervous disturbances, such as wakefulness, where at times they may be superior to narcotics. They stimulate the heart and slightly increase the cutaneous circulation, thus promoting sweating; and they are good expectorants, stimulating the bronchial mucous membranes. As a result of the quickened circulation they excite the brain to increased activity, without any subsequent depression, and moderate any irregular activity. Some members of this group in large doses may produce cerebral disturbances, but none produce poisoning except camphor and compound spirits of ether.

* 1. MOSCHUS or MUSK. Of complex composition. From the preputial gland of the musk-deer. One part communicates its odor to 3000 parts of non-odorous powder. An artificial musk is said to be equally good; it is prepared by adding nitric acid to oil of amber. Many who have used musk regard it as very useful in Hysteria, Chorea, Insomnia, Hiccough, and Low Fevers where death seems imminent; but others deny its power. Doses: of

the TINCTURA MOSCHI, 30 m. to 2 dr., and of the substance itself any amount up to 15 gr.

* 2. VALERIANA. Rootlets and rhizoma of *Valeriana officinalis*, a perennial found in Great Britain, and in New Hampshire, Vermont, and New York in this country. The American product is even superior to the English.

Composition. The most important constituent is the volatile Oil of Valerian, a mixture of several principles, chief of which is Valerianic Acid.

Physiological Action. The effects of Valerian and of the Valerianates are not constant; sometimes they act as nervous stimulants, and sometimes as nervous irritants and depressants. Valerian increases the heart's action, vascularity, and the secretion of urine. In frogs it antagonizes tetanic convulsions caused by strychnine.

Therapeutics. Used in small doses Valerianates are useful as stimulating nerve-tonics, but in large doses they are injurious, since they cause a disturbance of the gastro-intestinal tract. Valerian is useful in the flatulence of hysterical patients and in Hypochondriasis. The Tinctura and Extractum Fluidum are valuable alone or with other drugs in Hysteria, Headaches, and in what is properly called Nervousness. They are useless in Epilepsy, and of slight value in Chorea and Paralysis Agitans.

The preparations of *Valeriana* are the following:—

ABSTRACTUM VALERIANAE. Dose: 5–15 gr.

EXTRACTUM VALERIANAE FLUIDUM. Dose: 30–90 m.

TINCTURA VALERIANAE. Dose: 1–4 fl. dr.

TINCTURA VALERIANAE AMMONIATA. More stimulating.
Dose: 1–4 fl. dr.

OLEUM VALERIANAE. Unimportant.

FERRI VALERIANAS. Unimportant.

* AMMONII VALERIANAS. White or colorless deliquescent plates; sharp sweetish taste, odor like Valerianic Acid; neutral reaction; very soluble in water and alcohol. Dose: given in solution or in pills up to 10 gr., in the same class of cases as Valerian itself.

ZINCI VALERIANAS. A soft white powder, light, with a faint odor of Valerian, a sweetish and afterwards metallic taste; acid reaction. Soluble in 100 parts of water and 40 of alcohol. Dose: one-half to 3 gr., given generally in pills.

3. ASAFOETIDA. A gum-resin obtained by incising the living root of *Ferula Narthex* or *F. scorodosma*, growing in Afghanistan. The resin is scraped off, hardened, and exported. Commercially it exists in irregular masses of whitish tears em-

bedded in a brownish-gray sticky mass, of a most persistent alliaceous odor, named on this account devil's dung; and with a bitter acrid and alliaceous taste. It is used in some countries as a condiment. It cannot be powdered except at low temperatures.

Composition. 65 per cent. is resin, not all soluble in ether; 6-9 per cent. is a volatile oil, containing a good deal of sulphur; 25 per cent. is a gum. It is best given in pill form in doses up to 3-15 gr. The official pill is 3 gr.

Physiological Action. It is a local stimulant and carminative, and has a more decided action than Valerian on the mucous membrane of the alimentary canal. In small doses it increases the appetite and intestinal peristalsis, and is a mild excitant; in larger doses it also increases the rate of heart-beat, the respiration, and the sexual desires.

Therapeutics. It is useful in Hysteria, Nervousness, and Flatulent Dyspepsia; and has been used in Chronic Bronchitis and Whooping-cough. In the treatment of Tympanites it is very useful given as an enema.

There are a number of officinal preparations, and it is also an ingredient in several compound preparations. They are:

EMPLASTRUM ASAFOETIDAE. A mild irritant of no particular value.

MISTURA ASAFOETIDAE. The emulsion consists of 4 parts of the crude drug suspended in 100 of water.

TINCTURA ASAFOETIDAE. 20 per cent. strength. Dose: $\frac{1}{2}$ -1 fl. dr.

PILULAE ASAFOETIDAE. The pill contains 3 gr. of the drug with 1 gr. of soap, a dose being 1-5 pills.

PILULAE ALOES ET ASAFOETIDAE. These contain 1 gr. each of Aloes, Asafoetida and Soap. Dose: 1-5 pills.

4. CAMPHORA. A stearoptene obtained from the root, trunk and branches of Cinnamemun Camphora by distillation, and purified by sublimation, China and Japan. Camphor occurs in white, crystalline, translucent masses, readily pulverizable if mixed with alcohol, ether and chloroform; and it can be obtained by precipitation with water from the alcoholic solution. Its Sp. Gr. is just below that of water. It melts at 175° C., and sublimes without residue; burns with a smoky flame, and has a strong, fragrant, penetrating odor, and bitter, pungent and cooling taste. It is very soluble in alcohol, freely so in ether, chloroform and oils, and 1 part in 1000 of water. The solvent power of the latter is increased by carbonic acid gas, and sweet spirits of nitre. Equal parts of Chloral and Camphor rubbed together make a liquid which has the power of taking up atropine, morphine, and

other vegetable alkaloids. It is frequently of great value on this account.

Physiological Action. Camphor acts locally as a mild irritant. Internally it produces a sense of warmth in the stomach, and increases the rate of heart-beat and the arterial tension. It is also a diaphoretic and anodyne. In large doses it may give rise to fatal cases of poisoning. The pulse is weak, there is giddiness, fainting, delirium, convulsions and coma. It is eliminated by the breath, skin, and faeces, and a decomposition product is also eliminated by the urine. Camphor is also said to be an aphrodisiac in moderate doses of about 5 gr.

Therapeutics. In large doses camphor is useful in Nymphomania, Chordee, Spermatorrhoea as an anaphrodisiac; and in Flatulence, Hiccough, Vomiting, Palpitation and headache as an antispasmodic. It is also used to produce sleep, in many forms of mental disorder, to calm irritability and to relieve despondency. In Diarrhoea where there is no inflammation it is used in combination with opium. In a Cold in the Head it may be snuffed up as a powder. Camphor is also used in Epidemics and Cholera.

Externally, Camphor is used as a rubefacient, and dissolved in water as a wash in Erysipelas. It is applied in the form of a powder in Senile and Hospital Gangrene, to Sloughing Surfaces, and to indolent Ulcers. It is sometimes applied as an alcoholic solution to abort Boils and Cold-sores. The Liniment, containing 20 parts of Camphor and 80 parts of cotton-seed oil, is good in Gouty and Rheumatic Pains, Sprains, Bruises, Lumbago, and Sciatica. Camphor with soap, alcohol and water, also makes a useful preparation called Linimentum Saponis.

Internally, Camphor is contra-indicated in all inflammatory affections of the gastro-intestinal tract. *Administration.* It is given in a pill solution, or emulsion in doses from 1-20 gr. according to the action desired. Small doses of 1 or 2 gr. are best given in pill form. The following are the principal preparations:—

AQUA CAMPHORAE. Prepared by filtering distilled water through absorbent cotton saturated with spirits of camphor. It is used as a vehicle, and also as an antispasmodic in $\frac{1}{2}$ -2 dr. doses.

SPIRITUS CAMPHORAE. A 10 per cent. alcoholic solution used internally for the systemic effects of camphor, and externally as a lotion. It may be precipitated in water or dropped on sugar and taken internally in doses 10 times as large as camphor. *Incompatibles.* In writing prescriptions remember that water precipitates camphor from its alcoholic solutions, and that alkaline and earthy salts separate out even the small amount of camphor contained in the Aqua. *Minimum to 3 dr. dose.*

✓ * CAMPHORA MONOBROMATA. Camphor with one Hydrogen atom replaced by one of Bromine. This is recommended in the same class of diseases as camphor, but has no advantage over it, the Br. being very small in amount and not so efficient as KBr. It is also more apt to irritate the stomach than camphor. The dose is from 3–5 gr. in sugar-coated pills or dissolved in a bland oil with alcochol and glycerine, or in capsules.

* ~~5. CIMICIFUGA.~~ SNAKE-ROOT. In small doses Cimicifuga is a cardiac stimulant and antispasmodic. By some it is considered the best remedy in Chorea, and by others it is used in Chronic Bronchitis. It is also useful in Ovarian Neuralgia and as a Uterine Stimulant.

* ~~6. SCUTELLARIA.~~ SCULL'S CAP. A perennial found in places in the U. S. It has had some reputation as of use in Restlessness and spasmodic affections. It is perhaps almost inert.

* ~~7. AMMONIACUM, (8) GALBANUM, (9) LUPULINUM,~~ and (10) OLEUM SUCCINI, of which the active principle is Oil of Amber, are not sufficiently important to be treated.

II. Anaesthetics.

The second group of the Nervines is that of the Anaesthetics used to produce anaesthesia, and remotely allied to the antispasmodics.

1. NITROGEN MONOXIDE. NITROUS OXIDE or LAUGHING GAS. Colorless, odorless, slightly sweetish, readily soluble in water, condensible by pressure and cold, and a good supporter of combustion, discovered by Priestly in 1776. It is obtained by heating ammonic nitrate, which is a white, crystalline deliquescent solid, without odor, having a very sharp and bitter taste; neutral in reaction; melting at 155° C. and above 180° C. giving off N_2O and H_2O , leaving no residue. In preparing the gas never heat above 204° C., for at this temperature nitric oxide, uncombined ammonia gas, and nitric acid fumes may be given off. Be sure also of the purity of the ammonic nitrate, especially noting that Cl. is absent. Collect the gas, after washing with ferrous sulphate to remove nitric compounds, and with potassic hydrate to remove acids and Cl. and store in gas-holders, rubber-bags, or if condensed in iron cylinders.

2. AETHER. ETHER or ETHYL OXIDE. There are two kinds of ether, the common ether, AETHER VENALE, containing 74 per cent. of ether and 26 per cent. of alcohol and water, used for pharmaceutical purposes; and the strong ether, AETHER

FORTIOR, containing 94 per cent. of ethyl oxide and 6 per cent. of alcohol. It is made by distilling at 130° C. a mixture of alcohol and sulphuric acid, and is purified by shaking with KCH and re-distilling. The common ether dissolves in about 5 volumes of water, and should have a Sp. Gr. of 0.750; the strong ether dissolving in 10 volumes of water, and having a Sp. Gr. of 0.728. Aether fortior must be free from all impurities, these being water, alcohol, and sulphurous acid. Its boiling-point is 37° C.; held in the hand in a glass tube it should boil on the addition of bits of glass or sand. It has a peculiar odor, a taste sweetish at first then bitter, is highly inflammable and vaporizes in the air. Its vapor mixed with air is explosive. It is soluble in water, as has been said, and in all the solvents, as alcohol, benzoine, the fixed and volatile oils, etc.

3. CHLOROFORM. CHLOROFORM, CHCl_3 . There are two kinds, the commercial or CHLOROFORM VENALE used in pharmaceutical preparations; and the purified or CHLOROFORM PURIFICATUM. The former is omitted from the new Pharmacopoeia, and the latter is spoken of simply as CHLOROFORM. It is used to produce anaesthesia and as an internal remedy. Chloroform is a clear, colorless liquid, with a diffusive odor, sweet burning taste and neutral reaction; soluble in alcohol, ether, benzene, benzine, fixed and volatile oils, and in 200 parts of water. It is much heavier than water, its Sp. Gr. being 1.470; it therefore sinks, and if pure remains clear. It is made by the action of bleaching-powder on acetone or alcohol, or by the action of an alkaline hydrate on chloral. It is a powerful antiseptic as well as anaesthetic, and will prevent alcoholic, lactic, and other fermentative processes. It is also an extensive solvent of organic and some inorganic solids. There are three preparations. Emulsion 40 per cent. soluble.

SPIRITUS CHLOROFORMI. 6 per cent. strength, for internal use; dose: 1-2 dr.

AQUA CHLOROFORMI. Non-official in this country but official in Great Britain. Very useful in beginning Bronchitis when the cough is distressing. A saturated solution is made by adding water to chloroform and shaking until all the chloroform is dissolved.

LINIMENTUM CHLOROFORM. Made from 30 parts of chloroform and 70 parts of soap liniment for external use.

The group of anaesthetics is small but important. There are practically but three in the group; the newer anaesthetics, such as the Bromide and the Iodide of Ethyl, Bichloride of Methylene and Bromoform, being incapable of supplanting them, because of

their danger, unreliability and inferiority. Anaesthetics have the power of producing temporary insensibility to pain from any cause. They are very volatile, are rapidly absorbed by inhalation, and as rapidly eliminated by exhalation and the kidneys. They are used in surgery to relax spasms and to relieve or to prevent pain as in biliary or renal colic, child-birth, convulsions, eclampsia, convulsions from strychnine and other causes. Their action is transitory but accompanied by quite marked constitutional disturbances. In child-birth never give to complete anaesthesia, for the action of the contractors may be interfered with.

Theories of action. These are various and it is hard to decide upon the true one. There are only four deserving consideration :

1. That the symptoms of anaesthesia are due to a partial arrest of oxidation.
2. That they are due to physical changes in the blood.
3. That they are due to cerebral anaemia, like sleep.
4. That the anaesthetics act directly upon the various organs and tissues concerned, especially upon the nervous tissue.

Anaesthetics are aided and modified in their action by narcotics, morphine being given before and chloral after to prolong their action. If the chloral be given first, the first stage of anaesthesia is easier.

There is some danger in the use of anaesthetics, the ratio of fatal cases being 400 for chloroform, 50 for ether, and 4 for nitrous oxide. The action of the latter persists for only a short time. Of the two former ether is less dangerous, yet chloroform is more convenient and less disagreeable, is quicker, less exciting, requires less of it, and is less liable to cause vomiting afterwards. That the difference is not merely due to care in administrations is shown by the fact that animals may be more easily killed by chloroform than by ether.

Contra-indications of anaesthetics. Heart disease, Atheroma, Aneurism, Serious Obstructions to the Circulation, Bright's disease, Peritonitis, Bronchitis, Brain-Tumors, etc. In Heart disease, if there is no disease of the muscular substance, general anaesthesia may be permitted if it cannot be replaced by cocaine. Ether is better than chloroform if an anaesthetic must be used. In Aneurism and Atheroma chloroform is better, as it causes less resistance on the part of the patient and since ether stimulates the circulation too much. In Bright's disease it is also better since it does not increase the arterial pressure as much as ether, and since it causes less irritation in its elimination, the dose being smaller. Ether is bad in Peritonitis on account of its rapid and forcible action on the diaphragm. In Bronchitis chloroform is

better since it has less influence upon the respiration than ether. Whenever in any of these cases it is possible to use cocaine, it should be used.

Action and uses of the anaesthetics. Nitrous Oxide is used more in dentistry than in surgery. It requires special apparatus and is therefore inconvenient for the general practitioner. It produces its effects quickly, being preceded by hilarity. Loss of consciousness comes on rapidly, there is pallor, the face is swollen, and there may be a rise of temperature. The pulse is at first irregular and tumultuous, but when unconsciousness is complete the pulse is large and full and the rate slow. Respiration is also slowed. On account of the high blood-pressure which it causes it is contra-indicated in diseases of the arterial walls, in atheroma for example, since there is danger of rupturing blood-vessels in the brain. It is also contra-indicated in Diabetes, and it is even claimed by some that it may cause this disease, but this is doubtful. It has the merit for purposes of anaesthesia of very great safety, and it acts by shutting off the oxygen. It is not an oxidizing agent as some have thought, but it is a stable compound at the temperature of the body. Its effects are very transient, and recovery is very rapid. There are no bad after-effects. For dentistry and minor surgery, as opening felons, it is excellent. Just how it acts is unknown. It sometimes causes laughing-fits, and when such symptoms occur, the gas should be withdrawn immediately and oxygen supplied.

Ether when inhaled produces irritation and burning in the fauces, a feeling of strangulation with coughing, followed by a feeling of exhilaration and light-headedness. It produces all sorts of mental effects; in some it causes semi-unconsciousness and dreams; some become belligerent, others cry, shout, or even pray. Soon there follows the loss of self-control, and hence ether may be used to detect feigned diseases. Loss of consciousness soon becomes complete, and there is great muscular relaxation. The pulse is little affected, respiration is slow, irregular and at times stertorous, the face is flushed. Stertorous breathing and dilatation of the pupils show the near approach to muscular paralysis, and at this point ether should be withdrawn. Marked pallor indicates a failure of the heart, and weakness of the respiration. If administration is pushed to complete muscular relaxation, there is danger of muscular paralysis.

Effects on the Nervous System and the Circulation. The cerebrum is the first portion of the nervous system to be affected, then the sensory centers of the cord, then the motor centers of the cord, the sensory centers of the medulla, and finally the motor

centers of the medulla. It does not affect the nerve-cords themselves except by direct application, when it causes paralysis of the sensory fibres. During etherization there is first a rise in arterial pressure due to stimulation of the cardiac movements and of the vaso-motor centers. The increased pressure lasts some time, then falls owing to a slowing action of the heart's action due to vaso-motor paralysis. Very large amounts may depress the respiratory function first and the circulation next, or they may depress the heart first. Ether has been used by the rectum somewhat for etherization, but it is not very successful since it is slow and irritating.

Therapeutics. Besides being an anaesthetic ether is often used as a remedy either subcutaneously or by the mouth in Colic, Collapse, Hiccough, Asthma, Nervous Attacks, and Neuralgia; and it has also been recommended for other purposes, e.g. as an anthelmintic. By the mouth it is given in a capsule, in sugar or ice water, to prevent choking. The dose is anything up to 1 dr.

There are the following preparations:

SPIRITUS AETHERIS. For internal administration in doses from 1-4 dr. with sweetened water. Composition: ether 375 parts, alcohol 625 parts.

SPIRITUS AETHERIS COMPOSITUS. Compound spirits of ether or Hoffman's Anodyne. Composition: same as the spirits of ether except that 25 parts of ethereal oil replace 25 parts of alcohol. It is used to produce sleep, to allay pain, especially the light spasmodic pains, and in restlessness as an antispasmodic. Dose: $\frac{1}{2}$ -1 dr.

AETHER ACETICUS. Ethyl acetate or acetic ether. A transparent colorless liquid with an ethereal odor and a refreshing taste, soluble in alcohol, ether, chloroform, and in 17 parts of water: less volatile, inflammable, and odorous than ether, but similar in its action. It is used internally, and is the equal of the spirits of ether or of Hoffman's Anodyne, and its effects are the same. It is sometimes inhaled to relieve a nervous cough, or to serve as a stimulant. Its other uses are those of Hoffman's Anodyne. Dose: 1 dr.

Physiological action of Chloroform. Externally it is an irritant, producing redness and swelling. It is also an antiseptic. As an anaesthetic it has the merit that it does not choke. There is first a stage of excitement shorter and less pronounced than that caused by ether, and the same nerve centers are affected in the same order. It acts more powerfully and more promptly on the lungs and heart, and may paralyze the respiratory center or cause heart-failure, especially when the chloroform is concentrated. Its action

is more persistent and powerful than that of ether, and there is more danger in its use. It is absorbed by inhalation and eliminated by the lungs and kidneys. If much is given the elimination by the kidneys may lead to irritation and inflammation. Internally it is a local anodyne. It is also a rubefacient, stimulative carminative, and it quickens the heart's action. Inhaled in Asthma and Cough it affords relief.

Precautions on the administration of anaesthetics. Be sure that there is nothing in the mouth before you begin, which can get into the trachea. In order to avoid trouble from vomiting during recovery, withhold solid food before the operation. If vomiting occurs, see that no vomitus is sucked into the trachea. During the period of narcosis look out for the signs of danger. Generally the cessation of respiration is gradual, but it may be rapid. If it becomes shallow and irregular withdraw the anaesthetic. The pulse also yields, and this is preceded or accompanied by a change of the facial expression and pallor. There is deep cyanosis. Watch the pupils carefully. In the stage of excitement they dilate, but during anaesthesia they remain contracted, though they are capable of dilating upon stimulation. If after contraction dilatation comes on again, look out for asphyxia. Alcoholic persons are etherized with difficulty, and it is hard to keep the pupil contracted.

In case of accident withdraw the anaesthetic immediately. If the pulse is weak and there is cerebral anaemia, the patient should be partially inverted. If the face is flushed the weakness is of the respiration, and the patient should not be inverted. Stimulate the respiration by opening the fauces and glottis, and pulling the tongue forward; and also by slapping the chest or by putting cold water or ether on the abdomen. If necessary, resort to artificial respiration. Do not give subcutaneous injections of alcohol or ether. Digitalis, strychnine, ammonia and possibly amyl nitrite are better, especially the first two. It is well not to be too hasty in resuming the operation.

Never give ether unattended, and in etherizing females a female assistant should be present. Do not use ether near lights, for accidents have been thus caused. Vapor of ether is heavy and sinks to the floor, therefore, lights should be placed above the level of the patient. Primary anaesthesia is often good for minor operations. There is loss of sensation and only partial loss of consciousness.

4. BICHLORIDE OF METHYLENE is the fourth member of the group of anaesthetics, and was once proposed as a substitute for chloroform and ether. It is a clear fluid, lighter than

chloroform, inflammable, but of doubtful value and little used in this country. The other anaesthetics are the bromide and iodide of ethyl, and Bromoform, but they are practically of no value.

III. Somnifacients.

Somnifacients comprise the third great family under the Nervines, and consist of drugs which produce sleep without delirium.

I. OPIUM AND ITS ALKALOIDS. Opium is a milky white exudation, obtained by incising the unripe capsules of the poppy (*Papaver somniferum*), inspissated by spontaneous evaporation. All parts of the plant contain the opium juice, but analysis of the leaves yields no morphine. The seeds have no narcotic properties, and are used in food; from them an oil may be expressed much like olive-oil. China, India, Persia, Egypt, and Asia Minor. Our opium comes from Asia Minor and is the variety known as Smyrna opium. It is also cultivated in Germany, France, and the United States.

Opium is imported in masses of all sizes from a man's fist to a child's head. It has a strong odor, bitter taste, brownish red color and, if pure, leaves a light brown interrupted line when drawn across white paper. Adulterated opium is darker and gives a dark continuous line. It is slightly soluble in water, soluble in dilute acids, ether and alcohol. Ether takes up only one principle, narcotine.

Active principles. Dried at 100° C., opium yields 55-60 per cent. of its substance to water and 80 per cent. to alcohol. In its normal moist condition 9 per cent. should be morphine; and dried, 12-10 per cent. Opium is a very complex substance containing 18 alkaloids, of which MORPHINE, NARCOTINE and CODEINE are the most important, in combination with meconic acid. Morphine is the chief active principle and is used in medicine chiefly to produce sleep, to relieve pain and irritation, as a sudorific, and to check secretions.

Incompatibles. The many preparations of opium may not be prescribed with alkalies, alkaline carbonates, tannic acid, tannin or vegetable infusions containing tannin, since insoluble precipitates and tannates result.

MORPHINA. When pure, morphine occurs in minute colorless shining crystals, insoluble in cold water, nearly so in hot, slightly soluble in cold alcohol and ether, freely so in hot alcohol, fixed and volatile oils. It is permanent in air, odorless, very bitter, with an alkaline reaction. With acetic, hydrochloric and sulphuric acids it forms salts which are much used in medicine of a strength

75–80 per cent. that of the alkaloid, weight for weight. These salts are all soluble in water and alcohol, and are not precipitated by tannic acid.

MORPHINAE HYDROCHLORAS.

MORPHINE SULPHAS. Both of these salts are stable, occurring in white feathery crystals, odorless, bitter, of neutral reaction. The sulphate is used most, and "morphine" most always means the sulphate. It is soluble in twenty-four parts of cold water, very soluble in hot.

NARCOTINA. Important only because it is the alkaloid which causes most of the bad effects of opium. It can be extracted from opium by ether, in which it is freely soluble and which takes up nothing else.

CODEINA. Less important than morphine but more so than narcotine. It occurs in white or yellowish crystals, somewhat efflorescent, odorless, bitter, with alkaline reaction, soluble in about eighty parts of water. It has been used to some extent as a hypnotic, but is used chiefly in Diabetes. It is usually prescribed as such. Dose: $\frac{1}{2}$ –2 gr.

Administration of Opium. Children bear opium very badly and should be given only the weaker liquid preparations. In the case of adults when rapid action is desired, give it in liquid form in small repeated doses. Old pills are best for Diarrhoea. The salts of morphine are given in solution, in pills and subcutaneously. The usual dose is $\frac{1}{8}$ gr. but more or less may be given. $\frac{1}{4}$ gr. is a large dose, and 1 gr. very large.

The preparations of opium and morphine are numerous. The following are the most important:—

MORPHINAE HYDROCHLORAS. Already mentioned.

MORPHINAE ACETAS. Morphine dissolved in acetic acid. A white powder, very soluble in water, (1–12). It gradually loses acetic acid, and becomes a mixture of soluble acetates and insoluble alkaloids. Doses as above.

MORPHINAE SULPHUS. Already mentioned. Doses given above.

PULVIS MORPHINAE COMPOSITUS. "TULLY'S POWDER." A compound containing twenty parts each of Camphor, Glydyrrhiza, and precipitated Calcic Carbonate with one part of Sulphate of Morphine. It is often used as a substitute for Dover's Powder, and is good for children where Dover's Powder is harmful. Dose: 5–15 gr.

TROCHISCI MORPHINAE ET IPECACUANHAE. Composition: Sulphate of Morphine, $\frac{1}{40}$ gr.; Ipecacuanhae, $\frac{1}{12}$ gr. Used as an expectorant.

OPII PULVIS. Powdered opium of the Pharmacopoeia is the crude drug dried at a temperature not exceeding 85° C., and powdered. It must contain not less than 13 per cent. and not more than 15 per cent by weight of morphine. Dose: $\frac{1}{4}$ –2 gr.

OPIUM DENARCOTISATUM. Made by extracting the Narcotine from opium by means of ether, the full weight being restored with sugar of milk. 14 per cent. is morphine. Dose: $\frac{1}{4}$ –2 gr.

PILULAE OPII. The officinal pills each contain 1 gr. Dose: 1–2 pills.

EXTRACTUM OPII. A watery extract of the crude drug evaporated to dryness. Not extensively used. It is useful in making some of the opium preparations as the troche and plaster. Dose: $\frac{1}{8}$ –1 gr.

TROCHISCUS OPII. A glyceriza composed of $\frac{1}{12}$ grain of powdered opium with other substances.

EMPLASTRUM OPII. The officinal plaster. Not important.

Beside the above mentioned there are five important fluid preparations made from powdered opium:—

ACETUM OPII. Black drop.

VINUM OPII.

TINCTURA OPII. (Laudanum.)

TINCTURA OPII DEODORATA.

TINCTURA IPECACUANHAE ET OPII. Liquid Dover's Powder. The dose of all five of these preparations is 10 m. All are of 10 per cent. strength. In the deodorized tincture the disagreeable smell and the narcotine are removed in the process of preparation. Liquid Dover's Powder is merely the deodorized tincture of opium to which 10 per cent. of Ipecac. has been added.

PULVIS IPECACUANHAE ET OPII. Dover's Powder. Composition: powdered opium 10 parts, Ipecacuanhae, 10 parts, Sugar of Milk, 80 parts. Dose: 5–15 gr.

TINCTURA OPII CAMPHORATA. Paregoric. It contains powdered Opium, Benzoic Acid, Camphor, Oil of Anise, 4 parts each; Glycerine, 40 parts, diluted to 1000 by dilute Alcohol. Strength, 2 gr. to the fl. oz. Dose: 1–4 fl. dr. for the adult. Very useful in children for Colic, Flatulence, and Irritant Cough.

Physiological Action. After a dose of opium or a subcutaneous injection of a salt of Morphine, the influence upon the system consists of a slight dizziness, fullness in the head, a quieting influence, a feeling of comfort and a dreamy state. Mental activity may be increased in those accustomed to it, or decreased in others. The sleep may be normal, dreamy or heavy, varying with the size of the dose and idiosyncrasy of the patient. Ordinarily it is quiet. With some there may be intense itching, beginning at the tip of

the nose, even eruption, nausea, distress, vomiting and faintness. During sleep there is sweating, the urine being diminished or sometimes suppressed. After the cessation of sleep the patient may return at once to the normal state, but more often there may be a reaction with depression, nausea, vomiting, loss of appetite, languor, and headache persisting for some time. When the doses are larger or the susceptibility greater, these first stages may be shortened or lacking.

Toxicology. In large or toxic doses, the first effect is a shortening sensory state. Sleep comes on sooner and is more profound. The pupils are contracted, the pulse is slow, full, and strong, the skin moist and clammy. Respiration is slow and deep, and may be stertorous. It is increased by shaking the patient or shouting in his ear. Next there follows a state of extreme exhaustion and prostration from which the patient cannot be aroused, where we have the pin-point pupil dilating as death approaches. Respiration becomes very slow, even three or four times per minute. The pulse is rapid, the skin pale and clammy, and the urine may contain albumen and casts. Recovery is possible, but slow and hard to bring about. Death is usually due to a failure of the respiration. In some cases there may be convulsions, additional or supplemental to the other symptoms.

Diagnosis: This conditions is often very difficult to diagnose. It may be mistaken for Alcoholism, Apoplexy, Uraemic Convulsions, or Poisoning from other Alkaloids. The fact that there is no alcoholic breath affords some negative evidence, but very often the victim may be a drinker. In alcoholism, however, the pupils are dilated. The history of the case often clears up the difficulty. To distinguish opium poisoning from Apoplexy, one looks for haemoplestic stages, such as dilatation of one and contraction of the other pupil. In uraemia we find oedema of the ankle, but not in opium poisoning; and the urine tells us much. In poisoning from the other alkaloids the pulse is not so markedly slow, nor the respiration so depressed.

Treatment. Remove all the opium present in the stomach. If there is no paralysis of the Vomitory Center, and if the patient can swallow, use emetics such as mustard, warm water, zinc sulphate or Ipecac. It may be well to use the stomach pump, if the drug has been ingested in the liquid form. A substitute can be made by using a piece of rubber-tubing, and syphoning off the contents. If the opium has been swallowed in a solid form, the tube is useless except with repeated washings of water. Rouse the patient from sleep if possible, and exert him to keep up respiration. Pain is the best antidote. Shaking and shouting may

have no effect ; switchings and cold applications to the abdomen may be used but not to excess. Electricity is sometimes better than flagellation, and it does not bruise. For internal medication, strong coffee or tea is good if the patient can swallow, and alcohol is efficient in keeping up the circulation. If the patient cannot swallow, caffeine, 3-20 grains, and atropine, $\frac{1}{60}$ - $\frac{1}{30}$ gr., may be given subcutaneously. Opium and atropine are physiologically antagonistic in their effects on the heart, respiration and the pupil. Give only enough atropine to raise the arterial pressure, and to re-establish reflex action, shown by the dilatation of the pupil. Large doses may cause paralysis of smooth muscular fibres and consequent dilatation instead of contraction of the arteries. If necessary, resort to artificial respiration. In recovery do not allow the patient to relapse into sleep, but keep him awake so that he may aid in his own cure.

Post-Mortem. There are no characteristic post-mortem appearances. The blood is dark, due to carbonic-acid gas, and the brain is congested and full of serum. The fatal dose of opium cannot be given satisfactorily, for habit and idiosyncrasy cause great variations. $\frac{1}{8}$ gr. has been fatal, and 1 oz. of opium has failed to cause death in one accustomed to its use. 55 gr. of opium and 18 gr. of morphine have not been fatal even in those unaccustomed to them, and there was no vomiting, nor was the stomach washed out. Ordinarily $\frac{1}{4}$ gr. of morphine is considered a safe dose subcutaneously.

Idiosyncrasy may give rise to bad after-symptoms, such as itching and erythema, and so prevent its use even in small doses. Ordinarily the system becomes rapidly accustomed to it, and the dose must therefore be increased with use. This may cause the formation of the opium and morphine habit.

Abuse of opium is very common in the East, and is quite prevalent in this country. Generally the victims are women and physicians. The origin of the habit is largely medicinal, but it is often voluntary to drown temporary trouble. The effects are variable. The victim may practice it for years with no apparent injury except loss of appetite, dyspepsia and constipation. Then there follows a loss of weight, even to emaciation, loss of mental and moral power ; the skin becomes a dusky hue, there is a lack of firmness and will-power, and finally melancholia with a great tendency to suicide.

The treatment of the habit is nearly always unsatisfactory, and a cure is impossible. However much the patient may desire a cure, he will obtain opium. He has two objects : to get rid of his habit and to get the opium. Cure is attempted by the with-

drawal of the opium, either (1) gradually, (2) rapidly, or (3) suddenly. The suffering from the gradual withdrawal is long drawn out. Sudden withdrawal is dangerous. On the whole the rapid withdrawal is best. At first there is complete loss of appetite, vomiting, diarrhoea, malaise and insomnia. Stimulating, easily digestible and highly nutritious foods should be given. If there is gastro-intestinal irritation administer Bi. Cocaine, KBr. and Valerianate of Ammonium are often used to effect a cure but the Cocaine may lead to the formation of a habit worse than the opium habit. In many cases much can be done by the imagination, by the administration of some drug, it matters not what. This may reduce the quantity taken by one-half, but the other half is hard to manage. Electricity is good from its effects on the circulation, but a cure cannot be brought about by medication of any sort; there must be some moral influence.

The so-called opium cures are those leading to a gradual withdrawal of the opium. Of twenty investigated only one was found free from morphine, Dr. Keeley's Bichloride of Gold. The high prices at which they are sold and the willingness of patients to buy them shows what they contain.

Why opium causes sleep is a question which is hard to answer. The action on the nervous system produces two classes of effects: hypnotic and excitant on the brain and cord respectively. Which effect predominates depends upon the relative development of brain and cord. In man the cerebral effects predominate, but in animals the spinal effects are more marked. It is for this reason that convulsions are rare in adults, but are more common in children. The cerebrum, sensory centers of the cord, motor centers of the cord, the sensory and motor centers of the medulla are affected in the order named.

Medicinal doses have no sensible effect on the circulation of the average man, but large doses cause a slight acceleration of the pulse with increased tension, followed by a slowing of the rate and increased fullness and force. The slowing of the pulse is due to stimulation of the Vagus, and its increased force to a stimulation of the heart-muscle and heart-ganglia. The rapid pulse in poisoning is due to weakness or to paralysis of the vaso-motors. Respiration is gradually slowed according to the amount taken, opium acting directly on the respiratory center in medulla. Death is most often due to failure of the respiration. Full doses raise the body temperature and toxic doses lower it. Doses sufficient to cause sleep cause decreased elimination of carbonic acid gas.

Locally applied opium does not affect the pupils. Hence the contraction of the pupils is nervous, due to the stimulation of the

motors of the eye, the ocule-motor centers, or to the depression of the sympathetics. When paralysis comes on, the pupils dilate ; hence the dilatation observed just before death. Opium also causes dryness of the mouth by checking the secretion of saliva, and also a decrease of urine and constipation, the latter resulting in part from diseased peristalsis. Strange to say the secretion from the skin is increased, this being the only secretion not checked.

Products of oxidation of opium are eliminated by urine. Opium is eliminated in slight amounts by the urine, sweat, and milk ; and it may be found in the gastric juice after hyperdermic injections. Since it is eliminated by the milk, never give opium to nursing women. Some deny that opium is eliminated by the milk urine, but certainly oxidation products of morphine are there found when large doses have been given.

Therapeutics of Opium. (1) As an anodyne no drug is its equal, but in some cases anaesthetics may be better. In acute inflammation of the brain it is contra-indicated. The amount to be given as an anodyne varies with the intensity of pain, for since this is its physiological antagonist sufferers can bear more opium, and the after-effects are less marked. When the pain is very severe, enough to produce narcotism must sometimes be given, and in this case there is a great likelihood of disagreeable after-effects. These after-effects must not be confounded with the cause for the original exhibition of opium. In painful spasms, Renal, and Biliary Colic, and in Colic it is a very useful anodyne. In Neuralgia, in small or if necessary in large doses, it is inferior to other drugs, such as antipyrin and phenacetine. In Sciatica it is good in deep injections over the seat of the pain. In the Headache of beginning Typhoid Fever, in Bright's Disease, Pb. Colic Rheumatism, and Gastralgia it is very useful. In Hysterical Pains it is of course useless, these being relieved just as well by a hyperdermic injection of distilled water.

(2) As a Somnifacient. It should not be given unless insomnia is caused by pain or cough. In habitual insomnia it is well to alternate with chloral and other drugs to guard against the formation of the opium habit. It has been advocated for Delirium Tremens, and when given should be combined with K Br. or chloral or aconite. In low Neurasthenic Fevers with muttering delirium it is very useful, and seems to support the system when food cannot be taken. In other cases alcoholic stimulation may be better.

(3) In feebleness of old age it is of great service, and the formation of the habit need not be so much feared. To support the

system forms the third therapeutic use of opium. In advanced Phthisis it may be given, but not in sufficient quantities to interfere with respiration. (In Gastralgia opium is given as Dover's Powder as a sedative.)

(4) As a Sudorific. Sometimes morphine has been given in acute Uraemia, but its value is doubtful. It is good especially with Ipecac. as in Dover's Powder or assisted by hot lemonade and other aids to diaphoresis in the early stages of a general cold or in other forms of Muscular Rheumatism.

(5) To check secretions. While increasing the secretions from the skin it checks all others, and this is one of its uses. For this purpose the alkaloid, morphine, is less efficient than opium itself. In Diarrhoea with camphor or any astringent opium is very efficient. In Mucous Diarrhoea it should not be given until the mucus is removed by means of castor-oil or some saline cathartic. Cholera Morbus is often checked when morphine is injected hypodermically $\frac{1}{8}$ gr. In true Cholera morphine and opium are useless and may be positively injurious. In Enteritis and Dysentery the opium is given as an anodyne with salines, and is not given to check secretions. It is often given in Diabetes Insipidus with gallic acid; and in Diabetes Mellatus with proper diet it has often effected a cure. In Mercurial Salivation the discharge is influenced by opium, but Belladonna does much better.

(6) As an Antiphlogistic. On account of its action in allaying irritation and inflammation it is very useful in Pericarditis, Meningitis, Colic and Peritonitis, given frequently at regular intervals in the latter diseases. In local irritation and itching skin diseases, opium is good, and in acute vomiting it is given as a suppository or a rectal injection or laudanum and starch water. For irritative cough, morphine is given in doses of $\frac{1}{12}$ gr. with syrup of wild cherry. In pulmonary diseases, as Bronchitis and Pneumonia, when it causes an increase of râles or cyanosis, decrease its use; and in these diseases it should always be given very cautiously owing to its depressing action upon the respiration. In advanced Phthisis it is sometime used, not to allay irritation, but as a somnifacient. In Obstruction of the bowels by spasms due to irritation or inflammation, opium relieves by relaxing the spasms, and indirectly as a laxative. In Dyspnoea from heart-disease, and in Mitral and Aortic Insufficiency where digitalis fails, opium is often of use.

As to the alkaloids, Morphia has less power as a sudorific and since it has little effect upon the secreting processes of the intestines it causes little constipation. Its chief use is an anodyne; and since it is absorbed very quickly subcutaneously, a hypodermic

injection is the favorite method of administration. Codeina is much less powerful than Morphia and of limited use. It can be used to check coughing and in Diabetes. Dose: $\frac{1}{2}$ –2 grs.

Narceina is not to be recommended for anything. Narcotina has been already mentioned. The other numerous alkaloids, as Papaverina and Thebaine, need no further mention.

Administration. Morphine may be given hypodermically as a solution of any of its salts, by the mouth as a solid or a solution, or by the rectum as an enema or suppository. Not all people can take morphine, and before administering it, it is well to ascertain if the person has ever taken it before and if so with what results. This lack of toleration is not always due to narcotine, for pure morphia and the denarcotized tincture have the same effects. The deodorized opium agrees with many persons better than do the other preparations. Children cannot bear opium, so avoid especially Dover's Powders and give them only very weak preparations. To produce decided narcotism only the liquid form should be given in repeated doses by the mouth. If the desired effects in the case of great pain are not produced immediately by administration by the mouth, do not follow it by a hypodermic injection. It is best to give it some time after a meal, as it diminishes the HCl in the gastric juice. Old pills are best for Diarrhoea. The after-effects may be in part avoided by KBr., and when they appear use some strong stimulant like coffee, or give Belladonna or Atropine in very small doses.

Opium is contra-indicated in Apoplexy, Coma, Asphyxia threatened by copious secretion in the air passages, Congestion of the Brain, marked idiosyncrasy, and in Pulmonary Diseases. Never allow the patient to take it himself, and keep the size of the dose from his knowledge.

2. CHLORAL. CHLORAL OR CHLORAL HYDRATE. Transparent, colorless tablets or distinct crystals; penetrating, slightly acrid odor, like over-ripe melons; bitter caustic taste; neutral reaction. Soluble in alcohol, water, ether, 4 parts of chloroform, glycerine, carbon bi-sulphide, benzine, benzol, fixed and volatile oils. It is formed by the action of chlorine gas to saturation on anhydrous alcohol, which is then purified from HCl. by sulphuric acid and lime. It is then mixed with water, and the hydrate is precipitated and pressed into tablets. Incompatibles: Alkalies decompose it into chloroform and formates.

Physiological action. Internally administered in moderate doses chloral causes a quiet, almost natural sleep, from which the patient is easily aroused. This is probably due to a direct action on the cerebrum, perhaps to anaemia. The sleep may be wanting,

or may not be quiet, being preceded by restlessness and even delirium. Large doses cause profound sleep; toxic doses, coma with complete anaesthesia and muscular relaxation. As a rule, there are no unpleasant after-effects upon awakening, but there may be headache and slight nausea. With increased doses the sensibility and reflex irritability of the chord are lessened or even extinguished, and in toxic cases the respiratory center may be depressed to the extent of paralysis. The effects in moderate doses outside the nervous system are not marked. On the circulation there is little if any effect, but large doses depress the heart, due to vasomotor paralysis and a direct depressant action. In toxic doses the pulse is very feeble, rapid and irregular; hence avoid its use in patients troubled with heart disease of any sort. With moderate doses the pupil is slightly contracted in sleep, but becomes, when the patient is awake, normal once more. Respiration is slightly checked with small doses, more so with large, becoming slow and full. With toxic doses it is irregular, very rapid and shallow, due to the direct action of chloral on the respiratory center. The temperature falls by failure of the circulation, and dilatation of the cutaneous vessels. 10 per cent. sol. for antiseptic.

Toxicology. The symptoms of poisoning are coma, weak, slow pulse, contracted pupils, relaxation of the muscular system and death due to sudden stoppage of the heart in systole, or to paralysis of the respiratory center, or to both. The treatment is much the same as in opium poisoning. Emetics should be given, or better the stomach-pump should be used, since this involves less strain upon the heart. Cardiac and respiratory stimulants should be applied externally; and internally strychnine, atropine and alcohol may be given for internal stimulation. For external application friction, electricity, dry heat, cold douches, mustard, flagellation and exercise are good. Do not allow the patient to exert himself too much. Support the heart by the subcutaneous injection of 10 m. of Tr. Digitalis every 20 minutes until the required effects are produced, preceded by the administration of brandy, whiskey, or ammonia. Keep the head below the heels to prevent cerebral anaemia. Atropine is said by some to be a valuable antidote, and its administration is to be guided by the state of the respiration. Strychnine is not so good; though chloral is an antidote for strychnine, the reverse is by some said not to be true. If the natural respiration shows signs of failure, resort to artificial respiration. *Post-mortem:* There is congestion of the meninges and substance of the brain and chord; and also oedema of the lungs.

Chronic poisoning is called "Chloralism." The respiration is

depressed even to dyspnoea; the mind may be weakened even to dementia; and there may be a loss of sensation in the legs, papaplegia, and partial paralysis of the pharynx. The first important symptom is an eruption on the skin varying in intensity, such as red blotches, or an erythematous redness of the face, especially after the ingestion of wine or other alcoholic drinks. It begins on the face and may extend down the trunk, and even involve the mucous membrane, causing conjunctivitis and catarrhal sore throat. The glands may be involved, and sometimes there are purpuric symptoms, petechiae and spongy gums. The eruption may be so bad as to cause inflammations and ulcerations about the finger nails. There may be acchymoses and diarrhoea.

The toxic effect of chloral is said to be due to the splitting up of its molecule into chloroform and formates, this decomposition being caused by the alkalinity of the blood. But the alkalinity is not sufficient to bring about this decomposition, and besides, no chloroform is ever found in the blood or expired-air. Chloral probably acts simply as such. It is eliminated in the urine as unrochloralic acid and as chloral, and may cause glycosuria and irritation of the kidneys.

Therapeutics. Chloral is used as a somnifacient, and is among the best of the class, though in insomnia due to pain it is of no particular value. In hysterical excitement, in acute delirium in combination with opium or better morphine, and in delirium tremens it is very good. In the Insomnia of adynamic fevers its use is dangerous. In Delirium Tremens it is used in combination with equal parts of KBr. In this disease the heart is always weak and somewhat fatty, due to the use of alcohol, so that great caution must be used in giving chloral, which may further depress the heart. In this case it should not be given in doses larger than 10 gr., nor often repeated.

As an anodyne chloral is not very good, its effects being slight unless given in large and dangerous amounts. In child-birth it has been proposed, but other drugs are better. As an anti-spasmodic it is useful with KBr. in relaxing spasms, and with opium in Tetanus. 10 gr. are given alone or with drugs every two hours by the mouth, or 20 gr. with 60 gr. KBr. by the rectum if swallowing is impossible. Intravenous injection is bad, for it has the danger of causing Phlebitis. It is given in strychnia poisoning.

Chloral is a valuable hypnotic. In convulsions from strychnine or in puerperal convulsions, it may be given in large doses, 30 gr. at once. It is also useful in Acute Chorea, Nocturnal Epilepsy, Hiccough, Whooping-cough, Nocturnal Emissions, Spasms of children, Nocturnal Enuresis, and in Convulsions of

children; but it is not to be recommended in Asthma as it endangers the heart.

Locally applied in water chloral is an irritant, and is used as a liniment for Rheumatism, Neuralgia, and to arrest itching in Eczema and other Skin Diseases. As a vesicant it causes too much pain. It is used as an Antiseptic in bed-sores and foul ulcers as a 10 per cent. aqueous solution. An ointment of $\frac{1}{2}$ dr. to the oz. has the same uses, and is also applied to sore nipples. For injection in Gonorrhoea it is given in a solution of 20 gr. to the oz. In a strength of 40 gr. to the oz. it has been used to preserve animal tissue, and to keep the urinals of paralytics from being offensive. The ordinary dose for internal administration is 10-20 gr.

Administration. Give only the pure drug, since impurities produce irritation and bad after-effects; and in general give in solution with a mucilage or syrup by the mouth, or as a suppository or enema by the rectum, since absorption from the rectum is easy. It cannot be injected hypodermically, since it is too painful. Ordinarily 20 gr. is as large a dose as may safely be given, and it should not be repeated at too short intervals. Give when necessary hourly until 60 gr. have been taken, then wait some hours. Contra-indications: When there is a tendency to Bronchitis use chloral cautiously; and especially if the heart is weak, for heart failure has resulted from 20-25 gr. Recovery has followed after the ingestion of nearly an oz. The habitual use of alcohol establishes a tolerance for both chloral and anaesthetics.

BUTYL CHLORAL. "Croton" Crystalline; disagreeable taste; soluble in water. It is used as a substitute for chloral, and is less depressant on the heart and circulation. It has no effect on the vaso-motors, but is very useful for its action on the fifth pair of nerves in Neuralgia of the fifth, and in headache due to weak eyes. Owing to its bad taste it is given with wine, glycerine, syrup or in pill form in 5 gr. doses every hour till 30 gr. have been taken. Like chloral it is dangerous when the heart is weak.

CHLORAL CAMPHOR. A liquid made by rubbing together equal amounts of camphor and chloral; a good liniment for Neuralgia used locally. It can be taken internally as a sedative narcotic in Mania in 10-20 m. doses.

PARALDEHYDE. This is a colorless liquid with a nauseous taste and disagreeable odor, sufficient to prevent its general use. It is an uncertain hypnotic, and is used where other hypnotics fail; and also for Epilepsy. There is no particular need of this remedy, nor of **AMYLENE HYDRATE**, which is safe but inferior to chlorate. **URETHAN** is safe but uncertain. **HYPNONE** has very

moderate power. METHYLAL depresses the heart and respiration, and has no advantages over the others. Trional and tetaronal both are similar to sulphonal but the first acts more quickly.

SULPHONAL. Manufactured under a patented process and therefore non-official. A new synthetic remedy and a valuable hypnotic. White crystalline substance, barely soluble in cold water, but more so in hot, with only slight bitter taste, and so may be given in hot tea or soup.

Physiological Action. Sulphonal is a pure hypnotic with no effect on the heart, respiration or temperature. It aids in the production of natural sleep. Since it is slow in acting it should be given an hour or two before its effects are desired. In some cases it must be given as much as 12 hours before. As a rule there are no bad after-effects, but headache, mental confusion, and lassitude may follow. There is no danger of forming a habit or craving for it, and it does not require the use of constantly increasing doses.

Therapeutics. Sulphonal has no influence on pain or insomnia due to pain or to cardiac or other organic diseases, but is useful for the insomnia of insanity, worry, over-work, etc.: and it can also be used when the use of chloral is dangerous. Dose: 5-45 gr. 15-25 gr. is enough to begin with.

✓ **CHLORALMIDE.** Non-official. An addition product with no marked effect on the circulation or on the cord. It has a pronounced action on the brain and is quicker than Sulphonal, but slower than Chloral. It should be given, therefore, half an hour before sleep is desired or required. It has a slightly bitter taste, is soluble in water, more so in alcohol; and is decomposed by hot water and alkalies. Dose: 20-50 gr. given in water, brandy and water, or in capsules. Usually there are no after-effects.

Therapeutics. It is useful in the same class of cases as Sulphonal, and in many cases of insomnia due to pain. It is also useful in cardiac Asthma. 30 grs. of Chloraldehyde and 30 grs. Potassium Bromide, after two days treatment with cholagogues, are said to prevent sea-sickness if taken the night before going aboard. Chloraldehyde and Sulphonal have no depressing action on the heart, and neither produces a habit or any poisonous chronic effect.

HYPNALE. Non-official. A compound of Antipyrin and Chloral, valuable as a substitute for opium in producing sleep and allaying pain. It is useful in Neuralgic Insomnia, and in Insomnia due to cough in Bronchitis and Phthisis. Dose: 5-20 gr. in syrup.

IV. Delirifacients.

Delirifacients are drugs which in sufficient doses produce delirium followed by stupor, and marked dilatation of pupils. Their action is chiefly on the cerebral nerve cells.

I. CANNABIS. INDIAN HEMP or HASCHISCH. There are two species: *Cannabis Americana* and *C. Indica*. In a sense they are identical except in source and therapeutic value, the Indian species being the better and the one used in the officinal pharmaceutical preparations. Cannabis is used as an intoxicant in Hindostan and Persia. The active principle is a peculiar resin, Cannabin, and a volatile oil is also present. Cannabin is a soft solid, insoluble in water, soluble in fixed and volatile oils, alcohol and ether; bitter, acrid taste, somewhat like balsam. The resin comes not only from the flowering tops, but also from the exudations on the leaves and stem. Peasants put on leather clothes, run through the fields, then scrape off all the resin that sticks to them.

Preparations. The pharmaceutical preparations made from the flowering tops are the following:—

EXTRACTUM CANNABIS INDICAE. A black resinous mass with peculiar narcotic taste and odor. Dose uncertain, $\frac{1}{8}$ – $\frac{1}{4}$ gr.

EXTRACTUM CANNABIS INDICAE FLUIDUM. Dose 2–5 m.

TINCTURA CANNABIS INDICAE. There is also a Tannate, and a resin named Cannabinen, which are non-officinal.

Physiological Action. In full doses Cannabis causes a peculiar intoxication like the first effects of opium exaggerated, except that it has no effect on the respiration and pulse. It is not poisonous and has no bad after-effects. Intoxication varies with the temperament and idiosyncrasy, and also at different times in the same patient. There is exhilaration with intervals of quiet and loud laughter, dreams and visions. There may be fright or maniacal delirium, double consciousness, and a sense of great extension of time and space. With some there is a sense of weight in the legs, marked disturbance of motility, and more or less anaesthesia. The first stage comes on within an hour after ingestion and lasts several hours. Then drowsiness and deep sleep follow, from which one awakes with a great appetite. The pupils are dilated, the pulse is quickened, and respiration goes on with reasonable frequency though it seems very slow to the subject. There is no danger of poisoning; lemon juice or a vegetable acid stops its action. Its abuse may lead to insanity.

Therapeutics. Cannabis is used as an analgesic and hypnotic. It is inferior to opium and is used when opium is contra-indicated.

It does not constipate and improves the appetite, and there is no after-nausea. It relieves Headache, Migraine, Neuralgia, and headache from strained eyes; and it may be substituted for morphine in cough medicines. In Bright's Disease it allays the pain over the kidneys, and it is also good in Tetanus, continued dull Headache, Paralysis Agitans, Chorea, Hysteria, Rheumatism, and to induce Euthanasia in Phthisis. As a hypnotic it is neither powerful nor certain.

Administration. The preparations are of very uncertain strength, so that it is best to determine the dose experimentally before using. The most convenient preparation is the extract in $\frac{1}{4}$ – $\frac{1}{2}$ gr. doses.

2. BELLADONNA. DEADLY NIGHTSHADE. Officinal in both leaves and root. The whole plant, indigenous in Europe and cultivated in United States, contains the active principle, but only the leaves and roots are used, the latter being gathered in spring and autumn from plants over four years old. The dried leaves do not keep well. A perennial herb, with faint narcotic odor, sweet, acrid and nauseous taste. Both leaves and roots yield their virtues to water. The leaves contain 4 per cent. alkaloids.

Active principles. The chief alkaloid is Atropine, but there may also be present a small amount of Hyoscyamine, both of these being in combination with malic acid.

There are the following preparations of Belladonna;—

— EXTRACTUM BELLADONNAE FLUIDUM. Dose: $\frac{1}{2}$ m.

EXTRACTUM BELLADONNAE. Dose: $\frac{1}{8}$ – $\frac{1}{2}$ gr.

— TINCTURA BELLADONNAE. Dose: $\frac{5}{36}$ m. or even more.

ABSTRACTUM BELLADONNAE. Dose: $\frac{1}{4}$ –1 gr. little used.

UNGUENTUM BELLADONAE.

ELPLASTRUM BELLADONAE.

LINIMENTUM BELLADONAE. Composition: Fluid extract 95 per cent, Camphor 5 per cent.

The preparations of the alkaloid are:—

ATROPINA. Yellowish white, colorless, or silky crystals; permanent in air; bitter, burning taste and alkaline reaction; soluble in 300 parts of cold water, and 58 of boiling; very soluble in alcohol, ether, chloroform, fixed and volatile oils. Dose $\frac{1}{120}$ – $\frac{1}{60}$ gr. or $\frac{1}{2}$ milligr. It occurs most abundantly in the root, only 4 per cent. being found in the leaves. Atropine can be decomposed into Tropic Acid and Tropine, which reunite to form Homatropine, which resembles Atropine but is less powerful.

— ATROPINAE SULPHAS. Combined with Sulphuric acid atropine form an indistinctly crystalline powder, very bitter, neutral, very soluble in water and alcohol. Dose: $\frac{1}{120}$ – $\frac{1}{60}$ gr.

Physiological Action of Belladonna and of Atropine. Belladonna acts on the system chiefly by the atropine which may be absorbed by the stomach, mucous membranes, including the conjunctiva, abraded surfaces, subcutaneous tissue, and even the unbroken skin. Small doses have no marked effect upon the system further than to cause a slight dryness of the throat and mouth.

Large doses cause increased dryness, dizziness, and dilatation of the pupil. More than $\frac{1}{30}$ gr. of the alkaloid produces extreme dilatation with paralysis of the muscles of accommodation, a strong and rapid pulse, and a bright scarletiform eruption not closely dependent upon the size of the dose, beginning at the face and neck and sometimes extending over the whole body. This may be followed by desquamation. There is next a marked stimulation of the vaso-motors, more or less mental confusion, dizziness, giddiness, and even active delirium.

Toxicology. In toxic doses these symptoms are intensified, and there may be convulsions with or without furious maniacal delirium, forcible expulsion of the urine, followed by retention; enfeebled and diminished pulse, but with the rate increased at times to 120 or 130 per minute; rapid and stertorous respiration. The delirium may alternate with stupor. The convulsions may subside into paralysis, more or less anaesthesia, and death by asphyxia. In some cases there is complete aphonia and aphasia, and an attempt to swallow leads to convulsions as in hydrophobia, these subsiding after a time into stupor.

Post-Mortem. There are no characteristic post-mortem appearances except a slight congestion of the lungs, brain substance, spinal cord and retina, the latter together with the dilatation of the pupil being almost characteristic of atropine poisoning.

Treatment. Remove the drug from the stomach by the stomach pump, and then treat the symptoms as they arise. Use external stimulation by heat, mustard, and switchings. If necessary use artificial respiration. To prevent the re-absorption of atropine from the bladder, draw off the urine by catheterization. Although atropine is the physiological antagonist of opium the reverse is not true. It will simply increase the danger to give morphine. Pilacarpine is a physiological antidote. Physostigmine in doses from $\frac{1}{80}$ – $\frac{1}{12}$ gr. may be injected hypodermically.

Action on the circulation. In small doses Belladonna stimulates the heart muscles and the vaso-motor centers. Large doses diminish arterial pressure by paralyzing the latter, and by causing a dilatation of the muscular coats of the vessels. The heart is depressed only in overwhelming doses. Sometimes the pulse is slow.

On the Respiration. Small doses do not affect the respiratory centers, except that in ordinary amounts they may stimulate them. Large doses depress and toxic doses paralyze the motor centers supplying the respiratory muscles.

On the Temperature. Small doses increase the body temperature, toxic doses lower it. In children there may be a rise of one or two degrees due to increased heat-production without a corresponding decrease in heat dissipation. The fall of temperature in poisoning is due to vaso-motor paralysis, thus giving increased heat-dissipation.

On the Secretions. Its effects are very marked. The mouth is dry due to the check upon the submaxillary, parotid and mucous glands. With small doses the skin becomes dry, so that the urine and its solids are both increased; but large doses diminish the urine, and fatal doses suppress it. Its action on the urine is uncertain, however, and unimportant. On the other secretions its action is not marked.

On the Muscular System. On the voluntary muscles it has no effect except in poisonous doses, or when injected directly into them. On the involuntary muscular fibres it acts as a paralyzant and antispasmodic. It increases peristalsis by counteracting any tendency to spasms, by depressing the inhibitory fibres of the Splanchnic. Toxic doses paralyze the muscles of the intestines and bladder.

On the Nervous System. On this it acts profoundly. It is a powerful excitant of the brain and spinal chord in moderate doses. Large medicinal doses destroy the excitability of the motor nerves, and depress the afferent fibres.

On the Pupil. The action on the pupil is very remarkable. Applied locally or given internally it causes a dilatation in all animals except birds. This is the most lasting of all the symptoms, and is accompanied by paralysis of the muscles of accommodation, due to paralysis of the peripheral ends of the third pair of cranial nerves, and to stimulation of the sympathetics. It does not dilate through the nerve centers, for the same effects are caused when the nerves of the eye are severed. It is therefore brought to the eye by the blood, and though taken internally really acts locally. $\frac{1}{2000}$ mgr. has caused dilatation lasting 20 hours, and in toxic cases 1 drop of the urine causes dilatation of the pupil of a cat or rabbit. When used locally in ophthalmic practice its effects may last for two weeks.

Therapeutics. As an anodyne it is of little value except when used locally. Injected near the nerve in mild Neuralgia it may sometimes be useful but not in severe cases. In Intercostal

Neuralgia, Belladonna plasters afford relief. It increases the analgesic power of opium and decreases its bad after-effects.

The chief indication for belladonna or atropine is to relax spasms, probably not by acting on the nerve centers. In spasms of the voluntary muscles its action is feeble unless it is injected directly into them, as in the muscular spasms of nerve-wounds and in Torticollis. It has more power over the involuntary muscles, and may be given internally or applied externally, the latter being the better method. It is given internally in Pb. Colic, simple Spasmodic Colic, Spasmodic Constriction of the Bowels with obstinate constipation, Dysmenorrhoea; and it can be used in large doses in Whooping-cough, though it is not a sure remedy, and in Renal and Biliary Colic. It is good for the spasmodic contractions of Asthma, as the cigarette or burned with saltpetre. Usually, however, the leaves of Stramonium are used. In Nervous Coughs Belladonna and Atropine are the best remedies we have. In Spasms of the Urethra, Chordee, and also to relax a rigid Os or contracted Sphincter Ani, it is very useful, applied directly as an ointment or poultice. In Incontinence of Urine in weak children due to irritation of the urine on the bladder, or to relaxation of the sphincter, or to irritation at the end of the penis, Belladonna is the best of remedies. It can be used steadily for weeks with children, for they bear the drug in relatively greater amounts than adults. The cure should be aided by keeping the urine alkaline. In Constipation, by its depressant action on the inhibitory fibres to the intestine, it is of great service, given as an addition to laxative pills or as an extract.

As a Stimulant to the Circulation, Belladonna is used in cases of poisoning, Typhus Fever, Collapse from acute diseases as Pleurisy, Pneumonia or Typhoid Fever, and also in acute Nephritis. It is also used when there is a contraction of the pupil, especially in Typhus Fever or after the shock of an operation, for the contracted pupil is a sign of vaso-motor paralysis, and consequently of increased heat-dissipation.

In Arresting Excessive Secretions, Belladonna is very useful. In Idiopathic Ptyalism, Mercurial Salivation, by paralyzing the Chorda Tympani and by stimulating the Sympathetics, it is very efficient; and in Exhausting Night Sweats as in phthisis it is very often of the greatest service, given in $\frac{1}{80}$ — $\frac{1}{60}$ gr. doses subcutaneously, or in full doses by the mouth. For the same reason it is also useful in exhausting Colliquative Diarrhoea, in profuse Sweating of the feet and other parts, given internally or applied locally. It is useful in Bromidrosis. It is the best drug in the Pharmacopoeia for checking the secretion of milk in an inflamed breast,

applied as an ointment. In Leucorrhoea from disease of the cervix it is applied locally with tannic acid.

In Diseases of the Eye, Belladonna is used locally to dilate the pupil for examination, and in Iritis to keep the pupil dilated in order to prevent adhesions. Tropine and Tropic Acid when combined give Homatrophine which is even better than atropine itself. It slows the pulse, but is like atropine in all its other actions, and in the eye it has the same effects except that recovery is quicker, that the conjunctiva is less inflamed, and that there is less likelihood to be any systemic disturbance. Hyoscyamine, another Belladonna alkaloid, is also better than atropine. The effects of the Hydrobromate of Homatrophine last three days, of Hyoscyamine seven to nine days, of Atropine two weeks.

Belladonna in cases of Poisoning. As an antidote of opium in toxic cases atropine is very useful, and is also of service in poisoning from Physostigma, Sb. HCN., As. and Aconite and Mushrooms. As an antagonist of opium it acts in several directions, but is not a complete antagonist. It has opposite effects on the pulse, temperature and respiration, and pupil. In treating opium poisoning do not give atropine in too large amounts, and never when the respiration reaches 10 per minute or above. It is best to inject it hypodermically, combined with Caffeine. The pupil is no guide, for morphia acts through the nerve centers, whereas atropine acts peripherally.

Administration. In prescribing Belladonna it is best to use Atropine subcutaneously. There are some cases where this is not desirable, as in children, and here the Belladonna preparations are given. The dose of the alkaloid is $\frac{1}{120}$ – $\frac{1}{30}$ gr. or $\frac{1}{2}$ mgr. The tincture is the favorite preparation when the drug itself must be used, the abstract being little used; and in general few abstracts are ever used. The plaster and ointment are for external use. The leaves and root are never used internally. Never give Belladonna internally before or just after a meal since it decreases the secretion of the digestive juices.

To designate their source, in the 1890 Pharmacopoeia the names of the Alcoholic Extract, the Tincture, and the Fluid Extract are given as follows:—

EXTRACTUM BELLADONNAE FOLIORUM ALCOHOLICUM.

TINCTURA BELLADONNAE FOLIORUM.

EXTRACTUM BELLADONNAE RADICIS FLUIDUM. Dose: 5–30 m.

3. STRAMONIUM, JAMESTOWN WEED or THORN-APPLE. Official in 2 forms; the seed, Stramonii Semen, and leaves, Stramonii Folia, of Datura Stramonium, a shrub 4 feet high growing in waste places in United States. The leaves when bruised

fresh give out a foetid narcotic odor lost in drying. The seeds are small, kidney-shaped and wrinkled, odorless, with a bitter nauseous taste. The active principle extracted by alcohol and water, is a mixture of the Halates of Atropine and Hyoscyamine, once called Daturine, and supposed to be a distinct alkaloid. The seeds contain more of the active principles than the leaves and from them the various preparations are made. The preparations are the following:—

EXTRACTUM STRAMONII SEMENIS. Dose: $\frac{1}{2}$ – $\frac{1}{4}$ gr.

TINCTURA STRAMONII SEMENIS. Dose: 15–30 m.

EXTRACTUM STRAMONII SEMENIS FLUIDUM. Dose: 1–3 m.

UNGUENTUM STRAMONII.

Physiological Action and Therapeutics. The effects of small and large doses of Stramonium are the same as those from Belladonna, and the symptoms of toxic doses are also identical. The Therapeutics of the drug are as those of Belladonna. In Spasmodic Asthma it is used more frequently than Belladonna as cigarettes or burned in a saucer with saltpetre and inhaled. The use of the drug must be made cautiously, for it may cause alarming symptoms. In local inflammations, as Hemorrhoids, the leaves are used as a poultice.

4. HYOSCYAMUS or HENBANE. Officinal as the leaves. Hyoscyami Folia, of Hyoscyamus niger. A coarse biennial, indigenous in England, naturalized in United States with a rank, offensive smell, containing the active principle in all parts though only the leaves are used. When bruised fresh these have a strong disagreeable odor, narcotic, like tobacco. The taste of the fresh leaves is described as mucilaginous and slightly acrid, but old and dried leaves have little taste or smell. They contain some potassic nitrate. Hyoscine and Hyoscyamine are the active principles.

The preparations of the drug are the following:—

ABSTRACTUM HYOSCYAMI. Dose: 3–5 gr.

EXTRACTUM HYOSCYAMI ALCOHOLICUM. Dose: 1–2 gr.

EXTRACTUM HYOSCYAMI FLUIDUM. Dose: 5–15 m. (1–4 dr. white.)

TINCTURA HYOSCYAMI. Dose: $\frac{1}{2}$ –1 fl. dr.

Physiological Action and Therapeutics. The effects of Hyoscyamus are practically the same as those of Belladonna and Stramonium, but it is more of a hypnotic than they, due to the alkaloid, Hyoscine. The therapeutics used are the same.

HYOSCYAMINA. A vegetable alkaloid found in Belladonna, Stramonium and Hyoscyamus, most abundantly in the latter. When separated from these plants it crystallizes out leaving the amorphous Hyoscine in the mother-liquor; the latter is extracted

by the formation of a salt of gold. Hyoscyamine has the same chemical formula as Atropine and Hyoscine, and occurs in needle-shaped crystals or star-shaped clusters. Its salts are golden or whitish yellow, in scales and plates. They are the sulphate, (officinal), and the Hydriodate (non-officinal), and hydro-bromate, (officinal).

/ **HYOSCYAMINAE SULPHUS.** A crystalline powder of golden or whitish scales or else an amorphous yellow powder, with neutral reaction, odorless, acrid, soluble in water and alcohol. Doses: Subcutaneously, $\frac{1}{60}$ – $\frac{1}{4}$ gr; by the stomach, $\frac{1}{60}$ –1 gr.

/ **HYOSCYAMINAE HYDROBROMAS.** A yellowish-white resin-like mass, or prismatic crystals which have particularly when damp a tobacco-like odor, and an acrid nauseous and bitter taste. Is deliquescent and soluble in water, alcohol and ether. Dose same.

HYOSCINA. Non-officinal, but in common use. Its chemical formula is the same as that of Hyoscyamina, of which it is an isomer. The hydrobromate (officinal) is freely soluble, the hydriodate less so. The alkaloid occurs as an amorphous powder or in the crystalline form, the crystals being large, yellow or white, and transparent. It is used much the same as the allied alkaloids. Doses: subcutaneously, $\frac{1}{150}$ – $\frac{1}{50}$ gr; by the mouth, $\frac{1}{120}$ – $\frac{1}{20}$ gr. It is tasteless and can be given to patients without their knowledge.

Physiological Action. It is a powerful nervous depressant, but has little effect upon the circulation. It quiets the cerebrum, causes deep sleep, and decided doses bring on dryness of the mouth, and sometimes giddiness or mild or even wild delirium. The dilatation of the pupils is not a constant effect, except in large doses. In such cases the pulse and respiration are slow and full, the skin is bathed in perspiration, there is muscular relaxation, giddiness, and lack of co-ordination. Over-doses destroy reflex action due to paralysis of the cord, and cause decided delirium. No fatal cases have been recorded, but $\frac{1}{50}$ gr. has caused alarming symptoms. It is used as the hydrobromate.

Therapeutics. In a limited class of cases it is good in Insomnia, Delirious Excitement as in Acute Mania, Alcoholic Mania and Hysteria. Sometimes in Nervous Excitement very minute doses may cause quiet without sleep. It is also good to relieve Sexual Excitement on account of its action on the nerve-centers; and in Paralysis Agitans where there is much pain. In cases where maniacal patients will not swallow, it may be given subcutaneously; and since it is tasteless, it can usually be given without their knowledge. In Insomnia it often fails, however. There are no disagreeable after-effects, but occasionally there is some headache. The drug produces its effect in 10 minutes and lasts

6-8 hours. It is of no use in Asthma, and may even bring on an attack. It is also useless in Insomnia from heart-failure; and in the sore throat of Scarlet Fever, where it may cause spasms of the glottis and larynx.

5. COCA (1890), ERYTHROXYLON (1880). The leaves of Erythroxyton Coca, growing wild in South America, especially Peru. The leaves are hand-picked and sun-dried. They are green if good, brown if inferior. They contain the alkaloid Cocaine and also Hygrina, which is unimportant. They have a bitter taste, and a fragrance not unlike that of tea is caused by a volatile substance also contained in them. The therapeutic use of Erythroxyton is slight. Dose: $\frac{1}{2}$ -4 dr. of the EXTRACTUM ERYTHROXYLI FLUIDUM.

COCAINE. A very valuable alkaloid occurring in colorless transparent prisms, soluble in 700 parts of water, more so in alcohol, freely in ether. It forms with acids soluble, crystalline, and bitter salts.

COCAINE HYDROCHLORAS. The most frequently used of the cocaine salts in a 4 per cent. aqueous solution, as it is quite soluble in water.

Physiological Action. Cocaine leaves have long been used by the natives of Western South America as a stimulant. They say that chewing them with a little lime gives great endurance for mental and physical labor with the need of but little food, and there is some truth in this. Coca is a cerebral stimulant, producing a peculiar mental excitement. In large doses it causes Narcosis, Delirium, Paralysis and Anaesthesia. Death is due to paralysis of the respiratory center. The temperature is increased due to increased heat-production. In smaller medicinal doses its effects on the circulation are very slight. It has no effect on the temperature and heat production in small doses, but they stimulate the respiratory centers, and over-doses paralyze them. Moderate doses increase the peristaltic movements and large doses paralyze them. Cocaine is eliminated by the urine and faeces, and is partially destroyed in the system.

Therapeutics. The strictly therapeutic use of cocaine is quite limited. It is often used as a stimulant in low fevers, and in the treatment it undoubtedly does some good, but unfortunately there is danger of the formation of the cocaine habit. For Excessive Vomiting it is good since it depresses the sensory nerves and diminishes gastric irritation. Its stimulative effect upon the cerebrum makes it good as a hypnotic in Hysteria, and Melancholia theoretically but not practically. It has been used with doubtful success as a tonic in exhaustion from acute diseases.

Mucilage of coca is the usual form used

Produces Anaesthesia on granulated surface.
Never use sub-cut over 1% sol.
 $\frac{1}{2}\%$ is better.

The local effect of cocaine is that of a distinct and sure anaesthetic, whenever it can reach the nerve filaments in sufficient concentration, affecting both the nerves of special sense and those of general sensibility. When applied to the mucous membrane it bleaches it, and is followed by pain after the anaesthesia passes off. The nasal and conjunctival membranes are more permeable and sensitive than those of the larynx, throat, trachea, vagina, etc. Applied to the eye it causes anaesthesia, and like atropine a dilatation of the pupil, but without paralysis of the muscles of accommodation. It cannot, however, be used like atropine to prevent adhesions in Iritis. When used in the eye for operations it is either injected or applied from time to time. If the operation is a severe one it is best to etherize.

Local anaesthesia by cocaine is very useful in minor surgery. A little of a 4-10 per cent. solution is injected into the tissues when used for this purpose. It is used extensively in operations on the nose and throat, and in the treatment of various affections of these parts. In Acute Coryza a 10 per cent. solution gives relief at once; or it may be used in a powdered form, of equal parts of cocaine and morphine with five parts of Bi. as snuff, especially in Hay-Fever. In Bronchitis a two per cent. solution is used to make a direct application to the nose and throat, and it is also given by atomization. It is very useful as a local anaesthetic in painful Ulcers, open Ulcerative Cancers, inflamed Hemorrhoids, Fissure Ani. When the tissues of mucous membranes are dense and impermeable, it must be used profusely. In Acute Gonorrhoea it lessens the pain of micturition. In irritable Stricture and in Catheterization it is used to prevent pain before exploration of the bladder in the form of a bougie, $\frac{1}{4}$ gr.

Internally cocaine is used as the fluid extract of Coca in $\frac{1}{4}$ -1 gr. doses, and also as a Vinum, "Wine of Coca," "Vin Marina," etc. The alkaloid itself is used in doses of $\frac{1}{4}$ -1 gr. Sometimes its internal or local use may be followed by unpleasant effects, including nausea which may be intense, vomiting, sometimes syncope and epileptiform convulsions, loss of speech, and temporary blindness.

Toxicology. There are a number of toxic cases recorded from the internal and local use of cocaine. One death occurred in 40 seconds from 10 m. of a 4 per cent. solution given subcutaneously. Another case was due to an injection of 1 dr. of a 20 per cent. solution into the urethra within 20 minutes. Recovery has followed the ingestion of very large doses, even 22 gr. Amyl Nitrite and Ether are the best antidotes, and may be followed by Chloral when the danger is passed.

V. Excito-Motors.

Excito-motors are drugs which produce violent tetanic spasms in large doses, and which increase the reflex activity of the spinal centers in small ones. The most important is Nux Vomica.

1. NUX VOMICA, from the seeds of *Strychnos Nux Vomica*, a small tree growing in the East Indies, Bengal, Malabar, Ceylon, and Cochin China. The wood and root are very bitter, and contain the active principles, but only the seeds are used. These are circular, nearly flat, $\frac{3}{4}$ in. in diameter, concavo-convex, thickly covered with short satin-like, shiny yellowish gray hairs, and with an intensely bitter taste.

Active Principles and Preparations. The plant contains two alkaloids, Brucine and Strychnine, in combination with an acid probably identical with malic, the strychnine salt being twelve times as strong as the former, but Brucine being more abundant. the preparations are the following :

EXTRACTUM NUCIS VOMICAE. Dose : $\frac{1}{8}$ –1 gr.

EXTRACTUM NUCIS VOMICAE FLUIDUM. Dose : 1–5 m.

TINCTURA NUCIS VOMICAE. Dose : 2–10 m. $\rightarrow$

The tincture is the favorite preparation. When the full physiological effect is desired Strychnine or its salts are prescribed.

2. IGNATIA. (Officinal 1880.) The seeds of *Strychnos Ignatia*, or St. Ignatius bean ; a tree closely related to Nux Vomica and found in Phillipine Islands. The seeds are larger than those of Nux Vomica, $1\frac{1}{2}$ in. long, a little less in breadth, irregularly angular, dull brown or black, very hard, odorless, very bitter, and covered with a fine down. They contain Strychnine and Brucine, but in larger amounts than Nux Vomica. Its use is the same as that of Nux Vomica. There are the following preparations :

ABSTRACTUM IGNATIAE. Dose : 1 gr.

TINCTURA IGNATIAE. Dose : 2–10 m.

EXTRACTUM IGNATIAE. Dose : 1–3 m. ✓

STRYCHNINA. The more valuable of the two alkaloids of Nux Vomica and Ignatia. It occurs as a grayish white powder, or in octahedral or quadrilateral prismatic crystals, permanent in air, very slightly soluble in cold water (1–6700), more so in hot (1–2500), sparingly soluble in absolute alcohol and insoluble in ether. In boiling officinal alcohol it is quite soluble, but is deposited on cooling. It is the most bitter substance known, one part in 20,000 of water being intensely bitter, and 1 in 700,000 perceptibly so. It is alkaline in reaction. Preparations :—

STRYCHNINAE SULPHAS. Minute, white, shiny, efflorescent crystals; neutral; soluble in water (1-10), alcohol, and glycerine; insoluble in ether. It is better than the alkaloid itself for subcutaneous use. Dose: $\frac{1}{10}$ – $\frac{1}{20}$ gr. *Incompatibles*:—It must not be prescribed with Bromides, Chlorides, Iodine, the Iodides, nor Tannic Acid on account of the formation of insoluble compounds.

FERRI ET STRYCHNINAE CITRAS. Transparent, garnet-red scales, bitter; soluble in water, slightly so in alcohol. Dose 1-3 gr. in a pill. Strength, 1% of the alkaloid.

SYRUPUS FERRI, QUININAE ET STRYCHNINAE PHOSPHATUM. Strength, 4 parts of Strychnine in 10,000. Dose: $\frac{1}{2}$ –1 dr.

BRUCINE. Non-official. A non-crystalline odorless powder very bitter, $\frac{1}{12}$ the strength of Strychnine; soluble in cold water (1-850), more so in hot, soluble in alcohol; insoluble in ether. It forms crystalline salts with acids. It is little used in medicine.

The physiological Actions of Nux Vomica and Ignatia are due to the same alkaloid, strychnine; hence they can be discussed together. An ordinary dose causes only hunger, and increased flow of the digestive juices; a full medicinal dose, increased spinal reflex activity, pulse, arterial pressure and respiration. If the dose is given subcutaneously, there is also an increased acuteness of sight and hearing. In doses sufficiently large these drugs cause restlessness, trembling of the extremities, stiffness of the muscles of the jaw, neck and chest, formication, and hyperaesthesia.

The principle effects of Strychnine are exerted upon the Nervous System, it being a powerful stimulant to the nerve cells of the spinal cord, directly stimulating the motor tract, and increasing the receptive activity of the sensory centers. Toxic doses cause tetanic convulsions due to this influence on the cord. The drug stimulates the respiratory centers, and increases the rate and capacity of the respiration. It increases the force and rate of the pulse by its action on the heart-ganglia; and it raises arterial tension by stimulating the vaso-motor centers, but in toxic doses there is a fall due to the paralysis of these centers. The body temperature is unaffected except in doses large enough to cause convulsions.

Strychnine is absorbed rapidly by the stomach and very rapidly after subcutaneous injection. It acts rapidly, and very soon appears in the urine, being eliminated in part as Strychnine and Strychnic Acid, but most of it is destroyed in the liver. After death it may be found in all the tissues, but especially in the viscera and spinal cord.

Toxicology. The symptoms appear very quickly after ingestion, within 15 to 20 minutes, and usually with great suddenness.

If they come on gradually as in smaller doses, there is stiffness in the back of the neck, and marked uneasiness; if suddenly, there is a sudden contraction and rigidity of the muscles, and the victim may be thrown several feet. The legs are extended, the feet everted, and the hands clenched. The body is put in a state of Opisthotonos, Orposthotonos, Pleurosthotonos, or of Emprosthotonos. Respiration is suspended during the convulsions owing to the tetanic rigidity of the respiratory muscles, and asphyxia results, causing death by suffocation, if the convulsion lasts long enough. The senses are generally quickened, but if the convulsions are severe there may be dimness of sight and ringing in the ears. The pulse is little affected, but there is a fall of arterial tension due to vaso-motor paralysis. The temperature is increased by the convulsions. The eyes are fixed and staring, and the corners of the mouth are drawn up so as to produce the "risus sardonicus." The face is pale at first, but soon becomes livid due to the interference of respiration. During the intervals of the convulsions there may be a slight rigidity of the muscles, but it is not at all marked. Convulsions follow with more or less frequency and may be brought on by slight noises, a touch or a draft of air. If recovery is to follow, they become less frequent and less violent and finally cease. At first there is great pain from the convulsions, but in time the muscular contractions become less and less painful. Consciousness is frequently preserved throughout; the intellect being generally clear till death except in cases of insensibility from asphyxia. In fatal cases death is caused by asphyxia during convulsions due to the spasms of the respiratory muscles, or to exhaustion between the paroxysms. The last muscles to be affected are those of the jaw. Post-mortem rigor mortis comes on very rapidly and is intense. Other than this there are no characteristic post-mortem appearances.

Treatment. Remove the poison from the stomach by emetics or a stomach-pump. Amyl Nitrite may be given to prevent the convulsions during operation. The strychnine may be precipitated by Tannic Acid in water, or Iodine in a solution of KI. and the precipitates removed by the stomach-pump, as the precipitates are not wholly insoluble. After the stomach is washed out, $\frac{1}{2}$ oz. of KBr. may be given, or in very severe cases 2 oz. KBr. with $\frac{1}{3}$ dr. of Chloral at one dose, both acting as depressants, the former of the sensory, the latter of the motor centers. If the patient cannot swallow, Chloroform may be inhaled to relieve the tetanus, and may be given to anaesthesia if necessary in order to save the strength of the patient. It may

also be given by the rectum with starch-water, for inhalation is impossible during convulsions. This drug prevents them and so keeps the patient from rapid and complete exhaustion. If chloroform does not produce relaxation, give amyl nitrite subcutaneously. Ether is too slow and irritating.

Diagnosis. There is usually little difficulty, for no other drug causes similar convulsions. However, they may be mistaken for those of Tetanus, especially hysterical tetanus. In making a diagnosis the muscular symptoms are the most important. (1) Strychnine poisoning cannot be confounded with Epilepsy, since in Epilepsy the convulsion are clonic; in Strychnine poisoning, tonic. (2) Idiopathic and Traumatic Tetanus begin with pain in the back of the neck and jaw, which is early affected and rigidly set. In Strychnine poisoning the process begins in the extremities or simultaneously all over the body, and the muscles of the jaws are the last affected and the first relaxed. In Idiopathic and Traumatic Tetanus there is persistent rigor with various forms of tetanus as Opisthotonos, Orposthotonos, Emprosthotonos, and Pleurosthotonos; but in Strychnine poisoning these come only during the convulsions. In these forms of Tetanus the onset is more gradual, the pain less severe, the convulsions less frequent, and the remissions much less complete. (3) In Hysterical Tetanus, the harder of the three to distinguish from Strychnine poisoning, the process begins in the jaw and gradually extends over the body, reaching the extremities last. The jaws are rigidly set before and between the convulsions. Not so in Strychnine poisoning. Again consciousness is lost during the convulsions but is preserved in Strychnine poisoning. In the latter very slight causes bring on convulsions, as a draft of air, but hysterical patients wish to be fanned. In Strychnine cases the feet are everted; in hysteria they are not. In the latter the pain is not so severe and the patient only cries; but in Strychnine cases he screams, due to the excessive pain. To summarize:—

STRYCHNINE.

Onset sudden.
Convulsions from draft of air.
Convulsions more numerous.
Intermissions more complete.
Jaw last affected.
Great pain; patient screams.
Feet everted.

TETANUS, of any sort.

Onset gradual.
A desire to be fanned.
Convulsions less frequent.
Intermissions less complete.
Jaw early affected.
Not so much pain; patient cries.
Feet not everted.

In these cases of Tetanus the treatment is the same as in Strychnine poisoning, except that no antidotes are given; so that

the diagnosis is not imperative. The minimum fatal dose is about $\frac{1}{2}$ gr.; 1 gr. is fatal to the average man, but recovery, after 22 gr. has been recorded.

Therapeutics. As a General Tonic in general relaxation and exhaustion of nerve-power it is very efficient. It is more than a mere vegetable bitter and stomachic, for it not only stimulates digestion, but it also acts universally on nerve-power, the spinal vaso-motor and probably the trophic centers. In Indigestion and lack of appetite the tincture of Nux Vomica, or Strychnine alone or the Syrup of the Phosphates of Iron, Quinine and Strychnine is good. With Digitalis it is useful as a Cardiac Stimulant. It also stimulates the respiratory center, preserves the reflex centers in opium-poisoning, and is good as an ocular stimulant in amaurosis from alcohol and tobacco or weak muscles; but is of no value in other cases of amaurosis.

In paralysis from Pb., Hg., alcohol, and diphtheria, it is useful. In the first mentioned it can be used in large doses to arrest the progress of the case, and Kl. be given internally at the same time to cause the elimination of Pb. In paralysis accompanied by depression of the spinal or motor centers it may be useful, but in other forms it is harmful. It is not good in Acute or Sub-acute Neuritis since it increases the irritation of the nerves, nor in Hemiplegia until irritation from the clot has ceased. It is useful in local paralysis, Prolapsus Recti, tonic Retention or Incontinency of the Urine, loss of voluntary motion, etc., owing to a temporary affection of a motor nerve; and also in some forms of Epilepsy, particularly "Petit Mal," which is least amenable to the KBr. treatment. It is given with cathartics for its effect on peristalsis, and to avoid their depressing after-effects on the intestine. In Dyspepsia, Constipation, or Diarrhoea dependent upon atony of the muscular coats of the bowels, it is also useful.

Administration. As a tonic all sorts of preparations are used in all sorts of doses. When its physiological effects are desired as in paralysis, give the sulphate of strychnine in solution since this acts most rapidly.

VI. Depresso-Motors.

Depresso-Motors are drugs which cause paralysis in large doses and which in small doses lessen the activity of the cord.

* ~~1.~~ **PHYSOSTIGMA.** CALABAR or "ORDEAL" BEAN, Africa, Introduced into India and South America. The seeds or beans of Physostigma Venenosum, a woody climbing perennial, 1 in. in

length, $\frac{3}{4}$ in. in breadth, with a firm, hard, brittle, brownish-red or chocolate brown integument; though it may be ashy gray; somewhat kidney-shaped, flattened, and with a furrow along the convex border. It has long been used by the natives of Calabar as an ordeal bean in trials of witches; if the accused vomits, he is innocent; if he does not, guilty. The bean yields its virtues to water and alcohol, and contains the alkaloid Physostigmine or Eserine. Some claim that a second alkaloid, Calabarine, is present.

Preparations. The substance of the bean itself is used in medicine in $\frac{1}{2}$ –2 gr. doses, usually 1 gr. There are also:—

EXTRACTUM PHYSOSTIGMATIS. Dose: $\frac{1}{10}$ gr.

TINCTURA PHYSOSTIGMATIS. Dose: 10 m.

PHYSOSTIGMINA. The alkaloid itself is the best form for medicinal use. It occurs in colorless or pinkish crystals, slightly soluble in water, readily so in dilute acids and alcohol. Of its salts PHYSOSTIGMINAE SALICYLAS is the most used, because of its greater stability and solubility. It occurs as yellowish or colorless crystals, odorless shining, neutral, bitter, and apt to turn red on exposure to the light; soluble in 12 parts of alcohol and 150 of water. For local use to relax the pupil it is given in a solution of $\frac{1}{2}$ gr. to the oz.

Incompatibles. Vegetable Astringents, Tannic Acid, and Caustic Alkalies.

PHYSOSTIGMINAE SULPHAS, a yellowish-white odorless, neutral, bitter, crystalline powder. Very soluble in alcohol and water.

Physiological Action. Physostigma acts chiefly by its alkaloid, but sometimes the effects of Calabarine or something are manifested in a marked degree. Large doses may cause general paralysis. Medicinal doses have no effect on the brain and respiration; and but little on the circulation except to increase arterial pressure somewhat by direct stimulation of the heart. The pulse may be slowed by the peripheral stimulation of the cardiac inhibitory nerves. On the cord, especially the motor tract, it acts as a powerful and direct depressant. On the voluntary muscles it has no action, but in small doses it stimulates the unstriated muscles and so increases peristalsis. A poisonous dose causes at first muscular tremors on account of a direct influence upon the muscle fibres. The patient then falls into a state of perfect muscular relaxation; the respiration is slow, irregular and weak, and there may be dyspnoea. Reflex activity is diminished or even extinguished. The heart is irregular and feeble, the pupils contracted. There may be vomiting with profuse sweating and purging. Death comes on quietly by paralysis of the respiratory

center. Consciousness may be preserved throughout as in Strychnine poisoning, but there are no convulsions.

Treatment. Inject atropine, apply heat externally, and give cardiac and respiratory stimulants, as ammonia or alcohol, to counteract the depression of the heart and respiration.

The action on the pupil is exactly opposite to that of atropine. Locally applied it produces extreme contraction with spasms of the muscles of accommodation by peripheral stimulation of the Oculi-Motors and depression of the Sympathetics. Its effects do not last so long as do those of atropine, however, and, like it, it has no influence over the pupils of birds.

Therapeutics. Physostigma is not much used in general medicine, but is used much more in ophthalmic practice in spasmodic conditions. It is sometimes useful in constipation due to its tonic action on the muscular fibres of the intestine; and also in certain conditions of chronic and bronchial catarrh since it aids in the expulsion of mucus, atonic conditions of the bladder, and in gastric and intestinal dilatation. It has many other uses which are unimportant.

2. BROMIDES. POTASSII BROMIDUM, KBr. Made by precipitating freshly-made bromide of iron with Potassic Carbonate, filtering and evaporating. A colorless, transparent salt, in cubic crystals, neutral. In commerce it may be milk-white and slightly alkaline, sometimes enough so to precipitate alkaloids. The use of this sort should therefore be avoided. It has a pungent, saline, and to most people, disagreeable taste. It is very soluble in water, but not in alcohol (1-200). Dose: 5-100 gr., varying with the object. In strychnine poisoning it is very large. Never give with acids, nor acid and metallic salts, for these are incompatibles.

AMMONII BROMIDUM, NH_4Br . Made as KBr. except ammonia is the precipitant. Transparent, prismatic crystals, or generally a granular powder, yellow on exposure to the air due to the escape of Br; odorless, neutral, saline, pungent taste; freely soluble in water and a little more so in alcohol than KBr. Its properties and incompatibles are as those of KBr. Dose: 10-20 gr. in solution, with a syrup or bitter infusion.

SODII BROMIDUM, NaBr., made like KBr., small, colorless or white crystals, or a fine crystalline powder; stable, odorless, with the same saline taste as KBr. only more bitter, neutral, very soluble in water and 13 parts of alcohol. It must be free from Bromates, Iodine, Sulphates even a trace, and contain not more than 3 per cent. Chlorides.

LITHII BROMIDUM, LiBr., white, granular, deliquescent salt; sharp, bitter taste, neutral, very soluble in water and alcohol.

Used when other Bromides are not well borne, for it is too expensive for general use. Of the other Bromides that of Ca. is unimportant; that of Zn. does not belong to this group; and that of Ni. is of uncertain value.

ACIDUM HYDROBROMICUM DILUTUM. Dilute H Br., containing 10 per cent. absolute H Br. A little Cl. or HCl. sets the acid free from a Bromide. A clear, colorless liquid, odorless, acid taste and reaction; volatilized completely by heat. Chlorine or nitric acid added to it sets bromine free. Dose: $\frac{1}{2}$ –1 dr.

Physiological Action. The most important and widely used of the Bromides is K Br. Locally on the mucous membrane in concentration it is distinctly irritant, more so than is generally supposed. On the lower animals it acts as a poison, but there are no cases of acute poisoning in man known, however. Circulation, respiration and temperature are not affected by 20 gr. Very large doses may cause gastric pain, nausea, vomiting, heaviness and drowsiness. The circulation, respiration and body temperature are slightly depressed by therapeutic doses; large doses given continuously slow the rate of respiration; and enormous doses lower the temperature by depressing the cord and nervous system.

Its chief influence is on the nervous system. On the brain and cord it is markedly depressant. On the cord it acts as a sedative, particularly to the sensory tract, and it lessens reflex irritability. It also paralyzes the peripheral ends of the sensory nerves, and so acts as an anodyne. The motor tracts are somewhat depressed by large enough doses, and tissue waste is diminished. KBr. is absorbed from the stomach and rectum, very slightly by the skin in a cold bath, and eliminated very slowly by the kidneys, skin, saliva, and milk. It is found in all the secretions. In the system it tends to accumulate in all the tissues, but principally in the nerve centers.

When KBr. has been taken in excess for too long a time, and owing to its slow elimination has accumulated in the system, a peculiar form of chronic poisoning called "Bromism" comes on. The face is dull and expressionless, the mind is dull, there is failing of memory, depression of spirits, and great drowsiness. The patient falls asleep easily, and is easily aroused, but soon relapses into sleep again. The special senses are affected; hearing is benumbed, the sense of taste is lost, there is impaired sensibility of the skin and mucous membranes. The gait is unsteady and paralysis seems imminent. In some cases there is aphasia. The sexual function is impaired and may be abolished, KBr. acting as an anaphrodisiac. There is a foul smelling breath, and an erup-

tion like acne on the face and whole body, frequently caused by even moderate doses. Fowler's solution should be given in small amounts, to clear up the acne, and the use of KBr. stopped. Death has been attributed to the persistent use of large amounts, in one case five pounds in about 10 months.

Therapeutics. The Bromides are of most use as Nervous Sedatives in diseases of the nervous system, to quiet cerebral excitement due to mental strain or anxiety, and also in excitement which sometimes occurs in convalescence from acute diseases. In children it is good in small doses for Night-Horror, and in adults for Night-Mare. In cases of wakefulness due to cerebral hyperaemia it produces sleep by causing anaemia of the brain. In sleeplessness from pain it may be combined advantageously in small amounts with opium or with chloral to aid its action and modify its disagreeable effects. It is sometimes valuable in Hysteria, and in Neuralgia unless it is due to anaemia. In nervous, irritable, fretting and worrying women, it often affords relief. In cerebral symptoms from eye-strain as Migrane it is very useful combined with Caffeine. In Delirium Tremens it is good to allay the restlessness and remove the delirium. In early stages it brings on a state of calm and sleep.

Its chief use is to lessen Reflex Activity. In Epilepsy it is better than all other drugs combined, frequently curing, generally relieving, but at times having no effect. Always give it a thorough trial in every case, even to mild Bromism. It is least efficient in that form of Epilepsy known as "Petit Mal," Strychnine being better. In spasmodic contractions, and in the nervous startings of hysterical women, KBr. is very good.

Bromides are also very useful in other nervous reflexes. In the reflex vomiting of pregnancy, or uterine diseases, and in seasickness, it is good since it depresses the vomitory centers; and in the latter case it is well to take it several days before starting on a voyage, three times per day in 15 gr. doses. In Chorea and in Bright's Disease with convulsions, and in convulsions from Teething it is very useful since it depresses the reflective activity of the cord. In Tetanus it is given in large doses combined with chloral. Its use in Strychnine poisoning with or without chloral has been treated under Strychnine Poisoning. In irritability of the pharynx and larynx preventing examination, it will frequently render examinations easy by decreasing reflex activity.

KBr. is of great value as an Anaphrodisiac, in quieting excessive excitement as in Nymphomania, Satyriases, and also in Semi-impotence due to over-sensitiveness of the penis. Where there is an actual inflammatory disease as in Gonorrhoea it

may fail. It is also good in the treatment of those prone to masturbation.

Contra-Indications and Administration. KBr. is contra-indicated in great exhaustion, especially great nutritive exhaustion of the nervous centers, as in insanity after child-birth, surgical operations, or typhoid fever. In these cases it may even check recovery. In Cerebral Softening and Senile Dementia it must be used with the greatest caution. In excessive irritability of the gastrointestinal mucous membrane it may induce exhausting Diarrhoea.

Administration. The effects of Bromides are best produced by continuous doses in solution, and preferably between meals. If Diarrhoea results, check it with opium.

The other Bromides act in about the same way as KBr. with slight exceptions. NH_4Br . is recommended by Brown Sequard in combination with KBr. instead of KBr. alone in Epilepsy, since acne and other disagreeable symptoms of Bromism are not so readily produced. Prof. H. C. Woods finds NH_4Br . with antipyrin also superior to KBr. alone, but the ammoniac salt is more of an irritant, and should therefore be given with more water. Some claim that Na Br. is superior to all, but this claim is not generally allowed. It certainly has more hypnotic power, and is not so generally depressant as KBr. Neither is it so likely to disorder the stomach. LiBr. may act in Epilepsy when KBr. and NaBr. fail. NiBr_2 and Ca Br_2 have been used but have no advantages over the other, and Ni Br_2 irritates the stomach. Dilute HBr. is less apt to produce acne or muscular and nervous depression, but is very irritant to the stomach. If used at all it is best to give it with KBr. When used alone the dose required is too large and the irritation of the stomach too pronounced.

3. NITRITES. AMYL NITRIS. Amyl Nitrite, from amyl alcohol by treatment with HNO_3 . A pale yellow, clear liquid; ethereal, fruity odor; aromatic taste; neutral or slightly acid; extremely volatile; decomposing in air, and giving a residue of amyl alcohol. It is insoluble in water, soluble in chloroform, alcohol, ether, benzine and benzol in all proportions. At 96 degrees C. it boils and gives off an orange vapor, burning with a fawn-colored flame. Warmed with an excess of KOH it gives the odor of amyl alcohol. It is preserved in glass bottles with ground stoppers, and kept in a dark cool place.

Administration. Usually by inhalation. Glass pearls containing 3-5 m. are crushed in the kerchief and the vapor inhaled. It may also be given internally in alcohol or on sugar. Dose 1-5 m.

Physiological Action. Amyl Nitrite is absorbed and eliminated with great rapidity, and its effects are transient. With moderate

doses the first effects are flushing of the face, suddenly increased rapidity of the pulse with a great diminution of arterial pressure; the heart beats rapidly and violently, there is a deep labored respiration, a roaring in the ears, and a sense of fulness in the head which may amount to intense headache, so that the patient staggers. Sometimes the cardiac disturbance comes first, but usually simultaneously with the other symptoms.

With large doses there is great pallor, dilated pupils, the muscles are excessively relaxed, the pulse scarcely perceptible, the respiration irregular. Of all the nervous depressants it is the most rapid except HCN. Medicinal doses have no effect on the Nervous System, but large doses cause paralysis and loss of reflex activity by direct action on the cord. On the Respiration moderate doses have some effect. They increase the depth and rapidity due to their action on the respiratory centers. Large doses depress these centers and respiration becomes shallow and slow. Toxic doses paralyze them, and in fatal cases death is always due to asphyxia.

The chief manifestation of the drug is on the Circulation, increasing the rate of the pulse very much by stimulating the ganglia and muscle partly, and by depressing the inhibitory apparatus. The effect following moderate doses gradually subsides. Toxic doses even cause cardiac paralysis. The arterial pressure falls on account of the depression of the vaso-motor centers and paralysis of the muscular coats of the arterial walls. The temperature is reduced by moderately large doses, the reduction being due partly to diminished oxidation and partly to the action of the drug on the centers governing heat-production and dissipation and partly to dilatation of cutaneous vessels. Large doses give the blood a chocolate hue, changing the haemoglobin to met-haemoglobin. The urine is increased in amount and often contains sugar or some substance that acts like sugar on Fehling's Solution. The drug is rapidly eliminated by both the kidneys and lungs.

Therapeutics. In Angina Pectoris it affords instant relief; why, it cannot be said, unless it be due to a sudden lowering of the arterial tension. In cases of Epilepsy where there is a distinct interval between the aura and the convulsion, a glass bead of the drug is very useful in aborting the attack and may be of great efficiency where these follow one another with great rapidity. In Asthma it will sometimes arrest the spasms immediately; and it has been recommended in many other diseases such as Whooping-cough, Puerperal Eclampsia, and in Migraine. As a cardiac stimulant in heart-failure during anaesthesia it has been used

Its value in Eclampsia is doubtful. It has also been used in Intermittent Fever, Tetanus and Strychnine Poisoning. After a person has taken it for some time larger doses are needed, and it becomes exceedingly disagreeable.

The Nitrites of Sodium and ~~Potassium~~ have the same effects as Amyl Nitrite, but they act more slowly and for a longer time. Due to this persistent action they are superior in the treatment of Angina Pectoris, Epilepsy, and also in Gastralgia, in 3-5 gr. doses of the pure salt. Large doses, 10-15 gr. produce great muscular relaxation and headache. The Nitrites are eliminated as Nitrates.

4. NITROGLYCERINUM. NITROGLYCERINE. In cases where a less rapid and more lasting effect is desired, nitroglycerine may be used. It is an oily, colorless or pale yellow fluid, insoluble in water, freely so in alcohol and ether; burning quietly in the open air, but exploding when confined, or upon percussion. The medicinal preparation is a 1 per cent. solution in alcohol given in very small doses, called "Trinitrine" or "Spirits of Glonine" to avoid scaring the patients. Dose of the dilute solution, $\frac{1}{2}$ -4 m. in water.

Physiological Action and Therapeutics. Nitroglycerine is the most powerful drug of the nitrite group, more persistent than amyl nitrate, less so than KNO_3 or NaNO_3 . It produces practically the same effects as the other nitrites. Moderate doses cause a sense of contraction in the head, leading to severe headache, which with large doses becomes exceedingly severe, lasting for a great number of hours.—Nitroglycerine has been recommended for the same diseases as the nitrites proper, namely, Angina Pectoris and Epilepsy; and also especially for Neuralgia, Gastralgia and Uraemia. Where very speedy action is desired Amyl Nitrite is better. In Angina Pectoris this drug and the other nitrites act by lowering arterial pressure. The rest of the group are drugs not now commonly used, but used more extensively in the past.

* 5. LOBELIA. The leaves and tops of *Lobelia Inflata*, a common weed growing in waste places in the United States, collected after the capsules are inflated. The odor is irritating; when chewed, the taste is acrid and burning, causing an increased flow of saliva and a tendency to salivation and nausea. All parts of the plant are medicinal but the root and capsules are most powerful. It yields its virtues to alcohol and water.

Active Principle. Lobeline. An oily yellowish liquid, lighter than water; alkaline; very acrid taste; aromatic odor; forming crystalline soluble salts with hydrochloric, sulphuric and nitric

acids; and a non-crystalline salt with Acetic Acid. It is in combination with lobelic acid.

Incompatibles. It forms insoluble compounds with tannin and tannic acid, and is decomposed by caustic alkalies.

Physiological Action. Large doses cause nausea, violent vomiting, with or without purging, great prostration and depression. Where there is no vomiting the cases are usually fatal, and there is usually great delirium. Small doses act as a sedative, emetic, and diaphoretic. It also excites the Respiratory and vomitory centers of the medulla. As a purgative it should never be used. Its use as an emetic is dangerous and unnecessary. The same may be said of its use in Chorea, Whooping-cough, Epilepsy, etc.

Therapeutics. As a Purgative and Emetic its use is dangerous and unnecessary. There are also better and less dangerous remedies for Chorea, Epilepsy, and Whooping-cough. In Spasmodic Asthma it is of undoubtful value either alone or burned with Saltpetre and Stramonium; and it is also good in Acute Bronchitis with bronchial spasms. As a lotion in Ivy-Poisoning it is useful; and it has also been used as an Expectorant. Doses, as an emetic, 20 gr. as an expectorant, 1-5 gr. There is only one preparation that is very important, the *EXTRACTUM LOBELIAE FLUIDUM*; dose; 1-5 m. There is also a *TINCTURA LOBELIAE*. 10-20 m. In case of poisoning, Tannic Acid may be given.

* 6. *GELSEMIUM*. *YELLOW JASMINE*. The rhizome and rootlets of *Gelsemium sempervirens*, a climbing plant of the South Atlantic States. The root has a slightly narcotic odor, and a bitter but not unpleasant taste.

Active Principles. It yields its virtues to water and dilute alcohol, and contains a transparent, crystalline alkaloid, Gelsimine, an amorphous alkaloid, Gelsaminine, and an unimportant glucoside. Gelsimine crystallizes with difficulty from alcohol, and is slightly soluble in boiling water.

Physiological Action. Gelsemium is a powerful depressant of the motor and sensory centers of the cord. It has very slight power over the brain, still it has some, shown by the symptoms of full doses. Its chief effect is on the motor apparatus of the nervous system. Small doses cause a feeling of languor; large, dizziness, disturbance of vision, and pain over the eyes. The pulse and arterial pressure are reduced by its direct action on the heart. The respiration and temperature are depressed, the pupils dilated. Its influence on the eye is marked. Locally applied, it dilates the pupil, with paralysis of the muscles of accommodation. When given internally in medicinal doses it contracts or dilates

the pupil according to the size of the dose; toxic doses always cause dilatation.

Toxicology and Treatment. In toxic doses there is extreme muscular weakness, double vision, impairment of the general sensibility, slow and labored respiration, feeble and thready pulse, collapse and death by asphyxia. For treatment administer cardiac and respiratory stimulants, and then treat the case symptomatically.

Therapeutics. Its value in local use in the eye is doubtful, for it may require too much to produce dilatation. It is recommended in Trigeminal and Ovarian Neuralgias. As a sedative in Delirium Tremens, Acute Mania, and in Malarial and other asthenic fevers it is useful, but in the latter case it is inferior to Veratrum viride and Aconite. In Pleurisy and Pneumonia its advantages are outweighed by the dangers which follow the large dose necessary to produce its effect. It has also been used in Asthma, Torticellis, Whooping-cough, and various nervous troubles and Neuralgias other than those mentioned above, but not very successfully. Never use it when the system is already depressed.

* 7. ~~TABACUM~~. TOBACCO. The commercial dried leaves of Nicotiana Tabacum contain 2-11 per cent. of the alkaloid Nicotine, one of the most powerful of poisons, in combination with Malic Acid. Nicotine when pure is a colorless, transparent, volatile liquid, with the odor of tobacco, and a burning taste. There is no Nicotine in tobacco smoke, nor does it collect in pipes. Carbonic oxide, and various pyridine compounds, and small amounts of HGN produce the unpleasant sensations of the beginner, and not the Nicotine. There are no officinal preparations of Tobacco.

Physiological Action. Tobacco, in the case of persons not habituated to its use, is a powerful depressant, and causes nausea, vomiting, dizziness, and intense weakness. With large amounts of the drug or minute amounts of the alkaloid, there is in addition a burning pain in the mouth, fauces, and stomach; extreme giddiness, delirium, very rapid weak pulse, cramps, total loss of strength, and all the phenomena of collapse.

Toxicology. Large doses cause death very quickly, and a number are recorded from the use of tobacco as an enema or from its external application. If they have ever occurred from smoking as is claimed, it was not from the Nicotine, however, since tobacco smoke contains no nicotine.

Treatment. For internal administration: wash out the stomach; administer stimulants internally, such as ammonia and alcohol; inject subcutaneously Strychnine in moderate amounts to

stimulate circulation and the nervous system, and apply dry heat and rubbing. If necessary use artificial respiration.

Excessive use of tobacco causes a disturbance of the Nervous System, insomnia, irritability, soreness of the throat and fauces, and general feebleness. The heart is irregular and peculiar, the so-called "tobacco heart." Angina Pectoris may sometimes result. It prevents the full development physically and mentally when used by the young. It may also cause a form of blindness amenable to treatment. The effects of tobacco on the nervous system are chiefly on the cord, but in toxic doses the brain may also be affected. It depresses both the centers of respiration and circulation.

Therapeutics. The therapeutic uses are limited. Its chief indication is in quieting muscular spasms. It quiets violent muscular spasms, as in Tetanus and Strychnine Poisoning, but there are many better remedies less dangerous and disagreeable. The Bromides and Chloral are better. As an emetic it is too depressing. In Spasmodic Asthma smoking may avert a threatening attack, but here, also, there are better remedies. In constipation it is sometimes used as the vinum, but other remedies are better. With some a cigar is an efficient laxative. Externally tobacco has been applied to relieve pain from Hemorrhoids, but its use is dangerous. On the whole, tobacco may as well be left alone. Dose of the alkaloid: by the mouth $\frac{1}{6}$ gr.; subcutaneously, $\frac{1}{60}$ gr.

8. ~~CONIUM~~.—POISON HEMLOCK. From Conium maculatum. A native of Europe, naturalized in United States. The full grown fruit is gathered green.

Active Principles. It contains the alkaloid Conine, a strongly alkaline fluid, existing in the fruit as a Malate. It has a strong odor like the urine of mice, a very acrid taste, decomposes slowly on exposure to the air, more quickly with heat, forming a brownish resinous mass. It forms soluble crystalline salts, the Hydrochlorate and the Hydrobromate, both of which are much better for medication than the alkaloid itself or any of the preparations of the crude drug. The Hydrobromate, the better of the two, is tasteless, odorless, freely soluble in water and alcohol. Dose: $\frac{1}{12}$ – $\frac{1}{20}$ gr. The best preparation next to those of the alkaloid is the fluid extract in 1–5 m. There is also a Tincture. Dose: 10 m. to 1 fl. dr.

Physiological Action. The drug or its alkaloid when taken in sufficient quantities, causes great muscular weakness, double vision due to paralysis of the muscles of accommodation, dizziness and staggering. Patients wish to lie down and close their eyes

when taking it. There may be nausea, vomiting, and pain in the head.

Toxicology. Toxic doses intensify these symptoms, and there are also convulsions with collapse and death from asphyxia. There are no post-mortem appearances beyond those of asphyxia. The chief influence is on the nervous system. It depresses and paralyzes the motor nerves, and extremely large doses depress the sensory nerves. Upon the cord it acts as a feeble depressant, while the cerebrum is not influenced. It also depresses the circulation and respiration, and the pupil is generally but not always dilated. The arterial pressure falls at first, then rises.

Therapeutics. Conium is unimportant therapeutically, the indications for its use being better met by other drugs. In irritation of a nerve trunk causing spasms it is useful; and in maniacal and hysterical disorders it produces calm and relaxation. It has been recommended for many other nervous disturbances. Preparations of this drug are very variable, due to the varying amount of the alkaloid contained in them, and due to its irritating qualities.

CARDIANTS.

Having finished the great orders of Nervines with its six large families, we are ready to begin on the Cardiants, consisting of two families, the Cardiac Stimulants, and the Cardiac Depressants.

1. Cardiac Stimulants.

Cardiac stimulants are drugs which increase the arterial pressure and the power of the circulation.

1. AMMONIA. NH_4OH . Ammonia compounds have as a basis a colorless, highly irritant, irrespirable gas, intensely odorous and strongly alkaline, exceedingly soluble in water, 670 parts at 10°C . being taken up by 1 of water, and the bulk of the latter being increased $\frac{2}{3}$. Its chief source is coal-gas of which it is a waste product. There are many pharmaceutical preparations, most important of which are the following:—

AQUA AMMONIAE. Strength, 10 per cent. of ammonia gas by weight. Used in the preparations of Aromatic Spirits of Ammonia and in the liniment.

AQUA AMMONIAE FORTIOR. Strength, 28 by weight of ammonia gas. A colorless, transparent, very volatile liquid; with a pungent odor; acrid, alkaline taste; alkaline reaction; used chiefly in making the officinal spirit. Dose: 2–5 m. in water.

SPIRITUS AMMONIAE. Strength, 10 per cent. by weight or the gas dissolved in alcohol. Used as a cardiac stimulant in 10-30 m. doses in water.

SPIRITUS AMMONIAE AROMATICUS. "Sal Volatile." Nearly colorless when fresh, or dark when old, alkaline, with an aromatic pungent ammoniacal odor. *Composition:* Oils of lemon, lavender and pimenta, 1 part each; aqua ammonia, 100 parts; ammoniae carbonas, 40; water and alcohol to 1000. Used as a cardiac stimulant, in making certain pharmaceutical preparations, and often given to overcome the effect of alcoholism, dispensed in soda-water. $\frac{1}{2}$ -1 dr.

AMMONII CARBONAS. Ammonic Carbonate. A white translucent solid consisting of both the carbonate and the bicarbonate, and giving off NH_3 and CO_2 on exposure to the air, becoming opaque and friable. It has a pungent ammoniacal odor, sharp saline taste, alkaline reaction; soluble in 5 parts of water. Alcohol dissolves the carbonate but not the bicarbonate. It is used as a cardiac stimulant in 3-10 gr. doses.

Incompatibles. Ammonia preparations are incompatible with vegetable and mineral acids, and acid salts; and the carbonate with earthy salts, and lime-water.

Physiological Action of the Ammonia preparations. Ammonia is a powerful cardiac stimulant. In medicinal doses its action is very quick and transient. The rate and force of the pulse is markedly increased by stimulation of the heart and accelerator nerve, and the arterial pressure is greatly raised, due to stimulation of the vaso-motor center and the increased blood sent into the arteries. It also quickens the depth and rapidity of the respiration by directly stimulating the respiratory center. It increases reflex activity by its action on the spinal cord. In the system it is oxidized to nitric acid and urea, and is eliminated by the urine, thereby increasing its acidity. Ammonic Carbonate has the same constitutional effects as the hydrate but is less irritating. Larger doses than 10 gr. may cause vomiting.

Locally ammonia water is an active irritant, and may cause intense inflammation and irritation of the mucous membrane of the air-passages when inhaled. When injected into the veins in large and toxic amounts, it may cause convulsions and death due to paralysis of the heart. Taken by the mouth in large doses it is an intense corrosive, and has given rise to several fatal cases. The antidote is vinegar. If spasm of the glottis is caused, tracheotomy may be necessary.

Therapeutics. Ammonia water is sometimes used as a counter-irritant in liniment, also to cause blistering. Internally the water,

spirits, aromatic spirits and carbonate are all used as cardiac and respiratory stimulants where there is sudden need from heart-failure, as in syncope from fright, and in operations. Where the failure is gradual as from wasting fevers it is not so useful. In serpent-poisoning and in other cases of poisoning it is very useful, although it does not act as an antidote. It is so powerful that it can even start a heart which has been stopped by chloroform, and is very useful on this account in accidents during anaesthesia. It is also used in Acute and Chronic Bronchitis as a stimulant expectorant, and has been used as a stimulant antacid in the stomach in gastric acidity due to fermentation. In sudden collapse in surgical operations and in shock 5–25 m. in 4 volumes of water may be injected into the veins of the leg or arm at intervals of 15 minutes with great advantage.

Administration. Ammonia must not be given by the mouth if the stomach is already irritated. Ordinarily it may be so given, or it may be inhaled as the water or spirits. The diluted aqueous solution may be given by injection, preferably in the leg or arm.

2. ALCOHOL. Made by the fermentation of a solution of sugar within certain temperature limits by *Saccharomyces cerevisiae* or beer yeast. The products of fermentation are CO_2 , alcohol, glycerine and succinic acid. There are many varieties of alcohol: — alcohol, absolute alcohol, dilute alcohol, brandy, whiskey, white and red wines. Over 16 per cent. of alcohol is seldom produced since fermentation is checked by the alcohol formed, and fermented wines are rarely as strong as 16 per cent. The stronger drinks are obtained in any percentage by fractional distillation or fortification.

The alcohol of the Pharmacopoeia is a colorless, volatile transparent liquid, with a peculiar penetrating odor, and a burning taste. Its density depends upon the amount of water present. It is inflammable, burning with a blue flame, giving no smoke, the products of combustion being CO_2 and H_2O . It mixes with water and ether in all proportions. The U. S. Pharmacopoeia Alcohol Absolutum contains not more than 1 per cent. by weight of water. The U. S. Pharmacopoeia alcohol contain 91 per cent. by weight of alcohol, and 94 per cent. by volume, the rest being water. It must be free from ether, methyl and amyl alcohol, acids and other organic impurities. There are the following preparations:—

ALCOHOL DEODORATUM. Is a new form with less odor than ordinary alcohol. It is of no great medicinal importance, its chief use being in the manufacture of perfumes. It has 92.5 per cent. by weight of absolute ethyl alcohol.

ALCOHOL DILUTUM. A 48.6 per cent. solution by volume in distilled water or 41 per cent. by weight, 50 per cent. by weight being water.

SPIRITUS FRUMENTI. Whiskey. An alcoholic liquid made by the distillation of a fermented infusion of grain, wheat, rye, barley or corn, and then redistilling. This gives the "raw spirits" or whiskey. The U. S. Pharmacopoeia says that whiskey must be two years old before it is used, since within this time the amyl alcohol or fusel oil present is oxidized. Fresh whiskey is nearly colorless, but it turns dark on being left in open casks; and it is sometimes colored by caramel. The U. S. Pharmacopoeia describes it as an amber-colored liquid, with a Sp. Gr. not over 0.93, and containing 44-50 per cent. by weight of alcohol.

SPIRITUS VINI GALlici. Brandy. Made by distilling fermented grape juice. A pale amber-colored fluid with a distinct taste and odor, Sp. Gr. higher than that of whiskey, and containing from 39 to 47 per cent. of alcohol. Whiskey may therefore be stronger or weaker than brandy. The highly colored brandies are colored with caramel. Commercial brandy is usually artificial, genuine cognac being an exceedingly rare article.

VINUM ALBUM. White wine. Any kind of wine other than red wine made by fermenting the pure unmodified juice of grapes free from skins, twigs, and seeds. It should be agreeable in taste and smell, must not be too sweet or acid, and must not contain tannic acid. 10-14 per cent. by weight is alcohol. Under this class of wines come the stronger Rhine and Hungarian, Californian, and Mediterranean white wines. Most white wines and champagnes are below the normal strength.

VINUM RUBRUM. Red wine. The juice is fermented in the presence of the skins. Strength, 7-14 per cent. by weight of alcohol. Clarets and red Burgundies are good examples. The doses of all of the preparations vary with the individual and the nature of the case. The physician must use his own judgment.

Physiological Action. The action of alcohol varies greatly according to the doses, habits and peculiarities, and the condition of the patient. Alcohol is much more than cardiac stimulant but is best considered in this group. For internal medicating pure alcohol is not used, but instead wines and liquors. It is a strong irritant, caustic to the mucous membrane, coagulates albumen and mucous, is quite antiseptic, preserving organic substances from decomposition and preventing fermentation. It is a powerful nervous stimulant, and if the dose is large enough, may be followed by great depression or even paralysis.

The first, and it may be the only effect of alcohol, is a stimulation of the functional activity of the brain, sharpened senses, and an increased flow of ideas. This may be followed by a state of diminished activity, the ideas are confused and rambling; there is no co-ordination of movements. Symptoms of intoxication begin to appear, and the depressing effects begin with a gradual paralysis of the physiological functions. The highest nerve centers are the first affected, the brain being depressed, shown by lack of co-ordination. The tongue is not well controlled, the speech being very thick. The mental effects vary much with the individual, a timid man may become brave, and a modest man, immodest. Larger doses or added ingestion gives increased or profound narcotism with suspension of the functions of the brain. There is complete unconsciousness, stertorous breathing, a loss of reflex activity, and complete muscular relaxation, save those of respiration. The man is truly paralyzed, "dead drunk."

The effects upon the brain are due to direct contact between the alcohol and the brain substance, and to changes in the intracranial circulation. If there is chronic abuse, there are permanent structural changes produced, impaired mental power, muscular trembling, and an unsteady, shambling gait; semi-anaesthesia, epilepsy, amaurosis, hemiplegia, paraplegia, or even insanity may come on. Delirium Tremens may follow, due generally to lack of food during the debauch. Nervousness and insomnia are common. Dysomania or craze for drink is another result.

Circulation. On the heart alcohol acts as a direct stimulant, increasing the strength and number of the beats, and raising arterial pressure. In over doses it acts as a depressant. The arterial pressure is diminished, the pulse weakens, and the temperature falls. Ordinary doses do not affect the temperature materially. *Respiration:* The effect is not marked. Small doses stimulate, large depress. *Temperature:* Strong alcohol in ordinary doses gives a sensation of warmth in the stomach, spreading over the abdomen and body. It is not an increase of temperature, but merely a change in heat-distribution. Large doses cause a diminution of the body-temperature by increasing the radiation. It is probable that more heat is produced, but the loss of heat is more than proportionately increased. Hence the temperature in drunkenness may fall very low.

Alcohol affects the secretions to some extent. The urine is increased, but the urea and other solids are decreased, due to the diminished tissue-waste. The elimination of CO_2 is also diminished, due to lessened oxidation. In the stomach in small doses alcohol increases the production of the juices, by stimulating the

glands, and therefore aids digestion; but large doses do harm by precipitating pepsin. Excesses cause gastric catarrh. Alcohol is very diffusible and so it passes directly into the blood from the stomach, and does not reach the small intestine. Hence the liver is early affected, there being at first a slight enlargement, followed by cirrhosis, called the "Gin-drinker's liver." Absorption of alcohol occurs rapidly from all the mucous membranes, as of the stomach, rectum, and respiratory passages; and also after subcutaneous injection. In the system it is ~~almost completely~~ oxidized to CO_2 and H_2O . Only 1-2 per cent. at the most is eliminated as alcohol in the breath, urine, sweat and faeces. A teaspoonful was obtained from the liver of a man who drank a quart of whiskey shortly before death. After long continued use alcohol can be detected in certain other tissues. The intermediate products of oxidation are not known.

Alcohol as a Food. It has a certain value, but alone it cannot long sustain life. The fact that it is burned up shows that it contains some force. Since it causes a decreased tissue-waste, it aids in the accumulation of fat, but it is not the source of fat. In a state of health it seems to be an unnecessary addition to the diet, but it does no harm, and in small amounts where the food supply is insufficient it is even beneficial. It has been urged that it delays digestion, but this is nothing against it.

The effects of the chronic abuse of alcohol are quite another matter. There result changes in the brain, liver, kidneys and stomach, which are very injurious. There is loss of appetite, and vomiting in the morning. This is a very bad sign, and is an indication that the man must mend his habits.—The effects on the kidneys are not well made out. It is said to cause chronic interstitial and parenchymatous nephritis, but this is doubtful. It is said, too, that fatty degeneration of the heart and other organs results. Whatever be said, it is very certain that alcoholic subjects succumb very easily to acute diseases and to operations.

Toxicology. Acute poisoning from alcohol is drunkenness, and is to be distinguished from opium poisoning, apoplexy, uraemia, coma, tetanus, etc., which is sometimes difficult to do. In making a diagnosis the breath is no sign, for epileptic persons often drink. The pupils, pulse, and character of the respiration afford the best data. Treatment consists of injecting Digitalis and Strychnine subcutaneously to strengthen the heart, and Belladonna to contract the cutaneous vessels and so produce loss of heat. External application of heat may be good. The after-symptoms should be treated as they arise. Vomiting may be stopped by ice, cocaine, or drop doses of wine of ipecac, or by counter-irritation over the

abdomen. If the stomach needs stimulation, aromatic spirits of ammonia, spices, and even alcohol itself are good.

The treatment of chronic alcoholism or the alcohol habit is like that of the opium habit. Isolate the patient, cut off the supply, and raise the general tone of the system. The gradual withdrawal is better than the sudden. The stomach must be stimulated, and spices, ginger, red-pepper, morphine, and cocaine may be given. Only easily digested foods should be eaten. In general the patent cures are useless except in their action on the imagination.

Therapeutics. Repeated small doses act as a stomachic tonic in feeble digestion, Dyspepsia, and in Convalescence from Acute diseases. Its chief value is to stimulate and support the system. In all forms of temporary weakness of the heart, such as Syncope, sudden shock, poisoning, and in Hemorrhages, it acts rapidly especially if given strong and hot. Here its action is aided by other stimulants as ammonia. In Acute Diseases in which the system is being rapidly weakened, it is very useful. In prolonged Wasting Diseases, Old Age, and Convalescence from acute diseases, it is very good in aiding digestion and preventing tissue-waste. It also provides a certain amount of force to the system. In those cases administration with milk or other easily assimilated food is best. In Snake-bites, and in Poisoning by any of the depressants, alcohol is very useful. In all stages of Adynamic Fevers it acts as a food, supporting the system; and also as a cardiac and nervous stimulant, as for example in typhoid fever. In disease the body is very tolerant, and its use in these cases can be pushed extensively without narcotism. The amount given can be determined empirically. In Typhoid Fever where the pulse is weak the patient is rapidly sinking, give it continuously as long as there seems to be any advantage in its use, and stop when the pulse is riotous and the patient restless. As soon as the pulse is riotous and the odor is perceptible in the breath, the patient is taking too much. Sometimes the tolerance is very great, some taking even 1 qt. of whiskey in a day without any odor in the breath. Many cases get on as well with no alcohol at all. In sthenic fevers it is not to be used, unless required by some complication.

In the treatment of chronic diseases alcohol is used to aid digestion, to limit excessive tissue-waste, and to supply force. In certain conditions the relief afforded may be so much as to cause the habit, especially when given for the support of the system in Melancholia, Hypochondriasis, Dysmenorrhoea, and during the period known as change of life in hysterical women. Therefore be cautious in using it for Neuralgia and Nervousness during this

time. In Phthisis and Scrofula it is good, and may be given with cod-liver oil; also of value in chronic neuralgia. It improves the appetite, checks tissue-waste, and gives increased tissue formation.

Administration and dose. The methods of administration and the size of the dose depend upon the indications for its use and the effects desired. For very rapid action give subcutaneously, or hot by the mouth. In convalescence from acute disease or for habitual use wines are better than spirits for they are more tonic and agreeable, and less likely to lead to the alcohol habit. When alcohol is used to aid digestion, give always dilute with food and never alone. For this purpose claret, ales, beers, and white wines are good. Sparkling wines, brandy and soda are good for irritated stomach on account of the CO_2 which they contain. Claret and porter are good in diarrhoea on account of the tannin they contain. When a mild stimulant is wanted wine whey is good. One part of sherry to two parts of boiling milk, strained, sweetened to taste. Milk-punch, egg-nogg, and mulled wine are very useful. Of the spirits whiskey and brandy are most used, gin being used only where diuresis is desired, (the juniper-berry being diuretic). Gin is most apt of all the spirits to cause cirrhosis of the liver.

Contra-indications. Alcohol is contra-indicated in Cerebral Excitement, Aneurism, Advanced Atheroma, Acute Nephritis, Apoplexy, Meningitis, Cerebral Congestion, in the acute stages of Inflammatory Diseases, and whenever the habit already exists.

3. DIGITALIS. FOXGLOVE. The leaves of *Digitalis purpurea*, gathered in the second year of the growth of the plant. Wild in Europe, cultivated in America for ornamental and medicinal purposes. The leaves are gathered before or during flowering, and dried. They deteriorate with age, have a faint tea-like narcotic odor, and bitter nauseous taste.

Active Principles. The leaves yield their virtues to water and alcohol. The active principle is not well understood. It is called Digitalin, but it is a mixture of complex bodies containing Digtaine, Digitalin, Digitonin, and Digitoxin, the first three being glucosides. The crystalline so-called Digitalin is mostly Digitoxin. The seeds are many times richer than the leaves, but are little used.

Preparations. Only the officinal preparations should be used, for the commercial vary so much that they are not safe. The crude drug can be given as a powder or in pill-form in $\frac{1}{2}$ gr. doses thrice daily. There are four officinal preparations:—

EXTRACTUM DIGITALIS. Less reliable than the leaves, which are just as easy for administration.

slow effect till 12 h. after.

EXTRACTUM DIGITALIS FLUIDUM. Little used. Dose : 1-2 m.

10 m. TINCTURA DIGITALIS. More important and used in 5 m. to 1 dr. doses. *Give till you get the effect desired. - 20-1 dr.*

INFUSUM DIGITALIS. A favorite with practitioners in 1-4 fl. dr. doses, because it contains all the principles which are soluble in both water and alcohol. *Composition* : Powdered digitalis and cinnamon, each three parts ; water, 185 ; alcohol, 15.

Incompatibles. Tannic Acid and Vegetable Infusions containing Tannin, the Cinchona Alkaloids, Sulphate of Iron, Tinctura Ferri Chloridi, and plumbic acetate.

Physiological Action. The principal effects are exerted upon the circulation, the other effects being too unimportant to remember. First there is a slowing of the pulse due to the prolongation of diastole produced by stimulation of the centers of the Vagi and their peripheral ends. Inhibitory. This gives the auricles a better chance to fill the ventricles. Therefore the force of the pulse is increased both because the heart has more blood to contract upon, and also because Digitalis stimulates at the same time the heart-ganglia and muscle to renewed energy. In addition to these two actions there is also a stimulation of the vaso-motors, and of the muscular coats of the vessels, reducing their diameter and thus causing a rise of arterial pressure. The tension is further raised by the increased force and volume of the pulse. To summarize : (1) Diastole is prolonged due to stimulation of the inhibitory apparatus. (2) Systole is rendered more energetic, due to direct stimulation of the heart-ganglia and muscle. (3) The vaso-motors are stimulated, and the diameters of the blood vessels decreased, thus further raising arterial pressure. Respiration and temperature are affected only by toxic doses, and are depressed. High fever temperatures prevent the working power of Digitalis. In certain diseased conditions it acts as a diuretic, but in health it has no such effect.

Toxicology. Toxic doses affect the nerves, lowering reflex activity, causing headache, lassitude, prostration, muscular tremors, and sometimes convulsions as the result of disordered circulation at the base of the brain. There is violent and often repeated vomiting, the vomiting containing mucous and bile. There then is great prostration, the pulse is feeble, but the heart beats strong, so that the state of the pulse is no guide to the true condition, for when recumbent the patient's pulse may be good, and when erect very bad, becoming rapid, feeble, and small. The stimulating effects of Digitalis, which counterbalances the depressant effects given in small doses, are here thrown out of balance and the heart stops in systole. Stimulants or electricity are

therefore of no avail, since the heart is contracted. The heart, has, however, been known to stop in diastole. The further symptoms of poisoning are intense headache, pain in the back and limbs, sometimes salivation, and usually diarrhoea. There is consciousness to nearly the end, then delirium, stupor and coma. As a rule the patient recovers, but death may come within $\frac{3}{4}$ -10 days, most often within 1-2 days.

Treatment. Empty the stomach and bowels. Give tannin to form precipitates, and aconite as a physiological antidote. Put the patient in a recumbent posture and apply external heat.

Elimination. This is not well understood. Since none of the active principles are found in the urine, they are probably oxidized in the system.

Therapeutics. In diseases of the heart where the cardiac power is impaired, Digitalis finds its chief use, and is an invaluable stimulant. In cases of rapid and imperfect systolic action where the ventricles do not fill nor empty completely, it will lengthen diastole and so allow the chambers of the heart time to fill, and the increased systolic energy will lead to complete emptying of the ventricles. Thus the irregularity of the heart is checked through the inhibitory apparatus, and systole is invigorated by the direct effect on the heart-muscle, and the effects of low pressure overcome. In simple failure of the heart-muscle and in dilatation of the heart without compensation, Digitalis is exceedingly good. Where there is simple or excessive hypertrophy do not use Digitalis.

In Valvular Diseases where there is dilatation with hypertrophy, it is often useful even though there is hypertrophy; for in these cases the heart is really weak, since the work to be done is generally increased out of proportion to the hypertrophy. If the power of the heart should be increased more than the work, Digitalis would be of no use; it would only increase the difficulty. When the muscle is not degenerated, it is an excellent stimulant; but when the muscle is fatty the drug must be used with extreme caution in very small doses. In Mitral Stenosis and Insufficiency Digitalis is often of great value. These diseases both cause pulmonary hyperaemia, and this is greatly relieved by Digitalis. In Stenosis more time is given for filling the auricles and ventricles, and the amount of blood in the lungs is thus diminished. Besides this the right ventricle is stimulated, and so it drives the blood through the lungs, and the left ventricle has greater power for carrying on the systemic circulation. In Mitral Insufficiency there is regurgitation into the auricle, and in this case digitalis is good, for the increased power of the left ventricle enables it to

gain constantly on the supply of blood, since the amount of resistance is greater at the insufficient mitral orifice than at the large aortic orifice. Besides, the increased force of the right ventricle helps to counteract the backward pressure from the left ventricle. Sometimes in mitral diseases Digitalis increases the distress, where compensation is sufficient or already too great. In Aortic Stenosis it may be of value when the heart begins to weaken. In Aortic Insufficiency it is less valuable than in mitral, as the prolonged diastole allows blood to flow back into the ventricle; but when the heart begins to weaken and before compensation begins, Digitalis is very good. Here it favors the development of the hypertrophy.

In Irritability of the Heart with Palpitation, "Soldier's Heart," digitalis is better than any other drug. Its action is direct upon the nerve centres. Probably the disease is dependent upon exhaustion of the inhibitory nerves, and in this case Digitalis may effect a permanent cure. Sometimes in Aneurism and General Atheroma a cautious use of Digitalis is good. Great caution is necessary, however, lest there take place rupture of the aneurism or of an atheromatous capillary in the brain. Digitalis also has some power over the nutrition of the heart substance, both by its influence on the trophic nerves of the heart and by improving its circulation; and by increasing its power it may very much favor the production of compensatory hypertrophy.

Digitalis is also a diuretic, partly on account of its action on the circulation and partly because it has some direct diuretic action. In Dropsy due to cardiac dilatation it is very good. Stagnation is prevented, and the kidneys have more blood to work upon. It is good also in Subacute and Chronic Renal Diseases and can be given in combination with Squill, Compound spirits of Juniper or gin.

In large doses Digitalis is valuable as a cardiac stimulant in Syncope and Collapse. Its action being slow it is best given subcutaneously in 20-30 m. doses; and the dose may be repeated after half an hour. In Delirium Tremens with soft and feeble pulse where the heart is somewhat benumbed, digitalis is good in very large $\frac{1}{2}$ oz. doses of the tincture. The beneficial effects are due to cardiac stimulation, and an increased flow of blood to the nervo-centres. It maintains the circulation and sustains the heart in the second stage of Pneumonia and in Exhausting fevers, and during congestion of the lung in Typhoid Fever. In the case of all poisons which stop the heart in diastole, as Aconitia and Muscarina, it is very good, and can be preceded by ammonia, alcohol, or some other cardiac stimulant or given subcutaneously. Some-

times if given continuously Digitalis may suddenly assert itself after a long period of inactivity. There will be great and sudden failing of the pulse, syncope, sometimes paraplegia, vomiting, diarrhoea and even delirium. This is all due to its cumulative tendencies brought about by slow elimination, particularly when it has no diuretic effect. Cumulative effects often result from absorption of effusion.

Administration and Contra-Indications. Digitalis or its official preparations should be used rather than the commercial drug, since this is of variable strength. A use of the alkaloid is both unnecessary and dangerous. As Digitalis acts irritantly on disordered mucous membranes, it cannot be given by the mouth in Gastritis. It is also contra-indicated in Arterial Excitement, Aneurism, Atheroma, and Apoplexy. In using Digitalis either alone or with Squills or gin, as a diuretic, if the diuretic effects do not appear as soon as the general effects, discontinue its use.

4. **CAFFEINA.** An alkaloid found in tea, coffee, Paraguay tea, guarana, and mate. It has only a feeble power, and is obtained from the dried leaves of tea, or the coffee bean. Caffeine and theine are identical. The usual source is damaged tea, unfit for drinking purposes. It is colorless or snow-white, crystalline, of a silky lustre, odorless, permanent in dry air, with a bitter taste. It contains more Nitrogen than any other alkaloid. It is soluble in 75 parts of water and in half as much alcohol; more soluble in boiling water. There are two officinal preparations. Some of its salts are more useful than the alkaloid itself, due to their greater solubility.

CAFFEINAE CITRAS. Unstable and unreliable. It is not a citrate of caffeine but citrated caffeine. It is made by evaporating a solution of equal parts of citric acid and caffeine. It is soluble in 3 parts of water, forming a clear syrup solution. When more water is added caffeine is precipitated, which redissolves when 25 parts of water have been added.

CAFFEINA CITRATA EFFERVESCENS is the citrated caffeine with the addition of Bicarbonate of Soda, tartaric acid, and sugar. When water is added the soda and acid cause liberation of CO_2 .

CAFFEINAE HYDROBROMAS. The best of the salts, but not to be confounded with Bromo-Caffeine.

CAFFEINAE SODIO-SALICYLAS.

CAFFEINAE SODIO-BENZOAS. (Non-official) Both of these salts are soluble in water and alcohol, and are used for hypodermic injection, though they have no advantage over the Hydrobromate.

Physiological Action. Caffeine is a powerful and rapidly acting stimulant to the nervous system, affecting both brain and cord. It causes wakefulness, increased mental activity, even to restlessness; and increased rate of the pulse in arterial tension, but whether directly or indirectly is as yet unknown. It has no effect upon the motor nerves. On the kidneys it acts as a mild diuretic, increasing the secretion of urine by direct action upon the secreting substance. It increases both the volume, and the total solids. Large doses cause muscular tremblings, mental excitement or confusion, deep sleep, or sometimes obstinate wakefulness.

Therapeutics. It is used to increase wakefulness, to increase the power of work; or as a cardiac stimulant and tonic in all forms of cardiac failure, valvular lesions, or muscular weakness where Digitalis is contra-indicated or undesirable, or when rapid action is imperative. Its action is more prompt but less lasting than that of Digitalis. It is more certain diuretic in Cardiac and Renal Dropsy than Digitalis, and has the merit of never disagreeing with the stomach and it has no cumulative action. As a diuretic, however, it and all other stimulants are contra-indicated in Acute Nephritis, but it can be used in the chronic forms, especially in the later stages, alone or with other diuretics. In Opium poisoning it is used to stimulate the respiratory centre, and in Migraine and Nervous Headache it is useful alone or with Antipyrin or the Bromides. Absorption is very rapid and it is burned up in the system.

Administration. It may be given by the mouth or subcutaneously. For subcutaneous use a preparation made up with 31 parts of Sodid Salicylate, 40 of Caffeine, and 60 of water is very good. Another good preparation is the Sodio-Benzoate. *CAFFEINAE VALERIANAS* in 1-2 gr. doses is good in Hysterical Vomiting. Dose of Caffeina, a fraction to 4 gr.

5. *GUARANA.* A dry paste or powder made from crushed or ground seeds of a Brazilian tree. It contains 4-5 per cent. of Caffeine, and is used almost wholly for the Caffeine, but also as an astringent in Diarrhoea. Dose 15 m. to 5 gr. It can be made as a tea by pouring boiling water over it; or taken with a syrup or elixir. There is one officinal preparation, an *EXTRACTUM GUARANAE FLUIDUM*; dose: 15-45 m. It is used for Neuralgic headaches, and for the same effects as caffeine itself. Active principle Guaranine.

* 6. *STROPHANTHUS.* The seeds of *Strophanthus hispidus*, used by the natives of Africa as an arrow-poison.

Active Principle. It contains a glucoside, Strophanthine, to the extent of 8-10 per cent. It is a white crystalline powder, in-

tensely bitter; soluble in alcohol and water; almost insoluble in ether, and chloroform. It contains also an alkaloid of no importance.

Physiological Action and Therapeutics. Its action, like Digitalis, is direct upon the heart muscle. Like Digitalis it slows the pulse and increases its force, but it does not contract the cutaneous blood-vessels. It also increases arterial tension. It is also a powerful diuretic, probably acting directly upon the secreting substance of the kidney. It is often useful where Digitalis fails, and acts more quickly but less persistently and certainly than Caffeine. As a diuretic it is regarded by some as superior to Digitalis. Some say that it is a cumulative, but this is denied by others. Nervous irritability and dyspnoea may follow its use. Dose: $\frac{1}{2}$ –1 mgr. or $\frac{1}{130}$ – $\frac{1}{165}$ gr. may hear Tr Dr " M. + sub Tr B. hear npe

TINCTURA STROPHANTHI, dose: 1–10 m.

7. ADONIDINE. From Adonis vernatis. (Non-officinal.) A glucoside found in small amounts throughout the plant; amorphous, or a canary-yellow powder, intensely bitter, odorless; soluble in water and alcohol.

Physiological Action and Therapeutics. It is almost identical in action with Digitalis, and is used as a substitute for it, or to alternate with it, being quicker and more powerful. Dose; $\frac{3}{4}$ – $\frac{1}{2}$ gr. It is not cumulative, and acts as a diuretic indirectly.

* 8. CONVALLARIA. LILY OF THE VALLEY, or CONVALLARIA MAJALIS. The rhizome and roots are used. It contains two bitter active principles, both glucosides, Convallarin and Convallamarin, the former is insoluble in water, soluble in alcohol, the latter soluble in both.

Physiological Action and Therapeutics. Convallaria acts on the circulation in the same class of cases as digitalis, but is less efficient. It slows the beat and increases arterial tension. When there is dropsy, it is good on account of its marked diuretic character. It may also cause purging, due to one of its glucosides. It is used in the same class of cases as digitalis, but is less efficient. There is an officinal EXTRACTUM CONVALLARIAL FLUIDUM

9. SPARTEINE. From Cystisus Scorparious, the broom-plant; non-officinal. The alkaloid Sparteine is a colorless, volatile liquid insoluble in water, soluble in alcohol; with a peculiar bitter taste: containing no Oxygen. The SULPHATE (officinal 1890) is a green crystalline body, bitter, soluble in water. It can be given by the mouth or subcutaneously. Dose, $\frac{1}{2}$ – $\frac{1}{4}$ gr. if given by mouth, half as much subcutaneously.

Physiological Action and Therapeutics. Sparteine has a direct influence on the heart and acts like Digitalis, but large doses act

as a cardiac depressant, and also depress the cerebral and spinal motor centres. Unlike digitalis, Sparteine has no effect upon the vaso-motor centers. For general purposes it is inferior to Digitalis, but is a very useful substitute, being more rapid in its action. It is not cumulative, and is also a diuretic, whether directly or indirectly is uncertain. In Palpitation purely nervous it is said by some to be better than Digitalis.

II. Cardiac Depressants.

Cardiac Sedatives or Depressants are drugs which diminish the activity of the circulation, and lower arterial pressure. They are used to check the violent action of the heart, to lessen palpitation, to slow the pulse in febrile conditions, especially in some severe local inflammations, and to lessen the force and frequency of the heart's action. In some cases of arterial excitement, they may be used simply to depress the heart, and in others also to relax the peripheral vessels, and thus to diminish the rapidity and force of the circulation. In extensive inflammation of the internal organs their value is doubtful. In local inflammations they may afford relief by lowering the force of the circulation, and by lessening the flow of blood to the inflamed part, due to their depressant effect upon the vaso-motors. When the veins are dilated, the arteries are empty, so that a depression of the vaso-motors lessens the flow of blood to the inflamed region. Thus, Cardiac Sedatives have the same general effects as the old process of bleeding, and they are not exhausting. The principal members of the group are Aconite, Veratrum viride, and Antimony. Other drugs in other groups also affect the heart in certain conditions as Belladonna in cardiac strain, Digitalis in palpitation and functional disturbance not due to indigestion, hydrocyanic acid in disturbance due to indigestion and senega in palpitation due to aortic disease. Simple pressure and plasters over the region of the heart, act very well as substitutes for members of this group.

I. ACONITUM. MONKS-HOOD or WOLFSBANE. The tuberous root of Aconitus Napellus, a tall perennial indigenous in Europe and cultivated in the United States and also growing in India. Formerly both leaves and roots were officinal, but the leaves have been discarded. The leaves when rubbed fresh have a faint narcotic odor. There are several varieties of aconite, but that from napellus alone is used for inofficinal preparations. From the other varieties the active principle, aconitine, is sometimes obtained.

All parts of the plant are active and very poisonous, but the root is most powerful. It resembles horse-radish, but differs from it in being odorless, brown instead of white, and in having a bitter, acrid and benumbing taste, followed by a tingling of the lips and mouth, lasting perhaps for hours. Long chewing of the root causes serious inflammation of the oral cavity.

The Active Principle of Aconite is the alkaloid Aconitine, found in two forms; amorphous and crystalline. It is usually combined with Aconitic Acid, and both forms make crystalline salts with acids. A second alkaloid, Napellin, is also found. Most commercial aconite is impure, consisting of a mixture of substances. The pure form occurs in colorless, rhombic crystals, slightly soluble in water, soluble in alcohol, ether. It must be used with the greatest care. Dose, $\frac{1}{4}$ – $\frac{1}{2}$ mgr. or $\frac{1}{240}$ – $\frac{1}{120}$ gr. The alkaloid itself is not officinal and should never be prescribed for internal use; it is used only externally, and very guardedly.

Preparations. Aconite in substance is not much used.

EXTRACTUM ACONITI.

EXTRACTUM ACONITI FLUIDUM. Dose: $\frac{1}{2}$ –2 m.

TINCTURA ACONITI. Dose: 1–5 m. Small doses are often better than large ones, unless quick and strong action is desired. The tincture is most commonly used.

Physiological Action. In small doses Aconite causes a sense of muscular weakness, a reduction in the force and rapidity of the circulation and respiration. There may be dizziness and tingling in the lips and extremities. Large doses emphasize the above effects. The tingling extends all over the body, the pulse becomes slow and so feeble that it can scarcely be felt, the respiration is diminished and the vision disordered.

Toxicology. Toxic doses have more marked effects. Respiration is very disordered. The pulse becomes weak, rapid and irregular, the tingling passes into numbness and local anaesthesia. With the vascular depression there comes on cold sweats, shallow, irregular and slow respiration. The countenance is pallid and anxious, eyes glaring and protruding, pupils normal or widely dilated or even contracted when there are no convulsions. There may be epileptiform convulsions which do not come on until arterial pressure is reduced $\frac{1}{2}$ and which are due to depression of the circulatory center at the base of the brain. The voice goes first, then sight and the other senses, and finally there is loss of consciousness. If the dose be very large death may be immediate from paralysis and failure of the heart. In ordinary toxic doses death comes on slowly, but may come on suddenly from syncope after slight exertion as trying to sit up. The heart stops in diastole.

Death may occur in one minute if the dose be given subcutaneously, particularly if the alkaloid itself be injected. Generally death is from $\frac{1}{2}$ to several hours after ingestion. The peculiar tingling sensation is the only diagnostic sign of poisoning by aconite of value, for this is the only drug which causes it.

Treatment. Cardiac Stimulants should be given freely. Ether subsequently followed by hot alcohol is very good, or concentrated ether when alcohol is not obtainable. After giving ether and alcohol inject Digitalis subcutaneously. The ether acts until the alcohol is absorbed, and the alcohol acts until the Digitalis can be absorbed. Hence the order of administration of ether, alcohol and Digitalis. Place the patient on his back with his feet higher than his head to keep up the blood supply to the base of the brain. Maintain temperature by artificial heat. Empty the stomach by the pump, and not by emetics. If the patient vomits of his own accord, do not let him raise up to do it. If the respiration is feeble, artificial respiration may be necessary. Amyl nitrite may be used carefully in small doses if the heart stops, but large doses may cause further depression.

Locally aconite is an irritant and anaesthetic. Applied to mucous membranes it produces tingling and numbness which pass into pain, by its action on the peripheral sensory filaments. Internally aconite greatly affects the circulation. Its method of action is unknown, but it certainly lowers arterial tension. Moderate doses act directly upon the heart muscle; it is not known that they act directly on the vaso-motor centers. On respiration aconite acts as a sedative, particularly if breathing be hurried. If the doses are toxic, they paralyze the centers of respiration directly. Aconite produces a loss of temperature due to increased radiation of heat and vascular relaxation. In fevers it usually causes an increase in the volume of urine.

Therapeutics. The principle use of aconite is to quiet the heart, to lower the pulse and arterial tension and incidentally to lower the temperature. It is very depressant to the nervous system of circulation in children with sthenic fevers. By its effects on the peripheral ends of the sensory nerves it is useful in the reflex vomiting of pregnancy, but relief only lasts while constitutional effects are apparent. In Peritonitis it is better than Veratrum viride, as it is important to avoid the vomiting that Veratrum causes. In Pneumonia, however, it is inferior. In Heart Disease where there is excessive compensatory, hypertrophy with valvular lesions, and in simple hypertrophy, and in nervous palpitation it is good. When there is degeneration of the heart muscle or dilatation, it is not a safe remedy. It is also used in

Pericarditis. In Neuralgias of various sorts it is used both externally and internally. In rheumatic neuralgia after exposure to cold, and in chronic neuralgia, it may be applied as an ointment over the nerves, or given internally. The oleate is also used.

Administration. Aconite should be given after a meal and in small doses frequently repeated rather than in large doses, unless rapid action is desired. Bear in mind the fact that the alkloid Aconitine is never used internally.

2. VERATRUM VIRIDE. AMERICAN HELLEBORE, or INDIAN POKE. A perennial found in the United States. The rhizome and rootlets are used, and they contain the active principles, Jervine and Veratroidine, two alkaloids, through both of which Veratrum acts. V. album is non-officinal.

Physiological Action. Jervine has little effect on the Vagus; it lowers the pulse rather by its direct action on the heart muscle and ganglia. Veratroidine, however, lowers the heart action by stimulating the inhibitory apparatus. Jervine depresses the Vaso-Motor Centers, and both Jervine and Veratroidine depress the motor tract of the cord. Small doses of Veratrum viride first reduce the force and then the frequency of the pulse even to 35. The pulse is soft and moderately full; but when it is very much depressed, it may be made very rapid and feeble by slight exertion. With the reduction of the pulse rate, or following it, there may occur severe nausea and vomiting. On the skin the tincture of Veratrum acts as an irritant, and increases its functional activity.

Toxicology. In over-doses vomiting occurs speedily, due to the Veratroidine. In cases of poisoning the best treatment is to place the patient on his back. Warm water should be given to wash out the stomach, and the vomiting should be restrained. Administer Cardiac Stimulant; apply heat externally; and inject Atropine for its effect on the Vaso-Motors, and for its stimulating effects on the circulation and respiration, and the nervous system. Strychnine is also very good, but inferior to Atropine.

Therapeutics. Although Veratrum viride is a very powerful drug it is the safest of the Cardiac Sedatives. It is also a powerful spinal depressant, but is not used as such. Its chief and almost only use is as a cardiac sedative in acute sthenic inflammations as Pneumonia, Hepatitis, Pleurisy, etc., where there is hyperaemia. It is also good in Peritonitis with hyperaemia, but when the hyperaemia stage is past, its use should be discontinued. In Peritonitis, however, and also in Gastritis, it is inferior to aconite owing to its tendency to cause vomiting. It has been highly recommended in Puerperal Fever, but it must be used with care. In Chronic Heart Disease where the use of digitalis is con-

traindicated it is good. In Irritation of the Brain it may be used. In Adynamic conditions it is not to be used; and in Delirium Tremens and Typhoid Fever its use is even dangerous.

Administration and Preparation. In acute diseases it should be given in increasing doses every half hour to an hour, until the physiological effects are apparent, i. e. when sweating appears. Vomiting should be avoided if possible, and if it occurs before these effects be produced laudanum may be administered in the intervals in doses of 5-10 m. There are only two preparations of the drug:—The TINCTURE VERATRI VIRIDIS, dose 1-6 m.; and the EXTRACTUM VERATRI VIRIDIS FLUIDUM, dose 1-3 m.

* ~~3.~~ VERATRINA. A mixture of alkaloids from the seeds of Veratrum Sabadilla. Commercially it is a white or grayish powder; alkaline; with an intensely acrid taste; causes persistent sneezing when smelled; insoluble in cold, slightly soluble in boiling water, and soluble in alcohol, ether, and dilute acids.

Preparations:—There are only two which are officinal:

OLEATUM VERATRINAE. 2 per cent.

UNGUENTUM VERATRINAE. Strength, 4 per cent. Both preparations must be used cautiously on account of the danger from absorption. The latter consists of veratrine 4 parts, olive oil 6 parts, and benzoinated lard 90 parts.

Physiological Action. Small doses cause a slowing of the pulse and a diminution of its force. Large doses cause gastrointestinal irritation, vomiting, and muscular weakness. The pulse becomes rapid and thready, and there may be tetanic convulsions similar to those of strychnine and brought on by a slight disturbance. Its action on the circulation is due to the stimulation and subsequent depression of the Vagus and its centers. It at first stimulates the vaso-motor centers and then depresses or even paralyzes them. It also acts directly on the heart muscle, and the temperature and respiration are both depressed. Veratrina is very irritant to all surfaces, especially to mucous membranes. Applied to the skin or mucous membrane, it causes burning, prickling and numbness. Applied to the mucous membrane of the nose it may cause violent sneezing lasting for hours.

Therapeutics. The therapeutic use is limited. As a cardiac sedative it is inferior to aconite and veratrum viride, and is not used internally on account of its secondary effects. It is used only externally over rheumatic joints, etc., as a stimulant and rubefacient, though there are many other better drugs.

4. ANTIMONIALS. ANTIMONII ET POTASSII TARTRAS. Tartar emetic, placed in several groups but best considered under cardiac depressants. It is made by boiling oxide of antimony in a

solution of acid potassic tartrate, or cream of tartar, and occurs in small transparent crystals which become white and opaque on exposure; of a sweet metallic taste and feebly acid reaction, soluble in water (1-17 cold, 1-3 hot) and insoluble in alcohol. In solution it is precipitated by hydrochloric acid, the precipitate dissolving in an excess of either hydrochloric or tartaric acid. Sulphide of hydrogen gives an orange red precipitate of the sulphide. It is incompatible with alkalies, gallic and tannic acids, and astringent solutions. Dose, $\frac{1}{2}$ -2 gr.

There are also the following antimonial preparations:—

* ~~ANTIMONII SULPHIDUM.~~ Used only in making the purified.

* ~~ANTIMONII SULPHIDUM PURIFICATUM.~~ Used in making the Sulphurate.

~~ANTIMONII OXIDUM.~~ Used in preparing James' Powder:

* ~~ANTIMONII SULPHURATUM.~~ Used in preparing Plummer's Pills. There are the two following important compound preparations:—

~~PULVIS ANTIMONIALIS.~~ James' Powder. Composition: Oxide of antimony, $\frac{1}{3}$; precipitated calcic phosphate $\frac{2}{3}$.

~~PILULAE ANTIMONII COMPOSITAE.~~ Plummer's Pills. Composition: $\frac{1}{2}$ gr. each of calomel and sulphurated antimony with 1 gr. of guaiac.

There are the two following preparations of tartar emetic:

~~VINUM ANTIMONII.~~ Strength, 4 parts to 1000 of stronger white wine.

~~SYRUPUS SCILLAE COMPOSITUS.~~ Contains $\frac{1}{2}$ as much tartar emetic as the wine.

Antimony is not much used except as tartar emetic, James' Powder, Plummer's Pills, the wine, and compound syrup.

Physiological Action. Tartar emetic in small doses causes a slight feeling of warmth in the stomach, a slight depression of the circulation, and increased perspiration. Moderate doses cause loss of appetite, nausea, more marked depression of the circulation, and diaphoresis. Large doses cause more intense and prolonged nausea, violent vomiting, great depression of the circulation, muscular weakness, fainting, salivation, and profuse perspiration. The secretions of the stomach, intestines, and respiratory passages are all increased.

Toxicology. Toxic doses produce symptoms of the gastro-enteritis with much gastro-intestinal irritation, and repeated vomiting, first mucous, secondly contains bile, and later it may be bloody. The first effects are produced in the oesophagus, consisting of burning pains, followed by colic pains in the abdomen, purging, and rice-water stools. There may be cramps of the

extremities, resembling cholera. The circulation is greatly depressed, the arterial tension is almost nothing. The respiration is feeble and shallow; the muscular exhaustion is extreme; the urine is suppressed. Death may be preceded by stupor and convulsions.

Treatment. Give tannic acid ad libitum, place the patient on his back with the feet higher than the head, and administer stimulants, such as alcohol and ether, and apply external heat. In a child $\frac{3}{4}$ gr. has proved fatal; in an adult 2 gr.

Locally tartar emetic acts as an irritant, particularly where it meets acid secretions as in sweat glands and stomach. On some skins it acts quickly, but usually after long continued contact. It causes reddening of the surface, and the formation of ulcers which heal slowly. On the mucous membrane it causes a burning sensation, also inflammation if the application is continued. Tartar emetic taken internally acts chiefly as a depressant of the circulation, diminishing the pulse rate by its direct action on the heart muscle. The arterial pressure is diminished, but how is not understood; it is partly accounted for in the depression of the heart. Sometimes the pulse is at first quickened, but usually it is slowed. Respiration is affected only by large doses, which cause irregular variations in the rhythm. Moderate doses act on the mucous membrane of the bronchi, causing excessive secretion of mucous. The Temperature is not materially affected by ordinary doses, nor is the Nervous system; large doses depress both. Vomiting is caused both by direct stimulation of the vomitory center in the medulla, and by the irritating action of the drug on the stomach. Tartar emetic is eliminated by all the excreta, urine, and faeces, largely the latter.

Therapeutics. (1) Tartar emetic is not used to any extent as an emetic nowadays. It is slow in action and very depressant, and the vomiting, which is preceded by intense nausea, is violent and persisting. It is sometimes used in Membranous Croup, but its value is very doubtful. Its use is to be avoided in all conditions of impaired vitality. (2) As a cardiac depressant it is inferior to aconite and veratrum viride. Its tendency to purge and nauseate is an objection to its use. It is used in Pneumonia to depress the circulation, however. In nothing but sthenic fevers where there is a bounding pulse should it be used. (3) As a diaphoretic it is used but little, because there are better drugs for this purpose and because of its disagreeable effects. (4) As a sedative expectorant it is the most efficient of all drugs in the early stages of acute Bronchitis, and it may stop an attack. When thus used give $\frac{1}{2}$ gr. every 15 minutes until the physiological

effects, *i. e.* vomiting, are produced. (5) As a counter-irritant it is used only when a slow, persistent impression is desired. (6) Very small doses are useful in Acute Intestinal Catarrh of children, and affect the entire tract.

Contra-indications and doses. Tartar emetic is contra-indicated as a rule in the extremes of age, in both the very old and in the very young; also in acute diseases of the kidney, and in gastrointestinal irritation or inflammation. However, $\frac{1}{60}$ gr. is often useful in Acute Catarrh of the alimentary canal with fever. The dose of tartar emetic varies according to the effect desired:—As a sudorific, $\frac{1}{12}$ gr.; as a cardiac depressant, $\frac{1}{20}$ – $\frac{1}{10}$ gr., every few hours; as an emetic, 2 gr. The wine of antimony has a strength of 2 gr. to the oz., and the doses should be varied accordingly.

HYDROCYANIC (2 per cent. sol.;—Dose: 1–5 m.), TAR-TARIC, CITRIC, and ACETIC ACIDS belong to this group, but they are seldom used as cardiac sedatives.

NUTRIANTS.

We come now to Nutrients, or drugs which affect the nutritive movements of the body. Under this order there are five families:—(1) Astringents, (2) Tonics, (3) Alteratives, (4) Antiperiodics, (5) Antipyretics. We will begin with the Astringents.

I. Astringents.

Astringents are drugs which call into exercise the vital function of contractility. They contract smooth muscle fibres but also act on tissues containing no muscle fibres. They also lessen secretions. They coagulate albumen, but not completely in the living body. When diluted they do not coagulate the albumens but they precipitate them from solutions. When astringents are applied to denuded surfaces or to mucous membrane, a pellicle of albumen is formed by coagulation which is more or less protective. At the same time the tissues are contracted and thus made denser, and the secretion is diminished. All soft tissues have some degrees of contractility and when the normal state of contraction is lessened the tissues are relaxed, when increased they are puckered or astringed. The old theory that puckering was due to contraction of the blood-vessels, resulting in cutting off the supply of blood, is only partly true. Some astringents do not contract blood-vessels at all, and too strong solutions even dilate them, as tannic and gallic acid. The astringent action is there-

fore exerted on the tissues themselves. The diapedesis of the white blood corpuscles is said to be stopped by astringents.

Astringents are either vegetable or mineral, the former class being more numerous. The vegetable astringents depend upon tannic acid in some form. They are all closely related to irritants, and when used too freely cause irritation, especially the mineral astringents. Generally they act from local application, but sometimes they are taken internally for remote or general effects after absorption. They are used to overcome relaxation, to check secretion, as antidotes for poisoning from lead, tartar emetic, etc., to reduce congestion, and to check hemorrhages. Locally they are applied as a solid, usually as a powder, or in washes, ointments, suppositories, gargles, plasters, and injections. In the alimentary canal they are used as powders, pills, or liquid preparations. Some astringents, as gallic acid and lead acetate, seem to have a remote action after absorption into the system, but most do not. Locally care must be taken not to apply astringents too soon or too freely, for they may do harm.

In inflammations astringents are good, but they must be used cautiously. Lead and silver may be used with care in all stages of inflammation where there is relaxation and distension of the blood-vessels. Astringents are useful in checking morbid secretions, but not if those secretions are in the efforts of nature to relieve inflammation, as in diarrhoea. In a serious Diarrhoea, however, where life may be endangered by profuse discharges, astringents are indicated. For checking hemorrhages the remote action of lead acetate is good; and also that of gallic acid in hemorrhages of the lungs, stomach and kidneys. In most cases of hemorrhages due to trauma, the astringents must be used locally, acting as styptics. They act by rapidly forming coagulated plugs of albumen, and also by contracting the blood-vessels themselves.

(A) VEGETABLE ASTRINGENTS.

The vegetable astringents depend for their action upon the presence of tannic, kino-tannic, and gallo-tannic acids. The list is unnecessarily long, for many are unimportant.

1. GALLA. GALLS. The chief source of tannin. They are vegetable excrescences produced by the puncture of insects and the deposition of ova, in various plants, the officinal form being from an oak. After hatching the larvae live on the substance of the gall, eats his way out, and escapes. There are two kinds of galls, (1) blue or green from the size of a pea to that of a hickory nut, smooth or tuberos, the centre containing a parti-

ally developed insect. These are the young galls, gathered before the larva escapes and before the interior is eaten out, containing 65-77 per cent. of tannin, glucoside easily broken up by ferments into glucose and digallic acid. (2) White galls, large whitish bodies, very light, with a cavity inside, the insect having escaped. They contain little tannin and hence are not very valuable. Most galls come from Asia Minor and the countries bordering on the Mediterranean Sea. Their chief use is as a source of tannic acid. There are two officinal preparations:—

TINCTURA GALLAE.

UNGUENTUM GALLAE. Strength, 10 per cent. Both are strong Astringents.

2. **ACIDUM TANNICUM.** Tannic acid exists in plants as kino-tannic and gallo-tannic acid. The latter on exposure to moist air becomes gallic acid. Kino-tannic acid with ferric salts gives a greenish-black color, while gallo-tannic, the officinal acid, gives a blue-black. Tannic acid is obtained by treating the powdered galls with ether which washes out impurities and coloring matters, leaving the pure acid behind. It is in the form of yellowish-white, crystalline, feathery flakes or powder; with a faint odor, astringent and slightly bitter taste. When pure it is odorless, colorless, and not bitter. It is freely soluble in water, somewhat so in dilute alcohol and in glycerine, insoluble in ether. *dos- 2-10 gr.*

Incompatibles. It is strongly acid and therefore forms salts with organic and inorganic bases. It forms precipitates with alkalies, alkaloids and their salts, lime-water, gelatine, albumen, gelatinized starch, tartar emetic (used as antidote) and many others.

Tannic acid exposed to moist air or treated with dilute sulphuric acid becomes gallic acid. Heated to 108-115 degrees C. it gives pyrogallic acid. Tannic acid is present in many vegetable preparations, and many astringent drugs are employed solely for the tannic acid which they contain. There are the following preparations of tannic acid:—

UNGUENTUM ACIDI TANNICI. *Composition:* Tannic acid, 10 per cent.; benzoinated lard, 90 per cent.

TROCHISCI ACIDI TANNICI. Each troche contains 1 gr.

COLLODIUM STYPTICUM. *Composition:* Tannic acid, 20 per cent. alcohol, 5 per cent.; stronger ether, 20 per cent.; collodium, 55 per cent.; Tannic acid and collodium are the most important ingredients. Tannic acid is also used in bougies, suppositories, gelatine pencils, and a spray may be inhaled. Injections with glycerine are also used in the urethra and vagina. Dose for internal use, 3-20 gr.

3. **ACIDUM GALLICUM. GALLIC ACID.** A white crystalline powder, soluble in 100 parts of cold and 3 parts of boiling water, freely so in alcohol and ether thus differing from Tannic acid; with an acid, astringent taste. It forms precipitates with alkaloids and gives a blue-black color with ferric salts. It does not coagulate gelatine, gelatinized starch or albumen, nor does it form a precipitate with tartar emetic. Locally it is less powerful than tannic acid, but is better for internal use. It is incompatible with spir. aeth. nit. and metallic salts. Dose, 2-40 gr.

There is an officinal **UNGUENTUM ACIDI GALLICI** of 10 per cent. strength, which does not coagulate gelatine. It is weaker than and not so good as the ointment of tannic acid.

Physiological Actions of Tannic and Gallic Acids. Locally Tannic acid is a powerful astringent. It coagulates mucous and causes dryness of the surface of mucous membranes. In the mouth it may destroy the sense of taste by paralyzing the peripheral ends of the nerves. Since it coagulates albumen when injected into the blood it forms a clot, but if it be injected slowly the alkaline carbonates hold the tannate of albumen in solution. A 5 per cent. solution of Tannic acid precipitates peptones, but not in the presence of hydrochloric acid. If it be applied too freely it is an irritant. Large doses taken internally may produce severe gastric and abdominal pains with vomiting and diarrhoea, followed by constipation. When taken into the stomach it is converted into gallic acid, only a little being absorbed as tannic acid; and ultimately all is so transformed. It is eliminated as gallic acid.

Locally tannic acid is the most powerful of the astringents, but when results through the circulation are desired, gallic acid is superior for the reason that its remote action is better, and since all the tannic acid taken into the stomach must first be converted into gallic acid any way.

Therapeutics of Gallic and Tannic Acids. Tannic acid is used to overcome relaxation, as spongy gums, sore mouth, chronic sore-throat; to check hemorrhages, as nose-bleed and bleeding from the lungs or stomach. In hemorrhage from the lungs it is given as a spray, 10 grs. to the ounce of water. When the hemorrhage can be reached only through the circulation, as hemorrhage from the kidney, gallic acid is indicated, given as a powder or in solution, but it is not clear how it acts as a styptic in these cases. Locally gallic acid cannot be compared with tannic acid for the treatment of hemorrhages. Tannic acid is also used to arrest excessive secretion as in Leucorrhoea, Serous Atonic Diarrhoea, old Abscesses, excessive perspiration, and Chronic Ulcers. It

may be used internally in Colliquative Sweating, but here gallic acid is better. Gallic Acid is useful in Bronchorrhoea with excessive expectoration and exhausting sweats, given internally.

In certain forms of Bright's Disease gallic acid may be used to lessen the amount of albumen; and combined with opium it may be given for Diabetes Mellitus and Insipidus, and Acute and Chronic Diarrhoea. It is also used to harden soft tissues exposed to friction, as sore nipples and tender feet. It is used as an antidote in cases of poisoning from tartar emetic and the alkaloids with all of which it forms precipitates. These are not wholly insoluble, and must be removed at once by emetics and cathartics.

Administration. When intended for action in the stomach as in Haematomasis, give gallic acid in a powdered form, 10–20 gr.; when for action on the bowels, as in Diarrhoea, give in pill form so that it may pass from the stomach undissolved. For ordinary local use employ tannic acid in a powder or dissolved in glycerine. In ordinary solution, as the ointment, or as the Collodium Stypticum. For Haemoptysis, inhale a spray of tannic acid, 5–10 gr. to the oz.; for remote action use 20–40 gr. doses of gallic acid as a powder, in pills, or in solution. Repeat the dose as often as is necessary.

4. CATECHU. An extract obtained from Acacia Catechu, an East Indian Tree, naturalized in Jamaica. It occurs in masses of various shapes or in fragments of red-brown color; with a bitter astringent taste, becoming sweetish afterwards, soluble in alcohol and partially so in water. Catechu contains from 25 to 50 per cent. of peculiar tannin called catechu-tannic acid, a mixture of kino-tannic and catechuic acids.

Therapeutics. Catechu is a powerful astringent, used externally for all astringent purposes and internally in Diarrhoea in doses of 20–30 gr. There is an officinal TINCTURA CATECHU COMPOSITA, of a more agreeable taste than the simple Tincture of Catechu, and given in 1–2 dr. doses. An officinal TROCHYSCUS CATECHU exists, each troche containing 1 gr.

5. KRAMERIA. RHATANY. The root of Kromeria triandra, a shrub indigenous in Peru and Brazil, containing 18 per cent. of kino-tannic acid, mostly in the bark. It is never given in substance, but only in its preparations. These comprise an extract, fluid extract, and a tincture, the latter being given in doses of $\frac{1}{2}$ –2 dr. the best form for general use. The troche and syrup of the later Pharmacopoeia are no longer officinal.

6. KINO. The inspissated juice of an East Indian tree. Obtained by incising the bark and drying the juice in the sun.

There are several varieties from different trees of different countries, but the most common is the East Indian or Malabar Kino. It comes in small, irregular, reddish, shiny and brittle fragments; with a bitter astringent taste, becoming sweetish; and containing very much kino-tannic acid. It is soluble in alcohol, partly so in water. The dose in substance is 20-30 gr., but more commonly it is given as a tincture in the same doses as catechu, $\frac{1}{2}$ -2 dr.

Therapeutics. The three drugs just mentioned bear a close resemblance to one another therapeutically. They all contain kino-tannic acid, catechu containing in addition catechuic acid, and are all powerful astringents. They can all be used externally for astringent purposes, or internally for Diarrhoea of a serious type. When considerable mucous is present, remove it by castor-oil or epsom salts before giving these drugs. They can be used alone or combined with Opium in Chronic Diarrhoea, and they are useful as mouth-washes in spongy gums and as gargles in sore-throat. Kino and Catechu may be given in substance 20-30 gr. Of all their preparations the compound tincture of catechu is most agreeable to the palate, but the tincture of Kino is best borne by the stomach.

7. QUERCUS ALBA. The inner bark of white oak occurring in the form of a coarse fibrous powder containing 10 per cent. of gallo-tannic acid. It is used for cheap astringent infusions, for baths, as washes for hemorrhoids, as vaginal washes in Leucorrhoea, as a gargle in sore throat, and as a wash in Prolapsus Uteri and Recti. In powdered form it is often added to poultices. It may be used internally as a decoction. It should be remembered that it stains the clothing.

* 8. RUBUS. BLACKBERRY. The bark of the root is used, containing 10 per cent. of tannic acid, and given in decoctions. The officinal preparations consist of a fluid extract and syrup. The syrup consists of 20 parts of the fluid extract plus 8 parts of a simple syrup. Dose: 1-2 dr. The berries are also somewhat astringent, and blackberry wine is a mild and more or less agreeable astringent, said to be good for Diarrhoea.

* ~~9. GERANIUM.~~ Rhizoma of Geranium maculatum, with an astringent taste, containing 15 per cent. of tannic acid. It may be given boiled in milk for diarrhoea of children in 20-30 gr. doses, and it has the advantage of giving no taste to the milk. There is an officinal fluid extract, $\frac{1}{2}$ -1 dr.

* ~~10. HAEMOTOXYLIN.~~ The heart-wood of logwood, occurring as chips of a deep reddish-brown, faint odor, sweetish taste, containing Kino-tannic acid and a crystalline principle called

Haemotoxylin. It is used as a mild astringent in Diarrhoea and Leucorrhoea, but since it gives red stools and blood-red urine, it frightens the patients and cannot be used much. Besides, other drugs are better.

~~14. RHUS GLABRA.~~ SUMACH. The berries are used, containing tannic and malic acid. *Uses*: As an infusion in water, or with potassic chlorate, it is used as an acidulous and astringent drink or gargle in inflammations of the mouth and pharynx. The leaves and bark also contain tannin, even 27 per cent. There is a fixid extract, *EXTRACTUM RHOIS CLABRAE FLUIDUM*, dose: 1-2 dr. Diluted with 3 or 4 parts of water and saturated with potassic chlorate, it makes a good mouth wash.

* ~~12. UVA URSI.~~ BEARBERRY. The leaves of a low trailing evergreen found in Europe, Asia, and North America containing 6 per cent. of tannin and a glucoside, Arbutin; bitter and diuretic. A 10 per cent. decoction may be used as an astringent in disorders of the urinary system, such as Pyelitis, Cystitis, or Gleet. It is not used for general purposes as an astringent, however. When given in over-doses, it is eliminated as hydrochinone. There is an officinal fluid extract given in doses from $\frac{1}{2}$ -2 dr.

13. HAMAMELIS. WITCH-HAZEL. The leaves of Hamamelis Virginica, indigenous in the United States, the bark containing 8 per cent. of tannin and the leaves containing in addition a volatile oil and bitter oil, but no active principle. Hamamelis has considerable value in the treatment of local sprains and bruises. There are numerous "extracts" on the market for internal use, but much of their value is due to the alcohol which they contain. It is of use as an internal haemostatic, and in local treatment of varicose veins, uterine hemorrhage, hemorrhoids, bleeding from the bladder; also in various other venous hemorrhages as from the lungs and stomach. There is a fluid extract given in doses up to 2 dr.

(B) MINERAL ASTRINGENTS.

Mineral Astringents are hard to classify, for many of them have other than astringent actions, acting also as emetics and tonics, thus confusing the classification.

1. ALUMINUM. ALUMEN; Alum. A double sulphate of aluminum and potassium. The officinal alumen is the potassic salt, *ALUMINII ET POTASSII SULPHUS*. This occurs in colorless or white octohedral crystals in large masses, with a sweetish, acidulous, and astringent taste, and acid reaction; efflorescent; soluble in 10 parts of cold water, more so in boiling; insoluble in alcohol. A solution of alum will dissolve zinc or iron and set hydrogen

free. Heated to 200° C. all the water of crystallization is set free, leaving a bulky, white, deliquescent powder, called **ALUMEN EXSICCATUM**, used externally. It is less soluble than alum. Internally alum is best given in 5–50 gr. doses in solution with sugar and flavoring matters; externally for washes, gargles, and injections, a dilute solution under 5 per cent. is best. Alum is incompatible with alkalies, alkaline carbonates, potassic, calcic, and magnesian tartrates, and lead acetate. Sometimes the ammoniac alum is substituted for the potassic alum which it exactly resembles, but it can be detected by treating with lime-water, fumes of ammonia being set free.

ALUMINII SULPHAS. Pure white crystalline powder, permanent in air, odorless, with a sweetish and afterwards astringent taste, and acid reaction; very soluble in water, more so than alum, almost insoluble in alcohol. It is used externally as a wash and injection, and sometimes as a gargle, although it is bad for the teeth. It is an antiseptic as well as an astringent.

* **ALUMINII HYDRAS.** A light, white, amorphous powder, more or less tasteless, odorless, soluble in acids, caustic soda and potash, insoluble in water and alcohol. It is used internally as an astringent in Diarrhoea in doses from 3–30 gr. as a powder or mixture. The extract and powder act as protectives.

Physiological Action of the aluminum group. Alum, even in dilute solutions, coagulates albumen. Applied to mucous membranes it produces a constriction and puckering, and a loss of the natural redness by contracting the tissues and capillaries. Applied to the skin it thickens and toughens it. Small doses taken internally produce little effect beyond a diminution of the secretions of the alimentary canal and constipation. Large doses are irritant, and cause symptoms of gastric irritation, and larger amounts cause vomiting and purging. If death occurs it is due to gastro-enteritis.

Therapeutics. Alum is used locally as an active and valuable astringent. It has remarkable power as a styptic, since it coagulates the blood; causes a contraction of the vessels, and even exerts an astringing influence on the tissues themselves. In Haemoptysis and in Chronic Bronchitis with excessive secretions a saturated solution is very good, administered by atomization. It is used as a gargle in sore-throat, but is harmful due to its injurious effect on the teeth. In Chronic Ulcers, Follicular Stomatitis, increased Salivation from the free use of mercury or from any other cause, and in Conjunctivitis it is very useful. In night sweats, or in localized excessive perspiration of the feet or hands it is good, administered as a sponge-bath. As a vaginal wash in

Leucorrhoea it is useful in a strength of 20–30 gr. to the ounce of water. For internal use it is the least useful of the mineral astringents.

In Acute Lead Poisoning alum is an antidote, since it forms an insoluble precipitate of plumbic sulphate, which it removes by its emetic properties, thus acting both as antidote and emetic. Strangely enough in Lead-Colic due either to the Sub-acute or to the Chronic Lead Poisoning when there is no lead in the alimentary canal, it seems to be beneficial, but why it is so is not known. On account of its emetic properties it is also good for other cases of poisoning than those of lead. In Croupous Pneumonia and Membranous Croup it is used both as an emetic and for its local effect on the mucous membrane. In intestinal Dysentery, it is also useful.

Administration. As an emetic, give a teaspoonful with syrup to a child or a tablespoonful to an adult. As an astringent, it is given in 10–20 gr. doses. For Lead and Painter's Colic, give with morphine.

2. PLUMBUM. PLUMBI ACETAS, Sugar of lead. Made by the action of acetic acid on lead or its oxide litharge, occurring in colorless, transparent, efflorescent crystals, attracts the carbonic acid gas of the air; with an acetous odor, sweetish metallic taste, neutral or faintly acid reaction; very soluble in water and alcohol. It is incompatible with many substances, as the sulphates, carbonates, vegetable and mineral acids, mineral salts, alkalies, lime-water, potassic iodide, mucilage of slippery elm, albuminous liquids, and preparations of opium.

LIQUOR PLUMBI SUBACETATIS. Basic Acetate of lead, or Goulard's water. Made by boiling plumbic acetate with litharge and water. A clear, colorless liquid, with a sweetish astringent taste, and alkaline reaction; containing 25 per cent. of the sub-acetate of lead. It absorbs carbonic acid gas from the air and so must be kept well stoppered. It is never used internally, and for external use it is much diluted and used as a cerate or liniment.

LIQUOR PLUMBI SUBACETATIS DILUTUS. 3 parts of the concentrated liquor are added to 97 parts of water, for use as a lead water.

LINIMENTUM PLUMBI SUBACETATIS. A yellow, white, opaque, emulsion containing 40 parts of the officinal liquor combined with 60 parts of cotton-seed oil.

CERATUM PLUMBI SUBACETATIS. 20 parts of the sub-acetate with 80 parts of camphor cerate.

Physiological Action of Lead. When a soluble lead salt, the acetate, is applied locally to a part in not too concentrated solution,

it acts as a sedative astringent. Owing to its styptic action in contracting the vessels, the tissues become blanched, and any inflammation present is reduced. Strong solutions act as irritants, increasing or even causing inflammation. When salts of lead are taken internally in therapeutic doses no decided symptoms are caused, except a diminution of the secretions, especially of those of the alimentary canals.

Toxicology and Treatment. Toxic doses give rise to symptoms of an irritant poison, treated fully in another course.

Treatment. (1) Acute lead poisoning. Evacuate the stomach by magnesia or sodic sulphate which act as purges and chemical antidotes, precipitating the insoluble lead sulphate and then removing it. Albuminous drinks may be given to allay gastrointestinal irritation, followed by opium to allay pain if necessary. The further treatment is in general symptomatic. (2) Of Sub-acute Poisoning. Sub-acute cases rarely follow the medicinal use of lead, but are usually accidental in those whose daily occupation is connected in any way with lead, or are due to contaminated drinking water. Another source is cosmetics and hair-dyes. The treatment of those and chronic cases is a matter of general medicine, and the course of treatment depends upon the particular lesions present. First of all stop the source of the poisoning, then aid in its elimination by potassic iodide, 10 or 20 gr. three times per diem, and finally relieve the other symptoms and restore the lost functions. When potassic iodide is given a double salt forms which is eliminated by the urine. In Lead Colic purges of Jalap and Calomel with opium may be given, the latter to stop the pain. Alum in 2 gr. doses with morphine is said to be almost a specific.

Therapeutics. Acetate of lead is used in solution as a sedative astringent in acute external inflammation. Its strength must not be above 10 gr. to the oz. as stronger solutions cause decidedly irritant effects. Internally it is used in the treatment of Diarrhoea, especially in those with profuse serous discharges. If the purging is attended with inflammation, lead acetate is the most useful on account of its sedative properties, given in 2 gr. doses every two hours. In Dysentery it is good when the discharges are copious, in pills from 1-5 gr. It has been recommended for Haemoptysis, but its value is doubted by some. It is also used to diminish the night-sweats and expectorations of Phthisis in 2 gr. doses. The danger of chronic poisoning from medicinal use is almost nil.

Therapeutically the Subacetate is never used internally. When used externally it is well diluted with water, 1-4 oz. to the

pint of water. Its most frequent use is for superficial inflammations, and here it is better to add laudanum. When the surface is abraded decrease the strength. It can also be used as a poultice made by saturating stale bread with one volume of the solution to 5 of water. It is applied cold in the early stages of inflammation and it is said that it will abort felons. The officinal dilute subacetate, a 3 per cent. solution, is altogether too weak for ordinary use, but it is good as a wash in certain forms of Eczema and other Skin Diseases, applied once or twice per day.

The Oxide, Plumbi Oxidum, is used in the preparation of officinal lead-plaster, EMPLASTRUM PLUMBI. It is made by boiling litharge with olive-oil and water, and is used as a protective for ulcers and abrasions. By the addition of resin, the officinal EMPLASTRUM RESINAE is made. PLUMBI NITRAS or the nitrate of lead is used sometimes as a disinfectant, though it has no value as such. PLUMBI CARBONAS, the carbonate, is used with linseed-oil as a sedative dressing, and it is very efficient in fresh burns. When a large surface has been involved, guard against lead-colic due to absorption.

3. CUPRUM. CUPRI SULPHAS, blue vitriol. Large, deep blue, transparent crystals, efflorescent, with a nauseous, metallic taste; odorless; acid in reaction; soluble in $2\frac{1}{2}$ parts of cold and $\frac{1}{2}$ part of hot water; insoluble in alcohol.

CUPRI ACETAS. Improperly called Verdigris. Made by dissolving copper in acetic acid or by the action of acetic acid on verdigris; occurring in the form of a blue-green, crystalline powder, odorless, with a metallic nauseous taste and acid reaction; soluble in alcohol (1-135) and in cold and hot water. True verdigris is a mixture of basic acetates.

Physiological Action of Copper Salts. The sulphate acts locally as a stimulant and mild astringent in very dilute solution. In more concentrated form it acts as an irritant and in solid form it is almost caustic. In a solid form it is used as a mild caustic. Given continuously in small amounts internally, it is a tonic to the nervous system. In 5-15 gr. doses it acts as an irritant emetic.

Toxicology. In large amounts it is an irritant poison and gives both nervous and gastric symptoms. The treatment of poisoning by sulphate of copper consists in the administration of egg, milk, or ferrocyanide of potassium, to form insoluble precipitates; the further treatment is then symptomatic. The chronic form of poisoning is very rare. The treatment is symptomatic.

Therapeutics. Locally a solution of 4 gr. to the oz. is used as a gargle in relaxed sore-throat, and as an astringent injection for

the rectum, vagina, and urethra. It is also used for a stimulating dressing in sluggish ulcers, and as a stimulant in Conjunctivitis. Internally it has been used in Anaemia and various Nervous affections, but its value is doubtful. It may be used in pill-form as an astringent and stimulant in certain Diarrhoeas, as that of phthisis, of typhoid fever, usually combined with opium. It is also used more or less as an emetic, but though it is more rapid it is also more irritating than zinc and is not so safe. The acetate and nitrate have precisely the same effects as the sulphate and no advantage over it.

4. ZINCUM. ZINCI ACETAS, Acetate of zinc. White, micaceous, six-sided tablets, deliquescent, with a faint acetous odor; sweet, metallic and astringent taste, and acid reaction, very soluble in water.

ZINCI SULPHAS. Efflorescent crystals, white, odorless, with a sharp saline, nauseous and metallic taste, and acid reaction; very soluble in water; insoluble in alcohol, it resembles epsom salts and has been taken for it with a fatal result. It is incompatible with alkaline carbonates, lime-water, and salts of lead.

Physiological Action of Zinc. The sulphate of zinc in weak solutions is a stimulant astringent; in concentration, it is an irritant. In doses of 30 gr. it is an irritating emetic, and in large doses it produces the same train of symptoms as in copper poisoning. The treatment is also the same; eggs and milk are given and the further symptoms are treated as they arise.

Therapeutics. Locally zinc sulphate is used as a stimulating astringent in Catarrhal Inflammations which are not active, and in Eczema, being administered as an injection of 1-2 gr. to the oz. Sometimes it is given internally in pill-form, in doses of 2 gr. as a stimulating astringent in Chronic Diarrhoea with ulcerations. The acetate of zinc closely resembles the sulphate in its physiological and therapeutic action, but it is less active.

ZINCI CARBONAS PRAECIPITATUS. The carbonate is a white, impalpable powder, insoluble in water and alcohol, tasteless and odorless. It is applied to abraded surface as a protective powder or ointment.

ZINCI OXIDUM. The oxide is a soft, whitish, or pale-yellow powder, odorless, tasteless, permanent in air, insoluble in water and alcohol. In action, it is a mild stimulant astringent.

Therapeutics. It is used in certain moist Skin Diseases, Ulcers and Burns, and locally in Chronic Eczema as an ointment. Internally it is given for Chronic Catarrhal Diarrhoea and in the treatment of Chorea and Epilepsy. In small doses it acts as a tonic to the nervous system after over-indulgence in alcohol.

With belladonna it is useful in checking night-sweats, the action being due, perhaps, to the belladonna. The carbonate is very similar in effects to the oxide.

5. BISMUTHUM. ~~BISMUTHI SUBCARBONAS.~~ A heavy, white or pale yellowish-white powder, odorless, tasteless, permanent in air, insoluble in water and alcohol.

~~BISMUTHI SUBNITRAS.~~ A heavy, white powder with a slight taste and the same physical characteristics as the subcarbonate.

* ~~BISMUTHI CITRAS.~~ A white amorphous powder, permanent in air, odorless, tasteless, insoluble in water and alcohol used only in the preparation of the following compound, the double citrate :

* ~~BISMUTHI ET AMMONII CITRAS.~~ Small shining pearly scales, soluble in water, sparingly soluble in alcohol; with a metallic taste and slightly neutral or faintly alkaline reaction. It is more astringent but also more irritant than the carbonate and cannot be used where there is acute inflammation.

Physiological Action of Bismuth Salts. The subcarbonate and subnitrate are exactly alike in action, acting both mechanically and as astringents, to relieve and soothe inflamed mucous membranes. They are sedative astringents and also have some antiseptic power.

Therapeutics. Much of their beneficial action is due to the protection afforded by adhesion. In Gastric Catarrh with ulceration and irritation they relieve and soothe the irritated mucous membrane and check vomiting. They all check Diarrhoea and purging in Gastro-Intestinal Catarrh. In Typhoid Fever, Tubercular Diarrhoea, and Cholera Infantum, they act chiefly by their protective, sedative and astringent properties. When there is much mucous in the intestine, it must first be removed by a purging dose of castor-oil. In Serous Diarrhoea they are good in 5 gr. capsules with a drop of carbolic acid. These compounds are also antacids and are good in Heart-Burn from lactic and butyric fermentation. Besides the above-mentioned uses they are good in various other disorders of the stomach and intestines.

Locally Salts of Bismuth are useful in Excoriaceous Injuries, Ulcers, etc., where they are applied directly, and also in Acute Coryza and Ozaena, where they are snuffed up the nostrils. In Beginning Gonorrhoea a solution of 20 gr. to the oz. is injected every two hours. It is also valuable in Leucorrhoea, and is useful as a local application in Skin Diseases. The double citrate is more astringent and irritating, and should not be used if there is acute inflammation. In Chronic Serous Diarrhoea and in the Acute Diarrhoeas of Relaxation, it is sometimes given in doses from 2-4 gr. in aqueous solution, but it is inferior to the subnitrate

and subcarbonate. Sometimes the salicylate of bismuth is used when there is Gastro-Intestinal Catarrh.

Administration. On an empty stomach, give in 5-15 gr. doses. For action on the intestines give an hour or two after a meal in 15 gr.-1 dr. doses. The drug is borne well by children in even large doses, 5-10 gr. of the subnitrate being taken safely by a child of two years.

6. ARGENTUM. ARGENTI NITRAS, Lunar caustic. A heavy, anhydrous salt, occurring in translucent shiny plates turning black on exposure to the light in the presence of organic matter; with a styptic, metallic taste, odorless, neutral; soluble in its own weight of water, soluble in 26 parts of alcohol. It is incompatible with drinking water due to the chlorides in it, hydrochloric acid, all chlorides, sulphates, tartrates, alkalies and alkaline carbonates, potassic iodide, lime-water, and astringent infusions.

Administration. Given internally for the constitutional effects, a pill form is used, gum arabic being the excipient. Dose: $\frac{1}{6}$ - 1 gr. It is never given with a vegetable extract such as are commonly used in making pills, on account of the danger of forming an explosive compound. It has a very bad taste, so it is not given in solution. For local use, which is its most common one, it is a very important caustic stimulant and astringent, and is applied as a solid or solution.

~~ARGENTI NITRAS FUSUS.~~ Fused nitrate of silver. For application as a solid, silver nitrate is melted down with 5 per cent. of silver chloride, and made into pencils, the chloride being added to make them less brittle.

~~ARGENTUS NITRAS DILUTUS.~~ Mitigated caustic containing 30 parts of silver nitrate and 60 parts of Potassic nitrate, and moulded into pencils. In contact with organic matter, it gives a black stain removed by tincture of iodine and sodic hyposulphate or potassic cyanide.

~~ARGENTI OXIDUM.~~—Olive brown, or brownish black, alkaline made by the action of potassic hydrate on silver nitrate; slightly soluble in water, insoluble in alcohol, metallic taste. It is used as a substitute for the nitrate in internal administration. It has the same physiological action, except that it is less irritating, and is incompatible with the same substances. It is given in pills made up with gum-arabic in $\frac{1}{2}$ - 2 gr. doses.

* ~~ARGENTI IODIDUM.~~—Of doubtful value. A heavy, yellow, morpous powder, insoluble in water and alcohol. Dose, when used, $\frac{1}{2}$ - 2 gr.

Physiological Action of the Silver Salts. Nitrate of silver when applied to the mucous membrane in dilute solution, is an

astringent, diminishing the calibre of the vessels and overcoming relaxation. It is one of the few astringents that can be applied to inflamed surfaces without danger of irritation, and has an alterative action as well as stimulant astringent. Pure, it is a mild caustic forming a whitish film of coagulated albumen which acts protectively against further action, so that its caustic effects never extend very deep.

Toxicology. Internally it acts locally and also somewhat generally, the mode of action not being understood. In sufficient doses it is an irritant poison, causing gastro-enteritis, and has a direct effect on the nervous system. In some, cerebro-spinal symptoms predominate, in others, gastro-enteritic; and there may be severe tetanic convulsions, which are plainly reflex. A peculiarity is that they may persist after complete loss of voluntary movements. Only three fatal cases are recorded, one being from 30 gr. Recovery has followed after the ingestion of an oz. For treatment give salts as an antidote to precipitate the chloride of silver and milk and oily substances to allay the irritation. Then treat the symptoms as they arise. Given internally for some time chronic poisoning called "Argyria" may result, causing a slaty-blue or dark color in the skin; usually permanent. The mucous membrane of the mouth stains brown first, due to the deposit of the oxide of silver, and the conjunctiva may be involved. It can be removed extremely slowly by potassic iodide and sodic hyposulphite, and it has been said that complete removal of the color has been thus affected. There is no ill health, the dark color due to the oxide being the only thing requiring treatment.

Therapeutics. The most common use of silver is for its local action on ulcerated surfaces of the skin, and also of the mucous membranes when these can be reached, as a simple caustic. It is also used in a solid form or in solution in inflammations of mucous membranes, as in Conjunctivitis, Laryngitis, Pharyngitis, and ordinary Sore-throat. In Laryngitis it is used in solutions of any strength from 10-20 gr. to the oz., applied by a brush. In Urethritis application of a solution of 12 gr. to the oz. may aggravate it. In subacute cases a solution of 2-4 gr. to the oz. and in advanced cases of 1-2 gr. to the oz. is often of considerable service in Gonorrhoea. In Uterine Ulcerations and in Leucorrhoea, silver nitrate can be applied in a solid form. It may be applied to ulcers of the skin and to flabby granulations as a stimulant. It may be used as a solution of 20 gr. to the oz. over the red skin when a bed-sore is coming on, often aborting it. A bed-sore on a paralytic will not be aborted, however. Boils and Felons may be removed by strong solutions, and applied to the scrotum,

it may abort an attack of Orchitis, or Epididymitis. Pitting in small-pox is said to be prevented by pricking the pustules with a needle dipped into a solution of 20-30 gr. to the oz.

Taken by the mouth silver nitrate is converted into the chloride. How it is absorbed is not clear, but some of it is probably absorbed in combination with peptone, and some with an excess of salt of chloride. On the stomach it has an important local action. In Gastric Ulcer it seems to be the best remedy, especially if combined with hyoscyamus or opium. In Gastritis, Dyspepsia, and Chronic Gastric Catarrh it is useful. Regulate the diet and administer a dose of $\frac{1}{2}$ - $\frac{1}{4}$ gr. in pill form on an empty stomach, three or four times per day. In Chronic Enteritis and Colitis, especially with ulcers, it is best given in hard pills which can escape from the stomach undissolved. To reach ulcers of the caecum, give by injections of large amounts of a solution of 1 gr. to the oz. into the rectum. If it is desired to reach only the rectum, inject much smaller amounts. Cleanse the bowels before injecting, with warm water. If it is desirable to stop the action administer salt. For constitutional effects silver nitrate is used only in diseases of the nervous system, but it is no longer used in Chorea and Epilepsy. There are certain chronic inflammatory diseases of the cord where it occasionally does good, and it may arrest some of them permanently. It is the only drug useful in these conditions, and even if it should fail it is worth trying and does no harm.

Administration. When the constitutional effects are desired, it is given in pill-form after meals during digestion. For local action on the stomach give 1-2 hours before meals. When it is given for constitutional effects, suspend its use for a week every three or four weeks, and never use it longer than three months at a time. The local administration has been considered at length in a previous paragraph. The oxide of silver is somewhat astringent, but it has no caustic action, is less irritating than the nitrate, and is better when the constitutional effects are desired. Dose: 3 or 4 pills per diem, each of the strength of 1 gr.

7. FERRUM. The list of iron preparations is a long one, and many are of no especial importance. Not all of them are astringents, many being tonics.

FERRI CHLORIDUM. Ferric chloride. Orange-yellow crystals, very deliquescent, odorless, or smelling of hydrochloric acid, with a strong styptic taste, and acid reaction; soluble in alcohol, water and ether. Is made by treating metallic iron with hydrochloric and nitric acids. This substance is used in making the following two preparations:—

~~LIQUOR FERRI CHLORIDI.~~ A reddish-brown aqueous solution, containing a small amount of free hydrochloric acid, with an acid reaction, and strong styptic taste. It used for external application well diluted in water, 1-4 per cent., sometimes externally as a substitute for the tincture, 1-10 m. largely diluted.

~~TINCTURA FERRI CHLORIDI.~~ 35 per cent. of the liquor with 65 per cent. of alcohol. On standing some months a hydrochloric ether develops from the free acid and alcohol. Valuable as styptic and tonic. Same dose as of liquor and even up to 1 dr. It is sometimes administered with a syrup. On account of their action on the teeth these last two preparations should be given through a glass tube.

~~LIQUOR FERRI SUBSULPHATIS.~~ Monsel's Solution. An aqueous solution containing about 40 per cent. of the basic ferric sulphate, dark reddish-brown, almost syrupy in consistency, odorless, with an acid reaction and astringent taste, mixing with water and alcohol in all proportions. Used as a local application as an astringent and internally in doses of 1-5 m.

~~LIQUOR FERRI TERSULPHATIS.~~ This is a 30 per cent. solution of the normal ferric salt, used chiefly in preparing the iron compounds and for making the ferric hydrate, the antidote in Arsenic poisoning. It is not good as an astringent. It has an acid reaction and styptic taste, and is of a dark reddish-brown color. For local use it is too irritant.

~~FERRI OXIDUM HYDRATUM.~~ Hydrated sesquioxide of iron, Ferric hydrate, the antidote in arsenic poisoning, made by precipitating an iron salt with ammonia or with sodic carbonate. The precipitate when used as an antidote, is washed and given in teaspoonful doses.

~~FERRI OXIDUM HYDRATUM CUM MAGNESIA.~~ Hydrated oxide of iron with magnesia. Used in arsenic poisoning instead of the hydrated oxide alone.

* ~~FERRI ET AMMONII SULPHAS.~~ A double sulphate of iron and ammonia, made by heating a solution of ferric with ammonia sulphate. It is a pale violet, crystalline, efflorescent substance, odorless, soluble in water, insoluble in alcohol; with a sour, acid and styptic taste, and acid reaction. It is used internally as a tonic.

The Therapeutics of such of the iron compounds as are classified under the astringents will be considered under this group of Tonics, next to be taken up.

II. Tonics.

Having finished the Astringents, the first great family of Nutrients, we pass by a series of intermediate iron preparations to the Tonics pure and simple. These are drugs which so influence nutrition as to increase vital power. The iron preparations already treated are best classified as astringents, but the following are really tonics. It may be said in addition that many of the iron compounds here treated as astringents are treated as tonics by many authors.

1. **FERRUM. FERRUM REDUCTUM.** Light, tasteless, odorless, grayish-black, lustreless powder of metallic iron. The sub-carbonate of iron is heated in a stream of hydrogen, and thus the iron is reduced. If it is black, it is impure. It is insoluble in water and alcohol, soluble in acids. This preparation is known as "Iron of hydrogen," "reduced iron," and "Quevenne's iron." It is nearly free from astringency, and is merely a tonic. Dose: 2-5 gr. in pills or powder.

~~FERRI PYROPHOSPHAS.~~ A mild but efficient preparation made by mixing solutions of pyrophosphate of sodium and citrate of iron in distilled water, and evaporating to dryness. It is a complex mixture in the form of thin apple-green transparent scales, permanent in air, odorless, with a slightly salty and acid taste and acid reaction; freely soluble in water, insoluble in alcohol. Dose: 1-5 gr. in pill, solution, or syrup.

~~FERRI CARBONAS SACCHARATUS.~~ A pleasant preparation made by precipitating ferrous carbonate from any ferrous salt in solution by carbonate of sodium, mixing with sugar of milk and drying. It is a greenish-gray powder, neutral, odorless, with a sweetish and ferruginous taste; slightly soluble in water. Exposed to the air it oxidizes. It is given in pills or tablets in 5-30 gr. doses.

* ~~FERRI IODIDUM SACCHARATUM.~~ Ferrous iodide with sugar of milk added to make it more pleasant and stable, yellowish-white or gray, odorless; with a sweet ferruginous taste and acid reaction, very hygroscopic, and so incapable of being given in pill-form. It is not very soluble in alcohol, but dissolves in 7 parts of water, Dose: 5-30 gr.

~~SYRUPUS FERRI IODIDI.~~ This contains 10 per cent. of ferrous iodide. It is a transparent, pale-green liquid, with a sweet ferruginous taste, odorless, and neutral reaction. Dose: 10-30 m. diluted with water.

~~PILULAE FERRI IODIDI.~~ Blanchard's pills. These contain 1

gr. of ferric iodide and $\frac{1}{5}$ gr. of the reduced iron with a coating of balsam. Dose: 1-2 pills.

* ~~FERRI ET POTASSII TARTRAS.~~ A transparent garnet-red salt occurring in scales, odorless, deliquescent, with a sweetish, ferruginous taste and neutral reaction; soluble in water and insoluble in alcohol. Its composition is not yet accurately known. It is easy to take in solution, and easily borne in 5-10 gr. doses.

* ~~FERRI CITRAS.~~ Very similar to but better than the double citrate of iron and ammonia. Transparent, garnet-red scales, odorless, with a faintly ferruginous taste and acid reaction. Dose: 2-5 gr. best given in solution.

* ~~FERRI ET AMMONII CITRAS.~~ Made by adding ammonia to the citrate of iron and evaporating to dryness on a glass plate. It occurs in transparent, deliquescent, garnet-red crystals, odorless, with a mild ferruginous taste and neutral reaction; soluble in water, insoluble in alcohol. Dose: 2-5 gr. ✓

FERRI ET QUININAE CITRAS. Quinine is dissolved in a solution of the citrate of iron, and evaporated to a syrup which is dried on glass plates, giving scales containing 12 per cent. of dry quinine. These scales range from a reddish-brown to a golden yellowish-brown color, slowly deliquescent, odorless, with a bitter and ferruginous taste, and acid reaction. They are slowly but completely soluble in cold water, more rapidly in hot, and slightly in alcohol. This is a very valuable tonic, combining the virtues of both iron and quinine. Dose: 5-10 gr. *pills 3t per day* ✓

~~VINUM FERRI AMARUM.~~ A ferric tonic containing 8 parts of the citrate of iron and quinine, 12 of the tincture of sweet orange peel, 36 of syrup, and 44 of stronger white wine. Dose: 1-4 teaspoonful. *dose same.* ✓

~~PILULAE FERRI COMPOSITA.~~ (Non-official, 1890.) Griffith's pills. These contain myrrh, sodic carbonate, ferrous sulphate, syrup, and as a result of decomposition, ferrous carbonate and sulphate of sodium. Dose: 1-6 pills. They do not keep well owing to their tendency to oxidize. They are very similar in properties, composition and uses to the compound mixture of iron, and are made fresh whenever wanted.

~~MISTURA FERRI COMPOSITA.~~ Griffith's mixture. Composition is almost the same as the pills.

~~FERRI SULPHAS EXSICCATUS.~~ Ferrous sulphate heated until it has lost its water of crystallization. It is a grayish-white substance, soluble in water, and used to make pills. 3 gr. of this mean 5 gr. of the non-dehydrated sulphate. Dose: $\frac{1}{2}$ -2 gr.

There are many other preparations of iron which need be merely mentioned, as Ferri Sulphas, Ferri Sulphas Precipitatus,

Ferri Hypophosphis, Lactas, Valerianas, Oxales, Phosphas, Liquor Ferri Citratis, Massa Ferri Carbonatis, Syrupus Ferri Bromide, Pilulae Ferri Iodidi, etc.

✓ *Physiological Action of Iron.* Iron is a normal and necessary constituent of the red blood corpuscles, and is a food rather than a medicine. In fact it is a normal constituent of many foods. It may be found in minute amounts in the urine, but it is eliminated chiefly by the liver, though it has been found in milk, sweat, tears, and intestinal juices. The ingestion of too much iron gives the sulphide in the faeces. Too little causes Anacima due to an insufficient supply of Fe. for the red blood corpuscles. The iron may be insufficient in amount on account of insufficient supply, abnormal excretion, or hemorrhage. Iron is not only a food for the blood, but it is a stimulant to the organs producing it. It is probable that it acts on an ozonizing agent in the blood, and so increases the activity of the body, for iron can convert oxygen to ozone. If this theory be true, we should expect a slightly increased temperature under its use, and we actually find it. It has no effect on the nitrogenous metabolism in health. Single doses do not affect the system, but repeated doses increase the amount and quality of the blood and the number of red blood corpuscles.

The preparations of iron are divisible into two classes, soluble and insoluble. Many of the former have an inky taste and may blacken the teeth. In the stomach they are large precipitated as albuminates and so absorbed; or a double albuminate of iron and sodium is formed in the blood after absorption. Some of the preparations are changed to the ferrous chloride, but the iodide is absorbed unchanged. Whether the preparation is soluble or not is unimportant in selecting the preparation for a given case. Some prefer one, some another.

Almost all iron salts have more or less astringent power and after absorption probably raise the tone and contractility of the tissue, acting through the blood. When given by the mouth they cause blackened stools, a portion of iron being converted to the tannate and sulphide. Small doses of the insoluble and less irritating iron preparations at first give increased appetite, and a tendency to constipation. Very susceptible persons may have gastric disturbance or headache, and subjects not particularly susceptible may have the same symptoms after long treatment of big doses. The gastric disturbance may go as far as decided irritation with much pain, and there may be heart-burn. The headache is largely due to constipation, and is relieved by catharsis. Headache in rheumatic and gouty persons who are taking iron

cannot be so relieved. Large doses of iron interfere with digestion, and since only small amounts will be absorbed, it is better to give small doses. Sometimes iron will cause some irritation of the bladder, shown by increased micturition and by the mucous; and in a child it may cause nocturnal incontinency.

Therapeutics. There is only one therapeutic indication for iron, Anaemia. All anaemias are not equally influenced; some yield readily, others do not. Those following syphilis or cancerous cachexia do not yield to iron, though they do to other drugs as mercury and potassic iodide in a case of syphilis. In some forms of Anaemia as Chlorosis, iron may do more harm than good, by its action on the alimentary canal and brain. Here, other drugs are better. Very minute doses of the reduced or dialyzed iron may do good. Where the anaemia is extreme the dose should be small, the rule being that the greater the anaemia, the smaller the dose. As improvement progresses the dose should be increased, and the form in which the iron is given should be varied. It is often combined with other tonics as quinine, strychnine and the group of vegetable bitters and also cathartics as Rochelle salts, rhubarb and aloes.

Some preparations of Iron are very astringent, others are only slightly so. The *Liquor Ferri Subsulphatis* is a very powerful astringent and styptic, and is used only for these purposes. In stopping hemorrhages from external wounds and those of the stomach, it is the best of all astringents. For the latter purpose 3-10 m. are given in water. In *Haemoptysis* it can be inhaled as a spray of a solution of 5-30 m. to the oz. of water. Apply it from 5-15 minutes and repeat at intervals of an hour. Sometimes it can be given in full strength or diluted in *Diphtheria*, *Pharyngitis*, *Tonsillitis*, and *Laryngitis*. In *Uterine Hemorrhage* it is very useful, applied in half strength solutions. In the stomach in large amounts it acts as an irritant poison. The double sulphate of iron and ammonia is a good astringent in 5 gr. doses three times per day, in *Leucorrhoea*. The Sulphate is a very decided astringent and is used as an aqueous solution of 5-30 gr. to the oz. In *Erysipelas* it is used as a wash, one oz. to the pint of water. It is not used as a simple chalybeate. In *Chronic Diarrhoea* it serves as a tonic astringent. The dried sulphate is used in constipated Anaemia as a laxative pill for the lower part of the bowel.

The Tincture and the *Liquor Ferri Chloridi* are both strong astringents. A portion of the good effects of the tincture is due to the free acid and ether which it contains. It is used locally as an astringent, applied in *Sore-throat*, *Diphtheria*, *Tonsillitis*, and

in Haemoptysis by spraying the lungs. Internally it is a good chalybeate and a decided diuretic, but why it is the latter is not known. In Chronic Bright's Disease it may sometimes diminish the amount of albumen in the urine, and is also good on account of its diuretic action. It is also given internally in Erysipelas in full doses frequently repeated, with good results. Due to its astringent action on the genito-urinary mucous membrane, it is used for Gleet in combination with tincture of cantharides. When taken by the mouth it should be given through a glass tube, and the teeth should be rinsed afterwards. Probably the best of the simple chalybeates is reduced iron, and it is the least astringent.

* 2. **ACIDUM SULPHURICUM.** OIL OF VITRIOL. The strong acid contains at least $92\frac{1}{2}$ per cent. of the absolute acid and $7\frac{1}{2}$ per cent. of water. A colorless liquid of oily consistence, inodorous and very caustic and corrosive. There is a dilute preparation, **ACIDUM SULPHURICUM DILUTUM**, which is a 10 per cent. solution of the strong. **ACIDUM SULPHURICUM AROMATICUM** contains 20 per cent. of the strong acid in alcohol, together with tincture of ginger and oil of cinnamon. It is straw-colored, stronger than the preceding, and has a more agreeable taste. Dose: 5-30 m. well diluted, given through a glass tube.

Physiological Action and Therapeutics. Besides being a tonic Sulphuric Acid is the most astringent of the mineral acids. The strong acid is powerfully corrosive and is used only for its caustic effects, being applied in a pasty mass with asbestos or charcoal. The dilute acid is used as a stimulant for venereal and other indolent ulcers. Internally sulphuric acid is converted into the sulphates, and is eliminated by the skin, alimentary canal, and somewhat by the kidneys. It acts as an astringent both locally and internally. Its most marked astringent effects are exerted upon the skin and bowels during its elimination, and it is therefore good in Exhausting Sweats and Diarrhoea. It is also useful in Hemorrhages, but is inferior to the other remedies. In Cholera it is valuable both as a remedy and as a prophylactic, given in lemonade, a few drops to a glass. It is also a prophylactic in Chronic Lead Poisoning, and a chemical antidote in Acute cases.

Administration. When prescribing the aromatic or dilute sulphuric acid, give in doses of 10-30 m. preferably through a glass tube. The aromatic acid is best for internal use as an astringent. The strong acid taken internally acts as a corrosive poison.

* 3. **ACIDUM NITRICUM.** NITRIC ACID. A colorless fuming liquid, turning yellow on exposure to light, containing 68 per cent. of nitric acid and 32 per cent. of water. **ACIDUM NITRICUM DILUTUM** is 10 per cent. solution of the absolute acid.

Physiological Action. Nitric acid is the most powerful of the corrosive acids in concentrated form. Greatly diluted it acts as a local stimulant, and also has a slight astringent action. Taken internally in small doses well diluted it increases the appetite, stimulates the glands of the alimentary canal and astringes relaxed parts. After absorption it is converted into nitrates and eliminated by the same channels as sulphuric acid, the skin, alimentary canal, and kidneys.

Therapeutics. Strong nitric acid is used locally as a strong acid caustic for Warts. It is applied by a glass rod or a piece of wood, and the surrounding tissues are protected by oil, soap or sodium carbonate. They are afterwards washed with warm water and soap. A very weak aqueous solution, 5-20 m. to the oz., is used for stimulating slow ulcers. It is also used internally for Gastric and Intestinal Dyspepsia, but it is inferior to Hydrochloric acid. Long use may cause gastro-intestinal derangement, spongy gums, and loosening of the teeth. The symptoms of poisoning and the treatment are much the same as in Sulphuric Acid.

* ~~4. ACIDUM HYDROCHLORICUM.~~ HYDROCHLORIC ACID. A colorless fuming aqueous solution of hydrochloric acid gas with a pungent, suffocating odor, and intensely acid taste; containing about 32 per cent. of absolute hydrochloric acid and 68 per cent. of water. ACIDUM HYDROCHLORICUM DILUTE contains 10 per cent. of the absolute acid. Made by mixing 100 parts of Hydrochloric Acid with 219 of water.

Physiological Action and Therapeutics. Hydrochloric is less corrosive than nitric or sulphuric acid, and its astringent power is very slight. Very dilute, it has the same stimulating action on the glands of the alimentary canal as the other acids. As a caustic it is inferior to nitric acid. It is used internally not as an astringent, but to aid digestion. In Dyspepsia it is taken to stimulate proteid digestion either alone as the Acidum Hydrochloricum Aromaticum or with Pepsin. In loss of appetite and tendency to Diarrhoea it is good, combined with Strychnine. The dilute acid may be given in doses up to 30 m. well diluted in water through a glass tube.

5. ACIDUM NITRO-HYDROCHLORICUM. AQUA REGIA. Made by mixing 18 parts of nitric acid with 80 of hydrochloric acid. Reddish brown fuming liquid, very corrosive, with a strong odor, orange at first; then turning yellow and finally colorless on standing. It is used both alone and as a basis for the preparation of the officinal ACIDUM NITRO-HYDROCHLORICUM DILUTUM. The chemistry of aqua regia is unknown. It is good

only fresh, and when it becomes a pale yellow its valuable medicinal proportions are lost. The officinal dilute acid is worthless medicinally.

Therapeutics. Aqua regia has greater power than any of the mineral acids in influencing the glandular organs of the alimentary canal, especially the liver. By reason of its stimulating effects it is also useful in Gastric and Intestinal Digestion, and is also useful to stimulate the liver when the flow of bile is deficient. In Chronic Hepatitis it is useful, but not in the Acute form. For the Chronic cases it is given in full doses till bilious purging and gastro-enteritic irritation occurs. In the condition of inactivity of the small glands of the alimentary canal and liver, the so-called "Biliousness", aqua regia is very useful. In Jaundice it is often of service, if the jaundice be Catarrhal, or from inactivity of the liver. If Obstructive it is of course useless. In Chronic Diarrhoea due really to Intestinal Dyspepsia, it sometimes cures when other remedies fail by restoring the normal digestive power. In constitutional Syphilis, and various Skin Diseases, it sometimes improves the general condition by its action on the digestive system and the glands. In Oxaluria it causes great improvement in a very short time, even in one or two doses; and the improvement is often permanent.

Administration. It should be freshly prepared and given in 5-10 m. doses well diluted in water, after a meal, through a glass tube. The mouth should be rinsed afterwards. In Chronic Liver Diseases the greatest beneficial results are obtained when the acid is applied externally in a bath.

* ~~C. CERI~~ OXALIS. OXALATE of CERIUM. A white, granular powder, permanent in air, odorless and tasteless; insoluble in water, alcohol and ether, with a certain amount of astringent properties. Its mode of action is not known. For Gastric Acidity and for the relief of Reflex Vomiting, especially that of pregnancy, or of uterine disturbances, it is useful in 1-15 gr. doses in pill form or powder 3-4 times per day. Otherwise it is unimportant. It is really more of an astringent than tonic.

This finishes the tonics that are also grouped astringents. The following are solely tonics.

7. PHOSPHOROUS. A translucent, waxy, nearly colorless solid; with low Sp. Gr., a disagreeable odor and taste; highly inflammable; insoluble in water, slightly so in absolute alcohol (1-350) soluble in oils (1-50), and freely soluble in chloroform and the bisulphide of carbon. It is given as pills.

OLEUM PHOSPHORATUM. A 1 per cent. solution in sweet oil

of almonds. Dose: 1-3 m., given in an aromatic emulsion, in capsules, or with camphor to disguise the taste.

PILULAE PHOSPHORI. The pills contain $\frac{1}{100}$ gr. each of phosphorous, and are coated with balsam of tolu. Dose: 1-5 pills.

Physiological Action. Phosphorous is a constituent of most of the tissues, especially bones and nervous tissues. Therefore in therapeutic doses it is a direct tonic to the nervous tissue, proved to be so clinically; and it also aids in bone formation proved by actual experiment, for if the food be deprived of its phosphorous, the new bone formed is soft and gelatinous as in the rickets. It also checks tissue-waste, and is said to excite the sexual desire. It is absorbed as phosphorous and not as phosphoric acid as is often stated, although it is eliminated both as phosphorous and phosphoric acid. That it is not absorbed as phosphoric acid is shown by the fact that the administration of a very large amount of the acid will not produce the same effects as a small amount of Phosphorous itself. When Phosphoric acid is given the affinities of phosphorous are fully satisfied, so that its effect is small, it acting as an acid.

Toxicology. In larger than therapeutic doses it acts on the connective tissue of the stomach and liver, giving rise to chronic inflammation, with atrophy of the secreting cells and fatty degeneration. It may cause cirrhosis of the liver. The fatty degeneration produced depends upon the rapid decomposition of albuminous matter together with insufficient oxidations.

Treatment. The treatment consists in the persistent use of emetics and cathartics. The former should be copper sulphate, this giving an insoluble phosphide of copper. The cathartics should never include castor-oil nor any fatty oils nor substances, since these aid absorption, Phosphorous being soluble in fats and oils. Old ozonized oil of turpentine (the French variety) is good, but the American form is useless. Give in 40 m. doses every 15 minutes for an hour. Chronic Phosphorous Poisoning is seen in those whose occupation brings them in contact with the fumes of phosphorous. The chief lesion consists in necrosis of the jaw, especially when the teeth are defective, and is due wholly to the local action of the vapors.

Therapeutics. The chief use of Phosphorous is as a nutrient tonic for nervous tissue in Nervousness, Nervous Debility, Neuralgia, Paralysis, and Locomotor Ataxia; and it is also valuable in Chronic Nervous Exhaustion, whether cerebral or spinal. In nervous exhaustion from typhoid fever, and during convalescence it is also very good. In Cerebral Softening and Myelitic Paraplegia due to excessive sexual indulgence, it is the only drug which

has any effect, and it is also valuable in the treatment of Neuralgia from Nervous Depression. In the treatment of Boils and Carbuncles it is often useful, and in certain Skin Diseases it is as good as Arsenic. Phosphorous is very good for a tonic after abuse of the sexual organs and in the resulting weakness. It is also good in Osteomalacia and Rachitis, and may be combined with iron.

Administration. It may be given in pill-form, as the oleum, or as a phosphide, as that of zinc. The first dose should never be above $\frac{1}{100}$ gr. or 1 pill, on account of a possible idiosyncrasy; but 5 pills may be given, and cases are recorded where $\frac{1}{12}$ – $\frac{1}{4}$ gr. has been taken; $\frac{1}{20}$ – $\frac{1}{12}$ an average dose; $\frac{3}{4}$ gr. in divided doses during 7 days, was fatal. Sometimes the smallest dose may cause nausea, and unpleasant eructations. Phosphoretted oil, a 1 per cent. solution, is given in 1–5 m. doses.

Other Phosphorous preparations:—

~~ACIDUM PHOSPHORICUM.~~ The officinal phosphoric acid is of 85 per cent. strength, and is used for the preparation of the officinal ACIDUM PHOSPHORICUM DILUTUM, which has an absolute strength of 10 per cent. It is colorless, odorless, with an acid reaction. It is not corrosive and is used as a tonic and reconstituent in fevers in doses of 15 m. to 1 dr. well diluted in water, sweetened and prepared like lemonade.

* CALCI PHOSPHAS PRECIPITATUS. A white, light, amorphous powder, tasteless, and odorless; insoluble in water and alcohol; soluble in acids; made by dissolving bone ash in hydrochloric acid and precipitation by ammonia. It is given in 10–30 gr. doses in Rickets, Osteomalacia, and sometimes in Phthisis and Scrofula. It is used to prepare the following compound:—SYRUPUS CALCI LACTO PHOSPHATIS. The precipitated calcic phosphate is dissolved in lactic acid and then made into a syrup of 2 per cent. strength. It is often given with cod-liver oil.

~~SYRUPUS HYPOPHOSPHITUM.~~ This contains the hypophosphites of calcium, sodium, and potassium, hypophosphorous acid and spirits of lemon. The hypophosphites are easily decomposed, but in this syrup they are stable and easily administered. 35 per cent. of the syrup is calcic hypophosphite, an odorless, bitter powder, permanent in air, quite soluble in water, insoluble in alcohol. The other hypophosphites are very deliquescent and are soluble in alcohol. This syrup is used in Phthisis, Anaemia, Rickets, and various other diseases with phosphatic waste. Dose: 2–8 dr.

~~SYRUPUS HYPOPHOSPHITUM CUM FERRO.~~ Same as the preceding with 1 per cent. of lactate of iron added. Given in the same class of cases as the preceding in 2–8 dr. doses.

III. Alteratives or Reconstituents.

Alteratives or Reconstituents, the third great family under Nutrients, are drugs which so modify nutritive processes as to alter morbid processes. Their ultimate effects are pronounced and beyond dispute, though their mode of action is unknown. Most important of these are arsenic, mercury, iodine, the iodides and cod-liver oil.

1. ARSENIUM. ACIDUM ARSENIOSUM. Arsenious acid, white arsenic or "arsenic" is a heavy white powder, permanent in air, odorless, tasteless, faintly acid in reaction, slightly soluble in cold water, much more so in boiling (1-15), sparingly soluble in alcohol, freely so in alkalies, alkaline carbonates and hydrochloric acid. Heated to 218° C. it volatilizes, and when burned gives an odor of garlic. It is used chiefly in making the official preparations of arsenic.

LIQUOR POTASHI ARSENITIS. Fowler's solution. It is made by boiling arsenious acid with potassic bicarbonate in water till it completely dissolves. It contains 1 part of arsenic, 1 part of bicarbonate of potash, 3 parts of compound tincture of lavender, this being used to give it color and taste, and distilled water q. s. ad 100 parts. It is therefore the equivalent of a 1 per cent. solution of acidum arseniosum, but it is an arsenite of potassium in solution. It has the color, taste and smell of lavender, and strongly alkaline reaction, and is decomposed by the usual reagents for arsenic. Dose is 1-10 m. in wineglassful of water, and this dose may be gradually and cautiously increased. It is incompatible with copper salts, lime-water, and infusions of conchona.

Physiological Action. White arsenic when sufficiently concentrated, is an active caustic, and diluted, a severe irritant. It does not coagulate albumen. On the normal skin it produces no action, but if there be abrasions or any sores, it gives rise to marked irritation. The pain that it causes and its liability to produce poisoning are objections to its use as a caustic, yet it forms the principal part of any quack cancer pastes. Therapeutic doses given internally produce no marked symptoms. They act as a nervous stimulant and influence the trophic nervous apparatus, and also stimulate the respiration and digestion. Small doses diminish and large doses increase the elimination of nitrogen, and repeated small doses increase the appetite. In certain cachexias arsenic raises the muscular strength and general vigor. Long use may give rise to nausea, irritation of the gastro-intestinal canal,

and puffiness under the eye-lids. This puffiness with cellulitis may spread with further use of the drug and produce general anasarca. It is absorbed by the mucous membrane of the alimentary canal and vagina, abraded skin, and the pulmonary mucous membrane; it is eliminated by the skin, milk, faeces, urine and saliva.

Therapeutics. Arsenic is used in many Skin Diseases with success, but not indiscriminately, for it is in many cases contra-indicated. In certain nervous diseases it is useful, although its mode of action is unknown. In Chorea it is almost a specific, given alone or with iron and other tonics, at first in small doses which are afterwards gradually increased. In nervous disturbances and neuralgia due to Eye-Strain it often affords great relief when all other remedies fail. In ordinary Anaemia, in combination with some bitter, it is very useful. For Asthma it acts well given internally or burned in combination with Hyoscyamus, Belladonna, or preferably Stramonium. In all forms of Serous Diarrhoea it is of service in small and frequently repeated doses, $\frac{1}{100}$ gr. It is also good in Atonic Dyspepsia with chronic diarrhoea. For tonic effects arsenic is given in $\frac{1}{100}$ gr. doses frequently repeated. Sometimes it is given to relieve Chronic Rheumatism alternately with potassic iodide, each being given 3 or 4 weeks at a time. Sometimes it is used successfully in Rheumatic Gout, but it more often fails. In depressed conditions of the mucous membranes as Coryza, Canker in the Mouth, Chronic Nasal Catarrh and Sore-throat it is good. In Malaria it is surpassed only by quinine, and it is often successful where this fails, especially where there is a great deal of nutritive disturbance. Sometimes after the ordinary paroxysms are stopped by quinine, it is well to put the patient on arsenic and iron, which serve as prophylactics against their return. Where quinine cannot be used give Fowler's solution for Malaria in large doses of 5-10 m. It is often useful combined with quinine in the treatment of malaria and intermittent neuralgia.

Administration. Give with or after a meal, and not on an empty stomach. The favorite preparations are Fowler's solution and white arsenic in pill form. Children bear them proportionately better than adults. As soon as puffiness appears beneath the eyes, stop their use for a time. The other preparations of arsenic are comparatively unimportant. They are the Arsenii Iodidum, Liquor Arsenii et Hydargyri Iodidum or Donovan's solution, Sodii Arsenias, and Liquor Sodii Arseniatis or Pearson's Solution. Generally if the effects of both arsenic and mercury are desired, they are used separately in alternation since their effects can then be better regulated.

2. HYDRARGYRUM. METALLIC MERCURY. A shining silvery liquid, slowly volatile at ordinary temperatures, boiling at 350° C., odorless and tasteless; insoluble in ordinary solvents. It is not often given by itself, but it enters into a number of preparations, as blue mass and pill, and blue ointment.

HYDRARGYRI CHLORIDUM MITE. Calomel. The mild chloride of mercury, mercurous chloride, called "mite" to distinguish it from corrosive sublimate or mercuric chloride, is a white, odorless, tasteless powder; insoluble in water, alcohol and ether. Moistened with ammonia water it turns black. For medicinal use it must be absolutely free from any trace of corrosive sublimate. It is used both for the constitutional effects of mercury in Syphilis, and also as a cathartic, for which it is mild and tolerably certain—dose: 5–15 gr. followed by a Seidlitz Powder or some other saline cathartic in the course of a few hours. If the constitutional effects are wanted, as in Syphilis, it is given in $\frac{1}{4}$ –1 gr. doses, 2 or 3 times per day, with opium to prevent catharsis. It is not a poison even in extremely large doses. It can be given in the form of pill or as a powder with a drink of water. It is incompatible with alkalies, alkaline earths and carbonates, soaps, ferri plumbic, and cupric salts, iodine (due to the formation of mercurous iodide), nitro-muriatic acid, (since it forms corrosive sublimate with it), hydrocyanic acid and oil of bitter almonds (since it forms the cyanide of mercury), and somewhat incompatible with the chlorides of Sodium, Potassium and Ammonium. Calomel is not given in the U. S. Navy to men living on salted meats.

HYDRARGYRI CHLORIDUM CORROSIVUM. Mercuric chloride or corrosive sublimate. A heavy, colorless substance, occurring in crystalline masses or isolated crystals, odorless; with an acid and persistent metallic taste and acid reaction. Unlike calomel it is soluble in water and alcohol, and is a violent irritant poison, so that it must be given with great caution even in washes. The therapeutic doses are not dangerous if properly given.

Corrosive sublimate is used for the constitutional effects of mercury in the treatment of Syphilis, as a surgical disinfectant, and as a parasiticide in Skin Diseases. Dose: $\frac{1}{16}$ – $\frac{1}{4}$ gr. for the constitutional effects, given in pills or aqueous solution with the addition of common salt. As a parasiticide it is used as a weak solution, $\frac{1}{8}$ – $\frac{1}{2}$ per cent. or weaker. Never apply it to abraded skin. It is an efficient antiseptic in a solution of 1–1000 or even 1–10,000 parts of water, used very much in Surgery and Obstetrics. It has the disadvantage of injuring steel instruments and gold. It is well to add common salt to prevent precipitation. For local injection in Gonorrhoea a solution of 1–25,000 is used.

For subcutaneous use it is given with common salt in the following proportions : corrosive sublimate $\frac{1}{8}$ gr., sodic chloride $1\frac{1}{3}$ gr., in $\frac{1}{2}$ dr. water.

ALBUMINATE OF MERCURY. Another form of mercury used in subcutaneous injections, made by adding to a 5 per cent. solution of corrosive sublimate a 25 per cent. solution of white of egg, and filtering and dissolving the precipitate in a 20 per cent. salt solution. It may also be made by mixing together an aqueous solution of corrosive sublimate and white of egg, shaking and adding salt and water. Filter off all the insoluble parts and use the filtrate. It is incompatible with alkaline carbonates, lime-water, tartar emetic, silver nitrate, acetate of lead, the sulphides, soluble iodides, and infusions including cinchona.

✓ **HYDRARGYRI IODIDUM FLAVUM.** (H. I. Viride, 1880.) Mercurous iodide; Yellow iodide of Mercury. Made by the direct action of iodine on metallic mercury; a greenish-yellow powder, tasteless and odorless, almost insoluble in water, wholly so in alcohol and ether; decomposed by potassic iodide into metallic mercury and the red iodide. It is used in advanced Syphilis in $\frac{1}{4}$ –1 gr. doses.

✓ **HYDRARGYRI IODIDUM RUBRUM.** Mercuric iodide. A scarlet-red crystalline powder, tasteless, odorless; almost insoluble in water, soluble in alcohol (1–30), very soluble in solutions of potassic iodide or mercuric chloride. It is used in $\frac{1}{16}$ – $\frac{1}{4}$ gr. doses either in pill form or in a solution of Potassium Iodide.

* **HYDRARGYRI OXIDUM FLAVUM.** Yellow mercuric oxide made by precipitating a solution of mercuric chloride with potassic hydrate. It is an amorphous yellow powder, permanent in air, insoluble in water and alcohol. It is used as a local application and stimulant in certain Eye diseases and in old inflammations; also in the preparation of an oleate and ointment.

* **HYDRARGYRI OXIDUM RUBRUM.** Red oxide of mercury. Red Precipitate. A heavy orange-red crystalline powder, becoming yellow on trituration; tasteless and odorless; insoluble in water and alcohol. Its chief use is in the preparation of the official ointment, and also in Cancers and certain ulcers.

✓ * **HYDRARGYRI SUBSULPHAS FLAVUS.** A basic sulphate of mercury called turpeth mineral, occurring as a lemon-yellow powder, with somewhat acrid taste, practically insoluble in water and alcohol. Dose: $\frac{1}{4}$ – $\frac{1}{2}$ gr. used as an alterative and also as an emetic.

✓ **MASSA HYDRARGYRI.** Blue mass or blue-pill. It is a pill mass made by triturating 33 parts of metallic mercury with glycyrrhiza, althaea, honey of rose and glycerine, until the metal-

lic globules cannot be seen with a lens magnifying ten diameters. It is the mildest of mercurial preparations and is often preferred to calomel for the constitutional treatment of Syphilis. It is used as a cathartic in 5-15 gr. doses, and on account of its peculiar action on the liver, should be followed shortly by a mild cathartic, as castor-oil or Rochelle salts. As an alterative it is taken at night in 1-3 gr. doses, followed by a mild purgative the next morning if necessary.

HYDRARGYRUM CUM CRETA. Mercury with chalk. Made by triturating 38 parts of mercury with honey and prepared chalk until no metallic globules are seen with a magnifying power of 10 diameters. It is a dry powder of uniform gray and usually contains mercurous oxide. If it is exposed to the light it may contain mercuric oxide, which is dangerous. It is insoluble in water and alcohol, and tasteless. It is a very mild mercurial, similar to blue mass but weaker, and is used as a cathartic and alterative, particularly in children with clay-colored stools, indicative of a lack of bile, in 10-15 gr. doses as a powder. It is incompatible with acid and acid salts.

The remaining preparations of mercury are for external use only.

UNGUENTUM HYDRARGYRI. Blue butter. Metallic mercury is triturated with lard or suet and compound tincture of benzoin until no metallic globules are visible under a glass of 10 diameters. It contains 50 per cent. of metallic mercury, and is used for constitutional effects, applied to indurated glands and local swellings, especially if syphilitic. It is rubbed in where the skin is thin, on the inner sides of the legs, the sides of the chest and abdomen. It may cause a bad eruption. It is also used to kill public lice on the pubes and to prevent pitting from small-pox.

UNGUENTUM HYDRARGYRI NITRATIS. Citrine ointment. Made by mixing a hot solution of 7 parts of mercury in 17 parts of nitric acid with 76 of lard-oil. It is very irritating and is considerably diluted with lard. It is used in certain Skin Diseases and may also be used for its constitutional effects.

LIQUOR HYDRARGYRI NITRATIS. A 50 per cent. solution of the nitrate in water, with some free nitric acid. It is an active but not a severe caustic, and is generally applied with a glass rod to ulcers. Constitutional effects may arise from its external application.

UNGUENTUM HYDRARGYRI AMMONIATI. An ointment used in certain skin diseases, made by mixing 1 part of white precipitate or ammoniated mercury with 10 parts of benzoined lard. It is used as a stimulant.

HYDRARGYRUM AMMONIATUM. White Precipitate. A white amorphous powder without odor, a metallic taste, practically insoluble in ordinary solvents; made by precipitating corrosive sublimate solution with ammonia water. Used in preparing the foregoing ointment.

OLEATUM HYDRARGYRI. A 10 per cent. mixture of yellow oxide of mercury, in pure oleic acid. It is used in nearly the same class of cases as the ointments in Skin Diseases, and for the constitutional effects of mercury in Syphilis. ~~5-10 m.~~ are gently rubbed into the skin.

EMPLASTRUM HYDRARGYRI. The officinal plaster contains 30 per cent. of mercury with 10 parts each of olive oil and rosin, and 50 parts of lead plaster. It is spread on linen and leather and is used as a mild counter-irritant to produce constitutional effects.

"BLACK WASH" and "YELLOW WASH." Both are non-official. Black Wash is made by adding 1 dr. of mercurous chloride to a pint of lime-water; white wash, $\frac{1}{2}$ dr. of the mercuric chloride to a pint of lime-water.

Physiological Action. The first indications of the constitutional effects of medicinal doses of the preparations of mercury given internally appear in the mouth. The symptoms begin with a slight peculiar foetor of the breath, and the teeth are sore when struck together or hit with a coin or key. After the foetor there follows a disagreeable metallic taste in the mouth. If the use of the drug is continued the gums become soft, spongy and swollen, and bleed easily. There is also increased salivation. Never continue the use of mercury beyond this point. Further use causes inflammation of the gums, loosening of the teeth, enlargement of the tongue, parotid, lingual and submaxillary glands. The volume of the saliva is enormously increased. A ropy viscid substance drools from the mouth, producing eczema and sloughing. Necrosis of the jaw-bones may follow and the teeth may drop out. The drug also has a profound influence on the whole system. The blood is more watery, less coagulable, contains less fibrin, less albumen, fewer red corpuscles, and a fatty foetid substance. The general nutrition is impaired and death may follow due to general exhaustion. The rapidity with which the train of symptoms follows varies with the susceptibility of the patient. Even one dose may produce salivation in some.

In small doses one effect of mercury is to increase the number of red corpuscles, especially in anaemia from syphilis; though how it acts is unknown. Some preparations, too, serve the purposes better than others. In some cases mercury produces marked nervous symptoms, neuralgia, paralysis agitans, headaches and

epilepsy. Sometimes chorea occurs during the mercurial course, and when it appears in an adult mercury may be suspected as the exciting cause. Sometimes there is loss of sight and hearing, disturbed sensation, hyperaesthesia, or anaesthesia, and fatty degeneration of the kidneys and other organs may occur; and there is a tendency to diarrhoea.

Mercury is absorbed in the intestine as a double albuminate. When applied as the officinal ointment, the metallic globules may be found in the ducts of the sweat-glands and sebaceous follicles, but before getting into the system it is chemically changed into some organic compound. It is eliminated by all the exits, especially the urine, saliva, and faeces. Small doses are quickly eliminated, but repeated doses only partially, and therefore they tend to accumulate. After accumulation mercury is very slowly eliminated, having been detected in the liver one year after cessation of administration. Potassic iodide hastens its elimination.

Therapeutics. Mercurials are used for their effects on the bowels and liver, in the treatment of inflammatory processes with fibrous exudations; they are used also in Syphilis, and locally for various purposes. Calomel and blue mass, the only preparations commonly used as purgatives, in moderate doses cause soft, thin, watery and greenish stools; the green it is said by some being due to bile; others that it is due to some mercurial salt. Whatever the cause, there is certainly an increased flow of bile. Whenever the normal flow fails or is diminished mercurials will start it up again. In "Biliousness," where the tongue is coated, the eye yellow, the stools light-colored, where there is headache and nausea, blue pill is good; and a clay-colored stool is the best single indication for its use, since it denotes a diminution of bile. In Malarial Fever with congestion of the liver,— "Bilious Fever,"—small repeated doses preceding the use of quinine are good, due to their action on the liver. In Jaundice from congestion, calomel is good in $\frac{1}{2}$ gr. doses. In Acute Dysentery calomel gives excellent results, acting on the intestinal glands, both as an alterative and antiphlogistic. In the treatment of Syphilis the mercurials are of great value, and since this use is taken up in a special course, it is here passed over. When given for Syphilis the mercurials are administered in various ways, chiefly by the mouth and as ointments. In applying the ointment the skin is well washed and softened and then the ointment rubbed in. Do not use the same spot more often than once in two days. When mercury is thus given, there is less disturbance of digestion.

All mercurials have an anti-inflammatory power, but their use is limited to sthenic cases. In Pleural Effusions, Meningitis,

Pericarditis, Peritonitis, and where there is fibrinous exudation, the use of mercurials, usually calomel, together with aconite and *Veratrum viride* or some cardiac sedative, is exceedingly good. In asthenic cases where the exudation is serous, as in cases of Pleurisy, Peritonitis, etc., from Tuberculosis or other wasting diseases, the use of mercury is contra-indicated, since it may increase the exudation. Calomel does not increase the flow of bile.

The strength of the bichloride solution for antiseptic purposes is from 1-2000 to 1-20,000, and for disinfectant use from 1-500 to 1-1000. Used as an antiseptic it is necessary to add a little tartaric acid to the solution to prevent the formation of the insoluble albuminate with the albumen of the tissues.

* 3. IODUM. IODINE. A non-metallic element, occurring in sea-weeds, sea-water, sponges, oysters, cod-liver oil and in minute amounts in certain vegetables; soft, friable, bluish-black scales, of a semi-metallic lustre, acrid taste, pungent smell something like chlorine, somewhat volatile at ordinary temperatures and completely so at high; sparingly soluble in water (1-7000), alcohol, and ether, very soluble in K. I. and sodic chloride. With starch it gives a deep blue, affording a very delicate test, showing 1 in 450,000 parts of water. In moderately large doses in substance or solution it acts as a violent irritant. It is rarely given as a solid but usually as the compound solution. Antidote, starch.

LIQUOR IODI COMPOSITUS. Lugel's solution, containing 5 parts of iodine, 10 of potassic iodide, and water to 100. Dose: 1-6 m. well diluted with water. It is used as an antidote for alkaloid poisoning, as it forms a precipitate with alkaloids.

AMYLUM IODATUM. This is a bluish-black powder made up of 95 parts of starch and 5 of iodine, triturated with a little water. It may be administered without irritating the stomach in 1-4 dr. doses as a water-gruel (non-official).

TINCTURA IODI. The tincture contains 7 parts of iodine to 93 of alcohol. It is used chiefly as a local irritant and stains the skin yellow, or with repeated paintings, a rich mahogany brown. It is more intense active on the mucous membrane than on the skin, where it is usually very mild. It is applied to indurated glands and to enlarged and chronically inflamed joints.

UNGUENTUM IODI. The officinal ointment is made of 4 parts of iodine, 1 of potassic acid, and 95 of benzoinated lard. Iodine and its preparations are incompatible with mineral acids, metallic salts, vegetable alkaloids, and starch. Never give iodine after a meal of starchy food.

POTASSII IODIUM. Potassic iodide. White or colorless cubes, slightly deliquescent, with a pungent saline and disagreeable taste,

neutral reaction; very soluble in water and alcohol. In contact with starch it gives no blue unless iodine is liberated or iodate of potassium be present. The latter is harmful. It is incompatible with the same substances as iodine, and also with potassic chlorate, with which it forms a poisonous iodate. It is given in 5 m. to 1 dr. doses, average 20 m., in simple solution or in the compound syrup of Sarsaparilla.

UNGUENTUM POTASSII IODIDI. The officinal ointment is of doubtful value, and contains 12 per cent. of potassic iodide.

AMMONII IODIDUM. Ammonic iodide. A granular or crystalline salt, white turning yellow on exposure, due to the liberation of iodine, very deliquescent, less stable and less valuable than the other iodides; with a sharp saline taste, neutral reaction; very soluble in water and alcohol. It is used in the same cases as potassic iodide in 2-10 gr. doses.

SODII IODIDUM. Sodic iodide. Small crystals, more deliquescent than potassic iodide, less so than ammonic iodide; neutral or faintly alkaline, odorless, tasteless, less pungent than potassic iodide, hence less disagreeable, and with the same uses. Dose: 5-30 gr. in solution or in a syrup.

SYRUPUS ACIDI HYDRIODICI. Syrup of hydriodic acid. Sweet taste and acid reaction. Strength 1 per cent. the absolute acid, given in 1-4 dr. doses.

Physiological Action of the drugs of the Iodine group. Iodine is a powerful irritant, and when concentrated is a mild caustic. Applied to the skin as a tincture it causes smarting and desquamation. Its action on the mucous membrane is still more intense. Taken internally in small doses, 1-2 gr., it gives rise to a sharp metallic pungent sensation in the mouth, a disagreeable taste, and sometimes nausea; 5 gr. may cause vomiting, diarrhoea, rapid pulse and thirst.

Toxicology. In large doses symptoms of gastro-enteritis, restlessness appear and even convulsions. The vomitus is brown, or blue if starch be present. When death occurs (rare), it is by failure of the respiration, but sometimes by cardiac arrest. Post-mortem examination shows extensive fatty degeneration.

Treatment. Administer starch and raw eggs, and remove the compound formed by emetics. The remaining treatment is largely symptomatic. Heat should be applied, and alcohol, digitalis, ammonia, atropine, or strychnine may be given as stimulants.

Iodine is absorbed rapidly from the stomach and perhaps slightly from the skin. It is rapidly eliminated partly as sodic iodide and partly in organic combination. Its chief exit is by the urine, but it is also eliminated by the skin and mucous membrane,

by the salivary glands, and by the alimentary canal. It can even be found in the saliva after it has ceased to appear in the urine. After long continued use of iodine, a condition called "Iodism" appears. The mucous membranes of the nose and mouth and skin are affected first. The symptoms are like those of a cold in the head, pain over the frontal sinus, sore-throat, coryza, nausea on rising, increased salivary secretion, sore teeth and gums, and a metallic taste in the mouth. Sometimes there is neuralgia. Acne on the face and shoulders is an early symptom, and an erythematous rash on the shoulders. Large boils may form. Anaemia is a common symptom and there may be also atrophy of the breasts and testicles and even the loss of sight.

Therapeutics. Iodine is used for constitutional and local effects. It is given internally as an alterative in enlarged lymph-glands, with no tendency to suppuration, but it should never be used in cases where rapid changes are going on. Sometimes even when there is a tendency to suppurate it may be good by reason of its healing effects. In Scrofula associated with Anaemia it is exceedingly useful combined with cod-liver oil. At the same time that it is given internally the ointment should be applied externally to the enlarged and indurated glands. In Goitre iodine may be valuable, but it is of no use in Cystic Enlargement. In the most chronic cases of Phthisis iodine may be of some use, but when softening is progressing and the lung is breaking down, iodine only hastens the process. In Diphtheria it may be taken with advantage by inhaling several times per day. In pregnancy it is used in 5-10 m. doses well diluted in water. The compound solution is used as an antidote for poisoning by the vegetable alkalis, since it forms precipitates, removed by emetics.

Locally iodine is used as a resolvent in Glandular Enlargement, Diseases of the Joints and Bones, Chronic Pleurisy, and in cases where there is a large watery exudation. It is also used in the tincture form as a counter irritant in Chronic Rheumatism, Bone diseases, and Pleurisy, to abort attacks and to aid in the removal of the fluid; also to relieve the sore spots in Phthisis. Sometimes the local application causes a burning pain which can be relieved by removing the iodine with potassic iodide solution. There is a great deal of dispute as to the frequency with which applications should be made. Some say daily, but others, that once is sufficient and must not be removed till desquamation takes place. No rule can be given; each case must be decided on its merits. In Erysipelas a tincture of iodine is painted along the spreading edge of inflammation, and is very beneficial. In various chronic diseases of the mucous membrane and in certain of the Skin Diseases it is

also useful. It is sometimes injected into serous cysts to give inflammation and adhesions, as in Hydrocele.

Iodine is usually administered internally in the form of the solution 2-6 m. or as the tincture 5-10 m. The iodide of potassium and the other iodides are used where the constitutional effects of iodine are wanted, for they are more quickly absorbed and eliminated than iodine, and are far less irritating. Potassic iodide is supposed to be partly decomposed in the blood and tissues, and iodine to be set free, this being taken up by albuminous substances. The elimination is rapid, the daily excretion being 90 per cent. of the ingestion, chiefly by the urine, almost none occurring in the faeces. Its administration is sometimes followed by coryza and catarrh of the laryngeal and pharyngeal mucous membrane. Acne may be avoided by a judicious use of arsenic.

Potassic iodide is used in a great variety of disorders. In Chronic Rheumatism it is of great value, but in the Acute form it is useless, though it may be of some use in Sub-Acute cases. In Gout it is of less service than in Rheumatism, but in the Chronic form it may be of value. In Muscular Rheumatism, Lumbago and Sciatica, after exposure to wet, it is also efficient. In Tertiary Syphilis it may be given frequently, alone, or with mercury, according to the symptoms; its value here is very great. In the treatment of Asthma it is frequently valuable but also often fails, and in Chronic Bronchitis without profuse secretions it is good; if the secretions are profuse it is not good. Sometimes a cold in the head may be stopped by 10 gr. of potassic iodide at the start. In Aortic Aneurism large doses are good, but why they should be so is unknown. In Chronic Bright's Disease it is a successful remedy in large doses, increasing the flow of urine and consequently diminishing any dropsy that might exist.

As it promotes the absorption of fluids it is useful in Pleurisy, Endocarditis and in the later stages of Pneumonia to aid in absorption of exudation. For the same reason it is good in Fibroid Phthisis. In various Chronic Metallic Poisonings potassic iodide is of great service. It forms soluble double salts with lead, arsenic, mercury and zinc, easily eliminated from the system. If large quantities of mercury have been taken previously it may cause mercurial salivation by suddenly setting free much mercury. Sometimes potassic iodide causes salivation where no mercury has been taken.

Administration. The ordinary dose is 10 gr, but smaller or much larger doses may be given if necessary. On account of its disagreeable taste it may be given disguised with compound syrup of Sarsaparilla, extract of licorice, or in milk. The physiological

and therapeutic actions of sodic and ammoniac iodides are the same as those of potassic iodide, and they may be used when the latter is not well borne.

4. ORGANIC COMPOUNDS OF IODINE. (a) IODOFORM. Iodoform. Small yellow crystals, with a strong disagreeable odor, unpleasant, slightly sweetish taste like the taste of iodine; practicably insoluble in water, soluble in alcohol, ether, chloroform and the other ordinary solvents. It is used chiefly as an external application but it is sometimes given as an internal remedy. It is used externally as a powder or ointment. *UNGUENTUM IODOFORMI* consisting of 10 per cent. of iodoform and 90 per cent. of benzoinated lard. For surgical dressings Iodiform gauze and cotton are often used. They are prepared by wetting gauze or cotton with a solution of Iodoform.

Physiological Action. When iodoform is given internally in moderate doses (1-5 gr.) no particular symptoms are produced. It is slowly absorbed by the alimentary canal and appears in the urine within two hours. It is absorbed more rapidly by a wound, and in this case has appeared in the urine within $\frac{1}{2}$ hour. It is also eliminated by all the other secretions, passing out as an iodide, an iodate, and as organic compounds.

Toxicology. Its absorption from surgical applications may give rise to fatal cases which resemble meningitis. The respiration is stertorous. The pulse may be fast or slow, the pupils are contracted, there may be somnolence deepening into stupor, or restlessness and delirium. Sometimes these cases resemble cerebral congestion. There is a flushed face, rapid pulse, low muttering delirium. If the fever seems high death invariably follows.

Locally iodoform acts to a certain extent as in an antiseptic, but not as a disinfectant. It is a powerful local antiseptic applied in the powder or in solution.

Therapeutics. Iodoform is used little internally, its uses being chiefly local. In syphilis it is very efficient in the 2nd and 3d stages. It has quite a distinct alterative action, and is said to have some value in Catarrhal Jaundice and the early stages of Phthisis. Locally it is used as a dressing for wounds and ulcers of various sorts, even when cancerous. Sometimes its local use is followed by furuncular and eczematous inflammation but this is relieved by very hot water. In Fissure and painful conditions of the rectum it is used as a suppository with advantage, making defecation possible without pain.

Administration. Iodoform is given internally as pills or capsules. Externally it is applied as a powder or solution with collo-

dion. When given internally, it should never be used with calomel, since it may form the iodide of mercury.

(b). IODOL. Made by the action of iodine on pyrol. A dirty yellow or brown crystalline powder, soluble in 3 parts of alcohol, in ether and fatty oils, practically insoluble in water, tasteless and almost odorless. Strength 89 per cent. of iodine. It is used as a substitute for iodoform, since it does not betray its presence by any odor.

Physiological Action. It is absorbed very slowly, and may produce constitutional effects, though it is not so likely to do so as is iodiform. It is very slowly eliminated, iodine being found in the urine two weeks after cessation of its use.

Therapeutics. It is used in Tubercular Laryngitis, administered by an aspirator. It may be applied as a powder or a solution in ether or collodion in all cases where iodiform is used.

(c) ARISTOL. A compound of Iodine and Thymol, made by the decomposition of a solution of iodine in potassic iodide by an alcoholic solution of thymol. Light reddish-brown, crystalline powder, with a slight odor increasing on exposure, very soluble in fats and ether, slightly soluble in alcohol, insoluble in water. It is used as a substitute for iodiform, is harmless, not irritant, has no disagreeable after-effects and is powerfully antiseptic. It is used only locally and is valuable in the treatment of ulcers in 3d Syphilis since it promotes cicatrication more quickly than iodoform. It may be used in any strength from the pure powder to 10 per cent. strength.

(d) SOZOIDOL. A newer preparation used as a local application and antiseptic surgical dressing, such as Acute Stomatitis, Pharyngeal Catarrh. It is used in combination with zinc and mercury.

5. OLEUM MORRHUAE. COD-LIVER OIL. A limpid colorless, or pale yellow oil, with a fishy taste, faintly acid reaction, slightly soluble in alcohol, freely so in ether, obtained from the fresh liver of the *Gadus Morrhua* and other species of cod. There are three kinds of cod-liver oil: (1) "Shore-oil", made from fresh livers, and meeting the requirements of the Pharmacopoeia, (2) the "Bank's oil", the "Strait's oil". The two latter are made from rotten livers, have a nauseous bitter taste and are not used in medicine. Cod-liver oil is a very complex substance containing many glycerides, fatty acids, biliary principles, phosphoric acid, iodine and bromide, traces of chlorine, phosphoric, ferris and calcic salts. The chief constituent is olein. The oil mixed with ammonia and distilled gives propylamine.

Administration. On account of its very fishy taste, it is hard to take, but there are many ways of giving it. Salt may be taken before and after its use. It is given with the froth of beer, ale or porter, or the mouth is first rinsed with brandy or whiskey. It can also be given as an emulsion with the whites or the yolks of eggs, or with glycerine. It is often preceded by orange poe. A little chloroform added to it, 10 drops in 3 oz., makes it palatable; or 1 part of Oil of Eucalyptus in 100 destroys both taste and smell. Children always learn to take it, and even to like it. It is given in doses from 1-4 dr. not on an empty stomach. A child of one year can bear a teaspoonful.

Physiological Action. Cod-liver oil depends upon a number of substances for its effects. Much speculation has arisen as to which of the ingredients cod-liver oil owes its usefulness, but as yet nothing is definitely known, although a substance known as Morrhuel has been isolated. More than any other oil it tends to cause the deposition of fat in the body. It seems to have some peculiar alterative power of its own. It aids in the maintenance of the body temperature and influences the composition of the blood increasing the number of red corpuscles. Anaemic persons frequently get well by its use. It is absorbed more rapidly than any other oil, perhaps due to the biliary salts it contains. The administration of the oil has no particular effect on any set of organs, except the alimentary canal; but it raises the general tone of all. If the stomach revolts it can be given only as an ointment. In some it may cause looseness of the bowels and indigestion, and if it does, do not use it.

Therapeutics. It is particularly useful in Scrofula, a condition of depraved nutrition, in which imperfectly organized tissue develops, breaks down and suppurates. It is best given in this case combined with other remedies, as Iodine. In some of the scrofulous bone diseases, as White Swelling, it is almost a specific. In Rickets it may be used alone or with the phosphate of calcium. In Chronic Rheumatism, especially the muscular sort, and in that accompanying scrofula, in obstinate Lumbago and Sciatica, in Chronic Neural Diseases, especially Neuralgia, it is very valuable. In Chronic Skin-Diseases and in fact in all chronic disorders with defective nutrition, it has proved itself a very efficient remedy. In cases of defective nutrition without any apparent cause it is good, especially in children. In 3d Syphilis it is invaluable and in pretubercular Phthisis it is often of great assistance in increasing the general health. It also acts very well as an expectorant, and at times is very useful in Chronic Bronchitis. In children it is good for overcoming constipation.

6. COLCHICUM. MEADOW-SAFFRON. Officinal in two forms, Colchici radix and Colchici semen; from Colchicum autumnale. The medicinal value of the root depends much upon the time when it is collected. It yields its virtues to wine and vinegar. They are $\frac{1}{8}$ in. in diameter, bitter and acrid. Colchicum contains galluntannic acid, a gum starch, sugar and a peculiar alkaloid, colchicoine, amorphous, but forming crystalline salts with acids. It is slowly soluble in water, readily so in alcohol, and insoluble in ether. The drug itself is rarely administered.

There are six officinal preparations as follows, three from the root and three from the seed.

- (1) EXTRACTUM COLCHICI RADICIS. Dose: $\overline{1\frac{1}{2}}$ –2 gr. pill.
- (2) EXTRACTUM COLCHICI RADICIS FLUIDUM. Dose: 2–4 m.
- (3) VINUM COLCHICI RADICIS. Dose: 5–15 m.
- (4) EXTRACTUM COLCHICI SEMENIS FLUIDUM. Dose: 2–5 m.
- (5) TINCTURA COLCHICI SEMINIS. Dose: 1 m.
- (6) VINUM COLCHICI SEMINIS. Dose: 1 m.

Only the two wines and the tincture need be remembered. Of these the most efficient is the wine of the root.

Physiological Action. Applied to the skin colchicum acts as an irritant. Small therapeutic doses have no effect on the nervous system and none on the circulation, until the effects on the alimentary canal are manifested, when the pulse slows somewhat; probably it increases uric acid and urea. In large enough doses it causes abdominal pains, discomfort and sometimes nausea. It may cause sweating. Large therapeutic doses give the same symptoms more intensified. There is also vomiting and prostration.

Toxicology. Sufficiently large doses act as a poison, causing violent and persistent vomiting, and purging, which is sometimes bloody. The nervous system may also be affected. The circulation weakens; there is collapse and failure of the respiration. The urine may be increased, diminished, or suppressed. Treatment consists in removing from the stomach and intestines all colchicum present, and in giving tannic acid for an antidote. Opium may be given to check the vomiting and purging, if necessary. 2 $\frac{1}{2}$ of the wine of the root have been fatal, and one oz. is almost invariably so. The alkaloid colchicoine is a poison even in small doses, $\frac{1}{100}$ gr. causing symptoms of poisoning. It is sometimes used in moderate therapeutic doses. Our knowledge of this drug is based on clinical experience.

Therapeutics. Colchicum is used as a specific in Gout to prevent the paroxysms in large doses, and also to lessen their severity. It has also been used in Rheumatism and in Croup. It acts by

the skin and kidneys rather than by the alimentary canal, the latter action being counteracted by opium. It is efficient when preceded by a cathartic. It is sometimes combined advantageously with potassic iodide in the treatment of Gout and Chronic Rheumatism. In Acute Rheumatism it has no value. It should always be used with great caution, especially in old persons.

* ~~7. SARSAPARILLA.~~ The root of *Smilax officinalis*, and of other species of *Smilax* found in Mexico and northern South America. The best varieties are those from Honduras and Brazil. It has little or no smell, a mucilagenous and persistently acrid taste, and contains starch, resins, and extractives, a small amount of volatile oil and an acrid neutral alkaloid called Sarsaparillin.

DECOCTUM SARSAPARILLAE COMPOSITUM. Is an officinal preparation containing sarsaparilla, sassafras, guaiacum, glycyrrhiza, mezereum and water, given in 3-4 oz. doses.

SYRUPUS SARSAPARILLAE COMPOSITUS. A very pleasant vehicle especially for potassic iodide, containing Sarsaparilla, Sassafras, Guaiacum wood, Licorice, Pale rose, Gaultheria, Anise, and Senega. Dose: $\frac{1}{2}$ -1 dr. when given for its own effects.

EXTRACTUM SARSAPARILLAE FLUIDUM and EXTRACTUM SARSAPARILLAE COMPOSITUM FLUIDUM are also used as vehicles, especially for Potassic Iodide and Mercury.

Physiological Action. Sarsaparilla even in very large doses has no physiological effect whatever except slight gastric disturbance.

Therapeutics. In Syphilis it has considerable alterative power, and in some cases where potassic iodide by itself fails a cure is effected by combining sarsaparilla with it. It is also combined with Mercury at times. Sarsaparilla has also been used successfully for Scrofula. Since it does no harm, it is an excellent vehicle. There seems to be no reason why it should not always be given with Potassic Iodide.

8. ~~GUAIACUM.~~ LIGNUM VITAE. Officinal in two forms, wood and resin. The wood is the heart-wood in the form of raspings and shavings of *G. officinale*, found in the West Indies. It is dense and hard, odorless, but developing an odor when heated. It contains a resin and an extractive. The resin comes in irregular lumps and masses of a dark reddish brown or green color, a feeble peculiar agreeable odor, intensified by heat; a taste slight at first, afterwards becoming acrid; soluble in alcohol and potassic hydrate. It is a very complex body, containing three pseudo-acids.

Therapeutics. Guaiacum is used in Syphilis and as an ingredient of the Sarsaparilla compound preparations. It is also given

in Tonsillitis, Bronchitis, and Rheumatism in certain stages as tincture or ammoniated tincture in 1-2 dr. doses, in emulsion with the yolk of an egg with mucilage.

* 9. MEZEREUM. Mezereon is the bark of two species of *Daphne*, found in Europe. It is a powerful irritant and may cause fatal cases. It contains a glucoside, called daphnanin, neutral and crystalline. It is used internally only with Sarsaparilla.

* There are a number of other unimportant drugs of this class, such as Sassafras, *Viola Tricolor*, *Pulsatilla*, *Sanguinaria*, and *Dulcamara*. *Taraxacum*, Dandelion, is supposed to have some action on the liver. It has practically no physiological action in large doses, except perhaps to cause a gastro-intestinal disturbance.

IV. Antiperiodics.

Antiperiodics, the 4th family of nutrients, are drugs which so modify nutrition as to overcome the effects of malarial poisoning.

1. CINCHONA. A very important drug, called Peruvian Bark and Jesuit's Bark. From all species of the genus *cinchona*, which contain 5 per cent. of certain alkaloids. Two species are recognized, *C. flavo* and *C. rubra*. Only the latter is officinal in the last Pharmacopoeia. It must contain at least $2\frac{1}{2}$ per cent. quinine. The *cinchona* trees are indigenous in South America, but have been naturalized in other parts of the world. In South America they grow everywhere from the north to Bolivia. The bark is stripped off by trained workmen who make long incisions, and strip it off. It is then sun-dried, thus causing it to roll up in quills in which form it comes into the market. The bark has a bitter taste, as do also the leaves and flowers, but the wood is tasteless. The leaves contain but a small amount of the alkaloid. The so-called "pale barks" yield little quinine.

The *Cinchona flavo* comes into our market as quills and flat pieces. It is better and yields much quinine and little cinchonine. The officinal red *cinchona* gives considerable cinchonine as well as quinine. There are a number of other barks, non-official, containing varying amounts of the alkaloids.

Active Principles. *Cinchona* contains besides tannic and chinic acids, and chinoidine which is a bitter resinous substance, a number of alkaloids, four of which are very important and are officinal, quinine, quinidine, cinchonine, and cinchonidine. The acid solutions of quinine and quinidine are florescent.

QUININA. The most important of the alkaloids, first separated in 1820, occurring in white feathery crystals, but they may be in

omit all salts

a

silky needles; permanent in air, odorless, very bitter, alkaline; very slightly soluble in water at ordinary temperatures (1-1600), more so in boiling water (1-700); very soluble in all the other solvents, as alcohol, ether, chloroform, fixed with volatile oils. It is very soluble in dilute acids forming crystalline salts which may be precipitated by alkalies or hydrates. A solution of quinine in water acidulated with dilute sulphuric acid is florescent.

QUININAE SULPHAS. The most important salt of quinine, occurring in white, bitter, silky crystals, neutral; soluble in 700 parts of water, 65 of alcohol; slightly soluble in chloroform and ether. Dissolved in sulphuric acid it gives double the sulphate.

QUININAE BISULPHAS. Contains 1 equivalent of quinine to 2 of sulphuric acid. Colorless crystals, efflorescent, clear, but becoming opaque on exposure to the air; with acid reaction; soluble in 10 parts of water, very soluble in boiling water and alcohol.

QUININAE HYDROBROMAS. White or colorless needles, persistent in air, odorless, bitter, neutral or slightly alkaline; soluble in cold, more so in hot water, alcohol, ether and chloroform.

QUININAE HYDROCHLORAS. Same characteristics as the hydrobromate; white needles, odorless, bitter, efflorescent, neutral or slightly alkaline; soluble in cold water (1-34), very soluble in boiling water and alcohol, unlike the other salts and is not florescent when dilute sulphuric acid is added to the solution.

QUININAE VALERIANAS. The valerianate occurs as a white crystalline substance, with the odor of valerianic acid; permanent in air, bitter, neutral; soluble in cold water (1-100), more soluble in hot water and quite so in alcohol.

Doses. The doses of the salts should vary theoretically with the amount of the alkaloid present in each, but practically they are all the same, 1-60 gr. according to the object desired. As a tonic the dose is small. As an antiperiodic, in which group quinine belongs, or as an antipyretic, moderately large or quite large doses are given. It is given in water suspended or dissolved, or in syrups, elixirs, pills, powders, wafers, or capsules, and quinine is so bitter that the latter methods of administration are the best. The valerianate is given only in small doses, 1-3 gr., and is not used for the general purposes of quinine.

QUINIDINA. This resembles quinine in many ways, but it gives no precipitate with potassic iodide, and neither it nor its salts are florescent with dilute sulphuric acid. Its salts are more soluble than the corresponding quinine salts.

QUINIDINAE SULPHAS. The only officinal salts of quinidine, occurring in white needles, odorless, with bitter taste, neutral or faintly alkaline reaction; soluble in water (1-100), very soluble in

boiling water (1-7), and soluble in alcohol. It is administered in the same way and in the doses as quinine.

CINCHONINA. White crystalline substance, odorless, very bitter alkaline; almost insoluble in cold and hot water, somewhat so in alcohol, quite so in boiling alcohol, readily soluble in dilute acids, but without florescence.

CINCHONINAE SULPHAS. The only officinal salt. Hard white prisms, permanent in air, odorless, very bitter, neutral or faintly alkaline; soluble in water (1-70), dilute acids and alcohol. When dilute sulphuric acid is added to it, it gives a bisulphate. Cinchonine and its sulphate may be used for quinine in doses 50 per cent. larger.

CINCHONIDINA SULPHAS. Is the only officinal salt of cinchonidine. It is a neutral salt obtained chiefly from the red cinchona bark, with the same general characteristics as the sulphates of the other three alkaloids. It is soluble in 100 parts of water. The alkaloid itself, **CINCHONIDINA**, is non-officinal. The bisulphate is more soluble, and this and the non-officinal salicylate and hydrobromate are sometimes used instead of quinine. The doses are $\frac{1}{3}$ larger than those of quinine, and have the same effects.

CHINOIDINE. Officinal 1880, non-officinal 1890. A brownish black or black substance with a resinous fracture, odorless, bitter, alkaline. It is a mixture of amorphous alkaloids obtained by evaporation to dryness of the mother-liquid from which the crystallizable alkaloids have been extracted. It is insoluble in water, soluble in alcohol, ether, chloroform, benzoin, and dilute acids. It is rather a useless and unreliable drug, its chief merit being its cheapness.

Of the preparations of cinchona itself there are 5 which are not very much used—the effect of cinchona being obtained by the use of the alkaloids themselves.

EXTRACTUM CINCHONAE. Dose: 2-15 gr.

EXTRACTUM CINCHONAE FLUIDUM. Dose: 1 dr.

TINCTURA CINCHONAE. Dose: $\frac{1}{2}$ -2 dr.

INFUSUM CINCHONAE. Dose: Wine-glassful.

TINCTURA CINCHONAE COMPOSITA. Dose: 1-4 dr.

The compound tincture contains red cinchona, bitter orange peel, serpentaria, glycerine and water. The infusion is used as a tonic in doses of a wine-glassful.

Incompatibles. Tincture and compound solution of Iodine, alkalies, alkaline earths, and their carbonates.

Cinchona is used for the alkaloids it contains, all of which have the same kind of action, though it varies in degree, quinine being the most important and most extensively used. As cinchona

is not much used, we will consider the effects of quinine. There are various reasons why the alkaloids are superior to the cinchona bark, except when used as a bitter tonic, and chief of these is the fact that they act with greater rapidity, since in the bark they are almost insoluble. Besides this the alkaloids are very easy to dose.

Physiological Action of Quinine. Quinine, and its salts, is one of the most certain drugs in the Pharmacopoeia, but its method of action is unknown. Locally it is an irritant. On the skin it produces little or no effect unless the epidermis is first removed. On the mucous membranes it acts as a stimulant or irritant; on the muscles it acts as a contractor; on the nerves it has no action locally. Hence, it is a muscle and nerve irritant. Taken by the mouth it is rapidly absorbed by the stomach and soon appears in the urine, but its elimination is slow, for though it appears quickly, it is two days before all is eliminated. Small doses probably are completely absorbed, but when large doses are given some escapes by the faeces without absorption. It is absorbed about as rapidly from the rectum as from the stomach, and most rapidly by subcutaneous tissue after hypodermic injection. It is eliminated chiefly by the urine, but small amounts appear in the sweat, milk, and other secretions. Much of it is destroyed by oxidation in the liver and tissues. It is eliminated as a crystalline quinine salt and a dihydroxyl of quinine. In the blood it exists probably as a carbonate held in solution by carbonic acid gas.

A small dose has no effect usually, but it exhilarates some like a glass of wine. Large doses give "cinchonism." Almost always 6 or 8 gr. are sufficient to cause this, but some persons are not very susceptible, the variations being extreme, women and children being more susceptible than men. The degree of cinchonism varies with the size of the dose. Small doses cause fullness in the head, ringing in the ear and perhaps some deafness; larger, roaring in the ear, headache, deafness, disordered taste, smell, and sight. Decided cinchonism causes dizziness and staggering, deafness which may be permanent, although it usually passes away. In extreme cases there is severe headache, delirium, stupor, convulsions, paralysis, complete blindness and deafness, collapse and failure of the respiration. Fatal doses are very large. 1 dr. has been known to cause no serious symptoms and 5 dr. taken over a period of ten days have caused death.

Ordinary doses act as cerebral and spinal stimulants. They stimulate the respiration, but large and toxic doses depress it. Small doses also stimulate the circulation, large 30-60 gr. doses lower the pulse and arterial tension by directly depressing the

muscle of the heart, and by acting on the blood-vessels. Therapeutic doses give an increase of red corpuscles, and large doses are said to check the diapedesis of leucocytes. Small doses do not affect the body temperature except to prevent a rise after exercise or eating. In fever, quinine reduces the temperature to an amount depending upon the kind of the fever. It is a powerful antipyretic in malarial fever. On the stomach and intestines it acts as a simple bitter, stimulating digestion and the appetite. Large doses may give rise to nausea, vomiting and even gastritis. On the uterus in pregnancy it acts as a stimulant, and it aids expulsion during child-birth by causing contraction of the uterine muscles. It is said to produce abortion. It is a powerful depressor of Katabolism, diminishing the urea and uric acid. It has some antiseptic power and will check fermentation by its poisonous on the organisms which are the cause. Small doses may produce in those particularly susceptible an eruption on the skin resembling erythema, eczema, etc., soon subsiding, though it may be followed sometimes with desquamation. Haematuria and oedema may also develop.

Therapeutics. The most important use of quinine is as a prophylactic and specific in malaria, for which it is the best drug we have. For a prophylactic it is given in small doses, 2-3 gr., three times per day in the morning or at night. In the treatment of Intermittent Fever the drug may be given in a single large dose so as to produce the maximum impression at the right time. Since it acts best when the bowels are moved and the liver is active, the patient should be prepared by a cathartic influencing the liver, such as Calomel or $\frac{1}{4}$ gr. of Podophyllum. If there is no time before the suspected paroxysm appears, then give without the cathartic. In Remittent of the so-called "bilious fever," a purge is of especial importance.

For malaria quinine is usually given in hourly doses, beginning 8 hours before the paroxysm is due, or else one or two larger doses are given so that the effects will appear as before. Doses: 10-15 gr. up to 60 gr. or even more. The larger doses are given partly by the stomach, the rectum, and subcutaneously, since the stomach takes only 1 dr. without irritation and even smaller doses may prove irritant. Subcutaneous injections may cause abscesses and even fatal tetanus, but they must be used at times as in Pernicious Malaria where the effect of large doses is needed at once. As an antiperiodic the drug is used chiefly for its effects on the malarial germ which partly disappear during use of the drug. As an antipyretic it is decidedly inferior to new drugs of that class. It can be used in high temperatures but not when there is inflam-

mation of the brain or meninges. It has been used in large doses in Typhoid Fever, but it is not very good. With children, especially in Lobar Pneumonia, it acts better than with adults. In Neuralgia, both malarial and non-malarial, it acts often most favorably. In acute Rheumatism it is of no great use, but after the acute symptoms abate and the patient is very weak it is often good in small doses. As a tonic, alone or with iron, it acts much more than as a simple bitter, for it undoubtedly increases the number of red corpuscles. It is widely used to break up a cold, but it is harmful, since it may cause congestion of the internal ear. The cold would probably break up just as well without it.

Locally quinine has been used successfully in Gonorrhoea in a solution of 5-10 gr. to the oz. In Whooping-Cough it is sometimes used as a prophylactic in children exposed to the disease. The back of the throat is sprayed with a solution of 1-2 gr. to the oz.

Administration. It is customary to give quinine as pills due to its bitter taste, but it is often given in powder and solution. Old pills with hard coatings of sugar are no good, as they may pass into the intestines which are alkaline, and so fail to be dissolved and absorbed. Do not give quinine in simple solution on account of its disagreeable taste, unless very rapid action is wanted. The solution is made by the addition of a little dilute sulphuric acid aids solution. Chocolate or liquorice renders it more agreeable to the taste. Given subcutaneously it acts more promptly and efficiently than by the stomach or rectum, but it has the disadvantage of causing abscesses and tetanus. When it is so used, the solution must contain sufficient tartaric acid to prevent the precipitation of quinine by the alkalinity of the tissues, 1 gr. of the acid to 5 gr. of quinine. Quinine is contra-indicated in inflammation of the middle ear, gastritis, meningitis, cerebritis, cystitis, epilepsy and idiosyncrasy. It must be used cautiously if there is any irritation in the gastro-intestinal or genito-urinary tract. Buzzing in the ear attending its use is prevented by 10 grs. KBr. or a little fluid extract of ergot.

The most commonly used form is the sulphate, but the bisulphate is more soluble and is better for subcutaneous use. The hydrochlorate and hydrobromate are also very good. It is claimed for the latter that a 10 per cent. solution in water and alcohol is not injurious when injected subcutaneously. There is a tannate of quinine, non-officinal, less disagreeable to the taste, and inferior to and slower in action than the sulphate. There is also a non-officinal double hydrochlorate of urea and quinine, used solely for subcutaneous injection, 61 per cent. being quinine. In 50 per cent. solution it is but a slight local irritant. The other alkaloids

resemble quinine in physiological and therapeutic action, but require larger doses. The liquid preparations of cinchona are used only for their tonic effects.

WARBURG'S TINCTURE. An old remedy, formerly a secret one, used in Remittent and Malarial Fever. It contains a large number of substances. Its virtue is due to a combination of quinine with cathartics and aromatics, as aloes, rhubarb, saffron, prepared chalk, cubebs, prepared camphor, etc. Before giving it, the bowels are freely opened.

2. **EUCALYPTUS. OIL OF EUCALYPTUS.** This is an antiperiodic of some value. Locally it has an irritant action. Taken internally in 10-20 m. doses, it gives a feeling of warmth, followed by a period of mental and physical activity succeeded by calm. The pulse is increased in force and frequency. Large doses cause violent cardiac action, headache, disturbance of the digestion and looseness of the bowels. It is eliminated by the lung, kidneys, skin and bowels. In its elimination by the urine it increases the urea. It also has much antiseptic value.

Therapeutics. It is an antiperiodic and it is valuable in obstinate cases where quinine does no good, or where it is contraindicated, or where there is especial idiosyncrasy. In addition to its antiperiodic action, it is used as a stimulant expectorant in Acute and Chronic Bronchitis and may be given in capsule or emulsion. It has also been used for its effect on the mucous membranes in sub-acute Gonorrhoeas. Also used in Rheumatic Headache and Headache dependent on malarial fever.

V. Antipyretics.

Antipyretics are drugs which so modify nutrition as to reduce abnormal temperatures. In general, the higher temperature, the more powerful their action. Heat is generated chiefly by the muscles and glands, and is so regulated and distributed that normally the body temperature is constant. It is dissipated by the skin, lungs, and urine and faeces. When the relation between the heat-production and dissipation is disturbed a fall or a rise of temperature results, a chill or a fever. In a large number of cases the rise is due to retention of heat and not to increased production.

Fevers of short duration do not injure the body, but long-continued fever causes structural changes and exhaustion of the heart with heart-failure. It is therefore important to reduce the temperature and yet not to weaken the patient or interfere with

the normal functions of the body. The lowering of the temperature can be brought about by increasing the loss, by decreasing the production of heat, or by a combination of both. The loss of heat is hastened by drugs or the application of cold air or cold water. Dry air not in motion takes up very little heat but when in motion, it takes up more. Moisture on the surface increases the loss of evaporation, this requiring consumption of heat. The effect of fanning and of cold bath is good while it lasts, but it is only temporary.

Drugs which can influence fever temperatures are called antipyretics, and they are divided into three classes, (1) those causing lessened heat production, (2) those causing increased dissipation, (3) those acting in both ways. Of drugs which cause the lessening of heat-production by decreasing the oxidation in the blood and tissues, quinine, carbolic and salicylic acids are examples. Those which bring about heat dissipation by depressing the circulation or dilating the cutaneous blood-vessels, as alcohol, aconite and sweet spirits of nitre, or by increasing the excretion from the skin, as by antimony, Dover's powder, thus causing a loss of heat by evaporation, and in general all cardiac depressants, are not to be recommended, especially in adynamic cases. Nor are simple diaphoretics to be used indiscriminately. The very best are those which lower the temperature without affecting the strength of the heart, and these are the antipyretics proper. They comprise a very valuable group of drugs.

1. ANTIPYRIN. Is non-official because manufactured under a patented process. A coal-tar product, white, gray or reddish-gray crystalline powder, soluble in water and alcohol, with a slightly bitter taste.

Physiological Action. A small dose to a healthy man causes no apparent effects. A medicinal dose may depress the temperature $\frac{1}{10}$ and cause the same symptoms as quinine, a feeling of constriction in the head, buzzing in the ear, etc. Larger doses give rise to malaise, profuse sweating, depression of the circulation, sometimes cyanosis, nausea and vomiting. Its frequent use gives disagreeable effects, as an eruption on the skin, small, irregular, red erythematous spots or patches, or an eruption resembling urticaria. This rash may or may not be accompanied by constitutional disturbances, a slight rise of temperature, cyanosis of the hands and face and cold extremities.

Toxicology. Ordinarily, though the symptoms may be alarming, they are not dangerous, lasting only 1-4 hours. More cases arise in women, children and girls, than in men, and generally from small doses. Several deaths have been recorded. In these

toxic cases the patient must be stimulated, and the body temperature maintained, and arterial pressure raised by means of atropine. The nervous system is disturbed, and there may be epileptic convulsions, and unconsciousness. In many cases great depression follows the use of the drug. In a large number of cases the effect seemed to be due rather to the constitutional peculiarity of the patient than to the drug itself, most fatal cases being from small doses. Post-mortem examination shows congestion of the cord and brain, mucous membranes, lungs and kidneys. The number of red corpuscles is much diminished.

On the nervous system medicinal doses act as a sedative, and the sensory nerves are first affected, and much more than the motors. The respiration is unaffected, but large doses accelerate the rate and toxic doses cause a failure. The circulation is little affected; usually the arterial tension in moderate doses is increased; in toxic doses, decreased, unless there be convulsions. In a normal man the body temperature is affected perhaps $\frac{1}{10}$, but in fever there is a marked reduction due to decreased heat-production, and increased heat dissipation. The loss of heat is not due to sweating, or to any action on the circulation, for there is a reduction of temperature even when sweating is prevented or checked by atropine. The drug seems to act directly on the nervous mechanism controlling heat. In fever the fall of temperature takes place from $\frac{1}{2}$ -1 hour after ingestion and lasts longer than in the other drugs of this class, 2-10 hours. Antipyrin has a distinct antiseptic action in small amounts, and inhibits digestion and fermentation, and prevents bacterial growth. It prevents tissue-waste, and in fever checks the amount of urine. Absorption is rapid, the drug appearing in the urine within three hours after ingestion, and most of all it is eliminated within 12 hours, although elimination may not be complete until 36 hours after it is taken. Some is eliminated by the saliva and other secretions, but most of it by the urine.

Therapeutics. Antipyrin is used as an antipyretic and analgesic. As an antipyretic it simply lowers the temperature without influencing the cause of the fever; and it is employed in any disease with a high fever, particularly sthenic fevers or wherever high temperatures demand prompt reduction. In some diseases, however, it is not used to the exclusion of other drugs, as in pneumonia where cardiac depressants are better. Large doses may give too great a reduction and collapse, seen often in Typhus Fever. It is to be used with great caution in the hectic fevers of Pulmonary Consumption on account of its too great effects and consequent collapse. In Rheumatism it is inferior to salicylic

acid and to the salicylate of sodium. In Malarial Diseases it simply prevents a rise of temperature.

As an analgesic it is very powerful, comparing favorably with opium, and there is no danger of forming an antipyrin habit. In deep-seated pains due to inflammation or organic disease it is inferior to opium unless given in doses which may be toxic. It is very valuable in Neuralgic pains, and sometimes may be superior to opium, causing less systemic disturbance. In Gouty and Rheumatic pains it is very good, being almost a specific in gout. It also relieves the pain during and after child-birth without interfering with the action of the uterus, and is very useful in painful menstruation. In violent Hemicrania it affords relief from pain. Antipyrin is also used for the relief of motor-disturbances, the shooting pains of Locomotor Ataxia; in Chorea, Minor Spasms, and is especially useful in Epilepsy. For the latter disease it has sometimes been extraordinarily successful, though it often has failed. It should be given in large doses, even 40-50 gr. in one day. It may be combined advantageously with ammoniac bromide, and together these are better than either alone. In Whooping-Cough it is the best of the endless remedies in $\frac{1}{2}$ -3 gr. doses at intervals of five hours. It lessens the number of paroxysms, but does not lessen their severity. In Malarial diseases it may control the rise of temperature.

Administration. On account of its solubility it can be given in simple solution. If it is disagreeable to the patient it may be given with aromatic waters or syrup of bitter orange peel. It is also given in powders and tablets, which are more convenient. It may be administered by the mouth, rectum, or subcutaneous tissue, but the latter method is accompanied by intense and burning pain, though there is rarely any local disturbance as is the case with quinine. Dose: for the adult, 10 gr. every hour till 40 gr. have been taken, or until sweating comes on or the temperature is reduced. Never give more than 30 gr. Some recommend a single larger dose of 10-60 gr. It is incompatible with sweet spirits of nitre. When the two are mixed a blue precipitate forms, changing to dark green; it is claimed by some to be poison. Hare says that it is not, still deaths have followed this double use. It is also incompatible with calomel.

2. ANTIFEBRIN. ACETANILIDE, Antifebrin. (Officinal, 1890.) Another new and valuable antipyretic, made from aniline and glacial acetic acid. White, crystalline, odorless powder, nearly soluble in cold water, more soluble in hot, freely so in ether and alcohol. It has a bitter and somewhat burning taste.

Physiological Action. Like antipyrin a small 5-10 gr. dose given to a healthy man has no effect. Large doses cause Malaise and sometimes nausea and vomiting. Toxic doses cause cyanosis, profuse sweating, nausea, depression of the circulation, collapse and sometimes sudden cardiac failure. The kidneys, liver and spleen are congested, and the number of red corpuscles progressively diminished as with antipyrin. The treatment in poisoning is the same as in antipyrin poisoning. Use external heat, support the heat, give strychnine to stimulate the respiration, inject atropine subcutaneously to sustain the circulation, and give oxygen if there is cyanosis.

On the nervous system antifebrin acts as antipyrin, namely, as a sedative, especially to the sensory portion of the cord. The respiration is not affected by small doses, but is increased and embarrassed by large ones. Death comes on from paralysis of the respiratory centre. The circulation is affected but little by moderate doses, but toxic doses diminish tension and cause cardiac depression. In the absence of fever there is practically no reduction of the temperature ($\frac{1}{10}$ of a degree), but in fever there is. Given to a feverish patient in 10 gr. doses, it gives a reduction in one hour, the maximum reduction within 2 or 3 hours, and ceases to act in 6 or 7 hours. Thus its action is not so lasting as that of antipyrin. The fall is due to diminished heat-production and to increased dissipation. Sometimes cyanosis comes with the fall of temperature and there is sweating which is not so profuse as with antipyrin. The sweating is not the cause of the fall, for the temperature may be lowered when sweating is prevented.

Very large doses have a marked effect on the blood, decreasing the power of carrying oxygen, and reducing the haemoglobin to methaemoglobin. The red corpuscles do not adhere in rouleaux, and may be disorganized; the normal alkalinity of the blood is also diminished. These changes are thought to be the partial cause of the failure of the respiration, the respiratory centre being depressed. Antifebrin has no influence on the elimination of Nitrogen, but large doses may increase nitrogenous katabolism, and the urine becomes dark, due to alterations in the blood-coloring-matter. The antiseptic power of antifebrin is slight, but it is said to have a decided effect on the bacteria of the intestines. In the system it is broken up into acetic acid and aniline and the latter is eliminated as a sulphate. Some say that much escapes by the urine unaltered, but this is denied by others.

Therapeutics. Antifebrin is used for the same purposes as antipyrin, as an antipyretic and analgesic. It influences the temperature in fever but not the cause of the fever. In sthenic fevers

it is very good, for it does not cause profuse sweating and collapse is rare. In the hectic fever of Phthisis, it must be used with caution. In asthenic fevers its use may tend to collapse. As an analgesic it has exactly the same uses as antipyrin, and in Chorea and Epilepsy, etc. Doses: 5-10 gr.

Administration. It is virtually insoluble in water, so it is given in pills, capsules, wine or spirits. The drug is not apt to produce bad effects given carefully, even with small doses the symptoms may appear alarming, but these symptoms soon pass away. In pregnant and nursing women it is said to act badly.

3. PHENACETINE or ACETPHENETIDIN is one of the coal-tar products. Non-official for the same reason as is Antipyrin. A tasteless, odorless, crystalline powder, slightly soluble in water, more so in glycerine, and still more in alcohol.

Physiological Action. It agrees in action closely with antipyrin and antifebrin. It is a nervous sedative and produces little or no effect upon the circulation except in very large doses; it affects the sensory part of the nervous system most. In fevers it depresses the temperature, and it also has some antiseptic power. It is less likely to cause cardiac disturbance than antifebrin or antipyrin, but more apt to alter the blood by changing the haemoglobin into methaemoglobin. It turns the urine dark and causes glycosuria. The effects of the drug are not very dangerous, however; cyanosis and profuse sweating and uraemia are rare. It is eliminated by the urine unchanged.

Therapeutics. The principal uses are as an antipyretic and analgesic. As an antipyretic it is very powerful, producing its effects in $\frac{1}{2}$ hour, and lasting 4-8 hours. In hectic fever of Phthisis, and in sthenic fevers, it must be used very cautiously for it may cause too great a reduction of the temperature. Its uses are the same as those of antipyrin and antifebrin, and it is safer, more powerful, and less likely to cause bad effects, although Hare states to the contrary. As an analgesic it is remarkably good, and in many cases superior to antipyrin, especially in Neuralgic cases. In pure trigeminal neuralgia the relief is only transient. It has been successful in Acute Rheumatism, and in large doses the desired effect is reached sooner than with salicylic acid. In Whooping-Cough it acts as does antipyrine. *Dose 10gr*

4. ACIDUM SALICYLICUM AND THE SALICYLATES. ACIDUM SALICYLICUM. A crystalline acid formerly obtained from the natural salicylates, as oil of Gaultheria and sweet birch, but now made artificially by combining carbolic acid with carbonic acid gas. Caustic soda is evaporated with carbolic acid and heated to 100° C. Dry carbonic acid gas is then passed through it and the

temperature raised to 250° C. by which the excess of phenol is distilled off and salicylate of soda is left behind. This is then mixed with water and decomposed by hydrochloric acid, which sets salicylic acid free, and takes up the sodium. The acid is then purified by sublimation or crystallization from the hot aqueous solution. The acid is a white, crystalline powder, permanent in air, free from the smell of carbolic acid, sometimes with a slight aromatic odor; with a sweet, slightly acrid taste and acid reaction. It is irritating to the nasal mucous membrane, and when smelled causes persistent sneezing. It forms salts with alkalies and metallic oxides. It is not very soluble in cold water (1-450), quite so in boiling (1-14), very soluble in alcohol and ether. The solubility in water is much increased by certain neutral salts as potassic nitrate, sodic sulphite, and sodic phosphate, as borax. With ferric chloride a small trace gives a deep violet color, very characteristic. It is incompatible with mineral acids, metallic salts and preparations of iron. Dose: 8 gr. to 1 dr.

SODII SALICYLAS. A white crystalline powder, permanent in air, odorless, with a sweet saline and mildly alkaline taste, and feebly acid reaction. It can be prepared extemporaneously by treating salicylic acid suspended in water with sodic bicarbonate. It has the same uses and incompatibles as the acid but possesses the advantage of not being so irritant. Dose: 10 gr. to 2 dr. or more.

LITHIC SALICYLAS. A white deliquescent powder, very soluble in water and alcohol, sweetish taste, little or no odor, faintly acid in reaction. It is given in 10-15 gr. doses where the effects of Salicylic acid and Lithium are both desired.

SALICINA OR SALICINUM. One of the original sources of salicylic acid; a glucoside from the bark of *Salix Helix* and other species of willow. A white or colorless crystalline substance, odorless, bitter, neutral, soluble in water (1-28), in alcohol (1-30), very soluble in both boiling, insoluble in chloroform and ether. It is light and bulky, and given in doses up to 30 gr. or in wafers, powders or mixture.

OLEUM GAULTHERIAE. Oil of Gaultheria, of Wintergreen, checkerberry, partridge berry. A volatile oil distilled from the leaves of *Gaultheria procumbens*; colorless or yellow, or even reddish, very volatile; with a sweet, slightly pungent taste, very agreeable and characteristic odor; slightly acid reaction. It is the heaviest of all the essential oils, and is readily soluble in alcohol. It contains 10 per cent. of gaultherilen and 90 per cent. of methyl salicylate, which is salicylic acid with one hydrogen atom replaced by the methyl radical. There is an artificial oil like

the natural one, giving the reaction for salicylic acid. Dose: 10 m. on sugar, in capsule or mixed with sugar and water.

SALOL. A volatile, officinal antipyretic and antiseptic, first brought into notice in 1880. It is a salicylate of phenol, made by heating 60 parts of salicylic acid with 40 of carbolic acid. One atom of hydrogen is replaced by the phenol radical. It is a white crystalline powder, tasteless, with a faint aromatic odor; insoluble in water, soluble in alcohol and ether. It is given in doses from 5-10 gr. hourly till not more than 90 gr. have been given in one day; in tablets, pills, powders, wafers, capsules or pellets. It has the advantage of not irritating the stomach so much as salicylic acid.

Physiological Action of the Salicylic Group. Salicylic acid in a single small dose causes no noticeable effects. Repeated 5-10 gr. doses cause in sensitive persons symptoms resembling cinchonism. There is fulness in the head, buzzing in the ears, deafness and headache. Large doses intensify these symptoms, depress the circulation, produce disturbances of sight and hearing, excessive sweating, and shallow feeble respiration, and in fatal cases ending in respiratory failure. The temperature falls as a rule, and it may fall so low as to cause collapse; or it may not fall at all.

Toxicology. In over doses there is extreme dyspnoea due perhaps to pulmonary congestion from weakness of the heart. The urine is olive-green, albuminous, and both it and the faeces are passed involuntarily. Several fatal cases are recorded, but only from very large doses. The chief postmortem appearances are congestion of most of the internal organs, coaguloses of the serous membrane, and alteration of the blood. In some cases of poisoning there has been prolonged mental disturbance, cheerful or sometimes melancholic delirium. They may be illusions like those of delirium tremens, without the terror, or acute mania which is often belligerent. This may be produced in idiosyncrasy by comparatively small amounts.

Therapeutic doses sometimes, not often, cause more or less severe eruptions of the skin, and have caused depression of the circulation, collapse and blindness from the retinal hemorrhages. Locally salicylic acid is an irritant to the mucous membrane, but not a marked one. Prolonged use or large doses cause gastric irritation. On the nervous system moderate doses have no effect, though they may decrease reflex activity and large ones sometimes cause epileptiform convulsions. On the circulation medicinal doses exert no marked influence except a slight depression. Though slight, it is worth remembering in patients where there is

cardiac weakness. The respiration is somewhat increased. Large doses cause a failure of the respiration which is either gradual or sudden.

The normal temperature is but slightly if at all depressed by moderate doses, but they will prevent the slight rise normally caused by exercise. In fever the diminution of temperature is due to decreased heat-production and increased dissipation. The first effect of an antipyretic dose is to cause profuse sweating, commencing in $\frac{1}{4}$ of an hour. The maximum fall of temperature does not come until six hours after ingestion. There is no relation between the amount of sweating and the amount of the loss of temperature. Since sweating ceases before the maximum fall, the fall of temperature is not then due to perspiration. Salicylic acid has a very pronounced antiseptic power. A solution of 4 parts to 10,000 delays the souring of milk for some time, and a solution of 15-10,000 prevents the bacterial growth in ordinary organic mixtures, as urine, wine, beer and foods. The effect of the prolonged ingestion of salicylic acid in foods in which it is used as a preservative, was investigated by a French commission and was reported as injurious, since it impairs digestion and causes disease of the kidneys. Its use was therefore prohibited in France, and other European countries followed the example thus set.

The drug is absorbed not as such but as the salicylate of sodium and it is eliminated by the kidneys, sweat and saliva as salicylic and salicylic acids. It appears in the urine very quickly but is eliminated slowly. The urine is often increased, sometimes diminished. When used in rheumatism, the urea and uric acid are increased at first, then decreased. It is frequently albuminous due to irritation of the kidney, and the color after a large dose may be olive-green from the indoxyl and pyrocatechin. There are present hyaline and granular casts due to the irritation accompanying elimination.

Therapeutics. Salicylic acid is used externally as an antiseptic in surgery, and as an application in various diseases of the skin and mucous membranes. It is used as a salve in Pruritus of the anus and vulva (Hare), made up with 2 parts to 100 of tallow. It is applied as a powder to the feet, equal parts of starch and salicylic acid, in offensive sweating, called "Bromidrosis" and in soreness due to walking long distances. Made up with collodion it is sold under various names to remove corns, and it certainly has a marked action upon them. The ordinary mixture for this purpose is 30 gr. of salicylic acid, 5 gr. of cannabis indica and $\frac{1}{2}$ oz. of flexible collodion. Salicylic acid is also used as a mouth-wash in Stomatitis after the blisters are broken, and it gives much

relief. A very dilute solution in olive-oil is an excellent application for small burns. It is also used locally quite extensively in various Skin Diseases treated of in the course on Dermatology.

Internally its chief use is in the treatment of Rheumatism, for which it is more valuable than all the other drugs combined. This action was discovered accidentally while it was being used as an antipyretic. It relieves pain and stops the attack, but it does not stop the changes in the joints and in the valves of the heart, except as it shortens the active period of the attack. In doses of 8-15 gr. every hour or two it causes a disappearance of the chief symptoms in two days, generally within 24 hours. Sometimes it has no effect. On account of the tendency to relapses it is best to continue its use several days after the pain has ceased. It is less certain in Chronic than in Acute Rheumatism, and has little effect on Gonorrhoeal Rheumatism or Rheumatoid Arthritis. In Acute Gout great claims have been made for it by some, but others say that it is valueless. It is very useful in Lumbago and Sciatica, and often effects a cure of Migraine in rheumatic persons. In Neuralgia it is inferior to antipyrine.

In the Tonsillitis of Rheumatics it is almost a specific. It relieves the pain and swellings and shortens the attack. As an antipyretic in other than rheumatic diseases it is not much used, other drugs taking its place. As an antiseptic in surgery it has gone out of use entirely.

Administration. The acid is somewhat irritating to the stomach and has a nauseous disagreeable taste, unless given in pills and capsules. It should be given in such a way that it will not be disagreeable to the patient, as with the syrup of ginger or glycerine and water. With water alone it is disagreeable. The sodic salicylate is less irritating to the stomach and is preferable to the acid. When the acid is given for rheumatism 8-15 gr. are administered every hour or two until 90 gr. have been given in 24 hours. Prescribe the sodic salt in syrup with aromatics in larger doses.

The physiological effects of Oil of Gaultheria are essentially those of salicylic acid, but it is a greater irritant locally. An ounce has caused gastro-enteritis, and death in 15 hours, and death has also resulted from 4 dr. Salol, when taken into the system, splits up into salicylic acid and phenol by contact with the pancreatic juice. The decomposition takes place slowly, however, and some of the dose escapes unchanged. After salol has been used freely, the urine may be black, due to the phenol or carbolic acid. Symptoms of poisoning from both salicylic and carbolic acids may be produced. It may irritate the kidney, and salol is therefore

contra-indicated where the kidneys are irritated or inflamed. It is not so prompt a remedy and is less certain than salicylic acid, but causes less gastric disturbance and less ringing in the ears.

Therapeutics. It is claimed to be almost if not quite as efficient in Rheumatism as salicylic acid, and should replace the latter when the stomach is too irritated to bear the acid. It is also used in Diabetes, Catarrh of the Bladder and Duodenum, supposed to exert an antiseptic influence. As an intestinal disinfectant it has been used in Typhoid Fever and in Cholera. It also is used to sterilize the urine in Gonorrhoea and to lessen the irritation on the urethral mucous membrane. Dose: 5-10 gr.; not more than 90 gr. in 24 hours nor above 15 gr. at any one time. In powders, wafers, or capsules.

SALICIN, already mentioned, is a feeble substitute for salicylic acid not very much used. It produces the same results, much more slowly, with less gastro-intestinal disturbance. It is absorbed rapidly as salicin, decomposed in the blood, and eliminated in the urine as salicin and salicylic acid.

* 5. THALLIN. PARACHINANISOL. A yellowish-white crystalline powder, with a slight odor, and salty, bitter, aromatic taste; soluble in water. It is used as an antipyretic in the form of a sulphate, tartrate or hydrochlorate.

Physiological Action. It causes an unpleasant taste in the mouth and in excessive doses a buzzing in the ear, cyanosis, labored respiration and coma. The prolonged use in large doses diminishes the number of red corpuscles and causes degenerative changes in the kidney.

Therapeutics. In fever 4-8 gr. give a fall of the temperature, in $\frac{1}{2}$ -1 hour, with profuse sweating, cyanosis of the face and extremities, and in some cases, chills, vomiting, severe diarrhoea, and sometimes albuminuria.

LOCAL REMEDIES.

Local Remedies include all drugs which affect one organ or apparatus more or less isolated from the remainder of the body. They include the following families, which will be taken up in the order named:

1. STOMACHICS, drugs which increase the functional activity of the glands of the alimentary canal, thus aiding in digestion.

2. EMETICS, drugs which are employed to produce emesis, or vomiting.

3. DIAPHORETICS, drugs which increase the functional activity of the skin.
4. CATHARTICS, drugs which promote purging by increasing intestinal peristalsis or secretions or both together.
5. ANTHELMINTICS, drugs which kill or cause the expulsion of worms from the intestines.
6. DIURETICS, drugs which increase the flow of urine.
7. EXPECTORANTS, drugs which promote bronchial secretion and facilitate its removal, thus relieving cough.
8. OXYTOXICS, drugs used during or directly after parturition to increase uterine action.
9. EMMENOGOGUES, drugs employed to promote the menstrual flow.
10. ANTACIDS, drugs used to counteract acidity in the alimentary canal or urine, acting either directly or indirectly.
11. DIGESTANTS, substances used to assist digestion, containing ferments of either animal or vegetable origin.
12. DEMULCENTS, bland substances which form gummy or mucilagenous solutions in water, capable of producing calm or soothing inflammation of inflamed surfaces.
13. EMOLLIENTS, bland substances which when applied to the skin make it more pliable and soft. Under this head come Poultices.
14. PROTECTIVES, materials used to protect inflamed surfaces, whether internal or external.
15. IRRITANTS, drugs used externally on the skin to exert an irritant action. They include Epispastics, Rubefacients, and Escharotics.
16. DISINFECTANTS and ANTISEPTICS. The former destroy organic life; the latter prevent or retard putrefaction and septic processes. They will be considered under one group.

I. Stomachics.

The group of Stomachics include a large number of substances which by their action on the mucous membrane of the alimentary canal cause an increase in the functional activity of its various glands, and so aid in digestion and assimilation. The group is unnecessarily large, including nearly 200 drugs. It is divided into three sub-divisions, (1) Simple Bitters; (2) Aromatic Bitters; (3) Aromatics.

The Simple Bitters have no direct influence as tonics upon the general tissues of the body, but act locally by stimulating the

gastro-intestinal mucous membrane, calling out an increased flow of saliva, mucous, and gastric juice. They have no power to aid digestion, but they stimulate the appetite, thus causing more food to be taken and so favoring assimilation. The increased appetite is due in part to the sense of bitterness, causing an increased desire for food, for when the taste of a bitter is concealed, a portion of their beneficial effects is lost. The bitters are essentially irritants, and are contra-indicated in inflammation or over-sensitiveness of the mucous membrane of the alimentary canal. Over doses produce nausea and may even cause active irritation. Given for a long time they cause gastric catarrh, diminished flow of the gastric juice, and impaired digestion. They are especially indicated by a loss of appetite due to a depressed condition of the stomach, and not to inflammation.

The aromatics depend for their activity upon the presence of a volatile oil. They are essentially local irritants, causing heat and pain when taken into the mouth; and applied to the skin, they cause rubefaction and even blistering. Therapeutic doses act almost exclusively on the alimentary canal. Large doses cause burning pain in the stomach and increased activity of the circulation, and in very large doses may act as irritant, narcotic poisons. While aromatics act more powerfully than the simple bitters their action is more transient and no permanent increase of the digestive power is produced. They are employed as Condiments to assist in digestion, and as Carminatives, to stimulate the intestines to expel flatus, to prevent the griping of purgatives, to conceal the disagreeable tastes of medicines, and to make nauseous drugs acceptable to the stomach; to give pungency to bitter tonics; and to produce local anaesthesia. Their use is contra-indicated in inflammation of the mucous membranes of the alimentary canal, but they are useful in the simple Diarrhoea of relaxation where there is no inflammation.

The Aromatic Bitters contain both volatile oils and bitter principles, and therefore have the combined properties of each.

(A). SIMPLE BITTERS.

1. QUASSIA. Among the most important of simple bitters. The wood of *Simaruba excelsis*, a large tree growing in the West Indies, light in color and density, very bitter, containing a neutral, crystalline, intensely bitter principle, slowly soluble in cold water, called Quassin. It is administered as a Tincture, dose 1-2 dr., Extract and Fluid Extract. A common form of administration is by the "Quassia cup," made of Quassia wood, in which water is al-

lowed to stand until it is rendered bitter. Quassin is probably the most active of all the simple bitters, and when simple bitters are indicated, this is generally given. When used too long or too freely it may cause gastro-intestinal irritation. It is very useful in loss of appetite after malaria, and in Dyspepsia. It is used in children for Pin-worms. The rectum is first cleansed and then an infusion of Quassia 12 dr. to the pint, is injected well up into the bowels.

2. GENTIANA. YELLOW GENTIAN. The root of *Gentiana lutea*, of a spongy texture, faint and peculiar odor, bitter taste. The active principle is Gentio-pikrin, neutral, crystalline, intensely bitter. It is a remedy of great antiquity and has always been used on account of its bitter taste. It is very useful in Gastric Debility and in Dyspepsia, never given in substance, but as one of its preparations. These include the Extract, Fluid Extract, and the Tinctura Gentianae Composita which is the best form for administration. It contains gentian, bitter orange peel, cardamon, alcohol and water; dose: 1-4 dr. It is particularly useful in loss of appetite after acute diseases and in Gastric Debility.

3. CHIRATA. Herb and root of *Ophelia Chirata*, a plant growing in N. India. It is one of the best of the simple bitters, contains no tannin, and therefore can be used with iron preparations. It is supposed to exert a peculiar influence on the liver, and is given when a cholagogue is indicated.

* 4. EUPATORIUM. THOROUGHWORT. Gathered after flowering from *Eupatorium perfoliatum*, indigeneous in this country. It is an efficient but disagreeable bitter, its bad taste being a great objection to its use.

* ~~5. TARAXACUM~~ The root of the common dandelion, containing a bitter principle called Inulin. It is a stomachic tonic, a mild laxative, and a feeble cholagogue. It is generally given in the form of an extract in water in doses of 30 gr. to 1 dr. There is a fluid extract given in doses of 30 m. to 2 dr.

6. PRUNUS VIRGINIANA. Bark of wild cherry or *Prunus seretina*, and not of *Prunus Virginiana* or the choke-cherry; with a reddish cinnamon color; slightly astringent and bitter taste; containing tannic acid, a bitter extractive, and two substances, Amygdalin, and Emulsin. Amygdalin is a nitrogeneous glucoside, and Emulsin is an albuminous principle; and in aqueous solution they react upon one another to give hydrocyanic and formic acids. The infusion is given with other drugs in debility with tendency to night-sweats. The Syrupus Pruni Virginianae is a common ingredient of cough-mixtures. Dose: 1-4 dr. of fl. extr.

* 8. **CALUMBA. COLUMBE.** The root of a climbing plant of the E. Indies; bitter taste, and slight aromatic odor. It contains a bitter neutral principle, Columbin, and a yellow alkaloid, Berberina. Columbo is a mild bitter and can be mixed with iron preparations without forming unsightly mixtures. It is given in Dyspepsia and enfeebled digestion as the tincture of fluid extract. Dose of tincture, 1-4 dr.

9. **HYDRASTIS. GOLDEN-SEAL OR YELLOW ROOT.** The rhizoma and rootlets of *Hydrastis Canadensis*, an indigeneous perennial. It contains a white alkaloid, Hydrastine, and a yellow one called Berberine, and probably a third alkaloid. It is used in Chronic Gastro-Intestinal Catarrh and in other conditions as the fluid extract in doses up to 1 dr. There is also a tincture which is unimportant. Hydrastis is incompatible with alkalies, tannic and hydrochloric acids. It has considerable value in various conditions of depressed mucous membranes, and as a stomachic and tonic after malaria and other similar depressing diseases. It is good in Catarrhal Jaundice, Uterine Catarrh, certain forms of Leucorrhoea and Menorrhagia. It is sometimes used as an injection in the second stage of Gonorrhoea, and at the same time is taken internally.

* ~~10. HUMULUS~~ **HOPS.** Containing a bitter, a resin, tannic acid, a volatile alkaloid called Lupulin, and a volatile oil which is supposed to have a slight sedative effect and to favor sleep. Hops are said to stimulate the appetite and digestion. Hops are given as an infusion or as beer, and are supposed to produce sleep and check nervousness. There is a tincture given in doses up to an oz., an infusion given ad libitum, and the beer. The hop-pillow has no action of its own, but works chiefly through the imagination.

* ~~11. LUPULINUM.~~ A yellow powder obtained from the cones of hops and representing $\frac{1}{10}$ - $\frac{1}{8}$ their weight, with the peculiar flavor of hops, and containing a bitter principle called Lupulin, a resin, and a volatile oil. In action it is a feeble narcotic and is given as the fluid extract in $\frac{1}{2}$ -2 dr. doses. There is also an oleo-resin.

(B) AROMATIC BITTERS.

This sub-division of Stomachics is not very important, and includes but few drugs.

* 1. **ANTHEMIS and MATRICARIA. CHAMOMILE.** True Chamomile is the dried flowers of *Anthemis nobilis* of Europe, containing a blueish or greenish volatile oil, a bitter principle, and some tannin. Matricaria or German Chamomile is the flowers of

Matricaria Chamomilla, stronger, less agreeable in odor and taste, and containing a very similar volatile oil. Both are given as an infusion of $\frac{1}{2}$ oz. to the pint as stimulant tonics. In large amounts they are used as emetics and anthelmintics. In small doses the infusion is used as a diaphoretic, and to prevent colds in teething infants.

* 2. SERPENTARIA. VIRGINIA SNAKE-ROOT. Containing a volatile oil and resin, and a bitter principle. It is often given in combination with cinchona as a tonic, and is used in Chronic Dysentery, and as an ingredient in the Compound Tincture of Cinchona.

* 3. CASCARILLA. It has been used as a tonic in Diarrhoea.

* ~~4. CIMICIFUGA.~~ BLACK SNAKE-ROOT. An old remedy containing a volatile oil, a resin, and tannin. It is used chiefly as a stomachic tonic, and is said by some to be of special value in Ovarian Neuralgia. Dose, 15-30 m. of the fluid extract.

* 5. AURANTII AMARICORTEX. BITTER ORANGE PEEL. Containing a bitter principle and a volatile oil. Its principal use is as one of the components of the numerous compound preparations, and it is also used for purposes of flavoring.

* 6. AURANTII DULCIS CORTEX. SWEET ORANGE PEEL. Use same as above.

(C) AROMATICS.

*omit all
spices*

The Aromatics are essentially local irritants, and have already been discussed at some length. They are used chiefly as condiments, to flavor food; and as Carminatives, to expel flatus, to prevent the griping of purgatives, to disguise the taste of medicines, and to give flavor to drugs. They form an unusually large group, but many are unimportant. They all contain volatile oils and act as local stimulants upon the alimentary canal.

1. ~~CINNAMOMUM.~~ CINNAMON BARK. Containing a volatile oil and tannic acid.

* ~~2. CARYOPHYLLUS.~~ CLOVES. Containing 18 per cent. of a volatile oil and a resinous principle called Caryophyllin. It is among the most stimulating of the aromatics and enters into the Compound Tincture of Lavender. The Oil of Cloves is used as a flavor, as a local anaesthetic in Toothache, and as a parasiticide.

* ~~3. MYRISTICA.~~ NUTMEG. Containing 3 per cent. of a volatile oil and 34 per cent. of a fixed oil. It is an aromatic, and in large doses, 2-3 dr. a narcotic poison. Its chief use is as a condiment. The Oil of Nutmeg is used chiefly as a flavoring extract. The spirit contains 3 per cent. of the volatile oil and 97 per cent. of alcohol.

- * ~~4. MACIS.~~ Unimportant.
- * ~~5. CARDAMOMUM.~~ The fruit of an East Indian plant, useful as a condiment. Its volatile oil enters into many officinal preparations.
- * ~~6. CARUM.~~ CARAWAY. Containing 4 per cent. of a volatile oil, used as a pleasant stomachic and carminative. The seeds when baked in cakes are supposed to stimulate digestion.
- * ~~7. PIPER.~~ BLACK PEPPER. Containing the alkaloid Piperina to the extent of 8 per cent., a volatile oil, and a resin, used chiefly as a carminative stimulant and a condiment. There is an officinal oleoresin.
- * ~~8. PIMENTA.~~ ALLSPICE. Containing a green fixed oil and a volatile oil, a resin and a gum, used as a warm aromatic stimulant and condiment.
- * ~~9. ZINGIBER.~~ GINGER. The rhizome of a plant growing in the East and West Indies, containing a volatile oil and resin, used as a stimulant and carminative. Applied to the skin it is an irritant. It is useful in Flatulent Colic, Dyspepsia, and in the pain due to sudden suppressed menstruation. It is given as tincture in 1 dr. doses in a wine-glassful of hot water. The Syrup is used largely for flavoring and as an adjuvant with saline and irritating cathartics. There is also a fluid extract and an oleoresin which are officinal. Dose of the substance, 8-30 gr.
- ~~10. CAPSICUM.~~ CAYENNE PEPPER. There is a number of species all of which yield the active principles Capsicin, a thick yellowish red liquid present to the extent of 4 per cent. in *Capsicum fastigiatum*. It is a powerful local irritant. Applied to the skin as an oleoresin it causes redness and great pain; if the application be long continued, it destroys the cuticle, produces redness and blistering. It is used as a counter-irritant to produce redness without blistering in the form of the officinal plaster in Lumbago, Rheumatism, and other conditions.

In the alimentary canal moderate doses produce a pleasant feeling of warmth; over-doses cause acute pain, gastro-intestinal irritation, vomiting and purgation. In slight doses given continuously for a long time, it may cause subacute or chronic gastritis. Its chief use is as a condiment. It is used with advantage in food where there is flatulence. It is useful in Flatulent Colic as a carminative, and to prevent the formation of gas. In enfeebled gastric digestion and debility, it is one of the best of remedies.

In adynamic diseases, especially in drunkards in Delirium Tremens, it stimulates the stomach to digest food, and in part serves in the latter case to overcome the craving for alcohol. In Chronic

Bright's Disease it tends to lessen the albumen and may be used to stimulate the kidneys. In Sore-throat and simple Tonsillitis it is used as a gargle consisting of equal parts of the tincture and glycerine. It can be painted on the tonsils or used as a gargle, and is especially good in Scarlet Fever, where it may be applied in the form of a powder. It is given in substance in 5-10 gr. doses. In Delirium Tremens as much as 20 gr. can be given in pill form. The Tincture is given in doses up to 2 dr.

* ~~11. MENTHA PIPERITA.~~ PEPPERMINT. The leaves and top of the plant contains 1 per cent. of a volatile oil. There is a spirit which is used for flavoring purposes, as a carminative, and as a component of the Aromatic Wine. It is used in Nausea, Flatulence, Abdominal Pain, Gastric Debility and Dyspepsia, as a stimulant, and as a wash for ulcers and chancroids.

* OLEUM MENTHAE PIPERITAE. Oil of peppermint. Greenish yellow or nearly colorless, reddening with age, strong penetrating smell, cooling pungent taste; soluble in alcohol. It is used as a local anaesthetic, as a constituent of the Aqua Menthae Piperitae, of the troche and of the spiritus. The aqua is used as a vehicle in indefinite doses. The troche is made up of the oil, sugar and gum tragacanth, and is used as a tonic. The most active part of the oil of peppermint is Menthol, and combined with some inert substance it is used as a local application in Neuralgia. The Oil of Peppermint is an irritant, used for this purpose very extensively in Neuralgia, but used too long it may cause blistering; and when it causes burning pain apply some inert oil as olive-oil or vaseline. It is used extensively as a domestic remedy for Flatulence and Colic, as a constituent of purging pills, and to cover the disagreeable taste of medicines.

~~12. OLEUM CAJAPUTI.~~ OIL OF CAJAPUT. A volatile oil, transparent, greenish, with a penetrating odor and warm pungent taste, very volatile and inflammable.

13. MYRRHA. MYRRH. A gum resin occurring in small irregular fragments of a reddish-yellow or reddish-brown color, with a peculiar odor and bitter taste; partly soluble in water, alcohol and ether. The Tincture is a brownish-yellow liquid, being opaque by the addition of water. It is used as a stimulating tonic in Dyspepsia, given internally, and locally as an application to spongy gums and ulcers in the form of the tincture. It is very useful as a dressing in minor surgery, and as an ingredient in many compound preparations as Pilulae Aloes et Myrrhae, Mistura Ferri Composita and the Pilulae Ferri Composita and the Pilulae Rhei Compositae. The Tincture Myrrhae is used as a mouth-wash, diluted with water.

* ~~14. ANISUM AND ILLICIUM.~~ Anisum is the officinal name of anise; Illicium is the star-anise. Both contain the volatile oil of anise, but the star-anise contains most. The oil is colorless or yellow, with the peculiar odor and taste of the seeds. Dose: 5-15 m. well diluted in water. The Aqua Anisi is used for Flatulence and Colic. It enters into Paregoric as one of the ingredients and is also used in other compound preparations. Spiritus Anisi is 10 parts of the oil in 90 parts of alcohol. Dose: 1-2 dr.

* ~~15. LAVANDULA. LAVENDER.~~ The flowers contain a volatile oil which acts as an aromatic stimulant. Lavender is seldom given in substance. Only the oil, Oleum Lavandulae Florum, is officinal. The oil is used as a stimulant and especially as a flavoring preparation. The Spiritus has 5 per cent. of oil in 95 per cent. of alcohol. The compound tincture of Lavender is rather a good aromatic stimulant, used also as a vehicle and corrective. It contains oil of Lavender, oil of rosemary, cinnamon, cloves, nutmeg, red saunders, alcohol and water.

The remainder of the Aromatics are unimportant. MENTHA VIRIDIS, spearmint, contains a small amount of a volatile oil of the same character as oil of peppermint, but weaker. HEDEOMA, pennyroyal, is supposed by the laity to have a peculiar effect on the uterus. SALVIA is sage, used in making sage-tea, a favorite domestic remedy. Contains a volatile oil. ORIGANUM or wild Mahoram and ROSMARINUS or rosemary, are both constituents of the Vinum Aromaticum, which contains 1 part each of lavender, marjoram, rosemary, peppermint, sage and wormwood, with 94 parts of stronger white wine. CORIANDRUM or Coriander and FOENICULUM or Fennel need only be mentioned. ALLIUM or garlic, contains a volatile oil given to children for Dyspepsia in the form of a syrup, Syrupus Allii, valued highly by some as a stimulant. Dose: 1 dr. for a child of one year. SASSAFRAS is the root-bark, containing a volatile oil. AURANTII FLORES, orange flowers, are used for the preparation of orange-flower water, used as a vehicle. AURANTII DULCIS CORTEM, sweet orange peel, is used to make the syrup, used for flavoring mixtures and for disguising the taste of disagreeable drugs. The elixir is also a very good vehicle.

II. Emetics.

Emetics are drugs and other means employed in medical practice to produce vomiting. Emesis or vomiting is the result of a

very complicated set of actions, in which the stomach is compressed by the abdominal muscles and the diaphragm. Simultaneously the stomach also contracts everywhere except at the cardiac orifice, which relaxes by means of the contraction of certain radiating muscle fibres. When contraction and cardiac relaxation occur together, we have vomiting; if relaxation does not accompany the general contraction, we have retching.

Emetics are divided into two classes, (1) those which act on the vomitory center by reflex action, due to irritation of the stomach, called Reflex, Eccentric or Irritant Emetics; and (2) those which act indirectly upon the vomitory center through the circulation called Direct, Centric or Systemic Emetics. Probably most emetics act in both ways. The vomiting produced by irritant emetics lasts only a short time, the action stopping when the emetic is expelled. They cause much less nausea and general depression and relaxation than Centric Emetics. The vomiting of the Centric Emetics may be long continued, and be accompanied by great depression, nausea, and muscular weakness. The circulation is also depressed and the secretions increased, especially the saliva, sweat and mucous from the stomach and bronchial tubes. The amount of manifestation differs with the drug and the size of the dose. During violent vomiting the blood is driven to the head and the abdominal circulation is considerably affected. The material vomited does not come from the stomach alone, but after repeated vomiting from the duodenum as well or even lower down.

The indications for Emetics are the following :

(1) To unload the stomach and remove poisons, indigestible fermented, acrid and irritating substances. In case of poisoning the stomach-pump may be better than the use of drugs, as when the vomitory center is deadened by narcotic poisons or the system is greatly weakened.

(2) To dislodge foreign substances from the oesophagus and respiratory passages, as in Membranous Croup to remove the membrane. When it is closely adherent emetics are useless. In these cases the remedies to be used depend largely upon the condition of the circulation; in many cases Apomorphine is best. In general give such emetics as produce little nausea and general disturbance, *i. e.*, one of the irritant emetics.

(3) To effect the liver in disturbances not due to organic disease, as in Congestion. In Catarrhal Jaundice they often do good by removing the mucous plugs which block the ducts. They have been used to remove Biliary Calculi, but they are very injurious and may rupture the gall-bladder.

In Hyperemesis due to irritant emetics wash out the stomach by large doses of a warm demulcent, give opium by the rectum, and apply counter-irritants to the epigastrium. When Hyperemesis is due to Centric Emetics, acting through the circulation, keep the patient as quiet as possible in a horizontal position, give opium enemata and alcoholic stimulants. Creosote, chloroform, and volatile oils are also useful.

Contra-indications. Emetics may not be given in Congestion of the Brain, Gastric Inflammation, and Aneurism. They are to be used with caution in Atheroma, Hernia, Advanced Pregnancy, and a tendency to Prolapsus Uteri.

Administration. Centric Emetics act no matter how introduced into the system. The irritants are always given by the mouth, and as a rule in full doses with warm water which aids emesis and renders it less painful. Sometimes vomiting may be further provoked by irritation of the fauces by a feather or one's finger. If protracted nausea is desired, give repeated small doses at short intervals.

1. IPECACUANHAE. "IPECAC." The dried root of *Cephaelis Ipecacuanha*, a small, shrubby plant, a native of Brazil. It has no odor in the piece, but powdered it has a peculiar odor, very offensive to some, causing irritation of the mucous membrane and sneezing. It is bitter, acrid and nauseating. The active principles are the alkaloid, Emetine, and a glucoside, Ipecacuanhic acid. As a rule the root contains less than 1 per cent. of the alkaloid. Emetine is a white, odorless, non-crystalline powder, bitter, burning, and alkaline; slightly soluble in water, freely so in alcohol and chloroform. The pure alkaloid is obtained only with great difficulty; the ordinary commercial variety occurs in brownish-red deliquescent scales, very soluble in water. Doses: of the pure alkaloid, $\frac{1}{4}$ gr. of the commercial, impure 1 gr.

There are the following preparations of Ipecacuanha:—

PULVIS IPECACUANHAE ET OPII. Dover's powder, already mentioned. *Opium pulv. 1 gr. Ipecac gr 1 Sugar with 8 gr.*

SYRUPUS IPECACUANHAE. Dose: 1-2 dr.

EXTRACTUM IPECACUANHAE FLUIDUM. Dose: 1-5 m.

TROCHISCUS MORPHINAE ET IPECACUANHAE. $\frac{1}{40}$ morph., $\frac{1}{12}$ Ipecac.

VINUM IPECACUANHAE. Trochiscus: 1-60 m.

Incompatibles. Vegetable acids, and astringent infusions which form a tannate of emetine.

Physiological Action. Locally applied Ipecacuanha is a decided irritant to the mucous membrane especially the nasal, which with some is so sensitive that very small amounts of the powder in the

air give persistent sneezing which may even lead to asthma. It is very irritating to denuded surfaces and even to the unbroken skin, and if rubbed in or if the application be long continued it may cause an eruption. Internally a very small dose gives no particular symptoms but small repeated doses increase the secretion of saliva, and of mucous from the bronchial tubes and the stomach. Large doses cause vomiting, a moderate degree of nausea, and a decided increase in the secretion of saliva and mucous, together with muscular relaxation.

Vomiting is produced partly by irritation of the stomach and partly by direct action upon the vomitory center after being absorbed, shown by the facts (1) that emesis is quicker if ipecac be taken by the mouth than if injected into the circulation, and (2) the emesis is produced when it is injected into the blood. Large doses taken by the mouth do not give hyperemesis since the excess of ipecac is expelled with the vomiting, but when Emetine is injected in over-doses hyperemesis invariably follows due to irritation of the vomitory center. Therapeutic doses have no effect upon the nervous system, circulation, respiration, temperature or pulse, but the intestinal secretions and the bile are increased.

Therapeutics. The most common use of Ipecacuanha is as an emetic, for it is safe, efficient, and does not cause much prostration. It is especially useful for emptying an overloaded stomach, and in removing mucous swallowed by children with Bronchitis. In Narcotic Poisoning it is less certain and less active than mustard or the mineral emetics, such as zinc, sulphate, but is constantly used as adjuvant. When very violent emesis is required as in Membranous Croup, it is inferior to zinc, sulphate and alum.

In the nervous vomiting of Pregnancy minute hourly doses often help but sometimes fail. In the morning vomiting of drunkards and in the repeated vomiting due to depression of the stomach, it is good. As a nauseant expectorant it is the safest drug we have, and the one most used in the early stages of Bronchitis, especially in children. Its expectorant action is due to the fact that it promotes the secretion of mucous from the bronchial tubes and quiets the inflammation. For this purpose the Syrup is usually given, but other preparations are good. As a nauseating diaphoretic it is used in both Acute and Chronic Rheumatism, and in suddenly suppressed menstruation, breaking up a cold, or in Muscular Rheumatism. It is usually given as Dover's Powder, but this is more apt to nauseate than in pill form. To produce sweating, give a single large dose.

As a Haemostatic Ipecacuanha has been recommended, and in some cases of Haemoptysis it is said to be a specific. In acute

Dysentery, especially in "Bilious Dysentery," and also in "Bilious Headache," it is very valuable.

Administration. As an emetic ipecac is given in powdered form suspended in water in 15–30 gr. doses repeated every quarter hour till the desired effect is produced. As a nauseating expectorant and diaphoretic small 2–5 gr. doses are given. For children the best expectorant is the syrup, given in 1–2 dr. doses.

2. APOMORPHINAE HYDROCHLORAS. An artificial alkaloid made by the action of hydrochloric acid on morphine in a closed tube at an elevated temperature; occurring as minute colorless, or greyish-white crystals, turning greenish-white on exposure to air and moisture; odorless, bitter, neutral, or faintly acid; practically insoluble in ether and chloroform, soluble in alcohol (1–50), and quite soluble in water. The aqueous solution soon turns green and its medicinal power is affected; hence it should be dissolved just before using. Solutions keep better if hydrochloric acid, glucose, or glycerine be added.

Physiological Action. Apomorphine is a certain and prompt emetic, acting quickly in small doses and causing little nausea and depression. The rapidity of action depends on the size of the dose. It is retarded or even prevented by sufficiently large doses of chloral and of narcotics. Usually the effect produced by an ordinary dose comes on within a very few minutes, even in one minute. With large doses vomiting recurs several times at 15 minute intervals, but with very large doses there is no vomiting at all since the vomitory center is paralyzed. Therapeutic doses do not affect the circulation, except to increase the pulse rate; large doses depress it. The respiration is increased in rate by large doses, and rendered irregular by poisonous doses, but they have no marked effect upon the temperature.

Therapeutics. Apomorphine is used as an emetic to empty an overloaded stomach in $\frac{1}{10}$ gr. doses given subcutaneously or $\frac{1}{5}$ gr. doses given by the stomach. If very rapid action be desired give $\frac{1}{4}$ gr. subcutaneously. This drug can be used when other emetics cannot be as in Extreme Alcoholism and Obstruction of the Oesophagus or when the patient resists. In Narcotic Poisoning it is good given subcutaneously in conjunction with atropine while sulphate of zinc is given by the mouth as an irritant emetic. The ingestion of this drug causes no irritation, and should there be any pain it is due to chemical changes in the drug after ingestion. It can be used as an expectorant in $\frac{1}{40}$ – $\frac{1}{15}$ gr. doses. With children it acts very badly and its use should be avoided. It must also be used very carefully in feeble persons, for $\frac{1}{15}$ gr. has proved fatal in a feeble child 4 years of age.

3. **SINAPIS. MUSTARD.** In mustard flour we have a prompt and sometimes violent emetic used in emergencies when no other emetics are obtainable. Dose, dessert-spoonful in $\frac{1}{2}$ pint of warm water repeated if necessary at 10 minute intervals 3 or 4 times, but it is too irritating to be repeated more than that.

* 4. **SANGUINARIA.** Blood-root has been somewhat used but it is a harsh emetic, and there are better and less dangerous drugs.

III. Diaphoretics.

Strictly speaking Diaphoretics are drugs which increase the secretion of sweat to such an extent that it does not run off the body but evaporates, but if it does they are properly Sudorifics. Ordinarily both Sudorifics and Diaphoretics are grouped together. The sweat-glands eliminate water and various substances from the body and so keep down the temperature by evaporation, this requiring the expenditure of much heat. The secretion of sweat is susceptible to stimulation both internally and externally. Mere exposure to heated atmosphere in a healthy man is sufficient to stimulate their action considerably. Another good stimulant is the hot-bath. Sometimes high temperatures fail to cause sweating and the body temperature rises to that of a fever, in some cases causing death.

Diaphoretics all act in various ways: (1) by relaxing the skin; (2) by reducing the force of the circulation; (3) by entering the circulation and directly stimulating the terminations of the nerves of the sweat-glands. Those which relax the skin are called Nauseant Diaphoretics; those which depress the circulation are the Refrigerant Diaphoretics; those which act directly upon the nerve terminations are Simple Diaphoretics.

Diaphoretics are used for the following indications: (1) To equalize the circulation by causing a flow of blood to the surface, thereby relieving internal congestion, as in a "cold," Muscular Rheumatism, or Suppressed Menstruation. (2) To favor absorption, as in Dropsy, especially renal. (3) To eliminate waste and noxious matter through the skin which are ordinarily eliminated elsewhere, especially by the kidneys. (4) To aid quinine in the cure of Malaria. Many of the Diaphoretics have been already considered. Hot alcohol well diluted is a decided diaphoretic, acting by causing vascular dilatation in the skin, but its effect is transient. The most important Diaphoretic is *Pilocarpus*.

1. **PILOCARPUS.** *JABORANDI*, a Simple Diaphoretic. The leaflets of *Pilocarpus Jaborandi*, a Brazilian tree. The wood is

inert; the bark and leaflets are active, but only the latter are officinal.

Active Principles. The leaflets contain a small amount of a volatile oil, tannin, Pilocarpine, a crystalline and Jaborine, a non-crystalline alkaloid. The two alkaloids are similar in chemical constitution but not in properties. The salts of Pilocarpine crystallize, those of Jaborine do not. Pilocarpine is the principle upon which the drug depends for its activity as a diaphoretic. The hydrochlorid of Pilocarpine is white, crystalline, deliquescent, odorless, with a faint, bitter taste; neutral; very soluble in water and alcohol, insoluble in ether and chloroform.

Physiological Action. Pilocarpus has an action peculiar to itself, not shared by any other drug. An infusion of 40–90 gr. of the leaves or an injection of $\frac{1}{10}$ gr. of the alkaloid salts produces in a few minutes flushing of the face and neck, followed by moistness of the skin and free perspiration and salivation. When the drug is given hypodermically the sweating takes place first at the puncture. The sweating and salivation are profuse, lasting for 3–5 hours, and in addition there is increased secretion from the conjunctiva and nasal and bronchial mucous membranes. Salivation may be so profuse as to prevent talking, and after it has ceased there may exceptionally be painful swelling of the glands. Sometimes it causes nausea and vomiting. Children are proportionately less susceptible than adults and some adults are not susceptible to ordinary doses. The secretion of sweat may be enormous but when salivation is profuse it may be relatively scant. The sweat is at first acid, then neutral, and finally alkaline. Salivation often begins before perspiration and lasts longer, and there is an increase of ptyalin and the salts ordinarily found in the saliva. The urea may also be considerably increased.

The pulse is increased in frequency and sometimes the heart is weakened. Large doses act as a decided cardiac depressant. In moderate doses it has no effect on the Nervous System. Sometimes the pupils are dilated, sometimes contracted. If dilatation occurs it is probably due to Jaborine which acts on the pupil like Atropine. Pilocarpine, the alkaloid, contracts the pupil, and when this is given the pupil contracts. Jaborine has a greater tendency to produce nausea than does pilocarpine. The secretion of the gastric juice is increased, while that of the bile and milk is decreased. Small doses, not large enough to produce perspiration, may increase the secretion of milk. The influence on the temperature is variable. There is a primary rise, sometimes lacking, followed by a fall which is constant when the drug acts well, due to loss of heat by evaporation of the perspiration. Its effect upon

the kidneys varies with the dose. If the sweating is profuse, the urine is scanty; if the dose is very small and the sweating slight, the urine is increased. The active principle is eliminated as such by the urine, and does not appear at all in the saliva. Sometimes it stimulates the growth of hair, but renders it coarse and dark. When its action ceases the patient is exhausted in proportion to the amount of action.

Therapeutics. It is the most reliable and powerful diaphoretic known. In Renal Dropsy it is very useful and in Uraemia it wards off the coma and convulsions by eliminating the poisons and urea through the skin. In Chronic Bright's Disease it prolongs life, and in the Acute it decreases inflammation and pressure. In Cardiac Dropsy it is efficient but it is too depressant to the heart. In ordinary Oedema it is beneficial. It has been highly recommended to facilitate the removal of effusions as in Pleurisy, etc., but other drugs are better. In less than diaphoretic doses it is used to stimulate the secretion of milk. It can hardly be used for its antipyretic action, and in Typhoid Fever it is probably injurious. Pilocarpine is the physiological antagonist of Atropine and in doses 4-10 times that of atropine is good in Atropine Poisoning, have exactly the same effect on the secretions and circulation.

Contra-Indications and Administration. Pilocarpus is contra-indicated in Fatty Degeneration of the Heart, in impeded Pulmonic circulation from Valvular Diseases, and Emphysoma. Its use is not wholly prohibited, however, but it must be very careful, with Atropine, Alcohol, and Ammonia at hand in case the effect on the circulation should be very bad. The leaves are given as an infusion of 40 gr. or more, or in the form of the Fluid Extract 40 m. or more. The Hydrochlorate of Pilocarpine is better since it is less likely to cause nausea. When given subcutaneously as diaphoretics, the dose is $\frac{1}{10}$ - $\frac{1}{2}$ gr.; by the mouth, $\frac{1}{4}$ - $\frac{1}{2}$ gr. Some cases of collapse, none of them fatal, have occurred. Sometimes local sweating is produced by a poultice, but at other times it may cause prolonged general sweating.

IV. Cathartics.

Cathartics are drugs which promote purgation by increasing peristalsis, or the intestinal secretions, or both together. It is probable that all cathartics increase peristalsis to a greater or less extent, but only a portion of them have this action very markedly. When peristalsis is increased the contents of the intestines are hurried along, and so cannot lose much water by absorption.

When discharged there may seem to be, therefore, an increase of intestinal secretion, though in reality there is none. Increased secretion can be shown only by analysis of the intestinal contents, and by direct experiments upon animals. By placing cathartics in certain loops of the intestines and none in others, it has been found that Magnesium Sulphate causes 4 gr. of secretion to an inch of the loop. The drastic cathartics cause so great an increase as to cause profound depression in a few hours.

Cathartics are divided into 4 groups: (1) Laxatives, drugs which slightly-increase the action of the bowels, rendering the stools more frequent and softer, but not causing purging even in large doses. (2) Simple Purges, drugs which purge actively, but which are not poisonous even in large amounts. (3) Hydrogogues, including Saline Purges, drugs which produce very large watery stools without irritation. (4) Drastics, drugs which cause great irritation of the alimentary mucous membrane, violent purging and increased peristalsis. In over-doses they cause inflammations and symptoms of violent poisoning. These four groups are not separated strictly from each other. Thus though Salines cannot act as Drastics, Drastics in small doses may act as Laxatives. Certain of the Cathartics may be grouped together in Cholagogues, removing bile by purgation. It is doubtful how they act; some increase peristalsis of the duodenum and so prevent absorption of bile, and others, as possibly calomel, may cause an actual increase in the amount of bile produced.

Some cathartics are partly absorbed and are eliminated by other organs, especially the Salines, which, failing to produce catharsis are eliminated by the kidneys. Some few drugs cause catharsis when injected into the circulation, but there is no drug which can be practically so used.

Cathartics are indicated for the following conditions: (1) To unload the bowels in both Acute and Chronic Constipation. The acute form which occurs in pregnancy and convalescence from acute which may be followed by a laxative diet, or laxative or purgative cathartics according to circumstances. The chronic form, which may be due to the influence of heredity, to diminished intestinal secretion, to sluggish peristalsis, to sedentary habits, to lead or other forms of poisoning, and to diseases of the nervous system producing a paralytic state of the intestinal muscular fibres, must always be examined for its cause, and this at once removed, instead of giving drugs habitually; for these lose their power and if abused they will increase the constipation. The best results are obtained by regulating the diet carefully and by insisting upon regularity in going to stool. (2) To remove poisonous substances,

foreign bodies, irritating and indigestible articles of food, etc. (3) To remove fluids in Cardiac or Renal Dropsy, and in other forms of local effusions. For this purpose Hydragogues and especially Elaterium are the best purgatives. Of the Saline Purges which are hydragogues, magnesian sulphate is the best. The sulphates of potassium and sodium are not soluble enough to give solutions sufficiently concentrated to be useful. A saline like magnesian sulphate in sufficient concentration will, however, remove a large amount of water from the blood, thus concentrating it. If too much diluted with water this action may not occur, hence sodic and potassic sulphate are inferior. The concentration of the blood is then diminished within an hour or so by absorption of fluid into the blood from the tissues. (4) To cause local depletion in congestion and obstruction of the portal circulation as well as in Dysentery and other acute intestinal inflammation. Saline purgatives are preferred since they produce very large serous discharges without irritation. (5) In Uraemia to remove the products of Katabolism and the toxic products which should have been eliminated by the kidneys. In Rheumatic Gout they are also good. In administering the Purges remember that purging is a hard way to remove either toxic products or fluids from the body, and that the patient ought to be supported or even stimulated during the process. (6) To remove foreign bodies, as coins, nuts, etc., frequently swallowed by children. Coarse foods, as coarse meal and brown bread, which have a large amount of indigestible matter in them are better than drugs. In obstruction of the colon it is unsafe to try to force a passage by Drastics. Salines are better since they make the stools very watery and thus may soften the obstruction. Then if the obstruction is not removed, the salines are very easily absorbed, and removed by the kidneys.

(A). LAXATIVES.

Among the Laxatives must be mentioned certain articles of food which by the bulk of the undigested residue distend the intestine and so stimulate peristaltic action. Cracked wheat, oat meal, many vegetables, especially those used for greens, as spinach are useful as laxatives. Foods giving little residue as meat, white bread, and milk especially, favor constipation. Fruits favor laxation on account of the large undigested residue left behind, and also on account of the laxative salts of the vegetable acids which many of them contain. Some fruits which contain tannic acid, as blackberries and strawberries, are constipating. Figs act mechanically by the small seeds to increase peristalsis. There are some

substances which seem to possess laxative power of their own, such as molasses and brown-sugar, which cannot possibly act mechanically. Apples and pears act both by their bulky residue and inherent laxative properties.

1, PRUNUM; 2, FICUS; and 3, TAMARINDS. Prunes, figs and tamarinds are officinal in the U. S. Pharmacopoeia. With many prunes form a very efficient laxative given stewed with much juice and a pinch of senna which increases their efficiency without injuring their taste. Figs act mechanically by the seeds which they contain. Tamarinds are no better than prunes as a laxative, but since they contain citric, malic and tartaric acids they are good for making refrigerent acidulous drinks in fever. They enter into an officinal purging preparation of senna.

4. MANNA. Manna is the most feeble of all the laxatives and consists of 40-80 per cent. of a peculiar sugar called manite. Large doses act as a gentle laxative, but they often cause flatulence and pain. Dose: 1-2 dr. It is given for Obstinate Constipation and to bottle-fed babies. It is often given to adults as an adjuvant to more powerful purges, or to cover the taste of drugs. It is an ingredient of the Compound Infusion of Senna.

5. EUONYMUS. WAHOO BARK. A slowly acting laxative, giving moderate results. It has some action on the liver, and increases the flow of bile. It is used in Chronic Constipation with torpid liver.

IRIS, Blue-Flag. Like Euonymus it is a cholagogue as well as cathartic.

6. CASCARA SAGRADA or RHAMNUS PURSHIANUS. CALIFORNIA BUCKTHORN or SACRED BARK. (Officinal 1890.) Containing a bitter brown resin, and several others, a volatile oil, various acids, and a neutral crystalline substance. It is an exceedingly valuable laxative particularly in Chronic Constipation, because it empties the bowel without much intestinal disturbance. At the same time it acts as a tonic to the bowel and prevents the constipation of depression following catharsis. Sometimes when given in large doses it may cause griping pains and irritation of the mucous membrane of the intestines. The fluid extract is given in 10-30 m. doses, generally on retiring, or both on retiring and on rising.

7. SULPHUR. Sulphur in sufficient quantities acts as a mild laxative, causing soft, mushy stools and hydrogen sulphide gas due to the action of the intestinal juices on the sulphur. A certain amount of the gas is taken up into the system and has some alterative effect on nutrition. Sulphur has some alterative action and increases generally the secretions to a slight extent,

acting especially on the skin and mucous membranes. Its alterative effects are manifested in Chronic Rheumatism, Sciatica, Lumbago, and various diseases of the skin, for which it is given internally as sulphur or in sulphur waters. Sulphur is one of the best parasitocides in cases of Itch, rubbed in as an ointment after the skin has been softened by soap and water and rubbed hard to expose the burrows. It is also very useful as a wash with glycerine and rose-water for Acne, especially in young women during menstruation. As a cathartic it is used only as a laxative, never as a purge. It is particularly useful in Chronic Constipation with Hemorrhoids, and often succeeds where other laxatives fail. As a laxative it is given with molasses, or syrup, or honey in 1-3 dr. doses.

3. **MAGNESII CARBONAS, MAGNESIA, and MAGNESIA PONDEROSA.** Light magnesia is made by calcining the light carbonate of magnesia and Magnesia Ponderosa by calcining the dense carbonate, carbonic acid gas and water being driven off. All three substances are officinal, occurring as white powders, odorless, tasteless, soluble in dilute acids, insoluble in water and alcohol. They are all said to be laxatives but they have no real inherent cathartic power. They are all Antacids and are therefore good in Acid Dyspepsia as laxatives, and in Sick Headache due to over-acidity of the stomach. They accumulate in the intestines and may do harm mechanically so they cannot well be used constantly.

Under laxatives Enemate may properly be considered, which like suppositories, soap, etc., stimulate peristalsis by irritating the mucous membrane, or by mechanical distension. The simplest Enema, the least irritating and the least active, is Cold Water, very good in Habitual Constipation, especially with Hemorrhoids, always given at the same hour each morning. Cotton-seed and Olive oils are also good. The most commonly used Enema is that of Soap and Water alone or with a tablespoonful of salt or molasses. Castor-oil is often added, and if it be desired to make it very active, a teaspoonful of Oil of Turpentine.

Large amounts of warm water are forced up into the intestines in Intussusception to distend them and thus unfold the invaginated portion. The patient should rest on his knees and shoulders so that gravity may assist in the administration. Enemata of various sorts are good in Catarrh of the large intestine, in the local treatment of Chronic Dysentery and Acute Colitis, to unload the bowels, to cleanse or remove acid secretions or foreign matters, and as anthelmintics, especially for the removal of *Oxyuris vermicularis*. Quassia is a valuable addition in the removal of seat worms.

(C) PURGES AND HYDROGOGUES.

It is impossible to divide the following drugs accurately into simple purges and hydrogogues, for many of the simple purges are hydrogogues as well. The group of the Purges is therefore rather large, and includes the Saline and Simple Purges.

1. OLEUM RICINI. CASTOR-OIL. A fixed oil, nearly colorless or faintly yellow; expressed from the Castor Beans, the seeds of *Ricinus communis*, which are first warmed to render the oil more fluid. After expression the oil is boiled with water to coagulate the albumen. The seeds contain a rapidly acting fixed principle, causing poisonous symptoms when chewed; and some think that minute quantities of this substance are present in the oil and cause its purging effects. The most important active principle is Ricinoleic Acid, and it is this which doubtless causes catharsis. Castor-oil is soluble in ether and alcohol, has a nauseous taste, causing vomiting in susceptible persons, and acts as a mild purgative. On account of its repulsive taste it is generally given with a vehicle, (1) in emulsion with gum acacia and mint-water, (2) with equal volumes of glycerine and a few drops of oil of cinnamon or wintergreen, or (3) with the froth of porter or lemon-juice, coffee, or floating on ice-water. Dose: $\frac{1}{4}$ –2 dr.

Physiological Action. Castor-oil is a decided purgative, but it is also mild and unirritating. Therapeutic doses produce copious watery discharges. Overdoses sometimes cause vomiting as well as purging. The purging principle is set free in the intestines where the oil is acted upon by the pancreatic juice. Some of it is absorbed, because a nursing infant is purged when the mother takes castor-oil. Castor-oil also has the property of soothing irritated intestines. Its cathartic action is manifested 4–6 hours after ingestion.

Therapeutics. Due to its mild and soothing effects castor-oil is very good when a simple cathartic is desired, or when an acrid, irritating, or foreign substance is to be removed from the intestine, such as seeds, nut-shells, undigested or putrifying food, etc. It is very useful for removing intestinal mucous preparatory to the administration of other drugs; and it is generally given before or just after Anthelmintics. There is more or less evidence that a poultice of the fresh leaves of the plant applied to the breast acts as a galactagogue, if a teaspoonful of a fluid extract is also administered 3 or 4 times per day.

Disadvantages in its use. It is nauseating, and has a tendency to cause hemorrhoids. Frequent use tends to make constipation more obstinate. Its effects may be increased with bicarbonate of

soda. If any griping occurs, as sometimes happens, a few drops of laudanum or tincture of belladonna are useful.

Toxicology. The castor-bean is very poisonous when chewed. The symptoms may come on quickly or be delayed from 4-5 hours. There is severe abdominal pain, violent vomiting and purging, thirst, restlessness, cold sweating of the skin, small rapid pulse and collapse. The dejections may be bloody. Three beans have proved fatal. Post-mortem examination shows intense redness of the stomach and small intestines.

Treatment. Evacuate the stomach by Ipecac. and warm water, give mild cathartics and demulcent drinks and follow out the treatment of gastro-enteritis. If the pain is great give opium.

2. RHEUM. RHUBARB. The root of *Rheum officinale*, containing a crystalline acid called chrysophanic acid, tannic acid, calcic exalate, and certain resins which probably are the active principle. It is given in substance, but may be administered as a powder. Dose: 20 gr.

There are a large number of officinal preparations, as follows:

EXTRACTUM RHEI.

EXTRACTUM RHEI FLUIDUM.

PILULAE RHEI. Each pill contains 3 gr. Dose: 1-3 pills.

PILULAE RHEI COMPOSITAE. These contain rhubarb, aloes, myrrh and oil of peppermint.

SYRUPUS RHEI. Good for children. Dose: 1 dr.

PULVIS RHEI COMPOSITA. Gregory's Powder, containing rhubarb, magnesia and ginger. Dose: $\frac{1}{2}$ -1 dr.

TINCTURA RHEI. Dose: 1-3 dr.

TINCTURA RHEI AROMATICA. Dose: 1-3 dr.

TINCTURA RHEI DULCIS. Dose: 1-3 dr.

VINUM RHEI. Dose: 1-3 dr.

SYRUPUS RHEI AROMATICUM. For children. Dose: 1 dr.

Physiological Action and Therapeutics. Rhubarb is an active purgative and to some extent a stomachic and tonic. After purging there is a decided tendency to constipation due to its astringent qualities. It does not purge excessively, and improves the appetite and digestion. The drug is undoubtedly absorbed in part, and the chrysophanic acid gives a yellow color to the sweat and milk and turns the urine yellowish-brown. It is largely used in Chronic Constipation on account of its efficiency and its beneficial influence on the appetite and digestion. It is very good for children, for its astringency prevents diarrhoea common with other cathartics in childhood. It is the most useful cathartic for removing acrid intestinal secretions, and for simple catharsis in intestinal weakness of debilitated people. In the Summer Diarrhoea of children

where the stools are greenish and contain much mucous, it is efficient. It is also a favorite prescription for children with white pasty stool. In Chronic Constipation small pieces of the drug may be chewed or eaten daily. The officinal preparations are unnecessarily numerous. Among the best is the compound pill, but for children the aromatic syrup is better given in 1 dr. doses.

3. ALOE. ALOES. Inspissated juice of the leaves of Aloe Socatrina. From this, Aloe Purificata is prepared by dissolving in alcohol and evaporating to dryness, or by melting it and treating with alcohol, straining and evaporating. It is soluble in alcohol, and in 4 parts of boiling water, making an extract of a dark color and bitter nauseating taste. It contains a volatile oil, a resin, and a crystalline active principle called Aloin, which is yellowish, odorless, neutral, sweetish, with a bitter after-taste. There are three sources of Aloin: Socatrine Aloes, Barbadoes Aloes and Cape Aloes. The first two are officinal.

There is a long list of officinal preparations, as follows:—

ALOE PURIFICATA. Already mentioned.

EXTRACTUM ALOES AQUOSUM. This does not keep well, and is unimportant.

TINCTURA ALOES. Dose: 1–2 dr.

TINCTURA ALOES ET MYRRHAE. Dose: 1–2 dr.

PILULAE ALOES. Each pill contains 2 gr. of soap and 2 gr. of Aloes. Dose: 1–4 pills.

PILULAE ALOES ET MYRRHAE.

PILULAE ALOES ET ASAFOETIDAE. Contains 3 gr. each of aloes and asofoetidae. Used in constipation of flatulence.

PILULAE ALOES ET FERRI. 1 gr. each of aloes, dried sulphate of iron, and aromatic powder used in habitual constipation with anaemia. Dose: 1–3 pills.

PILULAE ALOES ET MASTICHES. Lady Webster's Pills, containing 2 gr. of aloes and $\frac{1}{4}$ gr. each of mastic and red-rose. Dose: 1–3 pills.

Physiological Action and Therapeutics. Aloes is a stimulating cathartic acting with extreme slowness. Its principle influence is upon the large intestine, and over-doses cause irritation of the rectum. It has no effect on the flow of bile but increases the menstrual flow. It is partially absorbed in the system and aloin can be detected in the milk and urine. Large doses of 10–20 gr. give watery stools; small doses, 2–3 gr. give mushy stools. It is very useful as occasional cathartic, but if used constantly it causes an atonic condition of the bowels. On account of its action on the large intestine it is good in habitual constipation and sluggish bowels particularly combined with Strychnine and Belladonna in

the A. S. and B. pills or with iron. Aloes is often given with iron or for a tonic action, to promote the absorption of iron by stimulating the liver, and to prevent the constipation ordinarily caused by iron. Aloes cannot be given to pregnant women, for it may cause abortion due to its effect on the pelvic organs. Aloes is not commonly used also as it causes griping. As a purgative it is given in 10–20 gr. doses; as a laxative, in 3–5 gr. doses.

4. SENNA. The leaflets of a number of shrubs of the genus *Cassia*. The commercial varieties are the Alexandrian, the Indian, the Mecca, and the Tripoli Senna. They are active cathartics, bitter and nauseating. The active principles are not well understood; the most important is cathartic acid. Small doses are safe, and do not cause inflammation nor hypercatharsis, but in large doses senna is a very powerful cathartic producing watery discharges. It is particularly valuable in the constipation of pregnancy, and since it causes griping pains and nausea, it is best given with some aromatic or saline as a corrective. The most agreeable preparation is the *EXTRACTUM SENNAE FLUIDUM* in 1–4 dr. doses. The *INFUSUM SENNAE COMPOSITUM*, called Black Draught, contains epsom salts, manna, senna, and fennel given in 4 oz. doses. The *CONFECTIO SENNAE* is a mild laxative, containing Senna, Tamarinds, Prunes, Coriander, Figs and Sugar, and is highly recommended during pregnancy. There is also an unimportant Syrup. The *PULVIS GLYCYRRHIZAE COMPOSITUS*, or Compound Liquorice Powder, or German Powder, contains senna, licorice, washed sulphur, oil of fennel and sugar; and is an efficient cathartic in doses of 3 gr.–1 dr. Senna is a constituent of Compound Syrup of Sarsaparilla.

5. MAGNESII SULPHAS. EPSOM SALT. Occurring as small colorless crystals, slightly efflorescent in dry air, containing 50 per cent. of water of crystallization; odorless, neutral; of a bitter, saline, and to some people nauseous taste; soluble in water, insoluble in alcohol. It is one of the most active of the Hydrogogues, causing copious fluid discharges without irritation but with a feeling of cold or depression. Very large doses have been fatal by causing hypercatharsis.

Therapeutics. On account of its lack of irritating properties it is very useful when in inflammation it is desirable to replete through the bowels, and in Colitis and Enteritis. No other cathartic causes so little irritation. It is useful in Faecal Accumulations since it brings down much fluid, and when the accumulation is due to an organic cause it is especially good. Should it fail to remove the accumulation it does no harm, for it is simply absorbed into the system and eliminated by the kidneys. Author-

ities differ as to the best method of administration, some preferring it dilute, some concentrated. If it is too concentrated, however, it may prove fatal, whereas if it is diluted it cannot be dangerous. The dose is $\frac{1}{2}$ oz. Magnesian Sulphate is an ingredient of Hunyadi, Janos, Seidlitz, Pullna, and Kissingen waters.

6. MAGNESII CITRAS. From Magnesian Citrate two preparations are made:—(1) MAGNESII CITRAS EFFERVESCENS. A white, coarse, granular, deliquescent salt, with a mild acid taste and acid reaction; odorless; soluble in water with effervescence, insoluble in alcohol; containing magnesian carbonate, an excess of citric acid, and bicarbonate of sodium. (2) LIQUOR MAGNESII CITRATIS. The above is solution. Both are given in 2–8 dr. doses in 2–12 oz. of water. They are similar in action to magnesian sulphate, but are less efficient and may cause irritation and griping. They are contra-indicated in inflammation of the bowels.

* 7. SODII SULPHAS. GLAUBER'S SALTS. Harsh, and one of the most irritating of the Saline Purgers, causing large watery stools and much griping pain. It is a constituent of many mineral waters associated with Magnesian sulphate. Since this latter is very mild compared with sodic sulphate, Glauber's salts has gone out of use.

8. SODII PHOSPHAS. SODIC PHOSPHATE. Occurring as large colorless crystals, efflorescent; with a salty, cooling taste and slightly acid reaction; quite soluble in water, not in alcohol. It is a constituent of Vichy Water. It is a mild cathartic, especially useful in Bilious attacks, Jaundice from catarrh of the bile-ducts. Small doses regulate the bowels of young children with whitish stools, and it is given in 10 gr. doses in milk. The dose for adults is 1–8 dr.

9. POTASSII ET SODII TARTRAS. ROCHELLE SALTS. Occurring as colorless crystals slightly efflorescent, or as a white powder with a slight saline taste and neutral reaction; very soluble in water, not in alcohol; made by adding a solution of sodic carbonate to one of cream of tartar, and evaporating to dryness. Given in $\frac{1}{2}$ –2 oz. doses well diluted in water. Its chief use is making the PULVIS EFFERVESCENS COMPOSITUS, or Seidlitz Powder. This comes in two powders, one containing 40 gr. of sodic bicarbonate with 120 gr. of Rochelle Salts, the other containing 35 gr. of Tartaric Acid. They are dissolved separately, mixed, and swallowed while effervescing. They are best given on an empty stomach. Seidlitz Powder is rather a laxative; it can scarcely be called a purgative. Much used after blue mass.

(D) DRASTICS.

Drastics are those vegetable cathartics which are actively irritant, and with one or two exceptions they cause fatal gastro-enteritis in large amounts. In combination with one another they are less irritant than when given alone. They are to be used when revulsive action is desired as in some cases of brain disease, but are contra-indicated when there is gastro-intestinal irritation or inflammation. Many of them are ingredients of the various cathartic pills and drugs on the market, as Carter's Liver Pills which contain Podophyllum with Aloes; Holmes' which contain Colocynth and Aloes; Ayer's Sarsaparilla, containing Podophyllum, etc.

1. **PODOPHYLLUM.** MAY-APPLE or MANDRAKE. The rhizome and rootlets of Podophyllum peltatum, a perennial herb of the Northern and Middle States, with a bitter, acrid, and nauseous taste.

Active Principles. It contains the alkaloid Berberine, found also in a number of other drugs, and a compound resin, Podophyllia, consisting of a number of substances, and containing the purgative principle. Small doses act as a laxative; large doses act as a powerful purge or drastic according to the size of the dose. Very large doses act as a distinct poison causing gastro-enteritis which may be fatal. It is the slowest in action of all the drastics. It has decided chologogue properties and is used in the so-called "Bilious Attacks." In Chronic Diarrhoea it may cure when other drugs fail, and is very good in the watery diarrhoea of children. It is given usually the resin, podophyllin, in doses of $\frac{1}{16}$ gr. as a laxative, and $\frac{1}{2}$ –1 gr. as a purge. Of Podophyllum itself the dose is 1 gr. as a laxative and 10–20 gr. as a purge. There is an official extract and fluid extract.

2. **ELATERIUM.** Non-official. This is a substance deposited by the juice of the fruit of Momordica Elaterium or squirting cucumber. The fruit is small and ovate, containing an elastic sack which holds the seeds. As these ripen the sack becomes so distended with juice that it bursts at the stem end as it falls off the vine. The medicinal properties are contained in this juice, which is collected and evaporated. Elaterium comes into the market as light greenish-grey cakes, with an acrid, bitter taste and no odor. Only the active principle Elaterin is recognized by the U. S. Pharmacopoeia, owing to the variability of the commercial article. The principle Elaterin is a crystalline substance, very bitter and sharp in taste, neutral; insoluble in water, soluble in alcohol.

Physiological Action and Therapeutics. Locally, Elaterin is a distinct irritant to the mucous membrane and even to the skin, causing ulcers on the hands of those who prepare it. It is a most efficient and powerful hydrogogue cathartic, causing large watery stools without much pain or irritation. In Uraemia and General Dropsy, and in the treatment of Pericarditis, and Pleuritic Effusions it is very efficient. It is contra-indicated in marked exhaustion, or irritation and inflammation of the alimentary canal, and salines should be given instead. When using it remember that it is very exhausting, and support the patient by alcoholic stimulants and nutritious foods. It must not be given to debilitated patients. Do not give in large doses nor subcutaneously on account of local irritation. Dose: $\frac{1}{20}$ gr. given in pill form or in alcoholic solution.

3. JALAPA. JALAP, the tuberous root of *Ipomoea Jalapa*, a Mexican vine. The active principle is a resin, convolvulin, insoluble in ether, and another resin soluble in ether. Jalap comes into the market in two forms, undivided younger roots, and the older roots sliced up. Old worm-eaten roots are the best for they contain the most resin. It is commonly given as the PULVIS JALAPAE COMPOSITUS, 35 parts of Jalap to 65 of cream tartar, in $\frac{1}{2}$ –1 dr. doses. The officinal resin of Jalap is tasteless and easily administered to children alone or with the aromatic syrup of rhubarb in 2–6 gr. doses. Jalap is also a constituent of the Compound Cathartic Pill.

4. COLOCYNTHIS. COLOCYNTH. The fruit deprived of its rind of *Citaulus Colocynthis*, or bitter cucumber, a vine growing in Africa, Western Asia, and Japan. The fruit is a gourd 2–4 inches in diameter, whitish or pale yellow, and intensely bitter. The active principle is a crystalline glucoside, Colocynthin. Large doses of Colocynth cause copious watery discharges and symptoms of gastro-intestinal inflammation and poisoning. Fatal results have followed from $1\frac{1}{2}$ dr. of the powder and 1 dr. of a decoction. It is contra-indicated in gastro-intestinal inflammation. Like other Drastics it is used more often in combination with other drugs than alone. It is given usually as the EXTRACTUM COLOCYNTHIS COMPOSITUM, which contains aloes, colocynth, cardamon, resin of scammony, soap and alcohol. It is a constituent of Comp. Cath. Pills. Dose: 5–20 gr.

* 5. SCAMMONIUM. SCAMMONY. A resinous exudation from the living root of *Convolvulus Scammonia*, a Syrian vine. It is dark green inclining to black, with a slightly acrid taste, and a peculiar odor. The active principle is a resin present to the extent of 8–9 per cent., the former U. S. Pharmacopoeia demanding

a strength of at least 75 per cent. The resin is officinal given in 2-10 gr. doses rubbed up in pills.

* 6. GAMBOGIA. GAMBOGE. A gum-resin from an E. Indian tree; hard, brittle and orange in the piece, bright yellow when powdered with little or no taste, but when chewed for some time produces an acrid sensation. It is insoluble in water, but forms with it an intensely yellow emulsion. Gamboge contains 72 per cent. of an active resin called Gambogic Acid. It is a constituent of the PILULAE CATHARTICAE COMPOSITAE which is made up as follows: Gamboge $\frac{1}{4}$ gr., Jalap 1 gr., Calomel 1 gr., compound extract of Colocynth $1\frac{1}{3}$ gr., this latter containing other cathartics as aloes, scammony, cardamon, and soap. Dose: 1-3 pills.

Physiological Action and Therapeutics of Jalapa, Colocynthis, Scammonium and Gambogia. Not one of these drugs is commonly used by itself. Jalap and Scammony act much alike, but Scammony is more irritating and causes severer griping. Gamboge is the most irritating of the four. They are all active drastics, and cause copious watery stools. Gamboge is rarely used alone, though it is given in 1-5 gr. doses in pills with soap in very obstinate Constipation. Ordinarily it is used to assist other cathartics and as a constituent of the compound cathartic pill. It is less efficient than the others. Colocynth is less irritating than Gamboge, and is given to increase the action of the other purges or in small amounts with laxatives in obstinate constipation. The Compound Extract of Colocynth is useful in Dropsy and generally in Serous Effusions. Jalap is very valuable in Dropsy of any sort, and for the revulsion in Cerebral Congestion. Sometimes its action is accompanied by nausea and violent vomiting. The compound powder is a favorite in Ascitis and various Dropsies. Jalap is often given with calomel. The Compound Cathartic Pill is a very efficient laxative, causing watery discharges. It is used when it is desirable to empty the bowels or to deplete the portal circulation. All of these drugs are contra-indicated in inflammations of the mucous membranes of the alimentary canal.

* ~~7. BRYONIA.~~ The root of Bryonia alba. An old remedy of great cathartic power. It is irritating to the mucous membranes of the alimentary canal and has caused fatal gastro-enteritis. Moderate doses cause headache in susceptible persons. Bryonia is not commonly used; the dose as a drastic is 10-40 gr. useful in Pleurisy with effusion. It may be of use in atonic condition of the alimentary canal. Dose: 1-4 dr. of the tincture.

* 8. LEPTANDRA. The rhizome and rootlets of Leptandra Virginica. It acts as an irritant to the gastro-intestinal mucous membrane and has a moderate degree of influence on the flow of

the bile. Over-doses cause purging and vomiting. It used to be regarded by some as an excellent substitute for calomel but it has gone out of use now. May be used in the same atonic conditions as the former. The extract is a constituent of *Pilulae Catharticae Vegetabilis*, a new officinal pill.

9. *OLEUM TIGLII*. *CROTON-OIL*. A fixed oil expressed from the seeds of *Croton Tiglium*. It is viscid, pale yellow or shading into dark red or reddish-brown; with a hot acrid taste and acid reaction; having a faint, peculiar odor, insoluble in water, soluble in alcohol and ether. It is a very complex substance, and the active principle is not yet known.

Physiological Action and Therapeutics. Croton-oil is locally an intense irritant to the skin, causing an eruption, at first papular then pustular. It is used as a counter-irritant over tender nerves and over the chest in Bronchitis, well diluted with sweet-oil. The inflammation caused is due to Crotonol, which is not a purgative principle. Taken internally it is a violently acting hydrogogue cathartic causing severe griping. Large doses cause gastro-enteritis which may be fatal. How it acts is not well known, but it must be partly by absorption since purgation follows its external use. A drop of Croton-oil on the tongue purges actively. It is good in Mania or Delirium Tremens when patients refuse to take medicine. It is contra-indicated whenever there is debility, irritation or inflammation of the gastro-intestinal canal. Its chief use is in obstinate constipation from diseases of the nervous system and in Chronic Poisoning as by lead, also in acute Poisoning where rapid catharsis is desired. In Brain diseases and Cerebral Congestion it is very useful as a cathartic to cause revulsion. Dose: 1-2 drops in bread-pills or in emulsion diluted with sweet-oil, or applied to the tongue, in one dr. of alcohol, or on a sugar-pill. A fatal case of poisoning by three drops given to a child is recorded. 1 dr. has been recovered from. The other substances used as purgatives are not sufficiently important to mention.

V. Anthelmintics.

Anthelmintics are drugs which kill or expel worms from the intestines. They are sometimes divided into Vermicides which kill and Vermifuges which expel, causing the worm to loose its hold so that it may be swept out by cathartics. Many drugs not commonly classed as Anthelmintics may be used as such, and sometimes an accidental diagnosis has been made by a cathartic. Such a drug is Calomel, which seems to be particularly obnoxious

to parasites, probably because it causes bilious purging. Ether and chloroform cause worms to loosen their hold, but they cannot be recommended as Anthelmintics. Turpentine with Castor-oil is a vermifuge in large doses but it is not safe. No drug should be used except those which are poisonous to the parasite and harmless to the host. Some drugs attack one parasite, others another.

Therapeutically considered worms are divided into three classes, (1) Tape-Worms, (2) Round-Worms, and (3) Thread-Worms, the latter infesting the large intestine and in some females the vagina, the two former living in the small intestines. These are acted upon by drugs taken by the mouth, but the thread-worms are affected only by rectal injections, assisted by drugs taken through the mouth, such as santonin and calomel given prior to the injection. The bowel should also first be cleansed by soap and water, and 1-2 oz. of the infusion of Quassia in a pint of water be injected. A pad of cloth is pressed against the anus, and the injection is held in for some minutes. Aloes may be used in the same way but it is inferior to Quassia. Carbolic Acid is very efficient but very injurious to the patient, and should never be used.

For expelling Tape and Round Worms certain preparatory stages are necessary. The alimentary canal should be as empty as possible so that the parasite may not be protected against the action of the drug by a mass of food. The Tape-Worm is imbedded in mucous and clings to the intestinal wall by hooklets about the head. It is not sufficient to get out a few yards of the worm; the head must come out too, or the relief is only temporary. In order that the alimentary canal may be empty the patient must fast 12-24 hours before the drug is given, only enough milk being allowed to prevent faintness. Cathartics should be given to aid in emptying the intestines of food and any excess of mucous. If the Anthelmintic be not itself a purge, a brisk cathartic should be given 4-8 hours after the drug; or a purgative dose of calomel may be given simultaneously with it, this being very obnoxious to tape-worms, probably because it increases the flow of the bile. The best time to give an Anthelmintic is early in the morning after one day of fasting.

There are two substances which act on round worms mechanically, not generally used as Anthelmintics, which may be briefly mentioned. Tin Filings and Mucuna or Cowhage. The pods of Cowhage are covered with short stiff hairs which are scraped off and mixed with molasses. A tablespoonful is given in an adult night and morning for three days, followed by a cathartic. These hairs are intensely irritating applied to the skin, causing itching,

inflammation and pustules. They are also very irritant to the intestinal mucous membrane, and are supposed to kill the worm by piercing it.

(A) DRUGS AFFECTING ROUND WORMS.

1. SPIGELIA. PINKROOT. The rhizome and rootlets of *Spigelia Marilandica*, with a faint peculiar odor, a sweetish and slightly bitter taste. It contains a volatile and fixed oil, a resin, a bitter, and various other substances. The active principle is a bitter which is non-crystallizable. It is claimed that the active principle is a volatile alkaloid. The officinal preparation is the fluid extract, given with the fluid extract of senna, in 1-2 dr. doses.

Physiological Action and Therapeutics. *Spigelia* is the most efficient drug of this group, and while causing symptoms of poisoning in overdoses, is safe when used with care. It narcotizes the worm, and requires an active purge to follow it, though it sometimes acts as a purge itself. Over-doses cause delirium and drowsiness, increased frequency of the pulse, dilated pupils, pain in the eyes, flushing and puffing of the face and eyelids. Death is very rare, only two cases being recorded. It may be given alone but it is usually administered with equal amounts of the fluid extract of Senna, or with Aromatics, as Anise or Caraway, especially with children. If it is not given with senna it should be followed by a full dose of castor-oil or magnesian sulphate.

2. CHENOPODIUM. WORMSEED, the fruit of *Chenopodium anthelminticum*, growing in all parts of the United States. The seeds are of the size of a pin-head, with a bitter aromatic, pungent taste, and a peculiar odor. The active principle is an official volatile oil, *Oleum Chenopodii*, given in 5-20 m. doses on sugar, repeated morning and night, and followed by a cathartic. When *Chenopodium* is used, the oil is almost exclusively given, the seeds being very seldom used. It is very efficient against Round-worms and sometimes against Tape-worms.

3. SANTONICA. LEVANT WORMSEED. The unexpanded flowering heads of *Artemesia Contra*, of Asia, with a strong peculiar odor, bitter aromatic taste, containing a volatile oil, a resin, a neutral crystalline principle, Santonin, officinal as *Santoninum* in the U. S. Pharmacopoeia. *Santonica* is generally given in the form of *Santoninum*, which occurs in colorless crystals, turning yellow on exposure to the air, odorless and nearly tasteless; insoluble in water, soluble in alcohol, fixed and volatile oils and alkalis, with which it forms salts. There was a *SODII SANTONINAS* officinal in the last U. S. Pharmacopoeia.

Physiological Action and Therapeutics. Santonin in over-doses causes death with poisonous symptoms, including dizziness, convulsive tremblings leading to convulsions, unconsciousness, pallor of the face, cold sweats, dilated pupils and rapid pulse and respiration, and according to some gastro-intestinal irritation. A very curious effect, even of therapeutic doses, is the so-called "yellow vision," which may also be green, red, violet or blue. All objects have the same color, the effect being due to a staining of the humors of the eye. It may persist for days and weeks and may even end in total blindness. Santonin is eliminated by the kidneys more or less altered, and the urine is a yellow orange or purple red according to its acidity or alkalinity. It is said to increase the flow of urine and the elimination of urea.

Besides its use as an anthelmintic Santonin is used in ophthalmic practice for Amaurosis, and also in Incontinency of the Urine in which it may lead to a cure when all else fails. As an anthelmintic it is given in a lozenge made up of the unbroken crystals, and not of the powder, in $\frac{1}{4}$ – $\frac{1}{2}$ gr. doses for children, and 2–4 gr. for adults. Do not repeat the dose before 8 hours, for its action is very slow. It is not a very safe remedy for children, and should be used very cautiously. If it is not combined with a cathartic or with calomel, it should be followed by a cathartic and preceded by calomel. The sodic salt is readily absorbed owing to its solubility, so that it is both useless and dangerous as an anthelmintic, for the object is to bring the drug into contact with the worm. It is more useful in Ophthalmology and for Incontinency of Urine. The officinal troche contains $\frac{1}{2}$ gr.

* 4. AZEDARACH. (Officinal 1880, Non-officinal 1890.) The bark of the root of *Melia Azedarach*. The active principle is a yellowish-white resin with a bitter nauseous taste, yielding its virtues to boiling water. It is given in the form of a decoction of 2 oz. of the root to $1\frac{1}{2}$ pints of water, boiled down to a pint, in doses of $\frac{1}{2}$ –1 oz. every hour until the bowels are affected, or at longer intervals followed by a purge.

(B) DRUGS AFFECTING TAPE-WORMS.

1. GRANATUM. POMEGRANATE RIND. The bark of the root and the stem of the pomegranate, *Punica Granatum*, of Southern Europe; an efficient remedy against tape-worms. It contains 4 alkaloids of which Pelletierine is the active principle, an oily alkaloid forming crystalline salts with acids. The drug is given in the form of a decoction of the fresh root, 2 oz. to a pint of water, given in 3 doses, one hour apart, before breakfast. The alkaloid Pelletierine in 1–2 gr. doses in capsules is also used. It

In substance 20 to 30 grains

is the most efficient of all the remedies used against Tape-worms. The decoction has a tendency to nauseate and cause vomiting, but this is obviated by using the Syrup of Ginger with it. Over-doses cause dizziness, disordered vision, faintness, numbness, cramps, convulsions and purging.

2. ASPIDIUM. MALE FERN. The rhizome of *Aspidium Filixmas* of Europe. The active principle is an oleoresin, a dark thick fluid, with a bitter, nauseous and slightly acid taste. It is given as the oleoresin in capsules or in emulsions with gum tragacanth. Dose, to adults, $\frac{1}{2}$ –1 dr. followed by an active cathartic in 3 or 4 hours. The dose may be repeated at intervals till the head of the tape-worm comes away. It is very effective against tape-worms, being second to Granatum. Over-doses act as a violent poison, producing excessive gastro-intestinal irritation, general weakness, dizziness, stupor deepening into coma, cramps, and disordered vision.

* 3. CUSSO, 1890; BRAYERA, 1880. The dried flowers and unripe fruit of *Brayera anthelmintica*, with a fragrant odor, acrid and disagreeable taste. The active principle is Koossin, a bitter, acrid resin; and Koosse also contains a volatile oil and tannic acid. Koosin is crystalline, slightly soluble in water, freely in alcohol, present to the extent of 3 per cent. in the commercial Koosse. It is a most efficient and safe remedy against tape-worms. Very large doses cause nausea and some intestinal irritation. It possesses some cathartic power and it is therefore not always necessary to administer a purge with it. It must be used with care in pregnant women for it may cause abortion. It is given as the infusion in 4–6 dr. doses. There is an emulsion made with Koosse, castor-oil, the yolk of an egg, and a few drops of ether and oil of anise which is less bitter and nauseating. The emulsion is rendered still more effective if ten drops of the oleoresin of *Aspidium* be added. The amount of Koosse in the emulsion should be 20–40 gr.

4. PEPO. PUMPKIN SEEDS. Containing a resin which is the active principle, very harmless and sometimes very efficient. The shells are removed from the seeds which are beaten up with sugar, diluted with milk or water, and are taken in the morning after fasting. Dose: 4 oz. preceded and followed by a dose of castor-oil. The bulky mass may cause nausea.

5. KAMALA. The glands and hairs of the fruit of *Rottlera tinctoria*, containing a volatile oil and a resin which is soluble in alcohol, ether and alkalies, called Rottlerin, non-official. In full doses it is an active purgative and even a drastic. It may cause nausea and vomiting. It is very efficient against tape-worms

given in 1-2 dr. doses of the powder or the syrup, repeating in 8-10 hours if it does not purge. It yields its virtues to alcohol and so can be given as a tincture.

IV. DIURETICS.

Diuretics are drugs used to increase the flow of urine, or affect the urinary tract by action on the mucous membrane. The function of the kidneys is to remove waste products and any excess of water from the system. The amount of urine excreted depends on the difference in pressure between the capillaries of the glomeruli and the renal tubules, also upon the composition of the blood, and lastly upon the amount of blood sent through the kidneys, this being controlled by the arterial pressure. Arterial pressure may be raised generally or locally and thus more urine must necessarily be excreted. Arterial tension may be increased generally by stimulating the heart action, by causing a contraction of the blood vessels, by stimulating the nervous system or by administering certain drugs. Other factors affecting the secretion of urine are first the amount of fluid to be secreted, and secondly the local action of the solid substances excreted upon the kidneys. The amount of fluid to be excreted is influenced by secretion by the skin, lungs and bowels. Free catharsis and perspiration diminish it. If sweating be checked by cold the urine is increased. From this there is one practical inference; purging and sweating are to be avoided when diuresis is desired, and the patient should be covered lightly. It is aided by drinking water freely, and when the urine is concentrated this should be insisted upon.

Some diuretics act by directly stimulating the secreting tissue, others by removing the obstacle to secretion. In cases where the kidneys are extremely congested as in cardiac disease, or where the secreting tissue is all gone as in Bright's Disease, diuretics of course fail to act.

The chief indications for the use of diuretics are as follows:

1. To evacuate fluid from the tissues and serous cavities as in Dropsy. Their action depends not only upon the choice of the diuretic but also upon the cause of the Dropsy. In Cardiac Dropsy, Digitalis, Squill, and Strophanthus, remove the cause and assist in the absorption of the fluid. In Renal Dropsy and that depending upon the liver, the same drugs, or Scoparius, Juniper, or Sweet Spirits of Nitre are good. In Dropsy not dependent upon renal diseases Copaiba is very good.

2. To remove waste products which are injurious in renal diseases and other conditions, where they have accumulated in the system.

3. To soothe and diminish irritation of the genito-urinary mucous membrane. The diuretics which meet this indication act while they are being eliminated by the kidneys.

To maintain the action of the kidney, especially when the decrease of urine is functional. Usually only the very mild diuretics are used, and when there is Acute or Chronic Inflammation of the Kidney, irritating diuretics are to be avoided. In fevers water should be given very freely, alkaline diuretics and Sweet Spirits of Nitre may be given.

5. To diminish the acidity of the urine, and so lessen irritation, and also to prevent the deposition of calculi by affecting the reaction of the urine.

Diuretics are divisible into three groups, (1) Hydrogogues, increasing the flow of water from the kidneys, used chiefly to relieve dropsy; (2) Refrigerants, exerting a marked sedative effect on the kidneys, modifying the secretion in various ways, making it less irritating, but not increasing to any extent the quantity of water; (3) Alteratives, not necessarily increasing the flow of urine, but acting locally on the mucous membrane of the urinary tract.

(A) HYDROGOGUE DIURETICS.

1. SCILLA. SQUILL. The bulb of *Scilla maritima*, a plant of Southern Europe, growing especially along the shores of the Mediterranean. There are two kinds, the white and the red, of the same medicinal value. Squill contains a viscid acrid juice. In substance it has a faint odor, and a bitter nauseous and acrid taste. It contains two active principles, one of which is an acrid poisonous resin, Scillitoxin, and a bitter, soluble in water, called Scillin. There are a number of officinal preparations. The Vinegar and the Syrup of Squill are given in $\frac{1}{2}$ –1 dr. doses; the Tincture in 5 m.– $\frac{1}{2}$ dr. doses. There is also a fluid extract. There is one preparation deserving mention, the SYRUPUS SCILLAE COMPOSITUS, known as Hive Syrup, containing Squills, senega, tartar emetic, calcic phosphate, water, and sugar, given in 5 m.–1 dr. doses.

Physiological Action. In small repeated doses Squills is a diuretic and expectorant. It increases the flow of urine and stimulates the kidneys by virtue of its active principle, which is absorbed. External application will produce diuresis. Over-doses lessen the secretion of urine or even suppress it, causing bloody urine and all the symptoms of Acute Nephritis, together with vio-

lent purging and vomiting, dulness, stupor, and marked slowing of the pulse. There may be collapse and convulsions terminating fatally; 24 gr. has caused death. If an overdose has been given, the alimentary canal should be emptied by emetics as Ipecacuanha and cathartics as castor-oil. Opium should be given to relieve the gastro-enteritis. Large amounts of water may be given to prevent any injurious effect upon the kidneys. In the stage of collapse, Alcohol may be used, but care must be taken on account of the danger of increasing the gastro-intestinal irritation.

Therapeutics. Squill is very efficient given with Digitalis in Cardiac Dropsy, and with Calomel to aid in absorbing effusions in Pericarditis and Pleurisy. It has been recommended in very chronic Bright's Disease to stimulate the kidneys, but in all ordinary cases it should not be given, and never in Acute Nephritis, Inflammation of the Bladder, or in irritation of the kidneys.

~~2. SCOPARIUS.~~ BROOM. The dried tops of Cystisus Scoparius or common broom-plant; growing wild in Europe, cultivated in the United States; containing an active alkaloid, Sparteina, already considered under Cardiac stimulants, and a neutral, crystalline alkaloid, Scoparin, with diuretic and purgative properties. The ordinary dose is a decoction of $\frac{1}{2}$ oz. to a pint of water boiled down to $\frac{1}{2}$ pint, given in divided doses of 1 oz. every three hours. In action it is a hydrogogue diuretic, and is good in General Dropsies whether renal or cardiac. Large doses may cause catharsis and vomiting. It is contra-indicated in Acute Diseases of the Kidney.

3. CALOMEL is good with Squill and Digitalis, or alone. The dose is 1 gr. given 2-3 times per day with Opium to prevent catharsis. If no diuresis follows its use within a day discontinue it. All mercurials have more or less diuretic action.

~~4. THEOBROMINA~~ is closely related to Caffeine into which it can be converted, and from it a new remedy, DIURETINA, has been made, this being a salicylate of sodium and theobromine. It is absorbed much easier than Theobromine, and may be given in doses of $1\frac{1}{2}$ dr. in 24 hours, or 6 grams.

5. SPIRITUS AETHERIS NITROSI. SWEET SPIRITS OF NITRE. An alcoholic solution of ethyl nitrate, containing 5 per cent. of the ether and made by distilling 7 parts of sulphuric acid with 31 of alcohol and 9 of nitric acid at a temperature not exceeding 80° C. Wash with distilled water and mix with 19 parts by weight of alcohol. The product is a clear, straw-yellow fluid, increasing in color to green; with a fragrant, ethereal odor, and a sharp burning taste. As a Diaphoretic it has already been considered, given in 20-30 m. doses. As a diuretic it is used in $\frac{1}{2}$ -4

dr. doses to increase the amount of urine, and for slight febrile symptoms.

(B) REFRIGERANT DIURETICS.

The neutral salts of the alkalies and alkaline earths which have no other medicinal effects, e. g. catharsis, act as diuretics. The salts of magnesium and sodium act preferably on the bowels, but those of lithium and potassium effect the kidneys. The potassic salts increase the oxidation in the system, and in large amounts produce anaemia with excessive fluidity of the blood.

1. POTASSII BITARTRAS. CREAM TARTAR. The most diuretic of the potassic salts, occurring as a colorless or slightly opaque crystalline powder, with an acid taste and reaction; soluble in 200 parts of cold water and 15 of boiling. It is one of the constituents of the Compound Jalap Powder where it has a cathartic action. It is good with Juniper in Chronic Nephritis and in Acute Nephritis without it. In Chronic Bright's Disease it is given in daily doses of an oz. with Juniper or Gin. Doses of $\frac{1}{2}$ –1 oz. will produce watery catharsis if given all at once. As to its action on the kidneys and urine authorities differ. Most say that it renders the urine alkaline, but others declare that if it is originally alkaline the drug renders it clear and acid. It is used as a drink in saturated solution in some cases of Rheumatism. It is not very soluble in water (1–200), so an excess of it is put in a pitcher of water, and thus the supernatant fluid is kept saturated.

2. POTASSII CITRAS. A white deliquescent, odorless salt, with cooling alkaline taste, neutral or faintly alkaline reaction; soluble in water, slightly in alcohol. There is an officinal Liquor Potassii Citratis, made by the action of the acid on Potassic Bicarbonate, given in $\frac{1}{2}$ oz. doses hourly; and also a Mistura Potassii Citratis consisting of fresh lemon-juice neutralized by bicarbonate of potash and used instead of the former in the same dose. Both of these preparations are also used as Diaphoretics in sthenic fevers. The Citrate is the most palatable of the potassic salts except the Bitartrate. It is an antacid and also has a light diuretic and diaphoretic action. It is used as an alkaline diuretic in Incontinency of the Urine due to acidity or concentration of the Urine, given in 20 gr. doses every 4 hours. It is also given in the same dose with Ipecac. in the early stages of Bronchitis. The carbonate and bicarbonate, to be considered in another group, have equal value therapeutically, but the latter is less irritating. It has a nauseous taste and is therefore inferior in practical value to the Citrate and Bitartrate.

3. POTASSII ACETAS. A white, crystalline mass or granular powder; odorless, very deliquescent, soluble in water and alcohol; with a warm saline taste and neutral or faintly alkaline reaction. It has less disturbing influence on the stomach than the carbonates of potassium. It is decomposed in the intestines or the blood and eliminated as the bicarbonate, thus making the urine alkaline. It was formerly used in the alkaline treatment of Rheumatism which before the discovery of the value of Salicylic Acid was regarded as the best form of treatment. It is used in doses of 1-2 oz. per day with opium to allay any pain. In some cases it is combined with potassic iodide, especially in subacute cases.

The potassic salts are of great service in promoting the flow of bile in functional inactivity of the liver, as "chronic biliousness"; also in Chronic Malarial Poisoning, and Catarrhal Jaundice. They are also useful in preventing the formation and deposition of uric acid. They are best given with lemon-juice, since they are unpalatable.

4. POTASSII NITRAS. NITRE or SALT-PETRE. A colorless, transparent, crystalline solid, with a sharp saline taste; very soluble in water, not in alcohol. The Charta Potassii Nitratis is officinal, made by dipping white unsized paper into a 20 per cent. solution of the salt, and drying. They are burned in spasmodic asthma during the paroxysm and the patient inhales the fumes.

Physiological Action. Potassic nitrate is a powerful irritant to mucous membranes and abraded surfaces and in large doses it is a poison. Taken internally in over-doses it causes within a few minutes intense burning pain, vomiting and perhaps purging. The vomitus and dejections may be bloody. There is great muscular weakness and collapse. Death may come very suddenly due to paralysis of the heart.

Therapeutics. In medicinal doses nitre acts as a diuretic but it is more irritating than the vegetable salts and also inferior in value. It is therefore little used; when it is used 1 oz. is given in a pint of barley-water in 24 hours.

5. POTASSII CHLORAS. A crystalline solid, transparent, colorless or white, odorless, permanent in air, with a cooling taste, and neutral reaction; soluble in $16\frac{1}{2}$ parts of water and slightly so in alcohol. There is an officinal 5 gr. troche. Like the nitrate it is a powerful irritant to mucous membranes and abraded surfaces. It is very poisonous, more so than the nitrate, standing next to the cyanide of potassium. It has an entirely different physical action. In over-doses it causes violent vomiting and

purgation, great dyspnoea, marked cardiac depression and cyanosis. The blood is made to assume a chocolate color due to the formation of methaemoglobin. The kidneys are irritated and there may be pronounced acute nephritis. Many deaths have occurred from a little over $\frac{1}{2}$ oz. Among the post-mortem appearances may be mentioned gastro-intestinal inflammation, enlargement of the kidneys, liver, and spleen, these organs being filled with broken-down blood. The blood is chocolate colored.

Small doses produce no marked effects, acting very similarly to the nitrate. It is eliminated unchanged by the urine and saliva and never gives up its oxygen in the body. On account of a belief that it does it has been used in Septic Diseases, as Scarlet Fever, Diphtheria, Syphilis and Scurvy to improve the blood, but for this purpose it has no value. Although it is a diuretic it is not used as such, for the vegetable salts are better and less dangerous. In medicine it is used only locally in Follicular Stomatitis and Stomatitis accompanying the use of mercurials, as a mouth-wash or in powdered form with sugar. As a rectal injection in Dysentery and Cholera Infantum, it is useful; and with a few drops of laudanum in Hemorrhoids. As an injection it should not be applied longer than 20 minutes. It is also used as a gargle either alone or with myrrh or sumach berries in ordinary Sore-throat. It is best to add a little hydrochloric acid with it to liberate the chlorine.

6. LITHII CARBONAS. A white powder with an alkaline taste and reaction, soluble in 80 parts of cold water, less soluble in hot water. More soluble in water saturated with CO_2 , insoluble in alcohol. The Carbonate and Citrate of Lithium, next to be considered, are both powerful Diuretics with special relation to Uric Acid, forming soluble Urates when uric acid has been deposited in the system as in Gout and Rheumatoid Arthritis. They are then eliminated by the kidney. Both of these salts render the urine alkaline. Dose of the carbonate, 2-10 gr. in solution or as a wafer preceded and followed by water. The Carbonate of Lithium does not do all that is advertised. The so-called Lithia waters commonly contain no Lithium. Their effect on the patient is due to the imagination. In giving Lithia, therefore, prescribe the salt itself and not any Lithia water.

7. LITHII CITRAS. A white, deliquescent powder with a feebly alkaline taste and reaction, quite soluble in water; used in the same cases as the carbonate in 15 gr. doses. It is a powerful diuretic. Since it is rather soluble it will sometimes upset the stomach and cause vomiting.

(C) ALTERATIVE DIURETICS.

1. JUNIPERUS. JUNIPER. (Officinal 1880. Non-officinal 1890.) The berries of common Juniper, round, bluish, as large as a pea; containing a volatile oil which is the active principle called Oleum Juniper, and officinal. It is this which gives the flavor to gin, and imparts the odor of violets to the urine. It may be given instead of the berries in 2-20 m. doses. If the doses be too large they irritate the kidneys and even suppress the urine. Of the preparations there is a SPIRITUS JUNIPERI, 5 parts of the oil to 95 of alcohol, given in 1 dr. doses. The SPIRITUS JUNIPERI COMPOSITUS is very similar to gin, containing 8 parts of the Oil of Juniper, 1 part each of the Oil of Fennel and Caraway, 1400 parts of alcohol made up to 2000 by the addition of water. The dose is regulated as the dose of gin. Juniper can also be given in the form of an infusion of 1 oz. of the berries to a pint of water, taken in 24 hours.

Physiological Action and Therapeutics. Juniper is a decided stimulant to the kidneys. When its oil is administered too freely it causes irritation of the kidneys, diminished secretion and even suppression of the urine. The oil is excreted by the kidneys. Juniper is a very common diuretic. It is used most commonly to assist Potassic Bitartrate and other potassic salts. Since it exerts a gentle stimulating action on the stomach and intestines it makes the potassic salts more acceptable, and at the same time aids them by its own diuretic qualities. Sometimes it is used to stimulate the secreting surface of the kidney after Acute Bright's Disease, and to stimulate the kidneys of old persons with inactive kidneys who complain of weight across the lumbar region. Juniper is useful in Renal and Cardiac Dropsy as an adjuvant to other diuretics, and also in Chronic Pyelitis and Chronic Cystitis.

2. OLEUM TEREBINTHINAE. OIL OF TURPENTINE. A volatile oil distilled from turpentine which is an oleoresin; the residue is known as "resin." The oil is a thin, colorless, inflammable liquid with a characteristic odor and taste; neutral or faintly acid in reaction. In contact with a mixture of sulphuric and nitric acid and sulphuric acid, it takes fire. It is soluble in alcohol; almost insoluble in water. It is a local irritant, and used as such in the LINIMENTUM TEREBINTHINAE, and the TURPENTINE STUPE made by dipping a piece of flannel of the required size in hot water, wringing dry, and dipping next into warm turpentine, and again wringing out. It must not be applied longer than $\frac{1}{4}$ to $\frac{1}{2}$ hour, for it is a powerful irritant to any surface. OLEUM TEREBINTHINAE RECTIFICATUM (1890) is the form used in internal

administration. It is the ordinary oil distilled after treating with lime-water. It is neutral in reaction. Canada turpentine will be considered in another group. Dose, internally : 5-20 m. with gum arabic and water as an emulsion.

Physiological Action. Medicinal doses taken by the mouth cause a sensation of warmth in the stomach. Large doses cause dizziness, intoxication, increased force and frequency of the pulse and at times accelerated respiration. Large amounts cause vomiting, purging, loss of sensation, and motion. Fatal cases of poisoning are rare. Turpentine is readily absorbed by the lungs and intestines; but not easily by the skin, and is eliminated by the lungs and urine, giving to the latter a not unpleasant odor like violets. The odor of the oil is also perceptible in the breath. The diuretic action of the oil is very decided. Moderate doses given every three hours stimulate the kidney and increase the amount of urine. Larger doses than 10 drops cause unpleasant effects, ranging from aching pains in the loins with frequent micturition, scanty and albuminous urine with urethral spasms. The gastro-intestinal canal may also be irritated.

Therapeutics. As a diuretic Oil of Turpentine is never used simply to increase the quantity of the urine, but it is used wholly for its local effects on the kidney, and with great caution since it is a decided irritant. With the exception of Cantharides it is the most stimulating of the diuretics. It is used in Chronic Cystitis, Gleet and Chronic Pyelitis when a stimulating diuretic is needed. In cases of Excessive Diuresis due to a relaxed condition of the kidney, and in cases of Incontinence of the Urine due to debility of the bladder, turpentine is good. In certain conditions of Spermatorrhoea it is also useful, and in other cases of general debility.

The chief use of Oil of Turpentine is not as a diuretic but as a powerful counter-irritant especially for irritating a large extent of surface over deep-seated inflammations. It may be applied directly to the skin, either pure or mixed with an equal volume of sweet oil, or as the Turpentine Stupe. As an enema of 1 dr. to a pint it is good for the expulsion of flatus. An enema of the oil mixed with olive-oil may be used to arouse the system in stupor due to Narcotic Poisoning. Taken internally by the mouth for local action upon old Gastric Ulcers and Ulcers of the Bowels as in Typhoid Fever it is good, and it also influences the general condition of the system. In Puerperal Fever it is used both internally and externally. Its bad taste may be disguised by glycerine or oil of wintergreen. It is an efficient remedy against Tape-worms given in equal amounts of Castor-oil; but it is dangerous

given in $\frac{1}{2}$ –1 oz. doses. Turpentine is contra-indicated in any inflammation of the gastro-intestinal canal, and in Acute Nephritis.

3. BUCHU. The leaves of *Barosma betulina* and of other species of the genus, natives of South Africa; with a strong aromatic odor and bitter taste, containing a volatile oil and a bitter. Dose of the leaves in powdered form, 15–30 gr. made into an infusion. There is an *EXTRACTUM BUCHU FLUIDUM* given in 1 dr. doses well diluted. Buchu is an alterative diuretic which does not much increase the flow of water, and is therefore not given for Dropsy. It is both an alterative and stimulant to the genito-urinal mucous membrane. The bitter principle serves as a tonic, increasing the appetite and promoting digestion. Its use as a diuretic is confined to chronic disease of the genito-urinary tract where the mucous membrane is depressed as in Chronic Pyelitis and Chronic Cystitis, where the bladder is irritated by the acidity of the urine, and where there is a constant desire to micturate. It is much less stimulating and more soothing than turpentine. It is absorbed into the system and eliminated by the urine to which it imparts an odor.

* 4. PAREIRA. The root of *Chondodendron tomentosum*, a South American plant, containing as its active principle an alkaloid, Pedosine. Dose: 1 dr.

* ~~5. UVA URSI.~~ Already considered under astringents, is a weak astringent diuretic and alterative. It is used only as an astringent in diseases of the genito-urinary mucous membrane. It is given in Chronic Pyelitis and other conditions where only slight stimulation and astringency is required

* 6. CHIMAPHILA. PIPSISSEWA. The dried leaves of *Chimaphila umbellata*, a common wild plant found in abundance in woods in the United States. It contains about 4 per cent. of tannin, a bitter, a volatile oil and a crystalline principle called Chimaphilin.

* 7. OLEUM ERIGERONTIS. A yellow volatile oil, with a pleasant aromatic odor and taste, obtained from the flowering plant, *Erigeron Canadense*.

8. OLEUM SANTALI. SANDAL-WOOD OIL. A pale yellowish, volatile oil, obtained by distillation from the wood of *Santalum album*, with a pungent, spicy and slightly acid taste and reaction, containing Santal oil; insoluble in water, soluble in alcohol. It is a local irritant, and in over-doses causes great irritation of the genito-urinary tract. It is useful in Gonorrhoea after the first acute inflammation has subsided, and in Gleet, to stimulate the depressed mucous membrane. It is also efficient in the advanced stages of Bronchitis and in Chronic Bronchitis. Dose: 10–20 drops given

in a capsule or emulsion. It is less apt to irritate the stomach than Copaiba or Cubebs.

* 9. ZEA. CORN-SILK. Used as a fluid extract. (Officinal). It is a mild stimulating diuretic, without causing much increase in the flow of urine.

10. COPAIBA. COPAIBA BALSAM. An oleoresin obtained from *Copaiba Langsdorffii* and other species of the genus, a large tree growing in tropical South America; it is a yellow or reddish viscid fluid, with a strong odor, and bitter burning taste, containing 40-60 per cent. of a volatile, officinal oil, a soft and also a hard resin. It differs from a true balsam in containing no cinnamic acid. It is soluble in alcohol, ether, fixed and volatile oils. Dose: 10-20 m. given in emulsion with acacia, or in gelatine capsules. The resin and the oil are also somewhat used. There is an officinal *Massa Copaibae* made up with magnesia, containing 94 per cent. of copaiba balsam.

Physiological Action. In therapeutic doses Copaiba causes very decided gastro-intestinal irritation in susceptible persons with fever and increased pulse; but with little effect on the respiration. Ordinarily it has no effect on the general system even in large amounts. In some cases continuous use of the drug may cause dilatation of the stomach, nausea and diarrhoea. The urinary tract may also be irritated and there may be strangury and almost complete suppression of the urine, which is bloody. Large doses cause the urine to yield a precipitate with nitric acid, this being oxidized oil and not albumen, though it greatly resembles it. Elimination is very slow, for it may be found 4 days after ingestion. The urine may also give Trommer's test though there is no sugar present. Copaiba has a stimulating alterative action on other mucous membranes than those of the genito-urinary canal.

Therapeutics. The chief use of Copaiba is in Gonorrhoea after the acute inflammatory stage is passed. In females it has no value. The drug should not be used in the height of the inflammation. If given before this it may abort the attack, but if it fails it will aggravate it. It is given in the later stages to stimulate the depressed mucous membrane. In Chronic Pyelitis, Chronic Cystitis, Chronic Diarrhoea, Chronic Dysentery, and Chronic Bronchitis, with very free muco-purulent excretions, it is of value, due to its stimulating effect on mucous membranes. It is also used in certain skin diseases internally and as a stimulating dressing. The frequent use of small doses produces the best effects. In some cases of persons with very susceptible stomachs it is advantageously combined with cubebs or cubebs and iron. Copaiba

is more stimulating than buchu or pareira, but much less so than Turpentine.

11. CUBEBA. CUBEB. The unripe berries of *Piper Cubeba*, a climbing plant of Java, black, about as large as a small pea; with an aromatic, peculiar taste and smell. The active principle is an oleoresin of which the active portion is a volatile oil combined with an inert resin, and Cubebic Acid. Dose: of the powder, 10–60 gr., or even more, three times per day; best given with a syrup; of the oleoresin, 5–15 m. in emulsion, capsule or on sugar three times per day. The Oil of Cubebs is not a very desirable preparation. There is an officinal tincture, an oleoresin, and a fluid extract of no particular value. The oil does not thoroughly represent the drug.

Physiological Action and Therapeutics. In ordinary doses cubeb causes no marked gastric symptoms, but large amounts cause gastro-intestinal irritation, increased frequency of the pulse, headache, dizziness, with the urine slightly increased in amount and of a peculiar odor. Still larger doses cause more acute gastro-intestinal irritation, nausea, vomiting, purging, burning and colic pains. It may cause an eruption like *Urticaria*, precisely like that caused by *copaiba*, and is probably due to gastric irritation. After large amounts of cubeb have been taken in, the urine may give a precipitate with nitric acid, just as in the case of *copaiba*. *Cubeba* is used in the same class of cases as *copaiba*. It is less efficient but is less likely to cause gastric disturbance. In *Coryza* it may be used as a snuff-powder, and in *Catarrh* of the upper air passages it may be smoked as a cigarette or in a pipe.

12 ACIDUM BENZOICUM. BENZOIC ACID. Occurring as white lustrous scales or needles, permanent in air; with a slight aromatic odor or benzoin, and a warm acid taste; acid reaction; soluble in water (1–500), very soluble in alcohol and ether (1–3). It should be made from benzoin, and not from coal-tar or urine if it is to be officinal. The benzoic acid prepared from the two latter sources has the characteristic odor of benzol due to the small amount of the volatile oil which it contains. Dose: 5–30 gr. in wafers.

SODII BENZOAS. A white efflorescent powder, odorless or faintly smelling of benzoin; with a sweet astringent taste and neutral reaction; very soluble in water, less so in alcohol.

LITHII BENZOAS. A white powder, or occurring in small shining scales, permanent in air, odorless, or with a faint odor of benzoin; with a cooling sweetish taste and acid reaction; very soluble in water, and more soluble in alcohol than the sodic salt.

AMMONII BENZOAS has about the same general description as the two preceeding and is about equal in solubility to the lithium salt.

Physiological Action and Therapeutics of Benzoic Acid and its salts. Benzoic acid is an alterative diuretic, and is used to render the urine acid when it is alkaline as in Cystitis where the urine is phosphatic. In concentration it is an irritant. It is eliminated as hippuric acid and water. Large doses cause a general feeling of warmth, increased frequency of the pulse, increased cutaneous and bronchial secretion, and perhaps gastric irritation. It is useful in Chronic Cystitis and Bronchitis, and is said by some to be very valuable in Acute Rheumatism. The ammoniac salt has the same action as the acid. Sodid benzoate has great value in Chronic Cystitis and is also used internally as an antiseptic, especially in Puerperal Fever. Lithic benzoate is very useful in Gout and Uric Acid diathesis, since it is better borne than the acid itself and since the lithic salt of uric acid is the most soluble one.

13. TRITICUM. WITCH-GRASS, or COUCH-GRASS. The rhizome of Triticum ripens, found in Europe and America as a troublesome weed which is hard to get rid of. It is used wholly for its effect on the genito-urinary system in the form of a decoction, and may be given in unlimited doses. There is a fluid extract given in 1 dr. doses in water every three hours. It is used extensively by some for an irritated bladder.

14. CANTHARIS. Cantharides or Spanish flies are the dried bodies of Cantharis vesicatoria, a beetle of Southern Europe $\frac{1}{2}$ -1 inch long, with a large heart-shaped head and brilliant metallic green wing cases. When ground up they make a gray-brown powder with bright green specks within it. In life they have an odor, like mice, almost entirely lost on drying. They have an acrid, burning and urinous taste, and contain an oil, a fatty substance, several inorganic salts, and the active principle Cantharadin. Pure, the latter occurs as neutral, crystalline scales, insoluble in water, almost so in alcohol; soluble in ether, chloroform and fatty oils. It has no odor nor taste. Cantharadin is a violent poison and must be used with caution whether internally or externally. 24 gr. of the drug have been fatal.

The principal officinal preparations are the following:—

TINCTURA CANTHARADIS. Dose: 2-5 m. ✓

CERATUM CANTHARADIES. Cantharides, 35 per cent., with wax, ✓ resin, and lard. It is best applied spread on some material with a margin of sticking-plaster to hold it in place.

COLLODIUM CANTHARIDATUM. 60 parts of Cantharides with ✓ 85 of Collodium.

Emplastrum Canthar.

Physiological Action. The active principle of Cantharides is the most irritating drug eliminated by the kidneys. Moderate doses stimulate the kidney and all the urinary tract. Large doses cause pain and burning during micturition. Still larger doses cause very intense pain, priapism, unquenchable sexual desire, seminal emissions, acute nephritis, tenesmus, a complete suppression of the urine, and gastro-intestinal inflammation ending with collapse and death. There may be salivation and gangrene and sloughing of the labia and penis from irritation. There is no known antidote in toxic cases. The treatment rests on general principles; evacuate the stomach, and avoid all oily substances as they promote absorption of the active principle. Opium is given for the pain and tenesmus. If it is necessary anaesthetics may be given. Applied to the skin and mucous membranes Cantharides causes redness, burning and blistering, with severe pain; and if the application be continued long it causes deep inflammation and sloughing.

Therapeutics. On account of its intensely irritating action on the kidney, it is used internally only in those cases where a very strong action is desired as in Chronic Gleet, where it is employed with the tincture of Chloride of Iron. It is used very rarely in the same way in Chronic Cystitis and Chronic Pyelitis, but with great caution. It is used as a uterine stimulant to relieve Amenorrhoea from depression. In the latter stages of Acute Nephritis, when the kidney is inactive and in the same conditions in Chronic Nephritis, it is used in drop doses of the tincture, three times per day. In Irritability of the Bladder without inflammation it is good. It is not an aphrodisiac unless given in toxic doses. In Impotence due to excessive sexual indulgence 10-20 drops of the tincture given with strychnine and the chloride of iron may give good results, often bringing relief and the power to beget. It is used internally also in certain Skin Diseases, and externally as a constituent of applications to promote the growth of hair and to keep it from falling out. It is also used externally for blistering and as a counter-irritant in deep-seated inflammations. It must be applied with great caution, owing to its liability to be absorbed and to produce irritation of the kidney and tenesmus.

VII. Expectorants.

Strictly speaking Expectorants are those drugs which promote bronchial secretion or facilitate its removal, but they are commonly considered as drugs which modify, control, or promote the

bronchial secretion or relieve cough. There are two classes of Expectorants: (1) Nauseant or Sedative Expectorants are drugs which lower arterial pressure and increase bronchial secretion in the same way that they increase that of the skin. These drugs are good in the early stages of Bronchitis, accompanied with suspension of the function of the mucous membrane, a hard dry cough and dyspnoea. They relieve by establishing free expectoration. (2) Stimulating Expectorants act directly upon the bronchial mucous membrane, improve the tone of the circulation, lessen cough, and clear up the lungs. Some of them even diminish the secretion, others perhaps increase it, but most merely modify it by toning up the relaxed and over-secreting mucous membrane.

Some substances which are not strictly expectorants are useful in bronchial diseases. Sometimes, for example, when expectoration is made difficult by the tenacity of the mucus. Alkalies render it less viscid and so facilitate expectoration. In some cases, as Bronchorrhoea, where the excretion is excessive, Astringents, especially Gallic Acid, are good. When mucus accumulates in the lungs sufficiently to embarrass respiration, irritant emetics are good in emetic doses. Sometimes free expectoration is interfered with by spasmodic contraction of the smaller bronchial tubes, and in these cases Belladonna, Stramonium or Tobacco are good. Still other drugs allay cough and irritation by virtue of their anodyne action, as Morphine, Hyoscyamus, Hyoscyamine, Chloroform, and Hydrocyanic Acid. When the cough is out of proportion to the inflammation they are very good.

Certain drugs may be applied directly by inhalation or atomization. Fumes of some volatile substance may be generated in a closed room into which the patient should go and breathe in the remedy. Or volatile substances may be inhaled by an inhaling apparatus. Atomization does not give the desired effects unless great care is taken. Hand-atomizers are useless, but the steam-atomizers are good, provided the patient can inhale deeply; they will reach even the finest bronchioles. The steam should be generated evenly and with sufficient force, and the solution should be free from particles. Do not fatigue the patient by the length of the operation. The frequency depends upon the patient and the nature of the disease. As commonly carried out the throat only is reached, so that it is a very inefficient method.

(A) NAUSEATING EXPECTORANTS.

Of the Nauseating Expectorants all have been considered in detail in other groups with the exception of Grindelia. 1. IPECACUANHA is the safest and only one suitable for children,

given as the syrup or the wine. The trachea may be used in catarrhal troubles of adults. 2. LOBELIA is too depressing. 3. TARTAR EMETIC is very powerful but injurious for small children and very disagreeable to adults. It brings about the best results given in small doses.

4. GRINDELIA. The leaves and flowering tops of *Grindelia robusta*, with a warm peculiar taste; containing a volatile oil, a resin and an alkaloid. The officinal preparation is a Fluid Extract given in 20 m. to 1 dr. doses. It has been used chiefly in Asthma and Bronchitis with a tendency to bronchial spasms which it relieves by stimulating the mucous membrane and probably by its relaxing effect. In some cases the flowers are steeped in a solution of saltpetre, dried, and burned on a plate or pipe, and the fumes inhaled in Asthma. The active principle is excreted in urine, and hence *Grindelia* is valuable in Chronic Cystitis by stimulating the mucous membrane of the bladder. The fluid extract is used externally diluted 1-10, as an application for Ivy-Poisoning and Eczema.

(B) STIMULATING EXPECTORANTS.

1. AMMONIUM CHLORIDUM. A snow white, crystalline powder, permanent in air; with a slightly acid reaction, and a sharp saline taste; odorless, soluble in water, sparingly soluble in alcohol. There is an officinal troche containing 2 gr. It is an irritant to mucous membranes and raw surfaces. Taken internally in 5-20 gr. doses it increases and softens the mucous secretions, and stimulates the nervous system. In large doses or by the continued use of small doses it may produce a profound effect on the constitution of the blood, greatly impairing it. It is eliminated unchanged in the urine. It is used in Chronic and Subacute Bronchitis, Leucorrhoea, and Dysmenorrhoea, owing to its action on the mucous membranes. By reason of its stimulating effects on the nervous system it is said to be good in Neuralgia, particularly ovarian. Dose as an expectorant: 5-10 gr.; in Neuralgia, 10-30 gr.

2. SENECA. The root of *Polygala Senega*, a small perennial indigenous in the United States. The active principle is a glucoside called Polygalic Acid or Senegin, supposed to be a mixture of two glucosides. Of the officinal preparations may be mentioned the Fluid Extract, an Abstract, and a Syrup, the latter being given in 1-2 dr. doses. Senega is one of the constituents of the Compound Syrup of Squills. Locally Senega is an irritant and in large doses causes vomiting and purging. It is used chiefly as

a stimulant to the mucous membrane and in Chronic and Subacute Bronchitis. As it is the most stimulating member of this group, it is contra-indicated in Acute Bronchitis, but if modified by Tartar Emetic it may be used in the earlier stages.

3. AMMONIACUM. The concrete juice of *Dorema Ammoniacum*, a native of Persia, is a gum-resin, which contains a small amount of a volatile oil. Ammoniac exudes from the punctures made by insects and incisions by man. It comes into the market as yellow tears, hard and brittle, with a sweetish, bitter and acrid taste, and a faint disagreeable odor. There is an Emulsion Ammoniaci and an Emplastrum Ammoniacicum Hydrargyro, both of which are used as mild counter-irritants and local stimulants, the latter being used for syphilitic nodes and tumors and scrofulous glands. Ammoniacum has only a slight influence on the general system. Locally it is an irritant. Taken internally in large doses it causes vomiting and purging. The resin and volatile oil are eliminated by the bronchial and possibly by the urinary mucous membranes. Internally it is given only for Chronic Bronchitis and Bronchorrhoea, and generally as the Mistura Ammoniaci, in $\frac{1}{2}$ –1 oz. doses. Its external use has been mentioned.

4. BENZOINUM. Benzoin is a balsamid resin, the concrete *Styrax Benzoin* of Peru, obtained by incising the tree and allowing it to harden as it exudes. It comes into the market as white tears in a dark matrix of a pleasant odor and slight aromatic taste; almost wholly soluble in 5 parts of alcohol. The resin contains a resin, cinnamic acid, and 12–14 per cent. of benzoic acid. It is used in Catarrhal Affections, and as an external application and antiseptic. There is a tincture used in $\frac{1}{2}$ –1 dr. doses and a compound tincture given in the same dose, used as an ingredient of many cough mixtures. There is a preparation for external use, Benzoinated Lard, which will be considered later.

5. BALSAMUM PERUVIANUM. BALM of PERU. Obtained from *Toluifera Pereirae*, a native of Central America naturalized in Ceylon; called Balsam of Peru, not because it is a native of Peru but because it was first shipped from there. The juice of the tree is obtained by incision, and from this the balsam is prepared. It is a viscid, honey-like substance, with a fragrant odor, a reddish brown color, and a warm bitter taste; soluble in alcohol, insoluble in water. It contains as active principles, a resin, a volatile oil, cinnamic and benzoic acids. It is frequently adulterated with copaiba, castor-oil and turpentine.

Uses. It is used internally in Chronic Catarrh of the mucous membranes in substance in $\frac{1}{2}$ dr. doses, or with hot water. It is also used externally in certain Skin Diseases, alone or with oil.

6. BALSAM TOLUTANUM. BALSAM OF TOLU. Obtained by incision of the bark of *TOLUIFERA BALSAMUM*, a thick viscid fluid, becoming a hard translucent, yellowish-brown, resinous solid with time; with an agreeable odor and pleasant taste; soluble in alcohol, insoluble in water. It contains two resins, a volatile oil, and benzoic and cinnamic acids.

Therapeutics. It is used in Chronic Bronchitis, and Catarrh of the genito-urinary system, and for old and obstinate coughs. It is best given as an emulsion with mucilage and sugar with the addition of water. There are two preparations, a Tincture, used as a vehicle, a flavor, and for coughing given in $\frac{1}{2}$ dr. doses, and a Syrup used for the same purpose in $\frac{1}{2}$ oz. doses or more.

7. PIX LIQUIDA. TAR. An oleoresin obtained by destructive distillation of the wood of various species of Pine; a black viscid substance; with a bitter acrid taste, peculiar odor, and acid reaction. It is a complex mixture of resins and various other substances including acetic acid, oil of turpentine, and many hydrocarbons. On distillation it gives pyroligneous acid, and an Oil of Tar, the residue being Pitch. The oil contains many substances including creasote. Tar is slightly soluble in water, soluble in alcohol, ether, oils, and the alkalies of soda and potash.

Therapeutics. Tar is used either alone or as an ointment in certain Skin Diseases. Internally it is used as a stimulant expectorant in Chronic and obstinate or Acute Bronchitis, given in substance as pills or capsules made up with wax, sugar or flour, in 5-22 gr. doses. When shaken with 4 parts of water and decanted, the supernatant fluid is called tar-water, which is used extensively as an expectorant in oz. doses in Bronchitis given internally or by atomization. An officinal Syrupus Picis Liquida, containing $7\frac{1}{2}$ per cent. of tar, is given in $\frac{1}{2}$ oz. doses. There is an Unguentum made up of 50 parts of tar and 50 parts of yellow wax and lard, used in various Skin Diseases.

8. ALLIUM. GARLIC, from *Sativum*. Garlic acts as a stimulating expectorant, and is often of great value in certain stages of Bronchitis, especially in the acute stages of infants. It contains a certain volatile oil which in small doses stimulates the mucous membrane of the stomach and so aids digestion. It also stimulates the mucous membrane of the bronchial tubes. It has some rubefacient power taken advantage of in the Acute Suffocative Catarrh and Bronchitis of infants. Poultices of Garlic are applied over the chest. If the skin is too delicate they may be mixed with bran. There is a syrup used internally in 1-4 dr. doses.

9. TEREbene. (1890.) A clear, colorless liquid, isomeric

with turpentine, with a peculiar odor like pine wood; made by adding 5 per cent. of sulphuric acid drop by drop to turpentine, keeping the mixture cool. It is purified by distillation after neutralization with calcic carbonate.

Action and Uses. Terebene has a stimulating action on mucous membranes, and in general acts upon the system like Oil of Turpentine. It is a valuable stimulating expectorant in Acute Bronchitis, after the early stages have passed and in Chronic Bronchitis, in intestinal Dyspepsia, and as a substitute for copaiba, cubebs, and sandal-wood oil in Sub-acute and Chronic inflammations of the genito-urinary tract. It is given in emulsion or capsules in 5 m.—20 m. doses. In certain cases it may be necessary to give more, and no harm is done. It should not be given on sugar as it makes a hard, almost insoluble substance.

MISTURA GLYCYRRHIZAE COMPOSITA is used as an expectorant in Acute Bronchitis and in Catarrhal Laryngitis. It contains Ex. of Glycyrrhiza, syrup, mucilage of anacia, paregoric, wine of antimony, spirit of nitrous ether, and water.

VIII. Oxytocics.

Oxytocics are remedies used during or directly after parturition, to increase the uterine action. There are only four members of this group.

1. QUININAE SULPHAS. The oxytotic properties of this drug were mentioned on p. 129 and it needs no further mention now. It seems very probable that in 10–20 gr. doses it is a very powerful stimulant to uterine contraction during labor. There is no evidence that it will produce abortion in healthy females, but in those suffering from malaria it has a very marked tendency to abort.

2. GOSSYPII RADICIS CORTEX. The bark of the cotton root of various species of Gessypium. The active principle has not been isolated, but the bark contains a resin. It is much used by the negroes of the South to promote abortion. It is used in medicine as a uterine stimulant in labor and to control Uterine Hemorrhages. In action it is slower than ergot. It is not given in substance but as a decoction of 4 oz. of the bark to a quart of water, boiled down to a pint. There is a Fluid Extract given in 1–2 oz. doses.

3. USTILAGO. (Non-official 1890). CORN SMUT, a fungus grown on Indian Corn. It probably contains the same principle as Ergot and its effects and uses are practically the same.

4. **ERGOTA. ERGOT.** The product of the growth of the fungus *Claviceps purpurea* upon grains of rye. Black, irregular, cylindrical bodies, $\frac{1}{3}$ –1 inch long, curved, grooved on one side; with a disagreeable odor like rotten fish and a disagreeable taste. It is very complex in composition and its chemistry is unsettled; it contains several alkaloids, Ecbotine and Ergotine, non-crystalline, and Ergotinine, crystalline; it also contains Ergotic, Phosphoric and Scleretinic Acids, a fixed inert oil to the extent of 35 per cent. and many other substances of minor importance. Its active principle, whatever it is, can be extracted by water, and it may be driven off by high temperatures. It loses its virtues when it is a year old.

Physiological Action. In therapeutic doses Ergot exerts its chief action on the circulation and the smooth muscle-fibres of the uterus. Ordinary doses give no immediately perceptible symptoms. Large doses may act as a poison to the nervous centres and cause symptoms of paralysis.

Toxicology. There are two forms of poisoning, the Acute and the Chronic. Chronic Ergotism is frequently epidemic in Europe due to the use of bread made from ergotized rye. Under certain conditions, as a wet and cold summer, the oats and rye are all ergotized and bread made from them combined with insufficient food and exposure gives rise to the disease. This Chronic Ergotism manifests itself in two forms: Spasmodic and Gangrenous Ergotism. The former is due to a cutting off of the blood supply to the nerve-centers, the latter to cutting it off from the tissues.

Circulation. Moderate doses stimulate the vaso-motor centers and so raise arterial pressure, but toxic doses lower it by depress the heart. The same thing happens after a subcutaneous injection of Ergotin. The action on the laboring uterus is very pronounced. It stimulates the smooth muscle-fibres and assists contraction by also stimulating the nerve centres in the cord which govern the movements of contraction. It has more effect on the parturient uterus than on the pregnant but not parturient one. It begins to act within 15–20 minutes after administration, and its effect lasts 2–3 hours.

Therapeutics. Ergot is used extensively in Obstetrics. In very small doses it may help the labor pains, simply intensifying them. In large doses it causes a severe and prolonged contraction with shorter and shorter intervals of relaxation until one violent continuous uterine spasm which may put both mother and child in danger, the former by rupture of the uterus or perineum, the latter by cutting off the circulation. In the early stages of parturition

it must be used with very great care when Uterine Inertia comes on, where Quinine cannot be used, and never until the Os is quite dilated. The proper time is after the birth of the placenta and not before. Its indications and contra-indications will be treated extensively in the course on Obstetrics.

Besides the use above mentioned, Ergot is used in all sorts of Uterine Hemorrhages and Hemorrhages in general, as in Haemoptysis, Epistaxis, Bleeding from the gums, Monorrhagia, etc. It is used in Hemorrhages which cannot be directly controlled, and at times even where styptic applications can be made. It is given by the mouth, subcutaneously, and even applied locally. In making an injection, use a fresh aqueous extract made by rubbing up 15 gr. with water and straining through a cloth, and inject it deeply. There is less danger then of forming in abscess. In Colliquative Night-Sweats, due to relaxation of the blood-vessels, ergot is very efficient. In all these cases it acts by causing contraction of the blood-vessels. Ergot is also used occasionally in Diabetes Insipidus, Cerebral and Spinal Congestion, Prolapsus Uteri, Dysentery, Epilepsy, Diarrhoea, and Pneumonia. It has also been used in the treatment of Uterine Fibroid Tumors where they are small and just beneath the mucous membrane. It is a very painful and long drawn out treatment, acting by cutting off the blood supply and causing sloughing. It is a method rarely used since surgical measures are far more satisfactory.

Administration. Ergot is rarely used as the substance. There is a wine given in 2 dr.-2 oz. doses, and a fluid extract which is a very important preparation given in $\frac{1}{2}$ -2 dr. doses. The extract and the fluid extract are both used for subcutaneous injection. Ergotin, a combination of principles on the market, has no advantage over the officinal preparations.

IX. Emmenagogues.

Emmenagogues are drugs which are employed to promote the menstrual flow. Amenorrhoea is not a disease but a symptom of a disease. Since its causes are various the treatment must be so. The Emmenagogues are conveniently divided into three classes: Tonic, Purgative and Stimulating.

(A) TONIC EMMENAGOGUES.

In Amenorrhoea due to anaemia the Tonic Emmenagogues are indicated, and iron should be given in full doses until the anaemia is relieved. Myrrh also has some reputation as a tonic

emmenagogue and is often combined with iron in the compound mixture and pills of iron, and also in combination with aloes in the pills of aloes and myrrh.

(B) PURGATIVE EMMENAGOGUES.

Of the Purgative Emmenagogues Aloes is very good in Atonic Amenorrhoea, associated with constipation. It should be given in repeated moderate doses of such a size as will produce one or two stools daily. It is more efficient if given with iron and myrrh. There is an officinal tincture of aloes and myrrh. A full purgative dose is sometimes good when menstruation is due. In pregnancy, given in full doses, it may cause abortion.

(C) STIMULATING EMMENAGOGUES.

Stimulating Emmenagogues include drugs which contain a volatile oil. They are sometimes used in doses, among the laity, endangering life to promote abortion.

* 1. SABINA. SAVINE. The dried tops of *Juniperus Sabina*, with a peculiar terebinthine odor, nauseous bitter and resinous taste due to a volatile oil, *Oleum Sabinae* (officinal). This is a pale or colorless or dark yellow oil, with the odor of turpentine, and a burning taste. It is a powerful local stimulant. Dose: 5 m. Its action is considered with the next drug.

* 2. OLEUM RUTAE. (Non-officinal 1890.) OIL OF RUE. A volatile oil distilled from the leaves of *Ruta graveolens*, or garden rue. Dose: 1-5 drops. These two oils are powerful local irritants, causing burning, redness and vesication when applied to the skin. Taken internally in large doses they may cause gastroenteritis and abortion. Small doses act as powerful ovarian and uterine stimulants, causing hyperaemia of each, and so aiding menstruation. In toxic doses given to pregnant women they cause abortion, and death preceded by profuse flooding. They rarely abort except at the expense of life. Both are eliminated by the skin, breath and kidneys. For Atonic Amenorrhoea they are given in 5-10 drop doses. In Monorrhagia due to relaxation of the uterus, they are used to tone up the uterine tissue. The two oils are often given in combination.

3. TANACETUM. The leaves and tops of common tansy, containing a volatile oil. It is among the most powerful and irritant of the group, depending upon the volatile oil for its action. Besides its action as an emmenagogue it also acts as a diuretic. In sufficient doses it causes abdominal pain, vomiting, abortion, convulsions and death due to failure of the respiration. 1 dr.

proved fatal. As an emmenagogue it is given in 1-3 drop doses or as a tea made by adding an ounce of the leaves to a pint of water. Dose: 1-2 dr. As an abortifacient its use is very dangerous.

4. OIL OF PENNYROYAL. A weak emmenagogue supposed to be a safe abortifacient, a belief which is carefully fostered by extensive advertising. It hardly deserves mention.

5. PETROSELINUM. PARSLEY. Containing a liquid principle resembling the fixed oils but differing from them in not being saponifiable. This oily principle called APIOL, non-official, is highly recommended by Dysmenorrhoea and Amenorrhoea, particularly in cases depending upon anaemia, given in 3 drop doses in capsules three times per day, before the menses or in larger doses immediately before. In doses of 30-60 gr. it causes a dizziness, ringing in the ears, nausea, severe frontal headache, like cinchona. It has been used in Intermittent Fever, but is much inferior to quinine. Given in pregnancy it may exceptionally cause abortion.

6. POTASII PERMANGANAS. Deep purple, violet or nearly black crystals, purple in solution, permanent in air, odorless, neutral; soluble in water, (1-20); containing much oxygen which it readily gives up to organic matter, which is oxidized. It has been highly recommended as an emmenagogue, but it cannot be used when menstruation is arrested by constitutional or local disease, shock or cold. It is said to abort sometimes. Since it causes gastric irritation it is best to give it on a full stomach after meals in 1-2 gr. doses. In the stomach it is speedily reduced, so that it has no advantage over the black oxide of manganese. In 1 per cent. solution it is a disinfectant. It has recently been recommended as an antidote in morphine poisoning on account of its oxidizing effects. If the morphine has been absorbed the permanganate cannot act as it is not absorbed as such.

7. CANTHARSIS, in 3-5 m. of the tincture is a uterine stimulant and emmenagogue.

X. Antacids.

Antacids are drugs used to counteract acidity in the alimentary canal or urine, acting in the first case directly, and in the latter case, indirectly. The latter are really Diuretics, and as such have already been considered. The Direct Antacids are the ones commonly meant when the term Antacid is used. Some of these may also have in addition to their direct action upon the alimen-

tary canal, an indirect action on the urine. Others which are true Antacids as regards the alimentary canal, such as the hydrate and carbonate of ammonia, not only do not act indirectly on the urine to lessen its acidity, but they increase it, since they are oxidized in the system to nitric and uric acids. Then there are still other salts, as the citrates, and acetates, which have no direct action at all on the alimentary canal, but which by being eliminated as carbonates, lessen the acidity of the urine. These are the true Indirect Antacids.

Excessive Acidity in the stomach is due to lactic or butyric fermentation, or to an over-production of hydrochloric acid. It causes uneasiness, gastric disturbance, heart-burn, pain, and functional disturbance of the intestines. A common result is "sick headache," accompanied by nausea, heart-burn, vomiting, and gastric distress. In such cases of Dyspepsia and in the greenish Diarrhoea of infants the direct antacids are very valuable.

1. SODII CARBONAS. A white powder, or occurring as large colorless efflorescent crystals, or as a white powder, odorless with a sharp alkaline taste and reaction; soluble in water, not in alcohol. It is incompatible with acids and acid, earthy and metallic salts, and lime water. It is used internally in Dyspepsia up to 30 gr. and externally in Burns and certain Skin Diseases.

2. SODII BICARBONAS. A white opaque powder, permanent in dry air, odorless, with a cool saline taste, and alkaline reaction; soluble in water not in alcohol. It is decomposed by hot water. It is to be preferred to the carbonate since it has a milder taste and is less irritating to the stomach. Dose: 10 gr. to 1 dr. It is a constituent of the common soda-mint tablet, also of the officinal Trochisci Sodii Bicarbonates which contain Sod. Bicarb., sugar, nutmeg and mucilage of tragacanth, each troche contains 3 gr. of the drug.

3. POTASSII CARBONAS. A white crystalline or granular powder, very deliquescent, odorless, with a saline and slightly alkaline taste, and alkaline reaction; soluble in water, and insoluble in alcohol. Action to be considered later.

4. POTASSII BICARBONAS. A colorless, crystalline powder, with a slightly alkaline taste and reaction; soluble in water, almost insoluble in alcohol; decomposed by boiling water. It is used in the treatment of certain skin-diseases, and as an antacid in 15-60 gr. doses.

Physiological Action and Therapeutics, of the carbonates of sodium and potassium. The sodic preparations are better than the potassic salts in that they produce little systemic action. The Bicarbonate of sodium is best especially in Acid Dyspepsia. In

Rheumatism and Uric Acid diathesis the potassic salts are better, and the bicarbonate is the favorite. Long continued use of sodic bicarbonate may cause Anaemia, weaken the stomach, and increase the Dyspepsia. It may sometimes be used for a month at a time, however. It is also useful in Diabetes and locally in Aphthous Stomatitis and Thrush.

5. LIQUOR CALCIS. LIME-WATER. Containing .015 per cent. of calcic hydrate. A clear colorless, odorless liquid, with a caustic taste and alkaline reaction. Exposed to air it becomes turbid due to the formation of calcic carbonate. It is used to check vomiting, and as an addition to milk. Dose indefinite. The SYRUPUS CALCIS is lime triturated with sugar and dissolved in water; 20 m. is the equivalent of 1 oz. of the lime-water. It is better borne than the former.

Physiological Action and Therapeutics. Lime-water is nearly destitute of irritating properties and is slightly astringent. With equal volumes of milk it can be used when no other food can be taken. It prevents the formation of dense curds, and is so used in the milk of infants and of individuals with weak digestion. On account of its astringency it is used as a wash for sore nipples and in certain skin diseases. With equal volumes of linseed oil, cotton-seed oil or olive oil, it is useful for flesh burns. The Linimentum Calcis is about the same thing, except that cotton-seed oil is used. It has been claimed that lime-water dissolves diaphoretic membranes, but it is not well supported. The syrup of lime and lime-water are antidotes in poisoning by acids, such as sulphuric, carbolic, etc. They are sometimes used as injections to get rid of pin-worms and they also have many other uses.

6. CRETA PRAEPARATA. Prepared chalk is the carbonate of calcium, freed from most of its impurities. It is a white amorphous powder, permanent in air, odorless and tasteless; insoluble in water and alcohol. Its chief uses are as an ingredient of Hydrargyrum cum creta, of the Mistura cretae, of the Pulvis cretae compositus, and of the Trochiscus cretae. It is also used as an external remedy. It is an antacid and is mildly astringent. Dose: $\frac{1}{3}$ –1 dr. The PULVIS CRETAE COMPOSITAE is a preparation of sugar, acacia, and prepared chalk. The MISTURA CRETAE is made up of the compound powder of chalk with cinnamon water and water. It is useful with laudanum or paregoric in the diarrhoea of children in $\frac{1}{2}$ oz. doses. It is sometimes combined with Tincture of Kino or of Catechu. The officinal TROCHISCUS CRETAE contains 4 gr. of prepared chalk. Unlike the magnesian preparations, chalk and prepared chalk do not form cathartic salts in the alimentary canal. They are extensively used as dessicants

and protectives in ulcers and in various skin-diseases and also for excessive sweating.

7. **CALCII CARBONAS PRAECIPITATUS.** A white fine powder, free from grit; odorless and tasteless; insoluble in water and alcohol. It is made by precipitating calcic chloride with sodic carbonate. It is used as a substitute for prepared chalk, but has no advantage over it, and it is more expensive. Unlike magnesia it does not form cathartic salts by combining with the digestive acids. It is a common ingredient of tooth powders, and as a local application in excessive sweating. Other drugs which have an antacid reaction will be considered in other groups.

XI. Digestants.

Digestants are substances used to assist digestion, and most of them contain a ferment from the digestive organs of animals or from vegetable sources.

PANCREATINUM. (Officinal 1890). An exceedingly complex substance obtained from the fresh pancreas of the hog. It is a yellowish white or grayish amorphous powder, odorless, meat-like taste; slowly but almost completely soluble in water, insoluble in alcohol. It contains at least four ferments. Its function is to digest fats, starches and protoids. Three are important: Trypsin, Amylopsin or Pancreatic Diastase, and an Emulsion ferment, steapsin, which has the power of breaking up fat. Pancreatine acts only in alkalies and is destroyed by acids. It should therefore be given three hours after a meal, though some recommend that it be given before food is taken. It is used very much in peptonizing foods, especially milk, and the *Liquor Pancreaticus* is the preparation used.

In "peptonizing milk" a pint is diluted with $\frac{1}{4}$ its bulk of water. It is then heated to 140° F. and 2-3 dr. of the *Liquor Pancreaticum* is added with 10-20 gr. of Soda Bicarbonate. Pour into a covered jug and set in a warm place so that the ferments may work. At the end of 1½ hours boil 2-3 minutes to stop further action. The milk is then peptonized. To peptonize gruel precisely the same process is used. It is heated to 140°, the ferment is added as the *Liquor*, and it is cooled, etc. It is frequently combined advantageously with the peptonized milk.

* 2. **PEPSINUM.** **PEPSIN.** The digestive principle of the gastric juice obtained from the mucous membrane of the hog's stomach. There is one officinal preparation: (1) **PEPSINUM SACCHARATUM.** Pepsin and powdered sugar of milk. It is

white, crystalline powder with a white and not disagreeable odor and taste, slightly acid in reaction; not completely soluble in water unless a little hydrochloric acid is added. One part with 500 parts of water and 7 parts of hydrochloric acid should dissolve 50 times its weight of egg albumen in 5-6 hours, at a temperature of 100-104° F. (2) The LIQUOR PEPSINI has been dismissed from the 1890 Pharmacopoeia.

Pepsin is a ferment and not a solvent. It is best given with dilute hydrochloric acid, which improves it, in a capsule, tablet, or in the officinal solution. Its digestive power is impaired by alcohol, so that the two should not be prescribed together. For this reason wines and elixirs of pepsin are not worth much. Alkalies destroy and Bismuth retards its action, so that it is incompatible with each. Dose of the saccharated pepsin, 5-30 gr.; of the Liquor $\frac{1}{2}$ -2 oz. The ferment will continue its digestive action if new acid is occasionally added. It is good in Dyspepsia but pancreatin is better.

3. INGLUVIN. (Non-officinal). Inferior to pepsin, which is over-rated. There is a bitter principle called Ingluvine obtained from the dried and pulverized mucous membranes lining the gizzards of the common domestic fowls. It has little value in Dyspepsia. It has been claimed by some that it arrests the vomiting of pregnancy.

4. PAPAIN. (Non-officinal). A ferment obtained from the juice of *Carica Papaya*; a grayish fine powder, tasting and smelling like pepsin, soluble in alcohol. It digests albumen, muscle-fibre and even connective tissues. It acts in alkaline media and is destroyed by acids, but acid present in very slight amounts causes no trouble. Dose: 5-10 gr. It is used in Dyspepsia. Among other uses is the removal of diphtheritic membranes. For this purpose it is applied hourly with equal parts of glycerine and water and papain. Clinically it has not proved very successful.

5. MALTUM. (Non-officinal). Barley is treated one or two days with cold water from which it absorbs 10-50 per cent. its weight, and is then allowed to germinate. During germination it develops some heat, and the starch is turned into sugar by the natural ferment, Diastase. After germination the barley is dried, the sprouts having been broken off. The EXTRACTUM MALTI (Non-officinal), is made by evaporating an infusion of malt to the consistency of honey. It contains sugar and diastase, and is useful as a digestant of starch. It acts best in a neutral solution, and should therefore be given either with or directly after a meal, or else some hours after, so that acidity may be avoided. It is not very useful, for when diastase is in contact with gastric juice

it is rendered inert and killed sooner or later. Malt is over-rated.

6. **ACIDUM HYDROCHLORICUM DILUTUM.** This contains 10 per cent. of absolute hydrochloric acid. The ordinary dose in albuminous digestion when the stomach is alkaline, is 5-15 m. well diluted in water.

~~7. **ACIDUM LACTICUM.**~~ This contains 75 per cent. of the absolute acid with 25 per cent. of water. It is a colorless, syrupy liquid, vomitus odor, very acid in reaction and taste. It mixes freely with water, alcohol, and ether. It is found in sour milk, and in many secretions, especially in the gastric juices. It is formed whenever a solution of sugar is brought into contact with hydrochloric and mineral acids at moderate temperatures for some hours. Dose: $\frac{1}{2}$ -4 dr. These two acids are very efficient in assisting the digestion of albumen, given either alone or with bitters and aromatics. They are best given some time after the ingestion of food, generally $\frac{3}{4}$ -1 hour. In some cases they may be given sooner or even before eating. The time of administration depends much upon the object desired. Both should be well diluted and the former may well be given through a tube.

XII. Demulcents

Demulcents are bland substances which form gummy or mucilaginous solutions in water, capable of exerting a calming or soothing influence on inflammations or inflamed surfaces. They are not absorbed, for none have been detected in the blood. In all acute inflammatory conditions of the stomach and intestines, and in slight bronchial irritation, they are very useful. They not only exert a quieting influence on the mucous membrane of the mouth, but also on that of the respiratory passages.

1. **ACACIA. GUM ARABIC.** A gummy exudation from *Acacia senegal* and other species of *Acacia*, occurring in the form of tears of various sizes, transparent or opaque, brown or yellow in color, or often whitish, with a glassy fracture; odorless, with a mucilaginous taste; soluble in water, forming a thick mucilage, insoluble in alcohol. Its principal use is in pharmacy as a vehicle, in mixtures and emulsions.

Incompatibles. Do not prescribe with alcohol, borax, boracic acid, and salts of iron, the basic acetate of lead, and acid salts. The officinal preparations include a mucilage *Acaciae* containing 54 per cent. of *Acacia* in watery solution, and a *Syrupus Acaciae* containing 25 per cent. of the mucilage, and 75 per cent. of a simple syrup. The latter is used as a vehicle.

2. TRAGACANTHA. A gummy exudation from *Astragalus verus* and other species, occurring in large white horny flakes; insoluble in water, although it swells up in it to a gelatinous mass. It is used in the preparation of troches, in mixtures and emulsions. There is a Mucilage *Tragacanthae* consisting of gum tragacanth, water and glycerine.

3. ULMUS. SLIPPERY ELM. The inner bark of *Ulmus fulva*, occurring in long flat strips or pieces, very thin; of a pale buff or yellowish brown, with a peculiar odor, and an insipid mucilaginous taste. It contains a large amount of a peculiar mucilage which it gives up to water. An infusion is used as a demulcent, but its chief use is in poultices. In a strength of 6 parts to 100 of water it makes a good demulcent drink in Catarrh of mucous membrane of the intestine. There is an officinal Mucilage *Ulmi* consisting of 6 parts of slippery elm in 100 parts of water.

* ~~4. CETRARIA.~~ ICELAND MOSS. From Iceland and most of the northern portions of the world. It contains lichen-starch and a bitter principle; has a mucilaginous bitter taste; swells up in cold water and dissolves in hot. The mucilagenous principle is the lichen-starch. The hot solution on cooling becomes a gelatinous mass used as a food. *decoction 5%.*

* ~~5. CHONDRUS.~~ IRISH MOSS OR CARRAGEENIN. The fronds of *Chondrus crispus*, growing on the rocks at low-water mark in Ireland and the northern Atlantic coast of North America. It contains a starch-like or gummy principle called Carrageenin, and a vegetable albumen. It is used as a demulcent and as a food for invalids. ✓

6. GLYCYRRHIZA. LIQUORICE-ROOT. Containing a peculiar yellow glucoside with a sweetish taste, called Glycyrrhizin. It also contains a crystallizable principle identical with Asparagin, and an acid resin, with several other things. It is an excellent demulcent as a decoction, either alone or with other substances. The powdered liquorice is used in pills to make them consistent and to prevent adhesion with one another. Glycyrrhiza is used in making several officinal preparations, and it enters into many compounds. The *Extractum Glycyrrhiza* is Black Liquorice. There is an extract *Glyc. Purum*. There is also an *Extractum Glycyrrhiza fluidum*. The dose of either of these is indefinite. There is also a *Pulvis Glycyrrhiza Compositus* already mentioned. It enters into the Compound Decoction of Sarsaparilla, the Compound Fluid Extract of Sarsaparilla, the Compound Syrup of Sarsaparilla, and various other preparations. The *Glycyrrhizinum ammoniatum* is a dark brown or brownish-red substance, occurring in scales,

odorless, soluble in alcohol and water. It is a very elegant preparation, decomposed by acids and alkalies.

* 7. *ALTHAEA*. MARSH-MALLOW. The root contains considerable mucilage.

* 8. *CYDONUM*. (Non-official 1890.) The seeds of the common quince, yielding a mucilage cydonum.

9. *SASSAFRAS MEDULLA*. The pith of *Sassafras* occurring as light spongy pieces, with a mucilaginous taste, containing a gummy substance; soluble in water. The officinal mucilage is used as an agreeable drink in Dysentery, Catarrhal and Nephritic Diseases. A solution of 1 dr. to a pint of water is used as a soothing wash in diseases of the eye.

XIII. Emollients.

Emollients are bland substances, which, when applied to the skin, make it more pliable and soft. Their action is largely mechanical; they probably soften the skin in the same way that they soften a piece of leather. They are therefore especially useful when the skin tends to crack or chap, and whenever surfaces become sore by chafing. They also act to protect the skin against the stimulation and irritation of the air. Any bland oil is an emollient, but the blandest, when they become rancid, are very irritant. A very hard fat is not so easily applied as a soft one, and therefore only such fats as freely melt or become soft at the temperature of the body are used. Often common domestic fats, mutton-suet and goose-grease, are the best.

1. *ADEPS*. LARD. The fat from the abdomen of the hog, purified by washing it with water, melting and straining. The fat used comes chiefly from the *omentum*, mesentery, and kidney, but common commercial lard is made from every part of the body. It should be soft and white, free from all rancid qualities, and neutral. When melted it combines readily with wax, resin, and other fats. Never use rancid lard as it is irritant to the skin. Its chief use is as an ingredient of ointments and cerates. Of benzoinated lard 98 per cent. is lard and 2 per cent. benzoin.

2. *OLEUM ADIPIS*. LARD-OIL. A fixed oil obtained by compression at low temperatures from lard. It is used in making nitrate of mercury ointment.

3. *SEVUM*. MUTTON TALLOW OR SUET. The abdominal fat of sheep, harder than lard. It is used alone for dressing ulcers, and in a number of preparations for external use.

4. **OLEUM THEOBROMATIS.** **CACAO-BUTTER.** A fixed oil expressed from the seeds of *Theobroma cacao*, present therein to the extent of 45 per cent. It is a bland, whitish yellow solid, used chiefly for making suppositories and bougies.

5. **OLEUM OLIVAE.** A fixed oil expressed from ripe olives. It is an oily, pale or greenish-yellow fluid, with a slight odor and bland or slightly sweetish taste. It is often greenish, due to the presence of chlorophyll. As a laxative it is given in 1-2 oz. doses. It is a constituent of various liniments, ointments, cerates and plasters, and is sometimes used as an enema followed by warm water.

6. **OLEUM GOSSYPII.** A fixed oil, bland to the taste, of bright yellow color, expressed from cotton-seeds. It is used as a substitute for olive-oil and in liniments. It must not be used in lead plaster. **OLEUM LINI**, linseed oil. **Linimentum Calcis** consists of equal parts of lime-water and cotton-seed oil, used as an application to burns, already mentioned.

7. **CERA ALBA** AND **CERA FLAVA.** White and yellow wax, respectively, the former being bleached bee's wax and the latter being unbleached. They are both solid, with agreeable odor, and slight taste, insoluble in water, soluble in ether, chloroform, fixed and volatile oils. The white wax has more or less rancid odor and insipid taste. They are used in ointments, cerates, plasters, and suppositories. There is a non-official vegetable wax which is often used as a substitute for yellow wax.

8. **UNGUENTUM.** Official. 80 parts of lard to 20 of yellow wax. It is softer than a cerate and is used as a basis for other ointments.

9. **CERATUM.** Lard 70 per cent, white wax 50 per cent. A simple protective and basis for other cerates.

10. **CETACEUM.** **SPERMACETI.** A peculiar, concrete fatty, pearly white substance obtained from the head of the *Sperm-whale*. It is translucent, friable, soft, odorless, and tasteless; insoluble in water, soluble in ether, chloroform, and boiling alcohol; with a neutral reaction. It is used in many ointments and cerates. With white wax and olive oil it is used as a cerate. It has two preparations, the **CERATUM CETACEI**, consisting of spermaceti, white wax and olive oil, and the **UNGUENTUM AQUAE ROSAE**. This is the official name of "cold cream," one of the most elegant of ointments, containing expressed oil of almonds, white wax, spermaceti, rose-water and a little borax.

11. **ADEPS LANAE HYDROSUS** OR **LANOLINE.** Anhydrous wool-fat, agnine, a non-official purified fat obtained from the wool of sheep. It varies in color according to its purity from a

dark brown to a white, containing cholesterine instead of glycerine, combined with fatty acids. It mixes readily with water in all proportions. It is used externally in various preparations, and in the preparation of several non-official ointments. It is entirely free from irritating properties, and since it is missible with water in all proportions, it lends it self to use very easily. It penetrates the skin very rapidly. The American preparation known as Adeps Lanae is not so good as the German Lanolinum.

12. PETROLATUM. VASELINE or COSMOLINE. Obtained from petroleum. A semi-solid hydrocarbon, insoluble in water, soluble in ether, chloroform, fixed and volatile oils, and turpentine. It has no odor, does not become rancid, and is good for external use. It is also good internally to soothe the gastro-intestinal canal when it is irritated. In the last U. S. Pharmacopoeia there are three vaselines: PETROLATUM MOLLE (soft) is a semi-solid hydrocarbon. It cannot become rancid. PETROLATUM LIQUIDUM is practically the same only it is an earlier step in the preparation. PETROLATUM SPISSUM, hard petroleum, is still an earlier stage. It has practically the consistency of a cerate.

13. GLYCERINUM. GLYCERINE. A characteristic, colorless, syrupy liquid obtained from the decomposition of a fat and fixed oil; with a sweet, warm taste; soluble in water and alcohol, insoluble in ether, chloroform and fixed oils. It exists in fat as a glyceride and is freed by saponifications. It is very hygroscopic and so cannot dry. It does not become rancid when pure, and even checks decomposition. There is a GLYCERITUM AMYLI, a glycerite or starch, of 80 parts of glycerine and 10 of starch rubbed up to a smooth, transparent paste applied as an ointment. There is also a GLYCERITUM VITELLI, or glycerite of the yolk of eggs, consisting of 45 parts of fresh yolk rubbed up with 55 of glycerine and used externally.

Physiological Action and Therapeutics. Glycerine in large doses as 1 oz., is a laxative, and has little other action. It is absorbed by the alimentary canal, and when given freely, it is partly eliminated and partly oxidized in the system. A good deal of controversy has risen about the question whether glycerine can replace the fat of food, and to some extent it seems to be able to do so. Locally applied it is non-irritating. The chief disadvantage is its stickiness, but since it is hygroscopic and non-volatile, and is lasting in its action, it is extensively used. Applied to the mucous membrane it may cause burning and prickling, and if the skin or membrane be raw it may cause burning and inflammation. It enters largely into all the popular emollients, and is the staple domestic remedy for chapped hands and excoriations. It is useful

in Skin Diseases either alone or in combination with other remedies. By some it is said to have considerable value in Diabetes mellitus, but others deny its value. In this country it is not much used for that purpose. The most important of its internal uses is for the purpose of distinguishing nauseous medicines like castor oil, and with turpentine, solutions of iron and various other mixtures. The glycerite of starch is used as a protective, GLYCERITUM VITELLI as an application to burns and as a demulcent.

Under Emollients POULTICES may well be considered, since these soften the skin in inflammations. Poultices should be moist, soft, scarcely adhesive, perfectly bland preparations. They are used to a great extent to combat superficial inflammation. A poultice may be a stimulant or even an irritant in some cases, however, as when made of mustard. Hot poultices act as rubefacients, cold ones as emollients. Those which retain their heat longest are the best. The true or emollient poultice is prepared from some bland material wholly free from any irritating action on the skin.

Poultices are sometimes used in suppuration, acting as sedatives. They are especially useful when suppuration has already commenced or is about to set in, but how they favor the process is not known. Not only can they be used in external inflammations, but in deep seated inflammation, as that of the lungs, they are useful. In Pleurisy and Pneumonia they often afford some relief. Poultices are applied cold or hot as the case demands. If they are to be kept hot they must be removed very often. Flaxseed meal or ground slippery elm are commonly used. Flaxseeds are small, oval pointed seeds, and have a mucilaginous and bitter taste.

XIV. Protectives.

Protectives are materials used to protect inflamed surfaces whether internal or external. Many of the substances already mentioned are protectives. The group is a small one, and not very important.

1. RESINA. The residue left after distilling the volatile oil from turpentine; commonly called "resin." There is an officinal Ceratum Rosinae, containing resin, yellow wax, and lard. The Emplastrum Rosinae or Adhesive Plaster is a mixture of resin, lead-plaster, and yellow wax, spread on a strong cloth.

2. EMPLASTRUM PLUMBI. LEAD-PLASTER or DIACHYLON PLASTER. Made of lead oxide, olive oil and a small amount

of water, boiled together. It is essentially an oleate of lead. It is used as a basis of other plasters, and alone in various affections of the skin. The Emplastrum Saponis or soap plaster contains 10 per cent. of soap and 90 per cent. of lead plaster. The Unguentum Diachylon, or Diachylon Ointment, is lead plaster, olive oil, and oil of lavender. It is used in skin diseases, especially eczema, and for foul sweating of the feet.

3. ICTHYOCALLA. ISINGLASS. Obtained from the swimming bladder of the sturgeon, consisting almost entirely of gelatine. Used as a food and to make court plaster. EMPLASTRUM ICTHYOCALLAE, made of isinglass, alcohol, glycerine, water and tincture of benzoin.

4. AMYLUM. STARCH. The officinal variety is the wheat starch. It is inert, but is used as a protective powder, as an ingredient of protective powders, and as a paste to make stiff bandages.

5. COLLODIUM. A solution of gun-cotton in ether and alcohol. Collodium flexile is the same, with a small amount of Canada turpentine and castor-oil added to prevent shrinking after application. When applied dry to skin it forms a colorless, transparent film, closely adherent, not removable by washing, motion of the part, or force of a moderate amount. This film is impervious to air and water, and so is much used in minor Surgery. The ordinary collodium film is contractile and it is therefore not much used unless contraction be desired. There is a Collodium Stypticum, collodium with tannic acid, and also a Collodium cum Catharide.

✓ 6. GOSSYPIUM PURIFICATUM. Absorbent cotton freed from oil by means of weak alkalies. When thrown on water it should sink and absorb it immediately if pure. Common cotton does not do this owing to the action of the fat. It is used alone or is medicated with carbolic, boracic, or salicylic acid to make it aseptic.

7. GUTTA PERCHA. (Non-official 1890). An exudation from the Gutta Percha tree. Dissolved in chloroform it gives the Liquid Gutta Percha, used in the same way as Collodium. Gutta Percha softens in hot water and is easily moulded. Since it becomes hard when cooled, it is often used in making splints. Instead of Gutta Percha we now have ELASTICA or india-rubber.

8. CARBO ANIMALIS. ANIMAL CHARCOAL. Made by roasting bone and depriving it of its calcic carbonate and phosphate. CARBO LIGNI or vegetable charcoal is made from soft wood as of the willow or poplar. Charcoal absorbs many times its bulk of gas, and will also take up coloring matters and alkaloids. Since

it absorbs gas it is used internally in Acute and Chronic Dyspepsia. Externally it is used as a dressing, and is often added to flax-seed meal and other poultices.

* ~~9. PLUMBI CARBONAS.~~ Unguentum Plumbi Carbonatis, containing 10 parts of the carbonate made up with benzoinated lard. White lead is a heavy, white, odorless and tasteless powder, insoluble in water and alcohol.

* 10. LYCOPODIUM. The spores of Lycopodium, a moss. A yellow powder, odorless and tasteless, containing a good deal of a fixed oil. It is used for dusting on raw surfaces and to prevent pills from adhering to each other. It is the substance used in flash torches.

11. LIQUOR SODII SILICATIS. WATER-GLASS. A semi-transparent viscid liquid, with an alkaline taste and reaction. Its chief use is to stiffen bandages. It is often better than Plaster of Paris for it is lighter.

XV. Irritants.

Irritants are drugs used externally on the skin and which exert an irritant action. They are divisible according to the intensity of the action into rubefacients or remedies which merely cause redness and congestion of the skin by dilating the blood vessels; epispastics or drugs which cause blistering; and escharotics or drugs which cause death and sloughing of tissue, whether diseased or sound. Rubefacients and epispastics are used as counter-irritants, acting by reflex action, to relieve pain, affect the digestion, relieve the inflammation, whether deep seated or superficial, to cause the absorption of effusions, and for their general systemic effects.

Rubefacients cause no decided alteration in the structure of the skin. (1) They are commonly used to relieve pain, as the mustard plasters, for example. They do it by relieving congestion, or by regulating the blood supply to the controlling nerve as in Intercostal Neuralgia. (2) For systemic effects rubefacients are superior to epispastics and the turpentine stupes are generally used. Inflammation of the skin just like any sthenic inflammation has a marked influence on the whole system. Hence, if the skin be irritated or be inflamed by artificial means, a systemic effect is produced. Therefore in condition of depression of the system as in acute collapse whether from shock, snake-bite, or any other cause, irritants to the skin are good. The rubefacients are here preferable to epispastics since they leave no local after-effects. Of course if the acute collapse be due to exhaustion, irritants which

would cause further exhaustion are contra-indicated. If rubefacients are applied too long they may excite an acute inflammation of the skin. (3) Rubefaction of large surfaces may cause a considerable abstraction of blood from other parts, and upon this fact depends the rubefacient use of mustard plasters for the relief of cerebral congestion, etc.

Epispastics are used for pain where a more decided action is needed as in certain cases of neuralgia. They produce a decided structural alteration of the skin, or what are familiarly called "blisters." They are very useful in inflammations of serous membranes as in Pleurisy, Peritonitis, and Pericarditis, for they hasten the removal of the effusions. They are not, however, to be used in dropsy for this purpose. They are often of service in neuralgic and in other forms of nervous irritation. In Neuritis they should be applied as a long narrow strip, the course of the nerve. In some chronic affections long continued blistering is required, and the blisters may be kept open by stimulating ointments. In these cases Escharotics may be required. Epispastics are contra-indicated by high fever, arterial excitement, and lack of vitality. Where the vitality is poor the blistering may lead to sloughing and ulcerations which are very slow to heal, and which may therefore increase the constitutional disturbance. In certain cases, however, where they seem contra-indicated, they may be used with great caution, as in infants, for example, whose vitality is not great.

Escharotics cause the death of the tissue to which they are applied. Their action depends largely upon the strength of the drug supplied. Thus the strong mineral acids and zinc chloride in dilute solutions act as rubefacients or epispastics, but in strong solution they are escharotics, causing death and sloughing. They are not to be used for large masses such as tumors, but for old ulcers, and unhealthy granulations, and to kill malignant growths. The nitrate of silver, already considered, is an escharotic, but its action is superficial since a mass of coagulated albumen is formed which prevents further action. The escharotics which act chemically do so in many ways; some cause oxidation, and some, like sulphuric acid, abstract water. They are extensively employed to kill toxins in poisoned wounds and to prevent their absorption. Another use is to remove diseased tissue.

(A) RUBEFACIENTS.

1. SINAPIS ALBA and NIGRA. WHITE and BLACK MUSTARD SEED, respectively. The white seeds are larger, 2 mm. in diameter; the black are smaller, only 1 mm. in diameter. The

interior of each is yellow and the flour is yellow, the flour being what is commonly called mustard. Black mustard contains myronic acid, and an albuminous principle called emulsion. When to these substances water is added, a reaction takes place and a volatile oil, *Oleum Sinapis*, is formed. This is a colorless or pale yellow fluid, with an acrid burning and pungent taste and odor. Applied to the skin it causes immediate reddening and blistering. The white mustard yields a crystalline principal, Sinalbin, but no volatile oil. Both contain a fixed oil of no importance.

Therapeutics. Mustard is a most excellent rubefacient, easily controlled from a mild rubefacient to an epispastic. As the latter it is inferior to cantharides; the blister formed is very sore and painful, discharges but little, and is hard to heal. For very mild effects it is diluted with flaxseed meal. Diluted mustard forms an excellent poultice. The flour is used in this case locally as a paste between two cloths. If the black mustard is used it must be more diluted than the white, usually with an equal volume or more of flaxseed meal or wheat flour. It is not applied very long as a poultice, generally half an hour or 20 minutes. A blister is never allowed to form. The officinal charta sometimes replaces the poultice. It is made of mustard which has been freed from the fixed oil present. Soak in warm water 15 seconds before applying. It may be placed on the bare skin, or a cloth may be interposed. The officinal *LINIMENTUM SINAPIS COMPOSITUM* consists of 3 per cent. of *OLEUM SINAPIS VOLATILE* with *FLUID EXTRACT* or *MEZEREUM*, camphor, castor-oil, and alcohol.

Mustard is also used as an emetic in the proportion of a tablespoonful to a glass of water. Mustard foot baths are also used in commencing cold in the head, cerebral congestion, neuralgia, flatulent colic, etc.

2. *LINIMENTUM CAMPHORAE*. This contains 20 per cent. of camphor and 80 per cent. of cotton-seed oil. It is a mild preparation of some practical importance, applied with more or less friction.

3. *LINIMENTUM SAPONIS*. A more active preparation already described, used when no oil is wanted. It is made up of soap, rosemary, alcohol, camphor and water. There is also a *LINIMENTUM SAPONIS MOLLIS*, liniment of soft soap, consisting of soft soap, oil of lavender flowers, alcohol and water.

4. *LINIMENTUM CHLOROFORMI*. Already mentioned; made up of 40 per cent. of commercial chloroform with 60 per cent. of soap liniment. It produces a burning sensation without any rubbing, and if applied a long time, causes a blister. It is useful for neuralgia pains and will deaden normal sensation. The

linament is much milder than pure chloroform which is sometimes used.

5. CAPSICUM. CAYENNE PEPPER and the stronger spices afford excellent materials for rubefacients. The former is generally used as the tincture. "Spice plasters" are made up of equal parts of ground cinnamon, ginger, cloves and allspice, and $\frac{1}{2}$ parts of cayenne pepper, or $\frac{1}{2}$ part of red peppers. They are mixed and the mixture is quilted in a bag. It is then moistened with alcohol, whiskey, vinegar or water and applied to the skin.

6. OIL OF TURPENTINE. This is a powerful rubefacient; *ectis* applied for too long a time it is an epispastic, and it may wholly destroy the epidermis. With some it may cause a painful eruption so that it cannot be used. It is generally applied in the form of Stupes already described. There is an officinal liniment of 35 per cent. strength used as a stimulant application to burns and to some sluggish forms of dermatitis.

7. PIX BURGUNDICA. BURGUNDY PITCH is the concrete juice from the Norway spruce, found chiefly in Finland and the Black Forest, but not in Burgundy. It contains a resin and volatile oil. The pitch is hard, brittle, reddish or grayish brown, softening with heat. It is used in several officinal plasters, including the Emplastrum Picis Burgundicae made up of 80 per cent. pitch and 15 per cent. yellow wax; and the Emplastrum Picis Cantharidatum, made up of 92 per cent. of pitch with 8 per cent. of Cantharides cerate. This is called the "warming plaster."

* 8. PIX CANADENSIS. CANADA PITCH from *Abies Canadensis*, found in New England, the Middle States, and Canada; commonly called hemlock pitch. It is hard, brittle, opaque, reddish-brown, and bitter; it is softer than Burgundy pitch. Heat softens it still further. It contains resin and a minute amount of volatile oil. It is used to make the Emplastrum Picis Canadensis of 90 per cent. of strength.

Both of these pitches are mild rubefacients, and there is no danger of blistering. They may be applied for a long time in Chronic Bronchitis and Muscular Rheumatism. The warming plaster, which contains Cantharides, is a counter-irritant, and may cause blistering.

9. TINCTURE IODI. This is a moderate counter-irritant. When applied to the skin it causes rubefaction, pain and desquamation according to the susceptibility of the individual. If a blister is formed, and this is rare, it heals rapidly. It is used in Pleurisy, Chronic Rheumatism, Synovitis, Intercostal Neuralgia, etc.

10. ICHTHYOL. Non-officinal. A substance obtained from a bituminous sulphurous mineral made up of the deposits of fossil fish, by dry distillation. It is a tarry product, reddish-brown, with a peculiar butuminous odor and taste, soluble in water, alcohol, ether, and chloroform. It unites with fat and vaseline in all proportions. There is also an Ammonic and Sodic Ichthyol-sulphate. Ichthyol when applied to the skin produces burning and irritation. It is used extensively in certain Skin Diseases, and is said to have an alternative action on the skin and the tissues immediately beneath it. It is also used for the relief of pain. In large enough amounts it will cause blistering.

* 12. CHRYSAROBINUM. A pale, orange-yellow crystalline powder, odorless and tasteless, insoluble in water, slightly soluble in alcohol, very soluble in ether. There is an officinal Unguentum of 5 per cent. strength, with 95 per cent. of benzoinated lard.

(B) EPISPASTICS.

1. AMMONIUM. For epispastic purposes ammonia is applied as the Aqua Ammoniae, containing 10 per cent. of the anhydrous gas, and the Aqua Ammoniae fortior, containing 28 per cent. The liniment consists of 35 parts of the Aqua Ammoniae and 75 of cotton-seed oil. They are all efficient irritants. The Aqua when applied to the skin on cloth causes a blister with considerable quickness. If the action goes too far, it acts as an escharotic, and causes sloughing. The liniment is a mild irritant which is not likely to pass the bounds of rubefaction, but its action can be made strong by altering the proportions. In applying it do not use much friction.

2. CANTHARIDES. Already discussed. Preparations of Cantharides when applied to the skin cause itching, redness, burning, blistering and severe pain. Long continued application causes deep inflammation and sloughing. If it is applied over too large a surface, thin or abraded skin, it may be absorbed and so give rise to constitutional effects; and this should always be borne in mind and guarded against. Its elimination after absorption causes much irritation to the kidneys. The preparation usually used for blistering is the Tincture or Cerate. The Tincture may be painted on, or the cerate applied on sticking plaster, a good margin being left to adhere. The officinal Charta is neater but less powerful. The Linimentum is a powerful rubefacient which is apt to cause blistering. The Collodium Cantharidatum is very useful in cases where patients remove the counter-irritant, or in inaccessible and difficult parts to place a dressing. It does not

act very quickly, not producing a blister even in 12 hours. Its action can be hastened by applying a flax-seed meal poultice when vesication has begun.

Tartar emetic and Croton oil are not much used for counter-irritants.

(C) ESCHAROTICS.

1. POTASSA. A hard, white, opaque solid, deliquescent, soluble in water and alcohol, with a caustic acrid alkaline taste and strongly alkaline reaction. Like the rest of the escharotics, it is a corrosive poison. The *Liquor Potassae* is a 5 per cent. aqueous solution. *POTASSA CUM CALCE* or Vienna Paste, consists of equal parts of potash and lime. It is a gray-white, deliquescent powder, very alkaline and caustic, used externally as a paste made with alcohol.

Applied to the skin potash abstracts water, unites with the fat, causes sloughs surrounded by zones of inflammation, ulcers and great pain. In applying it, therefore, protect the surrounding healthy surface by something like adhesive plaster greased on the upper surface. When the application has been made and sufficient action has been secured, wash with a dilute acid like vinegar. Potash is a very thorough remedy. Although Vienna Paste is less active, still the surrounding tissue should be protected when it is used, in the same way or by cotton soaked in vinegar.

2. SODA. SODIC HYDRATE. A white, opaque solid, occurring in irregular pieces, pencils, or cylinders, very deliquescent with a strong caustic, acrid taste and alkaline reaction; soluble in water and alcohol. The *Liquor Sodae* is a 5 per cent. aqueous solution. The uses of Soda are the same as those of Potassa, but it is milder and more easily controlled.

3. ACIDUM SULPHURICUM. A heavy, colorless or brownish acid, containing 96 per cent. of absolute acid. It is an exceedingly powerful escharotic, and is used to remove large growths. It may be used in the form of a paste mixed with charcoal or asbestos.

4. ACIDUM NITRICUM. A powerful caustic already described in detail. It is used to remove warts, and as an application to ulcers and chancres. It is never used to destroy large growths. In applying it the healthy tissue should be protected by oil or cotton dipped in an oil.

5. ACIDUM CHROMICUM. This occurs as crimson needle-shaped crystals, deliquescent and caustic; very soluble in water, but decomposing with alcohol. It is used both as a solid and in solution. It is an active oxidizing agent and sufficiently

concentrated breaks down any tissue. It is used to remove morbid growths, the surrounding parts being protected by adhesive plaster or sodic carbonate.

6. *ACIDUM CARBOLICUM*. To be described later. This exerts an anaesthetic action on the skin, and causes sloughing and little pain. It is used for nasal polypi, for hemorrhoids, and as an application to corns but with these exceptions it is not ordinarily used as an escharotic.

7. *ACIDUM ACETICUM GLACIALE*. Nearly white, absolute acetic acid, occurring as a crystalline solid at 15° C., 60° F., but as a colorless liquid at higher temperatures; with an acetous odor and strongly acid taste and reaction. It is miscible in all proportions with water and alcohol. The ordinary *ACIDUM ACETICUM* contains 30 per cent. of the absolute acid. The *ACIDUM ACETICUM DILUTUM* contains 6 per cent. Both are colorless liquids. Glacial acetic acid acts powerfully on warts and old sores with flabby and abundant granulations. The dilute acid is used as a simple lotion in night sweats.

8. *BROMUM*. The most severe and rapid of the escharotics. It causes severe or intense pain and complete destruction by oxidation. The vapor of Bromine is very irritating to the mucous membrane of the lungs and eyes, causing coughing dyspnoea. It has been used in Hospital Gangrene in the sloughs, and for gangrenous ulcers.

ARGENTI NITRAS acts more superficially as it forms a protective film. It is used in the air passages, rectum, vagina, and uterus.

9. *HYDRARGYRUM CHLORIDUM CORROSIVUM*. Corrosive sublimate is a moderate escharotic, of some danger, and not much used. In saturated solution it is used for Chancres but it is inferior to the nitrate of mercury for this purpose. It causes severe but transient pain. The *Unguentum Hydrargyri Nitratis* or Citrine ointment is used in specific ulcers, chancres, etc., quite extensively.

10. *ZINCI CHLORIDUM*. A white, crystalline powder, diliquescent, odorless; with a caustic, saline and metallic taste, and acid reaction; soluble in alcohol and water. It is a very powerful irritant and caustic, producing intense pain lasting 6-8 hours, and a white slough which comes off in 6-12 days leaving healthy granulations. It is used for Chancres and other Specific Ulcers. Conquin's Paste is made up of a solution of the zinc chloride mixed with flour, used internally. It is generally regarded that zinc chloride is a very efficient disinfectant, but this is not so.

11. ACIDUM ARSENIOSUM. An energetic and powerful, but somewhat slow escharotic, causing intense pain, and violent inflammation in the neighboring parts. The great objection to its use is the danger arising from absorption. It affects morbid growth more rapidly than normal structures, and is especially used to destroy malignant growths, as in Cancer and some forms of Lupus. It should never be applied to fresh wounds.

* 12. ABRUS PRECATORIUS. GEQUIRITY. Guinea pea, Paternoster bean, Black-eyed Susan. The seed contains Abric Acid and abrine. It is used to some extent as an infusion in diseases of the eye, but its use is dangerous.

XVI. Disinfectants and Antiseptics.

Disinfectants destroy bacterial life, and Antiseptics prevent or retard putrefaction and decomposition. For this reason all disinfectants are antiseptics but an antiseptic is not always a disinfectant. Fire is the most efficient of all disinfectants. Next in order of efficiency is moist heat, employed as confined steam or boiling water. Dry heat is good but it requires higher temperatures, and it will not penetrate readily. Cold is not a disinfectant but it is an antiseptic at and below the freezing point. Most of the so-called disinfectants have no power to kill germs; they are simply deodorizers, or they may delay putrefaction, but they are not disinfectants. The nitrate of lead has no value at all, and zinc sulphate is no better, though each have been extensively used.

1. CALX, LIME, is a disinfectant, and the milk of lime is antiseptic, but neither is much used. Lime is prepared by heating marble, oyster shells, or other forms of calcic carbonate. It occurs in white or whitish grey lumps which on exposure to air take up water and carbon oxide and become a white powder. Lime is odorless, has a sharp caustic taste, soluble in cold water (1-750), less soluble in boiling (1-1300). Lime sprinkled with half its weight of water becomes heated and is changed to the hydrate. This mixed with three or four parts of water is the milk of lime.

See lunulellum calcis for lumps.

✓ 2. CALX CHLORATA. CHLORINATED LIME or BLEACHING POWDER. Made by the action of chlorine on slacked lime, contains less than 35 per cent. of available chlorine. It has considerable disinfectant power. It is a white granular or lumpy powder, moist or dry, which on exposure slowly decomposes and gives off its chlorine. It is this which gives to it its value. A

solution in water of 2-4 per cent. strength is used as a wash and to disinfect sick-rooms, floors, clothing, etc.

3. LIQUOR SODAE CHLORATAE. Labarraque's disinfecting solution or chlorinated soda, contains 2.6 per cent. at least of available chlorine. It has the same uses as chlorinated lime. It is a clear greenish liquid having a faint odor of chlorine and a disagreeable alkaline taste. It turns red litmus blue and then bleaches it. It is made from Sodium Carbonate and Chlorinated lime.

4. CHLORINE, IODUM AND BROMUM. These are all disinfectants but iodine and bromine are not available for general use. Chlorine as a gas may be good in some cases but it requires some degree of moisture and is likely to injure fabrics and other materials. It is not therefore a practical disinfectant. It does not penetrate bulky articles very well.

5. SULPHUR. Burning sulphur is the oldest and most commonly used disinfectant, but it has a very limited power and is very inefficient or even worthless. In disinfecting rooms and houses the practice is to burn 1 pound per 1000 cu. ft. of air. It should be remembered that even with good disinfectants, not only in the sick-room, but any room to which the germs may have been carried should be disinfected. *for trials*

6. CORROSIVE SUBLIMATE. This is the best chemical disinfectant known, and is used in varying strength from 1-500 to 1-20,000. As an antiseptic, is diluted still more. It is rendered inert by albumen and other elements of decaying material. Ten parts of salt or tartaric acid to one of corrosive prevents this action of albumen. It is sufficiently familiar to need no further mention.

7. IODIFORM. Iodioform is not a disinfectant but it is an antiseptic, due to its influence upon the pyogenetic ptomaines.

8. POTASSII PERMANGANAS. In contact with organic matter potassic permanganate gives off oxygen and becomes inert. It is used as a stimulating cleansing wash in a strength of 1-20 gr. to the oz. for foul abscesses. It is an excellent deodorizer. It is also used to some extent as a disinfectant and antiseptic.

9. ACIDUM CARBOLICUM. CARBOLIC ACID is the most important drug of its class. It is the product of the distillation of coal tar, at 180-190 degrees C. When pure it is a crystalline white solid at ordinary temperatures, with a peculiar odor and acrid burning taste. Exposed to the light and air it turns pink or brown, and since it is very deliquescent, it absorbs sufficient water to liquefy. It is inflammable, burning with a red flame, soluble in 20 parts of water, and in alcohol, ether, chloroform, fixed and vol-

atile oils, and other solvents. A solution of carbolic acid will coagulate albumen, arrest fermentation, and destroy the lower forms of organic life, whether animal or vegetable. The term "acid" is a misnomer; it does not neutralize alkalies, is neutral in reaction, and does not make salts. There is an officinal Unguentum Acidi Carbolici of 5 per cent. strength. The crude acid is dark colored, has a disagreeable odor and contains many impurities. It is quite as useful as a disinfectant as the pure, for of course it contains carbolic acid and the impurities act similarly. Carbolic acid is most commonly used in a strength of 1-40; 1-20 is a saturated solution. Its only disadvantage is that it may exert poisonous effects.

Physiological Action. Locally applied to the skin carbolic acid when strong has a decided action, producing slight pain, or a sensation of numbness, and a white spot at the point of contact. If the application be long continued an eschar is formed, but it is not deep since a layer of coagulated albumen formed acts as a barrier to further action. Its effects on mucous membranes are still more marked.

Taken internally it acts as a depressant to the cerebrum, and in toxic doses it causes stupor, and at times convulsions of a spinal origin. Small doses have no marked effect on the circulation but doses sufficiently large depress it. In the first stage of poisoning the respiration is quick, and shallow later on, and finally death results from respiratory failure. The temperature is lowered by increased heat dissipation, and diminishing heat-production. In the blood it exists as an alkaline carbonate, and it is eliminated as the sulpho-carborate of potassium, hydrochinone, pyrocatechin and glycurenic acid. Some of it is burned up in the system. The urine is rendered dark or even black when it is used.

Toxicology. At times toxic doses act nearly as rapidly as prussic acid, and the person drops dead. When death is not immediate there are symptoms of gastro-enteritis, with vomiting, purging and all the signs of collapse. The eschars in the mouth are white surrounded by a red zone. Besides the symptoms of gastro-enteritis there is also great depression, coma, marked disturbance of the respiration, muscular weakness, and even spinal convulsions rarely. Very numerous cases of acute poisoning have come from the free external use in surgical practice, and as vaginal washes and injections. The preliminary symptoms begin with unrest, cerebral disturbance, dark colored urine and pain in the lumbar region due to irritation of the kidneys. The diagnosis is assisted by the odor of the acid, and if the strong acid has been taken by the eschars. The urine also tells a good deal by its color. The

treatment consists in the free use of the stomach-pump, for since the stomach is paralyzed emetics are useless. Warm demulcent drinks are good and also epsom salt and the sulphate of sodium. Heat should be applied to the extremities, and the circulation and respiration stimulated by digitalis and strychnine.

Therapeutics. Carbolic acid has no value used internally in constitutional diseases to kill germs. It is used internally only for its local effects as in nervous irritability of the gastro-intestinal mucous membrane, and in gastro-intestinal fermentation. It is also useful in certain forms of Diarrhoea. In nervous vomiting it may be of use by depressing the sensory nerves of the stomach. Dose: $\frac{1}{2}$ –2 m. As an antipyretic it has no value. In gangrene of the lungs a weak solution may be used; but it is inferior to creasote. Externally carbolic acid has many uses. Mixed with oil in the proportion of 10 drops to an oz. it is very serviceable for burns. It relieves the pain, lessens suppuration, and assists cicatrization. As a caustic in the treatment of small growths, it has some value, but it is useless when applied to a large mass of tissue. It is also used locally in diphtheria, ulcerative sore-throat and ampthous stomatitis with glycerine. In surgery it has very many uses.

10. CREASOTUM. CREASOTE is a product from the distillation of wood-tar. The pure article is a colorless, oily liquid, with a caustic, burning taste and disagreeable and penetrating odor; volatile, inflammable, burning with a sooty flame; with a neutral reaction. Ordinarily the acid is yellowish or brown. It is soluble in 80 parts of water, very soluble in alcohol, ether, and chloroform. It does not coagulate albumen. In physiological action is almost identical with carbolic acid. It is used locally and externally in various skin-diseases and as a local anaesthetic and antiseptic. Taken internally it causes nausea and reflex vomiting. Aqua Creasoti is a 1 per cent. aqueous solution used internally to check vomiting in 1–4 dr. doses, and externally as a wash. Dose of creasote, 1–3 m.

11. CREOLIN Non-officinal. A black liquid derived from English soft coal by dry distillation, insoluble in water but forms emulsions with it. It is non-irritating and not very poisonous, and is a powerful antiseptic. It is used as an antiseptic and vaginal wash in a 2 per cent. solution. In Cystitis it is used at first as a 1 per cent. solution gradually increased to 2 per cent. It is also used in various other conditions treated of in other courses.

12. ~~NAPHTHALINUM~~. A derivative of coal-tar and petroleum, occurring in colorless crystals, with a peculiar odor, insoluble in water, soluble in alcohol. Slowly volatile at ordinary

temperatures, more so at high. It has marked antiseptic properties and its use has been suggested in gastro-intestinal conditions where fermentative changes are going on, as in ulcerations and foetid Diarrhoea. In practice it may be useful, but it is more often ineffective when so used.

~~13. RESORCINUM.~~ A derivative of Phenol, occurring in colorless or faintly reddish crystals with an unpleasant, sweet and acrid taste, aromatic odor, soluble in water, ether, alcohol and oils. On the mucous membranes it acts as an irritant. Taken internally its chief action is on the nerve centers. It has practically no value when so used. In Whooping Cough it is said to be of considerable value as a 5-20 per cent. solution applied locally as a spray, or as an inhalation, being heated in a porcelain crucible. It is also used locally in Hay-Fever and Diphtheria more or less. In the latter case a 10 per cent. solution in glycerine is painted on the pharynx. In Cystitis it is used locally as an injection, and is also used locally in Bronchorrhoea, Leukorrhoea, Gonorrhoea, and various other conditions, and in Skin Diseases.

14. ACIDUM BORICUM. Boric Acid occurs as transparent, colorless plates, odorless, with a cool, bitter taste; slightly acid in reaction; soluble in water and alcohol. It occurs in seawater, in certain minerals in combination with Magnesium, and mineral waters, and in borax. Its chief source is California and Italy. It is soluble in glycerine, making a glycerite of boroglycerine, useful as a disinfectant preservative.

SODII BORAX. Borax is a white, odorless, substance, with a mild, cooling taste, and alkaline reaction. Soluble in water and glycerine, insoluble in alcohol.

These two substances in 1 per cent. solutions act as feeble antiseptics but not as disinfectants. They are used in Antiseptic Surgery, in the treatment of abscesses, burns and ulcers and as eye-washes. They are also used as mouth-washes and for Pruritus Ani and Vulvae and certain Skin Diseases. Taken internally they have no marked action, though in some cases toxic symptoms have been produced, such as depressed circulation, nausea, vomiting, a fall of temperature, and great depression of spirits. They are both eliminated by the kidney, and may set up an acute nephritis. They are used internally more or less of late for Epilepsy in doses of 5-15 gr. Boric acid will acidify ammoniacal urine, and it is therefore used in Chronic Cystitis and Prostatitis in 10 gr. doses 3-6 times per day.

15. THYMOL. Also called THYMIC ACID. A substance obtained from Oil of Thyme, and other valuable oils of which it probably is the most important constituent. It is insoluble in

water but soluble in alcohol, ether, chloroform, fixed and volatile oils. It is somewhat irritant but has powerful antiseptic properties, and is something of a disinfectant. It is not free from toxic properties, but the amount necessary to produce toxic symptoms is larger than the amount ordinarily used. In summer weather it is not desirable since it draws flies. It is expensive, has no especial advantage over the other members of the group, and cannot be recommended highly. It is used as an intestinal antiseptic in Typhoid Fever in $\frac{1}{2}$ –2 gr. doses in capsule or wafer.

16. AQUA HYDROGENII DIOXIDI. HYDROGEN PEROXIDE. This is a very active germicide if it be true that a solution of 1–1000 will kill the germs of Typhoid Fever and Cholera, as has been claimed for it. It yields up its extra atom of oxygen very readily. The best preparations yield ten volumes of available oxygen. At temperatures above 60° F. it undergoes rapid changes, and so it should be kept in a cool place. It has a bitter, harsh, acidulous taste, and coagulates albumen, though it is not a caustic is used as an antiseptic wash and local stimulant.

17. SODII SULHIS, BISULPHIS AND HYPOSULPHIS. Sodic Sulphite is a white, efflorescent, odorless salt, with a cooling sulphurous taste and neutral or feebly alkaline reaction; soluble in water, very slightly so in alcohol. It is somewhat of an antiseptic, but not a disinfectant. Sodic Bisulphate is a white substance, with a faint, sulphurous odor, acid reaction, and disagreeable taste. It contains a larger percentage by weight of sulphurous acid than the former and is more antiseptic than the normal sulphite, for which it may be substituted. Sodic Hyposulphite is a white, odorless substance, with a bitter, cooling, saline and sulphurous taste, neutral or slightly alkaline in reaction.

For internal administration Sodic Hyposulphite is the best. The Sulphite and Bisulphite have a very slight disinfectant power, and they are used to prevent or control fermentation in various processes. The Bisulphite and Sulphite applied in solution to the skin act as parasitocides. The Hyposulphite is used as a gargle in Tonsillitis and is said to be valuable in Fermentative Dyspepsia in 15 gr. doses.

18. PYOKTANIN. This methyl violet or any of the aniline dyes which are freed from arsenic.—They are all feeble and antiseptics and hardly do what is claimed for them. Since they stain everything they come in contact with and have little antiseptic value, they are not to be recommended.

19. SACCHARIN. This substance possesses 200–300 times the sweetening power of cane-sugar. It is a crystalline substance, slightly soluble in water, soluble in alcohol and ether. It is used

as a substitute for sugar by diabetic patients and by those who avoid sugar in the treatment of obesity. It is eliminated unchanged in the urine. In a mixture of 2 parts of Saccharin to 3 of bicarbonate of soda, it is a powerful antiseptic, and is used successfully in the treatment of Chronic Cystitis with ammoniacal urine. It does not check gastric digestion, but a 1 per cent. solution will lessen pancreatic digestion. The ordinary dose when used as a medicine is 5 gr. When it is used as a food it is varied to suit the taste.

20. SODII SULPHO-CARBOLAS, colorless, transparent, rhombic prisms, odorless, saline bitter taste; neutral efflorescent in dry air; soluble in alcohol and ether. It is decomposed in the system to carbolic and sulphuric acids. It may be of use in fermentative dyspepsia and diarrhoea.

There are a large number of other proprietary disinfectants and antiseptics of no value as such, as Ozones, for example, and they will not be mentioned.

XVII. Unclassified Drugs.

There are left for consideration a large number of unimportant substances, but to which, nevertheless, attention must be called in order that it may be known that they are in the U. S. Pharmacopoeia.

1. SACCHARUM. CANE-SUGAR. Used as a vehicle, and also to conceal the taste of disagreeable drugs, and as a preservative. Soluble freely in water, and in 175 parts of alcohol, but a saturated aqueous solution of sugar is miscible with alcohol in all proportions. The officinal Syrupus is 85 per cent. sugar and 15 per cent. water.

2. SACCHARUM LACTIS. SUGAR of MILK. Less soluble in water, not so sweet as cane-sugar; insoluble in alcohol. Its chief use is making triturations and in the preparation of the food of infants.

3. MEL AND MEL DESPUMATUM. HONEY and CLARIFIED HONEY.

~~4. ACIDUM OLEICUM.~~ A yellow or brownish oily liquid with a bland taste when fresh but becoming rancid and acid when kept where it is exposed to the air. This fact should be borne in mind when it is used as a vehicle. It has a characteristic odor, generally very faint; is insoluble in water, but soluble in alcohol and chloroform. It is considerably used in pharmaceutical preparations.

5. SAPO AND SAPO MOLLIS. These are respectively a soap of soda and olive oil, and of potash with linseed oil; that is, hard and soft soap. The hard soap or Sapo is used as an antidote in many cases of poisoning, as an aid to emetics, and with water as an enema. As a simple suppository it is used to provoke movements of the bowels in young children. The soft or potash soap is used to a considerable extent in Skin Diseases. There is an officinal Linimentum Saponis of 10 per cent. strength, containing soap, camphor, oil of rosemary, alcohol and water. There is also a Tinctura Saponis Viridis, containing oil of lavender, alcohol and green soap. It is used in Skin Diseases.

6. ACIDUM HYDROCYANICUM DILUTUM. A colorless, clear liquid, with a characteristic odor and taste, like bitter almonds; with an acid reaction. It contains 2 per cent. of an hydrous hydrocyanic acid. Dose: 1-3 m. which can be quite frequently repeated.

POTASSII CYANIDUM. This may be used instead of the acid. It occurs in white amorphous pieces or a white granular powder, deliquescent, with an odor like bitter almonds, a sharp, alkaline taste and reaction; soluble in water. Dose: $\frac{1}{10}$ gr. for internal administration. The acid is used in various Cough mixtures, nervous vomiting and Gastralgia. It is used externally as a wash. The potassic salt is used as a substitute for the dilute acid. Both the acid and the potassic salt slow the respiration and circulation and stimulate the vaso-motor system directly and indirectly. In poisonous doses death is very rapid.

~~7. ACIDUM CITRICUM AND ACIDUM TARTARICUM.~~
These both have a certain power to lower the force of the heart, but they are not much so used. In large doses tartaric acid acts as an irritant and its effects are met by the administration of opium and alkalies.

8. Barii Chloridum. This acts on the circulation, slowing and steadying the pulse-rhythm and raising the blood pressure. It is used in Cardiac Diseases where the heart muscle is weakened, the dose being 1-2 dr. of a solution of 5 gr. to the oz.

9. OLEUM AMYGDALAE AMARAE. OIL of BITTER ALMONDS. A colorless or yellow volatile oil obtained from bitter almonds by maceration with water and subsequent distillation. The taste is bitter and burning, the reaction neutral. Soluble in alcohol and ether and in 300 parts of water. It is used as a flavor. There is an officinal Aqua containing 1 part in 1000 of water also used as a flavor. The officinal spirit contains 10 parts of the oil, 800 of alcohol and water to 1000.

10. **ARNICAE FLORES.** The flowers of Arnica contain two alkaloids, Arnicine and Cyticine. There is a tincture of arnica flowers which is a local stimulant, and upon susceptible persons may cause Acute Dermatitis. Taken internally in small doses it slows the heart; in large doses it paralyzes the pneumogastric, and so increases the rate of the pulse. It is not used internally. Externally it is used as a stimulating application to sprains and bruises as the tincture. It must be used cautiously lest it excite irritation and cause dermatitis.

11. **MENTHOL.** **OIL of PEPPERMINT CAMPHOR.** A stear-opten obtained from oil of peppermint. A local anaesthetic used in neuralgia pain along the course of the nerve. It relieves the pain. It is also used to control boils, carbuncles, superficial abscesses, etc., applied as an ethereal solution of any strength between 10-50 per cent. two or three times per day. It occurs in colorless prismatic crystals, odor of peppermint, aromatic taste, slightly soluble in water, soluble in alcohol and ether.

12. **RHIZOLENE.** A petroleum product, with a boiling point of 64.4° F. evaporating rapidly and producing when applied as a spray localized numbness or freezing, taken advantage of in Minor Surgery.

13. **AGARIC.** Agaric, boxwood, or from certain species of mush-room with a sweetish bitter taste; containing 72 per cent. of resinous matter and 2 per cent. of a bitter extractive. Its physiological properties and those of its alcoholic extract are not well known but it is supposed to act on the termination of the nerves which control the sweat-glands. In over-doses it acts as a cathartic. Agaric has great value, according to some, in the exhausting Night-Sweats of Phthisis. The Agaric is given in 5 gr. doses every few hours.

14. **OXYGEN.** This has been much used of late given by inhalation in the second and third stages of Pneumonia when there is insufficient aeration of the blood, in advanced Bronchitis, in poisoning by illuminating gas, and in other conditions where a supply of oxygen is needed. When so given the gas is diluted with air, and it may be mixed advantageously with small amounts of nitrous oxide. There is an Oxygen Water containing oxygen gas in water under pressure, valuable in Chronic Dyspepsia and persistent vomiting and headache from gastric derangements. A dilute solution of peroxide of hydrogen is similarly used.

15. **CASTANEA.** Chestnut leaves of *Castanea vesca*, used in Whooping Cough, being given as an infusion of 10 m. to 1 dr. in water. It has no other extensive use. There is a fluid extract given in $\frac{1}{2}$ -1 dr. doses or even more.

16. **VIBURNUM PRUNIFOLIUM.** BLACK-HAW. The bark of *Viburnum prunifolium*, containing a brown resin, a neutral principle Vibirnin, Valerianic, Tannic, Oxalic, Citric and Malic Acids, and inorganic. It is used to prevent threatened abortion, and in habitual Dysmenorrhoea as the fluid extract in 1-2 dr. doses.

17. **LACTUCARIUM.** The concrete juice of various kinds of lettuce, supposed by some to have a soporific action, but it is probably inert. The dose is practically ad libitum although a dose is given in the books.

18. **DERMATOL.** A new remedy, the sub-gallate of bismuth. A fine yellow powder, odorless and permanent in air. It has the same uses and same effects as Iodiform. It is used as an astringent dressing for wounds, and renders them unfavorable places for the development of micro-organisms. It has some toxic properties, but they are far behind those of Iodiform.

19. **CALX SULPHURATA.** A mixture of the sulphide and sulphate of calcium, containing not less than 36 per cent. of the absolute sulphide. It is a grey or yellowish white powder, with a faint odor like sulphurated hydrogen; with a disagreeable taste and slightly alkaline reaction. It is slightly soluble in water, insoluble in alcohol. It is used externally for the treatment of Boils in doses of $\frac{1}{10}$ - $\frac{1}{2}$ gr. in capsules every two or three hours.

There are a large number of other substances of even less importance than those discussed, which are scarcely worth mention.

PRESCRIPTION WRITING.

Names ending in *a* changed to *ae*. Exceptions: Cocoa (?) Physostigma, Atis, Folia.

Us, um, os, on.

Genitive in *i*. Exceptions: Quercus, Spiritus, Erigeron (ontis.)

All others in *s* or *is*.

us — atis.

is — idis or itis.

o — onis.

ex — icis.

ix — icis.

No change in genitive.

Amyl, Buchu, Cannabis, Catechu, Cocoa, Digitalis, Hydrastis, Kino, Quercus, Sassafras, Sinapis, Spiritus.

METRIC SYSTEM.

Weights:	Gram, 1000 = 15.43 + gr.
1 Grain	= 65 milligrams.
1 Drachm	= 3.90 Grams.
1 Ounce	= 31.2 Grams.
1 c c	= 16.23 M.
1 M	= 0.062.
1 fl. Drachm	= 3.70 c c.
1 fl. Ounce	= 29.76 c c.

QUESTIONS AND ANSWERS.

Mention the different uses of mustard and give methods of application.

It is an irritant, easily controlled as a paste between two cloths. usually mixed with flaxseed meal and applied from 20–30 minutes. As an emetic, tablespoonful to a glass of water. Mustard baths are used.

What is the difference between a cerate and an ointment?

A cerate is of firmer consistency.

What is the action of extract of Malt?

It acts as a digestant of Starch, acting best in a neutral solution. It should be given with or directly after a meal.

Describe the action of Digitalis and explain its action in Mitral Stenosis and Insufficiency.

It lengthens diastole, etc.

Why administer Gallic rather than Tannic acid internally?

Because Tannic acid is absorbed as Gallic, besides tannic has no remote effects.

What is the emetic dose of Sulphate of Copper?

Five to fifteen grains.

Write a prescription for Sulphate of Zinc 2 gr. in 4 oz. of an aqueous solution of boracic acid 3 per cent.

R. Zinci Sulphatis gr. ij.

Acidi Borici oz. j.

Aquae q. s. oz. iv.

What is Oleum Phosphoratum?

P. 1, Exp. oil almonds 90, heated to 250°.

What is the physiological action of Bromides?

Depresso-Motors. They act as a sedative to the sensory tract: lessen reflex irritability, act as an anodyne.

What are its uses?

To quiet cerebral excitement, due to mental strain, for night-mare and night horrors. Wakefulness caused by Hyperaemia, Migraine, Delirium Tremens. Its chief use is to lessen reflex action. It is used in Tetanus, Chorea, and Strychnine poisoning.

What is Bromism?

It is an accumulation of bromine in the system. See symptoms.

Write a prescription for Bromide of Potassium with a vehicle to cover taste.

R. Potassii Bromidi gr. x.

Syrupi Simplicis oz. j.

Glycyrrhizae gr. x. *M.*

How does Ammonia affect circulation?

Respiration is stimulated and arterial pressure is greatly increased.

Why not use Ammonia as an indirect antacid?

Because it is oxidized in the system to nitric acid and urea, thus increasing acidity of urine.

Belladonna : Its physiological effects and principle uses.

It stimulates the heart muscle and vaso-motor centres (the heart is depressed only in very large doses).

Small doses stimulate and large doses depress respiratory centres.

Small doses increase and large doses lower temperature.

On the secretions its action is not marked, (decreases saliva and sweat and increases urine.)

It has no effect on voluntary muscles except in poisonous doses, on the involuntary it acts as a paralyzant and anti-spasmodic on the nervous system. It is a powerful excitant of cord and brain in moderate doses, in large doses the opposite. It dilates the pupil.

It is used to relax spasms. It is used in nervous coughs, in spasms of urethra and chordee, also in incontinency of urine. As a stimulant to the circulation. In arresting excessive secretions.

In diseases of the eye to dilate the pupil, antidote of opium poisoning.

Compare Chloral, Sulphonal and Trional.

What is the action of Aloes on the pelvic organs?

It aggravates the menstrual flow and it may cause abortion.

How would you make the urine acid?

Give Ammonia. Benzoic Acid.

Write prescriptions for (1) Vegetable Cathartic Pills.

R. Pulveris colocynthis compositi gr. xij.

Hydrargyri chloridi mitis.

Jalapae.

Gambogia.

Describe Iodide of Potassium.

White transparent crystals, odorless, disagreeable alkaline taste and neutral reaction. It is very soluble in water and alcohol. Slightly deliquescent.

Describe Acetate of Potassium.

It is a white crystalline mass or granular powder, odorless, very deliquescent. Soluble in water and alcohol. Saline taste and faintly alkaline reaction.

Describe Terebene.

It is a clear colorless liquid, isomeric with turpentine—peculiar odor like pine wood. It is made by adding five per cent. of sulphuric acid drop by drop to turpentine, keeping the solution cool.

Describe Calomel. Repeated.

Describe Camphor. White crystalline, translucent masses with a strong fragrant penetrating odor, and bitter, pungent taste. Very soluble in alcohol. Slightly so in water.

Equal parts of camphor and chloral rubbed together make a liquid which has the power of taking up atropine, morphine and other vegetable alkaloids.

Composition of Paregoric :

Powdered Opium, Benzoic Acid, Camphor, Oil of Anise, four parts each, Glycerine 40 gr., dil. alcohol q. s. to make 1000 gr.

Compound Infusion of Senna (Black draught) ?

Epsom Salts, Manna, Senna and Fennel.

Compound Syrup of Squills (Hive Syrup) ?

Squill, Senega Tartar Emetic, Calcic, Phosphate Sugar and Water.

Dover's powders ?

Opium, Ipecac, and Sugar of Milk.

Compound Rhubarb powder (Gregory's powder) ?

Rhubarb, Magnesia, and Ginger.

Tully's Powders (Pulvis Morphinae compositus) ?

Camphor, Glycyrrhize, Precipitated Calcic Carbonate 20 gr., and Sulphate of Morphine 1 gr.

Compound Glycyrrhiza Mixture ?

Extract of Glycyrrhiza 30, Sugar 50, Mucilage of Acacia 100, Paregoric 120, Wine of Antimony 60, Spirits of Nitrous Ether 30, water to make 1000.

What is a prescription ?

Directions for compounding certain drugs, with instructions for their administration.

What are officinal preparations ?

Drugs recognized by the U. S. Pharmacopoeia.

Define the following pharmaceutical preparations :

(1) Suppositories are conical bodies for introduction into the rectum where they melt with the heat of the body.

(2) Ointments are preparations made of various combinations of medicinal agents with lard, vaseline and wax or lard alone.

(3) Tinctures are alcoholic solutions of non-volatile constituents.

(4) Extracts are solid or soft. The solid preparations made either by evaporating the fresh juice or an aqueous, alcoholic or acetic acid extract of the crude drug.

(5) Pills are small spherical bodies containing one or more medicinal agents.

(6) Mixtures are preparations in which one or more insoluble substances are held in suspension in water by means of mucilage, sugar, etc.

Doses and solubility in water of :

- (1) Salicylate of Sodium 5-60 gr. Soluble.
- (2) Corrosive Sublimate $\frac{1}{8}$ - $\frac{1}{4}$ gr. Soluble.
- (3) Bicarbonate of Soda. 5-60 gr. 11 p.
- (4) Calomel 5-15 gr. Insoluble.
- (5) Sulphate of Mag. 1-4 drs. Soluble.
- (6) Chloral 5-20 gr. Soluble.
- (7) Phosphate of Sodium 5 gr-1 oz. 5 p.
- (8) Gallic Acid 2-40 gr. 100 p.
- (9) Subnitrate of Bismuth 5-60 gr. Insoluble.
- (10) Castor Oil 1-4 dr. Insoluble.

Mention three preparations of Rhubarb with doses.

Pilulae Rhei Co., 1-3.

Aromatic Syrup 1 dr.

Tinct. Rhubarb 1-3 oz.

Mention one preparation of Podophyllum with dose.

Resina Podophylli $\frac{1}{8}$ -1 gr.

How does deodorized Tincture of Opium differ from Laudanum?

200 p. of Alcohol in Laudanum are replaced by 200 p. of Ether.

Mention with doses three compounds of K.

(1) Potasii Bitartras 20-60 gr.

(2) Potasii Acetas 5-60 gr.

(3) Potassi Citras 5-30 gr.

Two compounds of Ammonium:

(1) Aromatic Spirits of Ammonia.

(2) Carbonate of Ammonia.

Two compounds of Iodine :

Iodide of Potassium.

Syrup of Hydriodic Acid.

What are the active principles of?

- (1) Belladonna (atropine and hyoscyamine).
- (2) Jalap (convulvulin).
- (3) Nux Vomica (strychnine, brucine).
- (4) Galla (tannin-gallic acid).
- (5) Aspidium (an oleoresin).
- (6) Digitalis (digitalin).
- (7) Erythroxylon (cocaine).

Mention two useful alkaloids of Opium.

- (1) Morphine. (2) Codeine.

Write a prescription for pepsin.

R. Pepsini Saccharati gr. xvi.

How would you give Caffeine?

By the mouth or subcutaneously.

31 p. Sodid Salicylate. 40 Caffeine, Water 60.

Write two prescriptions for an emetic, one of them for hypodermic injection, with directions.

R. Sinapis oz. j.

R. Ipecacuanhae oz. ij.

R. Apomorphinae Hydrochloratis gr. j.

Sig. Dissolve in oz. iv. water and inject $\frac{1}{4}$ every $\frac{1}{4}$ hour until vomiting is produced.

Write three prescriptions for Iron.

R. Ferri Reducti oz. iij.

R. Ferri et Quininae Citratis oz. iij.

R. Pilulas Ferri Iodidi No. lx.

Write two prescriptions for Digitalis.

R. Tincturae Digitalis oz. j.

Write one prescription for Ergot.

Three for mercury—one for external use.

R. Hydrargyri oz. ij.

R. Unguenti Hydrargyri oz. ij.

How do we know that the fall of temperature after administration of Antipyrin is not dependent on sweating?

Sweating may be stopped and the fall still continue.

Compare the antipyretic effects of cold bath, fanning, and Antipyrine.

Mention the different methods of introducing Mercury, and state their relative advantages.

What effects are produced by small and large doses of Nitrite of Amyl?

Small dose : flushing of face, rapid pulse, labored respiration, roaring in ears and fullness in head. Large dose : pallor, dilated pupils, relaxed muscles, pulse very weak, respiration irregular.

Compare the action of Nitrite of Amyl, of K.Br. and of Nitroglycerine.

Potassium acts more slowly than amyl but longer. Nitroglycerine is still more slow and more lasting. It is the most powerful.

Action of Pilocarpine — Compare with Atropine.

Sweating and salivation, sometimes nausea and vomiting. Sweat at first is acid, next neutral, then alkaline. Pulse increased, and sometimes weakened heart. Pupils are sometimes dilated.

Pilocarpine is the physiological antagonist of Atropine.

Man found in streets unconscious, respiration slow and stertorous, pulse feeble and irregular, pupils contracted, breath alcoholic, oedema, urine albuminous. Discuss possibilities.

In what conditions are emetics contra-indicated?

Congestion of the brain, gastric inflammation, aneurism, hernia, advanced pregnancy and tendency to prolapse of uterus.

Mention best remedy to check secretion of milk in an inflamed breast?

Belladonna, internally or locally.

What dangers attend the misuse of ergot in childbirth?

It may rupture the uterus or perineum or kill the child by cutting off circulation.

In what form is Acetate of Potassium eliminated?

Bicarbonate of K.

How would you administer Aspidium?

The oleoresin in capsules or emulsion followed by a cathartic.

Describe, giving chief chemical and physical properties :

(1) Chloride of Iron. Orange yellow crystals, very deliquescent, odorless, strong styptic taste, acid, soluble in water, alcohol and ether.

(2) Biniiodide of Mercury. Scarlet red, amorphous, crystalline powder, tasteless, odorless, almost insoluble in water, soluble in alcohol.

(3) Sulphate of Quinine. White, bitter, silky crystals, neutral, soluble in 700 parts of water, 65 alcohol, chloroform, and ether.

(4) Iodoform. Small yellow crystals with a strong, dry, disagreeable odor, unpleasant and slightly sweetish taste, insoluble in water, soluble in alcohol.

(5) Chloral. Transparent, colorless tablets or crystals, penetrating acrid odor, bitter caustic taste, neutral, soluble in alcohol and water.

What is Homatropine?

Atropine when decomposed forms tropic acid and tropine these reuniting to form homatropine, which is less powerful than atropine.

What parts of the different plants do the following represent?

Digitalis, leaves; Belladonna, leaves and roots; Colchicum, seed and root; Stramonium, leaves and root.

Action of Acids and Alkalies given before and after meals.

Acids check acid secretions; and alkalies, alkaline. Therefore acids before a meal prevent the secretion of gastric juice, and so interfere with digestion.

Alkalies before a meal stimulate acid secretion and so aid digestion.

Acids may be given during digestion.

Upon what does the duration of action of drugs depend?

Rate of decomposition.

Rate of elimination.

Scientific names and doses of:

Castor-oil: *Oleum Ricini* $\frac{1}{2}$ –2 fl. oz.

Dover's Powder: *Pulvis Ipecacuanhae et opii*, 5–15 gr.

Paregoric: *Tincture Opii Camphorata*, 1–4 dr.

Tincture Nux Vomica: *Tincturae Nucis Vomicae*, 5–20 m.

K Br: *Potassii Bromidium*, 5–60 gr.

Compound Rhubarb pill: *Pilulae Rhei Compositus*.

Reduced Iron: *Ferrum Reductum*, 2–5 gr.

Cod Liver Oil: *Oleum Morrhuae*.

Tincture Digitalis: Same.

Tincture Catechu: Same.

How would you administer Calomel for its cathartic and for its constitutional effects?

5–15 gr. as cathartic. $\frac{1}{2}$ –1 gr. with opium.

Compare the action of large doses of irritant and centric emetics.

The irritant will have action for a short time only, the drug being expelled by the act of vomiting.

The centric's action will be long continued with great depression,

nausea, and muscular weakness. Circulation and secretions are depressed.

How would you treat a case of poisoning by Aconite?

Give cardiac stimulants (ether followed by alcohol) and digitalis subcutaneously. Place feet above the head, artificial heat. Empty stomach by pump, use artificial respiration if necessary. Small doses of Amyl Nitrite if heart stops.

Physiological action of the Bromides? How avoid bromide acne?

Irritant to mucous membrane, circulation, respiration and temperature are depressed, marked depressant of brain and cord, acts as an anodyne by paralyzing periphery.

Fowler's solution in small doses clear up acne.

In what condition is Digitalis contra-indicated and why?

In gastritis because it is an irritant. Arterial excitement, aneurism, atheroma and appoplexy because it increases blood tension. Aortic regurgitation on account of prolonged diastole.

What action has Alcohol on temperature and digestion?

It does not increase heat but changes its distribution; large doses cause increased radiation. In small doses it aids digestion.

What influence, if any, has the habitual use of alcohol on the chances of recovery from acute diseases and surgical operations?

It has a very bad influence, as patients succumb very easily.

Value of Iodoform as an antiseptic?

Locally it is an antiseptic.

Should Iron be given in large or small doses, and why?

Large doses interfere with digestion and since small amounts only will be absorbed it is better to give small doses.

Give instances of different and even opposite effects of drugs in large and small doses.

Ipecac: Large doses cause emesis, small check it.

Define a suppository, tincture, extract pill mixture.

Doses and solubility in waters of:

Salicylate of Sodium.	Soluble	5-60 gr.
Bicarbonate of Sodium.	"	5-60 gr.
Corrosive Sublimate	"	$\frac{1}{80}$ - $\frac{1}{10}$ gr.
Calomel.	Insoluble	$\frac{1}{2}$ -10 gr.
Sulphate of Magnesia.	Soluble	$\frac{1}{2}$ -4 dr.

Phosphate of Soda. Soluble 5-gr. 1 oz.

Gallic Acid. " 10-40 gr.

Give examples of chemical and physiological incompatibility.

Spirits of Camphor and Alkalies.

Morphine and Atropine.

What is the effect of Narcotics on anaesthesia?

They modify symptoms and lengthen time of action.

What accidents may occur during anaesthesia by ether, and what course would you pursue to meet them? See Anaesthetics.

Differentiate between tetanus and strychnine poisoning?

The latter comes on quicker, more convulsions, and they are produced by draughts of air; intermissions are more complete; jaw is last affected; great pain; patient screams; feet are everted.

Salicylic Acid. Absorption, action, elimination and uses.

It is absorbed as Salicylate of Sodium.

It produces fullness in the head, buzzing in the ears, deafness and headache, depresses circulation, produces sweating, feeble respiration and respiratory failure. It is eliminated by kidneys, sweat, and saliva as salicylate of sodium and salicyluric acid (salicylic acid?)

Physiological action of heat and cold. See Imponderables.

A child under treatment for whooping cough, takes medicine, face and neck flushed, mouth dry, mental confusion. Name drug giving those effects.

Belladonna.

In what ways do cathartics promote purgation? Classify cathartics and give examples. By increasing peristalsis and secretion or by doing both.

Hydrogogues (Castor Oil). Drastics (Mandrake). Laxatives (Cascara Sagrada).

How is the reaction of the urine affected by:

Ammonia? Made acid.

Benzoic Acid? Made acid.

Carbonate of Lithium? Made alkaline.

Citrate of Potassium? Made alkaline.

Cream of Tartar? Made alkaline.

Mention the unpleasant effects of Quinine.

ringing in ears, fullness in head, slight deafness. Large doses produce giddiness, disturbed vision, and headache.

How is Quinine used as a prophylactic and as a remedial agent in intermittent fever? Contra-indications.

Give 5 gr. doses during the interval of attacks, and large doses 2-3 hours before.

- (1) Persons with acute or sub-acute diseases of the middle ear.
(2) Gastro-intestinal irritation. (3) Idiosyncrasy.

Mention important antipyretic drugs, and state how they reduce temperature in fever.

Antipyrin, Phenacetine, Antifebrin.

To what extent do they affect normal temperature?

They may lower it at about $\frac{1}{10}$ degree.

1. *Opium*. (a) Mention any preparations suitable for treatment of children. (b) Percentage of morphine in dry opium. (c) Solubility of morphine in water. (d) Composition of pulvis morphineae compositus. (e) Dose of codeine. (f) Write prescriptions for five preparations of opium.

(a) Paregoric. Morphine powder Co. (b) 10-12 per cent. (c) Insoluble in cold, nearly so in hot water. (e) $\frac{1}{2}$ -2 gr.

Mention the comparative advantages of Ether and Chloroform.

How prepare the Sesquioxide of Iron as an antidote?

Perchloride of Fe. $\frac{1}{2}$ oz. Water half tumblerful. Mix with an equal amount of a solution of Washing soda. Thoroughly mix. It should be freshly prepared.

Composition and dose of Unguentum Diachylon.

Lead plaster, olive oil and oil of lavender flowers.

Give alcoholic strength of alcohol 91 per cent. by weight, brandy 39-47 per cent., and whiskey 44-50 per cent.

What is Vinum Allium Fortius?

It is made by adding 1 p. of alcohol to 7 of white wine. 20-25 per cent.

What is Sparteine, and from what obtained?

It is a colorless volatile liquid, insoluble in water, soluble in alcohol, bitter taste. Obtained from Scoparious.

What is active principle of Digitalis? Digitalin.

Dose of tincture of Strophanthus: Caffeine.

1-6m. 1-5 gr.

Acetate of K. 5-60 gr.

How administer Nitrite of Amyl?

2-3 m. inhaled.

Criticise the following :

R. Apomorphine Hydrochloratis oz. iv.

Sig. : For immediate use as directed.

R. Magnesii Sulphatis oz. j.

Aquae Destilatae oz. ij.

Sig. : Take at once.

R. Bismuthi Subnitratis oz. ij. ss.

Aquae Camphorae oz. iv.

M. Sig. : One teaspoonful before meals.

R. Sodii Salicylatis oz. v.

Tincturae Ferri Chloridi oz. vi.

Aquae q. s. oz iv.

M. Sig.

R. Extracti Malti oz. ij.

Sig. : Two teaspoonfuls thrice daily.

Dose and method of administration, of Citrate of Iron and Quinine.
5-10 gr. in solution.

Describe Ferrum reductum.

It is a light, tasteless, odorless, grayish-black lustreless powder of metallic iron. Insoluble in water and alcohol. Soluble in acids.

Solubility in Water of :

Acacia : insoluble.

Tragacanth : insoluble.

Salicylic Acid : soluble.

What is the value of Chloral and Sulphonal in sleeplessness due to pain?

They are of no particular value.

What is the action of opium on the secretions?

It depresses all except sweat.

Dose of Liquor Mag. Citratis 2-8 dr.

Tinct. Nucis Vomicae 2-10 m.

Wine of Ipecac. 1-60 m.

Chloral: Solubility in water and in alcohol, dose, action of alkalies on :

It is soluble. Dose 10-20 gr. Alkalies decompose it into chloroform and formates.

What part or parts of the plant is used, and give active principles.

Belladonna, Leaves and Root. Atropine.

Stramonium, Seed and Leaves. Hyoscyamine.

Hyoscyamus, Leaves. Hyoscyine and Hyoscyamine.

How is Cocaine used?

Hypodermically.

What is a Massa?

It is a combination of medicinal agents of proper consistency for making into pills of any desired weight.

A Charta?

It is a medicated paper.

Give chief descriptions of KBr.

It is a colorless, transparent salt, in cubic crystals, neutral. Pungent, saline taste. Soluble in water. Dose 5-100 gr.

Carbonate of Lithium. It is a white powder with an alkaline taste and reaction. Soluble in 80 p. water. Insoluble in alcohol. Dose: 2-10 gr.

Salicylic Acid. It is a crystalline white powder, permanent in air, slightly acrid taste, and acid reaction. Slightly soluble in water. Soluble in alcohol.

Carbolic Acid. It is a crystalline white solid, peculiar odor and burning taste. Deliquescent: inflammable, soluble in water, alcohol, and ether. Neutral in reaction, and does not make salts.

Nitrite of Amyl. It is a pale yellow, clear liquid, fruity odor, aromatic taste. Neutral or slightly acid. Volatile. Insoluble in water. Soluble in ether and chloroform, etc.

1894-95 QUESTIONS.

1. (a) In what forms and through what channels may drugs be introduced? (b) What conditions are most favorable for rapid and complete absorption of drugs from the stomach? (c) Mention drawbacks to administration of drugs by the mouth. (d) What is physiological incompatibility? (e) Why should medicines introduced by the rectum and intended for absorption not be of large bulk.

2. (a) What is opium? (b) Mention five preparations and give doses. (c) What action has ether on opium? (d) Write a prescription for sulphate of morphine. (e) What is the action of opium on the secretions?

3. (a) You are called to a patient with a weak, rapid, and irregular pulse, shallow and irregular respiration, tingling then numbness of the surface, cold sweat and much depressed temperature. To what drug may these symptoms be due? (b) How would you treat the case? (c) Describe tartar emetic. (d) What is the local action? (e) Composition of compound syrup of Squill? (f) What is the action of astringents on albumen? (g) Mention five vegetables and five mineral astringents. (h) Write prescriptions for four vegetable astringents.

5. (a) Dose of phosphorous. (b) How is it best administered? (c) How is it absorbed and in what form is it eliminated. (d) Treatment of phosphorous poisoning. (e) Describe calomel. (f) What is blue mass? (g) Action of calomel in large and small doses.

6. (a) What is digitalis? (b) Describe its physiological action. (c) In what conditions is it contra-indicated? (d) Mention the principal cardiac sedatives. (e) How prevent the unpleasant effects of cinchona alkaloids?

7. (a) How do antipyretics affect the temperature in health? (b) What is salol? (c) Write prescription for salicylic acid and salicylate of sodium. (d) Action of the simple bitters. (e) Upon what do the aromatics depend for their activity?

8. (a) Mention three anthelmintics for use against round worms, and three for tape-worms. (b) How prepare a patient for treatment for tape-worms. (c) Into what three groups are diuretics divided? (d) Give examples of each group.

9. (a) Describe sweet spiritus of nitre (b) Why are sodium salts to be preferred to potassium salts as direct antacids? (c) Action of ergot. (d) Which contains the more lime, the liquor or the syrupus calcis, and why? (e) Treatment of hyperemesis caused by irritant emetics.

10. (a) Write prescriptions for two of each class of cathartics. (b) Describe castor oil, rhubarb, senna, epsom salts. (c) Composition of compound powder of jalap; compound rhubarb pill; compound cathartic pill. (d) What is the action of drastics in large doses? (e) Action and methods of administration of cod-liver oil.

1894-95 ANSWERS.

1. (a) (1) Solids; (2) Liquids; (3) Gases.

(a) skin; (b) mucous membrane; (c) alimentary canal; (d) serous membranes; (e) cellular tissue.

(b) It depends upon the drug, individual and time of administration, blood pressure, contents of stomach, its chemical reaction and the condition of its membranes. A healthy empty stomach with no turgid veins are favorable conditions.

(c) (1) The bad taste of the drug; (2) It may spoil the appetite; (3) It may interfere with digestion.

(d) Drugs mutually antagonistic in their physiological action.

(e) Bulkiness causes irritation and spasmodic contraction and so produces evacuation.

2. (a) It is a milky white exudation from the unripe capsule of the poppy. It has a strong odor, bitter taste, brownish color and leaves an interrupted brown line when a mark is made on paper. It is slightly soluble in water and soluble in alcohol. It yields morphine, codeine and narcotine.

(b) (1) Tully's powders. Dose: 5-15 gr.

(2) Dover's powders. " 5-15 gr.

(3) Tinctura opii. " 3-20 m. (minims)

(4) Paregoric. " 1-4 drs. (drams)

(5) Pills of opium. " 1-2 pills.

(c) It takes up only narcotine.

(d) *R* Morphinae Sulphatis gr. j.

Fiat chartulas No. viii.

Sig. Take one every three hours.

(e) It increases secretions of the skin, and checks all other secretions.

(3) (a) Aconite.

(b) *Treatment.* Cardiac stimulants. Give ether, alcohol and digitalis subcutaneously. Place patient on the back with feet above the head. Empty stomach by pump and not emetics. Artificial respiration. Amyl Nitrite in small doses may be used. (c) Tartar emetic is colorless, transparent, crystals becoming white, sweet, afterwards bitter taste. It is soluble in water and insoluble in alcohol. Dose: $\frac{1}{10}$ - $\frac{1}{2}$ gr. diaphoretic. $\frac{1}{2}$ -1 gr. depressants. 1-2 gr. emetic.

(d) It acts as an irritant.

- (e) Squill, senega, tartar, emetic, calcic phosphate, sugar and water.
- (f) They coagulate albumen but not completely in the human body.
- (g) Tannic acid, gallic acid, kino, hamamelis and catechu, alum, acetate of lead, copper and zinc and nitrate of silver.

(h) (1) *R. Acidi Tannic* gr. x.

Aquae q. s. oz. j.

M. Sig. : use as a spray.

(2) *R. Tinctura catechû composita* oz. ij.

R. Acidi Gallici oz. ij.

Alcoholis oz. ij.

M. Sig.

(3) *Tinctura kinô* oz. ij.

5. (a) $\frac{1}{100}$ — $\frac{1}{20}$ gr.

(b) Pill, oleum or phosphide.

(c) As phosphorous, eliminated as phosphorous and phosphoric acid.

(d) Persistent use of emetics and cathartics except castor oil or any fatty oils since these aid absorption.

(e) It is a white, odorless and tasteless powder ; insoluble in water, alcohol and ether.

(f) It consists of glycyrrhiza, althea, honey of rose.

(g) Large doses : cathartic. Small doses : constitutional effects.

6. (a) Foxglove leaves of digitalis purpurea. They contain the active principle digitalin. Dose : 1—2 gr. Cardiac stimulant.

(b) Its chief action is on the circulation : (1) slowing the pulse due to prolonged diastole by stimulation of nerve centres and ends of vagi ; (2) Force of pulse is increased because the heart has more blood to contract upon and its ganglia and muscles stimulated. Stimulates vasomotors and muscular coats of vessels hence arise in arterial pressure. It acts on the kidney as a diuretic. Toxic doses depress respiration and temperature.

(c) Arterial excitement, aneurism, atheroma, appoplexy, and by the mouth in gastritis.

(d) Aconite, Veratum, Viride, Viratrina, Tartar emetic.

(e) By giving KBr., also fluid extract Ergot.

7. (a) They have no effect unless given in large enough doses to cause collapse.

(b) A volatile anti-pyretic and anti-septic. It is a white, crystalline, tasteless, aromatic powder. Insoluble in water. Soluble in alcohol and ether. Dose : 5—10 gr.

(c) *R. Acidi Salicylici.*

Sodii Salicylici aa oz. j.

Aquae q.s. oz. ij

(d) They act locally by stimulating the gastro-intestinal mucous membrane.

(e) The presence of a volatile oil.

8. (a) (1) *Spigelia*. (2) *Santonin*. (3) *Chenopodium*. *Granatum*. *Aspidium*. *Pepo*.

(b) Patient must fast 12-24 hours. Clean out the intestine by Cathartic, and follow the anthelmintic with a cathartic.

(c) (1) Hydrogogues. (2) Refrigerants. (3) Alteratives.

(d) (1) *Squill*. (2) *Potassii Bitartras*. (3) *Juniper*.

9. (a) It is an alcoholic solution of ethyl nitrate, with five per cent. ether. It is a clear straw colored fluid, with a fragrant ethereal odor, and a sharp burning taste. Dose: $\frac{1}{2}$ -4 gr.

(b) Because they produce little systemic action.

(c) Its chief action is on the circulation and smooth muscle fibres of the uterus. It contracts blood vessels and excites the uterus to contract and expel its contents. Flow of secretions are diminished.

(d) ? (e) Wash out stomach. Give demulcents, opium by rectum, counter-irritants to epigastrium.

10. (a) *R. Magnesii Sulphatis* oz. j., etc.

(b) See cathartics.

(c) *Jalap* 35, *Cream Tartar* 65, *Rhubarb* 13, *Aloes* 10, *Myrrh* 6, *Oil of Peppermint*, 5 c.c.

Comp. Ext. Colocynth, *Calomel*, *Jalap*, *Gamboge*.

(d) They produce inflammation and poisoning.

(e) It assists to maintain body temperature, increases blood corpuscles, raises tone of alimentary canal, tends to cause deposition of fat.

Salt may be used before and after using. It may be taken with froth of beer, ale or porter; also with whiskey, glycerine, etc.

1896-97 QUESTIONS.

1. Write prescriptions for the following, avoiding abbreviations and giving directions for use: (1) Tincture of belladonna. (2) Iodide of potassium. (3) Salicylate of sodium. (4) Sulphate of magnesium. (5) Dover's powder. (6) Calomel. (7) Phosphorous pills. (8) Tincture of nux vomica. (9) A liniment. (10) An emollient.

2. Describe: (1) Chloral. (2) Corrosive sublimate. (3) Opium. (4) Acetate of potassium. (5) Senna.

3. Constituents of: (1) Tully's powder. (2) Compound licorice powder. (3) Diuretics. (4) Chalk mixture. (5) Compound rhubarb pill.

4. Describe as fully as you can the action and uses of digitalis. Repeated.

5. Advantages of antipyrin over opium as an analgesic. (b) What is Pelleterine, and for what is it used? (c) Why give small rather than large doses of iron? Repeated. (d) What is an oleatum.

6. (a) Into what three groups may diuretics be divided? (b) What is the action of the drugs of each group? (c) Give examples of each. (d) What is the dose of phosphorous? (e) In what form is it absorbed and eliminated? (f) Upon what does it exert its chief action?

7. (a) What is the action of Belladonna on the circulation, temperature, secretions, pupils and peristalsis?

(b) How is the character of the blood affected by Cod Liver Oil, Iron, Quinine, and by the continued use of Mercury.

8. (a) Action and uses of tartar emetic:

(b) Why not give Pilocarpine in cardiac dropsy? (c) Compare the action of Nitrite of Amyl, Nitrite of Sodium, and Nitro-glycerine.

(d) In case of great depression from poison, what drugs would you use to stimulate the respiration and circulation?

1896-97 ANSWERS.

1. See prescription writing.

3. Diuretin: It is salicylate of sodium and theobromine.

4. Compound licorice powder, senna, licorice, washed sulphur, oil of penna and sugar.

5. It compares favorably with opium, and there is no danger of forming an antipyrin habit.

(b) It is the active principle of granatum. It is used as a remedy for tape-worms.

(d) It is a solution of medicinal principles in oleric acid.

6. (1) Hydrogogues. (2) Refrigerants. (3) Alteratives. Hydrogogues, increasing flow of water from kidneys. Squill.

The second, exerting a marked sedative effect on kidneys, modifying secretion in various ways making it less irritating but not increasing to any extent the quantity of water. Cream tartar. Alteratives, not necessarily increasing the flow of urine but acting locally on mucous membrane of urinary tract. Juniper.

(d) Each pill contains $\frac{1}{100}$ gr. Dose: 1-5 pills.

(e) As phosphoric acid and eliminated as phosphorous and phosphoric acid.

(f) It is a direct tonic to the nervous tissue, and also aids in bone formation.

7. It increases temperature, circulation and peristalsis. It checks secretions and dilates the pupil.

8. In small doses it causes a slight feeling of warmth in stomach, a slight depression of circulation, and increased perspiration. Large doses cause more intense and prolonged nausea, violent vomiting, great depression of circulation, muscular weakness, fainting, salivation, and profuse perspiration. The secretions of stomach, intestines and respiratory passages are all increased. As an emetic, cardiac depressant and diaphoretic, it is inferior to other drugs. As a sedative expectorant it is the most efficient of all drugs in early stages of acute bronchitis. It is used as a counter-irritant and in acute intestinal catarrh of children.

(b) It acts as a depressant.

(c) Nitrite of Amyl acts most rapidly. Nitrite of Sodium acts slower than the above but longer. Nitro-glycerine is the most powerful and more persistent than amyl but less so than the sodium.

(d) Ether, alcohol, ammonia, nitrite of amyl, digitalis, strychnia, etc.

o g a c b d
g a b a c

e h j l p p
f. b. p. h. c. p.

Acacia 200	Teratium 80	Aspidium 173.
Acetum 134	Adeps 202	Changii Cortex Amari
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Pepium 198	Sanguinaria 154
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Phyostigma 51	Saccharilla 124
Pilocarpus 154	Sassafras 201
+ Pimenta 147	Serum 167
4 Piper 147	Scilla 175
	Scoparia 176
	Schilaria 18

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Spartea Sulphur 75
Spigelia 171
Spiritus Aethers Nitrosi 176
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 Sublimatum 159
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Tammaria 154
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 * *Taraxacum* 144
Terebinthina 190
Thymol 218
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Triticum 185
 201
Ulmus
Unguentum Aquae Rosae 203
 * *Uva Ursae* 89
Valeriana 15
 Ammonii Valerianus
 Zinci
Verumum R. nifolium 223
Zinci Acetas 94 ✓
 " *Carbonas Precipitatum* ✓
 " *Oxidum* ✓
 " *Sulphur* ✓
 " *Chloridum* 213
 * *Zingiber* 147

Adonidin 75
Afaria (pink) 1-5
Apicol (purple)
Arnica Flores
Arare
Asulin
Dermatol 223
Grophen
Formaldehyd
Ichthyol
Lactophenin
Lysol
Piperazine C., H., N.
Pyridin
Saccharin 220
Sulphenol
Tonal
Rosae
Theobromine 176
Urethra 17

Unguentum

Do. not learn.

Citric acid ✓
Lactic " ✓
Dil. Nitro / HCl. acid ✓
Chic. acid ✓
Phosphoric " ✓
Tartaric " ✓
Ammoniacum. ✓
Camomile
Antimony Compounds ✓
except Tartar emetic. ✓
Silver compounds of ✓
nitrate.
Arsenic
Nitrate of Bi ✓
" " & Ammonium ✓
Sub nitrate ✓
Sub carbonate ✓
Dryoria ✓
Hypophosphites. ✓
Cloves ✓
Oxalate Cerium ✓
Cetraria ✓
Chondrus ✓
Ciniceifuga ✓
Cornium ✓
Iron Compounds except ✓
Chloride ✓
Carbonate ✓
Citrate Fe & Aluminium ✓
Saccharated Iodide ✓
Sulphate ✓
Reduced Iron. ✓
Geranium. ✓
Grindelia
Guaiac. ✓
Hamamelis ✓
Humulus. ✓

Labelia

Lupuline ✓
Naphthalinum. ✓
Phycostamine ✓
Lead carbonate ✓
Iodide
Nitrate
Oxides
Hypophosphite of K
Nitrate. K ✓
Salts of alkaloids of Quinine
Resorcin
Rhus klabrum ✓
Sassafras ✓
Sassafras
Scoparium ✓
Scutellarium. ✓
Hypophosphite of Sodium ✓
Nitrate " "
Tobacco. ✓
Taraxacum ✓
Uva Ursi ✓
Valerian ✓
Veronica ✓
Theobromine

Acetanilid	1	Epsom salts	3	Potassium	
Aconite	1	Ergot	2	Bromide	3
Tr Aconite	2	Gallie Acid	2	Citrate	2
Alcohol	1	Glycerine	1	Acetate	4
Flaes	1	Glycerhyzza		Nitrite	1
Ammonia	2	" Co. Tr. pow.	1	Iodide	3
Amyl Nitrate	3	Hydrargyrum	6	Bitartras Co. Tr.	1
Anti Pyrin	3	Calomel	6	Quinine	5
Antimony tartar emetic	3	Corrosive Subl.	3	Sulphate	2
Apomorphine	1	Oleate of	1	Rhubarb	2
Arsenic	3	{ Red Iodide	1	Co. Rhu. Powd.	1
Aspidium	2	{ Biniodide	1	Pill	5
{ Atropine	1	Blue mass	1	Salicin	1
{ Homatropine	1	Hyescine	1	Salicylic acid	3
{ Belladonna	6	Iodoform	3	Salol	1
Benzoic acid	2	IRON	3	Sandalwood oil	1
{ Bismuth		Reduced	6	Senna	3
{ Sub nitrate	1	Chloride	1	Co. Infus.	4
Boracic Acid	1	Ipecac wine	1	Silver	
Calx		Jalap		Nitrate	1
liquor	2	Co. Jal pulv.	4	Sodium	
		Lithium		Salicylate	3

chlorate 2

Camphor 1

Carron Oil 1

Castor Oil 3

catechu Tr. 1

Cathartic Pill co. 3

" " veg 1

Carbolic acid 1

Chalk mixture 2

Chloral 7

Chloralamid 1

Chloroform 1

Citrine Ointment 1

Cod liver oil 5

Copper sulphate 1

Colchicum 1

Croton Oil 1

Digitalis 7

" Tr 1

Diuretin 1

Elatrin 1

Malt ext. 2

Mustard 2

Nitre swt. salts 3

Nitro glycerine 2

Oleatum 1

Opium 6

Tully powders 2

Dovers " 4

Paregoric 4

Morphine

Sulphate

Apomorphine 1

Pelletierine 2

Pepo 1

Pepsin 2

(Pilocarpine 3

Hydrochlorate 1

Phosphorus 4

Oleum 1

Squill 4

Stramonium 1

Strophanthus 1

Strychnine 1

TR. NUX Vomica 3

Sulphonal 4

Sulphur

Tannic acid

Trional 1

Zinc

Sulphate 1

