and that all real advance towards the establishment of therapeutics as a science must be made upon the lines laid down by Haller, namely, drug-proving upon the healthy human organism. Still, in the words of Brown-Séquard, "Therapeutics will cease to be empirical, only when this last kind of knowledge shall be fully obtained;" but its fulness will never be fully realized unless the results have been thoroughly considered with regard to the differences due to the action of drugs *in different doses* on *the human organism* in health and disease.

A thoroughly-prepared materia medica of half-a-dozen standard drugs, such as Aconite, Arsenic, Belladonna, Mercury, Opium and Quinine, based upon their actions and uses in different doses and under different states of the organism, would be of more real value to the physician who wishes to do his work accurately and with his eyes open, than all the contents of the dispensatories, plus the entire literature of the "new remedies," and every symptom in the ten quarto volumes of the largely discredited and partly repudiated homeopathic materia medica. If medical students would devote but one month of their annual college vacation to the personal investigation of some one feature of the action of some one drug, under such safe-guards against error as would secure the acceptance of the resulting observations, a mine of therapeutic gold would soon yield its solid truth to eager eyes. Formally laid down by Haller in 1755, cultivated to some extent by Alexander in 1768, Crumpe in 1793, Thommassini, Curtis, etc., urged by John Hunter, Sir Thomas Watson, Dr. King Chambers, and many other luminaries of the medical profession, the scientifically guarded proving of drugs on the human organism has lain, like the similar work of Jenner, neglected these many years, waiting for another Koch to re-inaugurate the work.

CONSTITUENTS OF ORGANIC DRUGS.

Drugs are derived from all the three kingdoms of nature. Those which belong to the mineral kingdom may be termed *inorganic drugs* and are resolved by chemical analysis directly into their ultimate principles, the elementary bodies of which they are composed. *Organic drugs* are those which are taken from the animal and vegetable kingdoms. They are to some extent composed of inorganic materials (water, gases, salts, etc.), but chiefly consist of organic compounds (proximate principles) obtained by a proximate analysis. The further reduction of these proximate principles to their elementary constituents shows that Carbon plays the leading role therein, associated with Hydrogen, Oxygen, Nitrogen and other elements. The proximate principles of vegetable drugs may be divided into insoluble and soluble groups; the first containing those

which resist the action of ordinary solvents, the second including those which may be dissolved in suitable menstrua and thereby separated from those which are not soluble in a particular menstruum.

The *Insoluble Constituents* are substances which make up the cell-walls of vegetable drugs, namely—Cellulin (Cellulose), Lignin and Sclerogen. They are extremely intractable to the action of solvents and yet find places in the materia medica under various forms. Cellulin in the form of Cotton is used extensively by both the surgeon and the pharmacist, and by the action of strong acids or alkalies thereon, there is obtained Pyroxylin (Gun-cotton), which dissolved in ether makes Collodion. By the destructive distillation of cellulin and lignin a large number of solid, liquid and gaseous products are obtained, including acetic acid, methylic alcohol, phenol, creosote and tar. From their natural decomposition result amber, coal, coal-tar and the many derivatives of the latter substance. The *Soluble Constituents* include some principles which are medicinally inert and also many active principles.

The Active Principles include carbohydrates, alkaloids, glucosides, neutral principles, organic acids, resins, fixed oils and fats, waxes, volatile oils, camphors, miscellaneous principles (phenols, ketones, etc.), protein bodies (albuminoids) and ferments. Some of these are not proximate principles from the strict chemical point of view, as they are not simple bodies (*e. g.*, fixed oils, fats, waxes, and many of the volatile oils), but for the purposes of the materia medica it is convenient to so classify them. Others are active chiefly as foods, though in some cases they are employed as medicinal agents. For the methods of extracting the soluble principles from drugs see the articles entitled MACERATION and PERCOLATION, in Part II of this book.

Carbohydrates are properly regarded as foods rather than as medicines, yet many of them possess remedial qualities due to their neutral, bland, demulcent, lubricant, protective or soothing action. They include the *Amyloids*, cellulose, starch, dextrin, inulin, etc., the *Sugars*, as glucose, levulose, lactose (milk sugar), maltose (malt sugar), saccharose (cane sugar), etc., and the *Gums* and *Pectin Bodies*, as arabin, pectin, bassorin, cerasin, etc

Gums are not proximate principles but amorphous, transparent substances which are widely disseminated in plants and yield *Mucic Acid* when treated with nitric acid. They form sticky preparations with water and are precipitated by alcohol. *Arabin* is the main constituent of soluble gums. *Bassorin*, which swells up in water, is one of the constituents of gum tragacanth, also of cherry and plum gums. [Compare the articles entitled ACACIA and TRAGACANTHA, in Part I.]

Alkaloids (*alkali*, εἶδος, resemblance)—are organic basic substances existing in many plants, usually in combination with organic acids. They readily combine with acids to form crystalline salts which are soluble in water, the alkaloids themselves being almost insoluble therein though dissolving in alcohol. They are odorless, of more or less bitter taste, and generally possess powerful physiological actions. They are easily decomposed by alkalies or alkaline carbonates, and are precipitated from their solutions by several reagents, including iodine in a solution of potassium iodide, potassio-mercuric iodide, auric chloride, also picric, tannic, phospho-molybdic and phospho-tungstic acids. Their Latin names terminate in *—ina*, their English names in *—ine*, as Morphina, *Morphine*.

Alkaloids are sometimes called *organic or vegetable alkalies*, to distinguish them from the inorganic or mineral alkalies, which they resemble in little except their reaction and basic qualities. The term *artificial alkaloid* is applied to secondary alkaloids derived from natural ones, as Apomorphine. The term *synthetic alkaloid* should be restricted to those which occur in nature but have been prepared synthetically, and should never be applied to bases which are only obtained by synthesis and do not occur naturally, as Antipyrine, Thallin, etc.

Chemically the alkaloids may be regarded as derivatives of Ammonia (NH_3) or ammonias in which one or more atoms of H are replaced by various radicles. They are believed to be decomposition products of vegetable albumin occurring in the plant-cells during the process of growth. They all contain the elements C, H and N; most of them also contain O (amides), and usually occur as crystalline solids which (except Berberine) are colorless. A few containing O occur as liquids, namely—Lobeline, Lupuline, Muscarine, Pelletierine and Pilocarpine. Some are devoid of O (amines) and occur as volatile, oily liquids, namely—Coniine, Nicotine, Piperidine, Pyridine, Sparteine and Trimethylamine In their chemical composition the latter are closely related to *Pyridine*, C_5H_5N, an alkaloid which seems to underlie the molecular structure of many others. Some of them may be synthetically prepared from the pyridine bases (picoline, collidine, etc.). By changing the chemical constitution of an alkaloid its physiological action can be completely altered.

Allied to the alkaloids are the organic products termed *Leucomaïnes* and *Ptomaïnes*, the former being alkaloidal substances produced by the decomposition of albuminous matter in the living animal tissues during the normal destructive metamorphosis, the latter being similar substances produced by the process of putrefaction. Many of the ptomaïnes are identical with certain vegetable alkaloids.

Many so-called alkaloids are in reality mixtures of different alkaloids, *e. g.*, Veratrine. Some plants contain more alkaloids than one, including a second which may be similar in action to the first but weaker (as Brucine) or antagonistic in action to the principal one (as Calabarine).

The first alkaloid discovered was Morphine, isolated and described by the apothecary Sertürner in 1816. Within sixteen years after that date Strychnine, Brucine, Quinine, Cinchonine, Narcotine, Codeine, Veratrine, Coniine, Atropine, Nicotine, Aconitine and Hyoscyamine were discovered by different chemists.

Incompatible with the alkaloids are: Alkalies, Alkali Carbonates and Bicarbonates, Benzoates, Bichromates, Bromides of the alkalies, Borax, Cyanides, Gold Chloride, Ichthyol, Iodides, Mercuric Chloride, Oxalic Acid, Picric Acid, Piperazin, Potassio-mercuric Iodide (when acacia is absent), Oxidizers, Salicylates, Sodium Phosphate, Tannic Acid. Many alkaloids are physiologically incompatible with others.

Twenty-four alkaloids are official, under either their own names or those of their salts, including Pelletierine and Veratrine, which are described as mixtures of alkaloids. They are as follows:—

Aconitina, *Aconitine,*—from Aconitum Napellus.
Apomorphina, *Apomorphine,*—a derivative of the alkaloid Morphine.
Atropina, *Atropine,*—from Belladonna and some allied plants.
Caffeina, *Caffeine,*—the active principle of Caffea, the coffee plant.
Cinchonina, *Cinchonine,*—a minor alkaloid from Cinchona (Peruvian Bark).
Cinchonidina, *Cinchonidine,*—another alkaloid from Cinchona.
Cocaina, *Cocaine,*—from the plant Erythroxylon Coca.
Codeina, *Codeine,*—the second in rank of the Opium alkaloids.
Colchicina, *Colchicine,*—the active principle of Colchicum.
Homatropina, *Homatropine,*—a derivative of the alkaloid Atropine.
Hydrastina, *Hydrastine,*—from Hydrastis canadensis.
Hydrastinina, *Hydrastinine,*—a derivative of Hydrastine.
Hyoscina, *Hyoscine,*—one of the alkaloids of Hyoscyamus (Henbane)
Hyoscyamina, *Hyoscyamine,*—another alkaloid from Hyoscyamus.
Morphina, *Morphine,*—the principal alkaloid of Opium.

Pelletierina, *Pelletierine,*—a mixture of alkaloids obtained from Granatum (Pomegranate)
Physostigmina, *Physostigmine,*—also called *Eserine,*—from Physostigma.
Pilocarpina, *Pilocarpine,*—the principal alkaloid of Pilocarpus (Jaborandi)
Piperina, *Piperine,*—a feeble base obtained from Pepper.
Quinina, *Quinine,*—the principal alkaloid of Cinchona (Peruvian Bark).
Scopolamina, *Scopolamine,*—from plants of the *Solanaceæ*, identical with Hyoscine.
Sparteina, *Sparteine,*—a volatile alkaloid from Scoparius.
Strychnina, *Strychnine,*—the principal alkaloid of Nux Vomica.
Veratrina, *Veratrine,*—a mixture of alkaloids from Asagræa officinalis.

Unofficial but Important Alkaloids are the following:—

Berberina, *Berberine,*—from Berberis, Hydrastis, Calumba, and other plants.
Brucina, *Brucine,*—the second alkaloid of Nux Vomica.
Coniïna, *Coniine,*—the principal alkaloid of Conium (Hemlock).
Curarina, *Curarine,*—the active ingredient of Curare (Woorara).
Duboisina, *Duboisine,*—from Duboisia; identical with Hyoscyamine.
Emetina, *Emetine,*—the alkaloid of Ipecacuanha.
Gelsemina, *Gelsemine,*—the active principle of Gelsemium.
Muscarina *Muscarine,*—from the Fly-agaric, a poisonous mushroom.
Quinidina, *Quinidine,*—a powerful but scanty ingredient of Cinchona.

Glucosides (γλυκύς, sweet),—form a group of organic principles, existing in plants and generally neutral in character. They may be resolved by boiling with dilute acids or alkalies, or by the action of ferments, into *glucoses* (chiefly dextrose) or other bodies (mannite, phloroglucin) which themselves yield glucoses, also one or more other bodies (alcohols, aldehydes, phenols, etc.) which are different in each case. Thus, Salicin, $C_{13}H_{18}O_7$, which is a glucoside, by the action of a dilute acid is split up into glucose and saligenin, according to the following reaction, $C_{13}H_{18}O_7 + H_2O = C_6H_{12}O_6$ (glucose) + $C_7H_2O_2$ (saligenin). Under the supposition that glucose and its congeners are alcohols it is probable that glucosides are the corresponding ethers. Few of them, if any, contain N, but they all contain C, H and O. They are often the most active of the principles in the plants containing them, but they are more frequently associated with other active principles, as alkaloids, oils, resins, etc. Like other neutral principles, the glucosides have Latin names which end in *—inum,* and English names ending in *—in.* The official glucosides are—

Glycyrrhizinum, *Glycyrrhizin,*—from Licorice-root.
Salicinum, *Salicin,*—obtained from Salix and Populus barks.
Strophanthinum, *Strophanthin,*—from Strophanthus, and one of the most powerful poisons known.

Unofficial but important Glucosides are the following-named:—

Adonidinum, *Adonidin,*—from Adonis vernalis.
Arbutinum, *Arbutin,*—from Bearberry leaves.
Cathartic Acid,—one of three glucosides in Senna leaves.
Colocynthinum, *Colocynthin,*—the active principle of Colocynth
Convallamarinum, *Convallamarin,*—from Convallaria majalis.
Digitalin, Digitaleïn, and Digitonin,—active principles contained in Digitalis, the last-named one anatogonizing the others.
Ipecacuanhic Acid,—existing in Ipecacuanha
Jalapinum, *Jalapin,*—the active principle of Scammony.
Saponinum, *Saponin,*—obtained from Quillaja, the Soap-bark.

Tannins, except Tannic Acid, which is an organic acid, are considered to be glucosides; the chief ones being Caffetannic Acid, Chinotannic Acid and Quercitannic Acid.

Incompatible with the glucosides are: Acids, Alkalies, Ferments, Lead Acetate and Subacetate, Tannic Acid, Water (hot).

Neutral Principles,—are all neutral in character, of various composition and powers, and characterized by the absence of basic or other properties which would place them in the other groups. Many have a very bitter taste and have been therefore called *Amaroids* or *Bitter Principles*. Like the glucosides their Latin names end in *—inum*, their English names in *—in*. Those which are official are the following-named:—

Aloinum, *Aloin,*—from various species of Aloes.
Chrysarobinum, *Chrysarobin,*—obtained from Goa-powder.
Elaterinum, *Elaterin,*—extracted from Elaterium.
Santoninum, *Santonin,*—the active principle of Santonica (Wormseed).

Unofficial, but important Neutral Principles are—

Anemoninum, *Anemonin,*—a camphoraceous principle from Pulsatilla.
Cantharidinum, *Cantharidin,*—the active principle of Spanish Flies.
Cotoinum, *Cotoin,*—an acrid principle in Coto Bark.
Quassinum, *Quassin,*—a bitter principle in Quassia-wood.

Besides the above-mentioned principles, there are several other medicinal substances bearing names ending in *—inum* or *—in*, which have no relationship to either of the groups previously described. Among them are—

Chinoidinum, *Chinoidin,*—an unofficial mixture of alkaloids from Cinchona.
Gelatinum, *Gelatin,*—a product from certain animal tissues.
Glycerinum, *Glycerin,*—a triatomic alcohol from fats and fixed oils.
Kaolinum, *Kaolin,*—a native aluminum silicate.
Lupulinum, *Lupulin,*—a glandular powder from Hops.
Paraffinum, *Paraffin,*—a mixture of hydrocarbons from Petroleum.
Vanillinum, *Vanillin,*—an aldehyde occurring in Vanilla.

Also *Abrin*, a toxic albumose in Jequirity-seeds; *Ricin*, a poisonous ferment in Castor-oil seeds; and Benzin, Chinolin, Kairin, Lactophenin, Pancreatin, Pepsin, Phenacetin, Piperazin, Pyroxylin, Thallin, and other organic compounds not derived from either the animal or vegetable kingdoms but manufactured in the chemical laboratory.

Organic Acids or Carbon-acids, contain the univalent group CO_2H (carboxyl) linked with a hydrocarbon residue. They contain no N, but have acid properties, forming salts with bases. The principal organic acids are—

Official.		*Unofficial.*	
Acetic Acid.	Oleic Acid.	Agaricic Acid.	Malic Acid.
Benzoic Acid.	Salicylic Acid.	Angelic Acid.	Meconic Acid.
Camphoric Acid.	Stearic Acid.	Butyric Acid.	Oxalic Acid.
Citric Acid.	Tannic Acid.	Cerotic Acid.	Succinic Acid.
Gallic Acid.	Tartaric Acid.	Formic Acid.	
Lactic Acid.	Trichloracetic Acid.		

Coloring Matters form a group of bodies having very different properties, the nature of many being not yet understood. Among them are—*Carminic Acid*, in the cochineal insect, also in some plants; *Carthamin*, from the safflower;

Chlorophyll, in all green parts of plants; *Curcumin*, the coloring matter of turmeric; and *Hæmatoxylin*, from logwood.

Resins. The proximate principles called by this name are neither the commercial resins nor the resins of pharmacy (see under RESINÆ in Part II), all of which are complex bodies, but include only the chemical individuals of resinous character existing in nature, as those in Copaiba, Cannabis, Gamboge, Guaiac, Gurgun, etc. Even these, in their commercial form, are accompanied by other principles. It is difficult to define the resins correctly, but they are generally considered to be oxidation products of hydrocarbons, such as terpenes. They are mostly brittle, amorphous, uncrystallizable solids, insoluble in water but soluble in alcohol, ether, chloroform, benzin, etc. Most of them are of acid character, combining with alkalies to form a kind of soap, these "resin-soaps" being soluble in water and giving up their resins again to the action of acids. They soften or melt when heated and solidify again on cooling. They may be obtained from oleo-resins, as turpentine, by simple distillation, the volatile oil passing over and the resin remaining behind; or by heating the part of the plant in which they are contained, as in the case of guaiacum resin.

The substances ordinarily called Resins are usually classified as follows:—
True Resins are hard, compact products of oxidation, and are made up chiefly of resin acids. Such are Copal, Damar, Mastic, Sandarach, Dragon's blood, Gum-lac and Amber.
Gum-resins are natural mixtures of gum and resin. When they are rubbed up with water the gummy matter dissolves and the resin is suspended in the form of an emulsion. [Compare the title EMULSA, in Part II, also the subtitle GUMS, p. 5. Such are Olibanum (frankincense), Myrrh, Ammoniac, Asafetida, Galbanum and Tragacanth.
Oleo-resins include all mixtures of volatile oils and resins of whatever consistency, also the Balsams or mixtures of resins with benzoic and cinnamic acids. Such are Copaiba, crude Turpentine, Storax, and the true balsams—Benzoin, Balsam of Peru and Balsam of Tolu. There are six official oleo-resins, which are described under the title OLEORESINÆ in Part II.
Pharmaceutical Resins are solid preparations obtained by precipitating the resinous principles of plants from their alcoholic solutions by the agency of water. Three such preparations are official in the U. S. Pharmacopœia, and are described under the title RESINÆ in Part II.

Fixed Oils and Fats, though usually placed among the constituents of animal and vegetable drugs, are not proximate principles, being compound bodies containing the radicle *Glyceryl*, C_3H_5, in combination with anhydrides of the various fatty acids. The decomposition of these bodies by heating with water and an alkali yields the triatomic alcohol *Glycerin*, $C_3H_5(OH)_3$, and one or more fatty acids (stearic, palmitic, oleic, etc.). The latter combine with the alkali, forming soaps, and the glyceryl is converted into glycerin, a portion of the water being consumed in the reaction. An exception to this rule is the case of Cod-liver Oil, which does not yield glycerin when saponified but oxide of propyl. The following-named fixed oils and fats are those which are chiefly employed in medicine, viz.—

Adeps, *Lard,*—the abdominal fat of the hog.
Adeps Lanæ, *Wool Fat,*—the purified fat of the sheep's wool.
Sevum, *Suet,*—the abdominal fat of the sheep.

Cetaceum, *Spermaceti,*—obtained from the sperm whale.
Oleum Adipis, *Lard Oil,*—expressed from lard.
Oleum Amygdalæ, *Almond Oil,*—expressed from almonds.
Oleum Gossypii Seminis, *Cottonseed Oil,*—from cottonseed.
Oleum Lini, *Linseed Oil,*—expressed from flaxseed.
Oleum Morrhuæ, *Cod-liver Oil,*—from the liver of the cod-fish.
Oleum Olivæ, *Olive Oil,*—expressed from ripe olives.
Oleum Ricini, *Castor Oil,*—from the seed of the castor-oil plant.
Oleum Theobromatis, *Oil of Theobroma, Cacao-butter,*—expressed from the seed of the Chocolate-tree.
Oleum Tiglii, *Croton Oil,*—expressed from the seed of Croton Tiglium.

Waxes are compound bodies, closely allied to fats but containing no glyceryl, and are usually placed among the proximate principles for sake of convenience. The official *wax* (Cera) is prepared by the honey-bee. Chinese insect wax is the secretion of a coccus upon a variety of ash. Japanese wax is obtained from the fruits of several varieties of Rhus. Myrtle wax is obtained from the fruits of various species of Myrica. Wax is used in pharmacy; internally it is practically inert and harmless.

Volatile or Essential Oils form a large group of organic bodies existing in plants, from which they are usually extracted by distillation with water, being volatilizable at the temperature of boiling water. They are generally liquid at ordinary temperatures, and when exposed to cold many of them separate into a solid, crystalline portion, called *stearopten*, and a liquid portion, called *elæopten*. They are highly odorous, oily, sparingly soluble in water, more or less soluble in alcohol and in ether, colorless or yellowish, inflammable, and prone to become resinous on exposure to the air. A few consist of but a single proximate principle, for example *Oil of Betula*, which is wholly methyl salicylate. Most of them are complex bodies, consisting of two or more principles which can be separated from each other. The list of the volatile oils is quite an extensive one, 33 being official in the U. S. Pharmacopœia and described in Part I of this book under the titles of their respective sources. The group may be subdivided into the following classes, viz.—

Hydrocarbon Oils (or **Terpenes**),—consist of C and H, most of them having the formula $C_{10}H_{16}$ and being therefore isomeric with rectified *Oil of Turpentine*, which is the type of this class.

Oxygenated Oils,—contain C, H and O, are highly aromatic and usually consist of a terpene mixed with an oxygenated principle (an acid, an aldehyde, etc.). The oils of Cinnamon and Peppermint are examples of this class.

Sulphuretted Oils,—contain Sulphur in addition to their other elementary constituents, and are pungent and disagreeable in odor and taste; as the oils of Garlic and Mustard. In the latter case the oil is formed by the reaction of the constituent principles in the presence of water and does not preëxist in the plant.

Nitrogenous Oils,—contain N, as the compound Cyanogen, CN, in the form of Hydrocyanic Acid, which is formed only after maceration with water. Examples are the oils of Bitter Almond, Peach-kernels, etc.

Camphors are volatile, aromatic principles, composed of ten atoms of C with various proportions of H and O. They are solid and crystalline at ordinary temperatures, and are closely related to the terpenes, with which they are

associated in plants and by the oxidation of which they seem to be formed. The principal member of the group is the official *Camphora*, $C_{10}H_{16}O$, which is described under its own title in Part I. Stearoptens obtained from various essential oils are often, though incorrectly, called camphors, as Borneol, Menthol, Eucalyptol, etc.

Borneol, or *Borneo-camphor*, $C_{10}H_{18}O$,—is a secondary alcohol occurring in a tree which grows in Borneo and Sumatra. It may be formed artificially by heating common camphor with alcoholic potash or by treating it with sodium.

Menthol, or *Mint-camphor*, $C_{10}H_{20}O$, occurs in Oil of Peppermint together with a terpene and separates in crystals on cooling the oil. It is a secondary alcohol, is official, and is described under the title MENTHA PIPERITA, in Part I.

Miscellaneous Compounds include several organic bodies (phenols, ketones, etc.) which occur as proximate principles in plants but are not referable to the other groups. Among them are—

Anethol, $C_{10}H_{12}O$,—from the oils of Anise and Fennel.
Apiol, $C_{12}H_{14}O_4$,—from the Oil of Parsley.
Carvol, $C_{10}H_{14}O$,—from the Oil of Caraway.
Cineol, Cajuputol or *Eucalyptol*, $C_{10}H_{18}O$,—a liquid obtained from the volatile oils of several species of Eucalyptus, also from the oils of Cajuput, Myrtle, Rosemary, Sage and Wormseed
Eugenol, $C_{10}H_{12}O$,—from Oil of Cloves and other volatile oils.
Guaiacol, $C_7H_8O_2$,—the essential constituent of Creosote.
Safrol, $C_{10}H_{10}O_2$,—obtained from the oils of Sassafras and Camphor and the bark of several plants.
Thymol, $C_{10}H_{14}O$,—a phenol from Oil of Thyme and other volatile oils.

Albuminoids or **Protein Bodies** all contain N, as well as C, O, H and Sulphur. They are formed exclusively in plants, in every part of which they occur in small amounts but in larger quantities in the seeds. When consumed and assimilated by animals they undergo little alteration but enter into the animal tissues and form the chief part of the solid constituents of the blood, muscles, nerves, glands and other organs. They are chiefly valuable as foods, and may be conveniently divided into the following classes:—

Native Albumins, are soluble in water; as Serum-albumin, Egg-albumin, Plant albumin (in the juices of plants).

Derived Albumins or **Albuminates,** are insoluble in water but soluble in very dilute acids or alkalies; as Syntonin (acid-albumin), Alkali-albumin, Casein, the chief proteid in milk, Legumin or plant-casein. *Gluten*, the chief nitrogenous constituent of the seeds of cereals (wheat, rye, etc.), is believed to be a combination of four albuminoids, gluten-fibrin, gluten-casein, gliadin and mucedin.

Globulins, are insoluble in water but soluble in dilute saline solutions and in very dilute acids or alkalies, and include—Globulin (Crystallin), Myosin Fibrinogen, Vitellin, Para-globulin and Globin (residue of Hemoglobin, which forms the chief part of the red blood-corpuscles; contains Iron and is closely related to the proteids).

Fibrin (Animal Gluten), is insoluble in water and sparingly soluble in neutral saline solutions and in dilute acids and alkalies. It has a filamentous structure and possesses remarkable elasticity.

Coagulated Proteid, is formed from albumin, fibrin, etc., by the action of heat or alcohol, and is insoluble in water or alcohol but soluble in strong hydrochloric acid and gradually in acetic acid.

Peptones, are formed from albumins by the action of the acid gastric juice. They are highly diffusible and readily soluble in water, but are insoluble in alcohol or ether.

Amyloid Substances, include Ichthin, Ichthidin, Ichthulin and Emydin, which occur in the eggs of fishes and amphibii also Lardacein or Amyloid Substance, a pathological infiltration into various organs.

Collagenes and **Mucilaginous Bodies,** include Ossein, Collagen (and their derivative Gelatin), also Elastin, Chondrin, Keratin and Mucin.

Ferments are known only by their power of effecting peculiar changes in other organic bodies. The true ferment-substances have not yet been isolated, but they are present in certain preparations obtained from animals and plants, the most important of which are named in the following list, viz.—

Pepsin,—contained in the gastric juice of animals.
Pancreatin,—obtained from the pancreas of animals.
Papayotin (Papain),—from the sap of Carica papaya.
Bromelin,—contained in the juice of the Pineapple.
Ptyalin,—the peculiar ferment of animal saliva.
Diastase,—formed during the germination of seeds.
Emulsin,—the ferment occurring in almonds.
Myrosin,—the ferment contained in mustard-seeds.

The first four above-named are described under the title PEPSINUM, *Diastase* under AMYLUM, *Emulsin* under AMYGDALA, and *Myrosin* under SINAPIS, in Part I of this book.

CLASSIFICATION OF MEDICINES.

In the present state of knowledge respecting the actions and uses of medicinal agents, no really scientific classification of these substances is possible. Some writers have adopted a system based on the natural relations of the various articles to each other, while many classify them according to their effects on the human system, and others make no attempt at arrangement but treat of them in alphabetical order. The latter method has been chiefly followed in this work, from a conviction that every medicine should first be studied as an individual, both with respect to its physiological actions and its therapeutical applications. When the student has thus made himself familiar with the characteristic features of each article of the materia medica, he may begin, by comparing one with another, to seek acquaintance with their more delicate lights and shades. Some system of classification then becomes imperative as an aid to the memory, and as the titles of the groups to which the various agents belong in any physiological classification are also used to express their actions and uses, the following synopsis is inserted as an appropriate introduction to the section on Materia Medica and Therapeutics.

Accommodation of the Eye is impaired or paralyzed by the following named drugs, acting upon the ciliary muscle, viz.—

Atropine.	Homatropine.	Cocaine.
Daturine.	Physostigmine.	Gelsemine.
Hyoscyamine.	Pilocarpine.	Coniine.

Intraocular tension is increased by Atropine (large doses), Hyoscyamine and Daturine; and is decreased by Physostigmine and by Cocaine. Gelsemine paralyzes the external ocular muscles, especially the levator palpebræ and external rectus, by its action on the terminal nerve filaments.

Acids are compounds containing the electro-positive element Hydrogen united directly to strongly negative elements, or as the negative radicle Hydroxyl (HO) united to positive elements. The terminal syllables of their names indicate the comparative amount of oxygen or other electro-negative constituent present, those terminating in *-ic* having the greater quantity, those ending in *-ous* having the lesser quantity. When there are more than two such combinations the prefix *hyper-* is affixed to the highest, and *hypo-* to the lowest. Many strong acids (as hydrochloric) contain no oxygen, but all contain hydrogen. They change the color of litmus from blue to red, and unite with bases to form salts. Their physiological actions are chiefly due to their powers of neutralizing alkalies, withdrawing water from the tissues, and precipitating the globulins and some other proteids. They are poisonous to protoplasm, somewhat antiseptic, and many of them are powerfully corrosive to the tissues. Taken internally in dilute solution they have a sour taste, and cause an astringent sensation in the mouth and throat, induce a reflex flow of saliva, and in the stomach displace weaker acids from their combinations. Applied to the mouths of ducts from glands having an alkaline secretion they stimulate the latter, but check the secretion of glands producing acid secretions. This doctrine has but a limited application, as they do not pass beyond the stomach in their own form, though they increase the flow of the alkaline pancreatic juice by reflex action. In the blood and tissues they exist as salts by combination with the alkalies of the body, and if administered in sufficient quantity to neutralize the latter the animal dies, its blood being unable to carry carbon dioxide from the tissues to the lungs. They are rapidly excreted by the kidneys as acid salts, increasing the acidity of the urine. Therapeutically they are employed locally as caustics, styptics and anhydrotics, and internally in very dilute form as refrigerants, stomachics, astringents, hemostatics, and antidotes in poisoning by alkalies.

Incompatible with Acids generally are: Alcohol with strong acids; Alkalies, Alkaloids; Benzoates and Borates with strong acids; Bismuth and Ammonium Citrate, Bicarbonates, Bromides of weak bases, Carbonates, Chlorides of weak bases, Glucosides, Iodides of weak bases, Metallic Salts with organic acids, Pancreatin, Potassium and Sodium Tartrate, Potassium Tartrate, Salicylates, Silicates. [See also the particular Acids in Part I.]

Alkalies are compounds possessing certain properties in common, viz.—solubility in water, neutralizing acids and with them forming salts, saponifying fats, changing reddened litmus back to its original blue color, and altering the color of turmeric from yellow to brown. The *alkalies proper* are the five fixed alkalies, Potassa, Soda, Lithia, Cæsia, and Rubidia, which are hydrated oxides of the corresponding alkali metals, and the volatile alkali Ammonia, a