THE CHEMISTRY OF ANIMAL SUBSTANCES.

[Concluded from page 52.]

FIBRIN.—In the common glutin of wheat there is another substance called fibrin, which is similar in its chemical properties to the fibrin in the blood of animals. It is obtained by agitating the fresh blood of animals with a twig, to which it adheres in the form of fibrous filaments, and which may be cleansed by washing in water. When removed from the living animal, it possesses the power of spontaneous coagulation, and becomes insoluble. When washed and dried, it is translucent and horny. According to Dumas, water containing only a millionth part of hydro-chloric acid gelatinizes fibrin; and if a few drops of gastric juice are then added to it, the whole will dissolve the fibrin at a temperature of 96° to 100° Fah. This fact may have some bearing on the theory of digestion.

GELATIN.—This principle is widely diffused in the animal kingdom. It exists ready formed in the skin, and is obtained for manufacturing purposes from the clippings of hides, and the legs and feet of cows, calves, and sheep. When these are cleansed in cold water, and afterwards subjected to boiling, the muscles, &c., dissolve, forming a jelly, which when cut into slices and dried, forms gelatine. This substance when obtained from fish, is called isinglass. It is used in large quantities as an article of food in Russia; where it is prepared from the air bladders and roe of the sturgeon. These bladders are cleansed, dried, and scraped, to separate the external and internal membrane; and, without further preparation, the residue forms leaf isinglass, which is then cut into filaments by a machine to prepare it for sale. It is soluble in hot water, after a short period of maceration in cold water. A very pure form of gelatin is manufactured from the cuttings of the skins of calves, by cleansing them from fat, &c., in lime water, then in cold water, and digesting them in clear water heated to 200° Fah. The gelatinous liquor thus obtained is then strained through flannel, and allowed to cool to a proper consistency; after which it is poured upon a marble slab. When nearly set, it is transferred to an open network, and dried in a covered shed, exposed to the air passing through lattice work. It is subsequently damped, rolled into thin sheets, and afterwards cut into shreds. Gelatin is also obtained from ground bones, by submitting them to water at a temperature of 250° Fah., under pressure. This kind has generally a disagreeable odor.

From whatever source obtained, pure gelatin is colorless, transparent, inodorous, and insipid. In cold water it softens and swells, but scarcely dissolves until heated. Its solubility in hot water distinguishes it from fibrin and albumen. When subjected to destructive distillation, it yields carbonate of ammonia, and leaves carbon in the retort. In solution, it is very subject to putrefaction during warm weather; but a little acetic acid, or creosote, retards decomposition. Gelatin is soluble in all dilute acids. The action of strong sulphuric acid upon it produces leucine, and a peculiar saccharine product, called glycocine, or gelatin sugar. When boiled with caustic potassa, ammonia is evolved; and leucine and gelatin sugar are also formed. A solution of alum and common salt unites with gelatin, and forms an insoluble compound called "tawed leather." This also is the solution used for preparing white sheep-skins. Tannic acid, which is derived from nutgalls, oak, and hemlock bark, &c., unites with gelatin, producing an insoluble compound; which in the form of hides constitutes leather. Gelatin and tannic acid unite in nearly equal parts, constituting tanno-gelatin. The albumen in skins also unites with tannin, and forms an insoluble compound known as tannate of albumen.

Leucine is a white substance, obtained by boiling gelatin in sulphuric acid diluted with four parts of water. It is also obtained from the fibrin of muscle, from glutin, and other nitrogenous principles. Glycocine, or gelatin sugar—which is produced by boiling gelatin in dilute hydro-chloric acid—has a sweet taste; but differs from common cane and grape sugar, in not undergoing vinous fermentation.

The three nitrogenous principles—albumen, fibrin, and casein—are the constituents of animal food, and substances precisely similar in nature are found in the vegetable kingdom. In a chemical sense, therefore, there is not that broad distinction between animal and vegetable food which some persons have imagined. The constituents of flesh exist in vegetables, from which the flesh of the herbivora is formed. These principles pass into the blood through the chyle, which is the liquid product of digested food. Gelatin is not found in the blood, but is formed from it in the living organism. The human body can only be properly nourished by a variety of food, to suit the varied character of its textures. At one period a theory was extensively accepted, that the body could be supported by any one of the nitrogenous principles, excepting gelatin; but upon due investigation, a commission of the French Academy reported that neither man nor animals should be restricted to food which did not contain all the proximate principles of their entire bodies. The four nitrogenous principles—albumen, fibrin, casein and gelatin—under the influence of life-force, or vitality, appear to be convertible into each other. This is proved to some extent by the process of incubation. A recently laid egg contains only liquid albumen and oil. But when incubation is complete, fibrin and gelatin are found in the muscles and soft parts of the young bird; and a large proportion of the soluble albumen has passed into the insoluble state. Casein, as contained in milk, is convertible in the living body into the other principles.

The constitution of gelatin is represented by the formula $C13\ H10\ O5\ N2$. It contains no sulphur. The size used by painters and gilders is gelatin, made chiefly from cuttings of parchment. Chondrin is a peculiar variety of gelatin, and is found in cartilage, the wind-pipe, the cornea of the eye, and at the ends of the long bones. Its formula is $C32\ H26\ O14\ N4$. The soft solids of animals are chiefly formed of albumen, fibrin, and gelatin.

Fibrin enters largely into the composition of muscle or flesh, forming about 22 per cent of it. Muscle also consists of cellular tissue (albumen), nerve and fat. By analysis, dry muscle yields the same elements as those of blood. The juice of flesh is always acidulous; and the nitrogenous principles exist in it. These can be separated by a complex process; and are found to be definite compounds, composed of the same elements combined in different proportions.

Albumen enters into the composition of muscle, the brain, spinal cord, and nerves. It is a constituent of cellular tissue; and of the soft organs, such as the liver, spleen, lungs, and kidneys. The substance of the brain consists of 80 per cent water, with 7 per cent of soluble albumen, cerebric—a white fatty acid—and oleophosphoric acid—an oily liquid. The waxy secretion of the ear (cerumen) is a compound of albumen with an oily substance, and a yellowish resin, soluble in alcohol.

Gelatin enters into the composition of the skin, tendons, ligaments, and the white fibrous tissue generally; as well as into horn, cartilage, ivory, and the teeth. In 100 parts of dry human bone there are 33.3 of organic matter—gelatinous tissue—and 66.6 parts of earthy matter, consisting chiefly of sub-phosphate of lime, carbonate of lime, and phosphate of magnesia. The quantity of earthy matter in the bones increases with age. In childhood it amounts to 48 per cent; in middle age, 74 per cent; and in old age, 84 per cent. The mode in which the organic and inorganic constituents are blended in the frame of man is worthy of deep consideration. When a fresh bone is digested in dilute hydro-chloric acid, all the mineral matter is removed; but the bone perfectly retains its shape, the residue consisting of flexible and elastic gelatinous tissue. If a similar bone is carefully burned where there is a free access of air, a white brittle mineral substance is obtained, which retains the perfect shape of the bone. This consists of the phosphate and carbonate of lime. These results show that every atom of mineral is associated with an atom of organic matter in our bones. Bone also contains a large quantity of oily matter, which may be extracted by boiling in water. This rises to the surface like oil, and may be removed in a solid cake when the liquid is cooled. Bone fat is manufactured in large quantities at establishments erected in the vicinity of most cities. Its composition is similar to other animal fats; only containing a greater quantity of oil. It is soft, and inodorous; is largely used in the manufacture of toilet grease; and makes a better toilet soap than common animal fat. Animal charcoal consists of bones which have been burned in retorts. The composition of ivory is similar to that of bone. Dentine—the bony part of the teeth, contains 68 per cent of mineral matter; enamel contains no less than 84 per cent, and 5 per cent of gelatine. Teeth which contain the most mineral matter—hard shining enamel—are the most enduring, and least liable to decay. How complex is the human frame, and how wonderful the processes carried on in the animal laboratory. The elements and compounds of which it is formed are eliminated from the food taken into the stomach, which when digested and converted into chyle, enter the blood—that red current which forced through innumerable minute canals by the action of the heart—"the wheel at the cistern,"—as it passes through the system, deposits its constituents of phosphate of lime, fibrin, albumen, casein, and gelatin, in all their appropriate places, forming the soft crystal of the eye, and the hard enamel of the tooth; the horny nails, the spiral hair, the tough skin, the elastic tendon, the strong bone, and the complex brain. The chemical transformations which take place in the living body surpass the comprehension of the wisest and most learned men. The chemist can tell what is the composition of the skin or other parts of the body; but he cannot form a bone, nor fabricate an inch of fibrous tissue. How excellent in wisdom and skill and power is He by whom man has been so fearfully and wonderfully made.

Trial of Mowing Machines.

We learn from the *Country Gentleman*, that a trial of mowers took place at Huntsville, near Albany, on Thursday, the 9th inst., under the auspices of the Albany County Agricultural Society. The ground was level, and the grass (timothy) in good condition. There were eight machines entered for competition, viz., "Shipman's," manufactured by Shipman & Son, Springfield Center, N. Y.; the "Farmer," manufactured by Parmenter & Bramwell, Troy, N. Y.; the "Monitor," manufactured by F. Nishwitz, Williamsburgh, N. Y.; the "Hubbard Light Mower," manufactured by C. Tompkins, Troy; "Wood's Prize Mower," manufactured by Walter A. Wood, Hoosick Falls, N. Y.; "Hallenbeck's Mower," manufactured by Hallenbeck & Cunningham, Albany, N. Y.; the "Buckeye," manufactured by J. P. Adriance, Poughkeepsie, N. Y.; and the "Union Mower," manufactured by the Union Mowing Machine Company, Worcester, Mass. The ground having been previously divided into eight equal portions of one half acre each, the owners drew lots for their respective stations. All started together at a given signal. The first machine to complete its task was the "Farmer;" time about twenty-one minutes. The judges have not yet made their report.

Calomel and Tartar Emetic Prohibited.

An order has been issued by Surgeon-General Hammond against the use of calomel, and tartar emetic, in the army. In that order it is stated that the administration of calomel has been frequently pushed to excess by military surgeons, and that its abuse has produced melancholy effects, such as profuse salivation and mercurial gangrene. It seemed impossible to remedy this evil, except by striking calomel from among the medical supplies of the army.

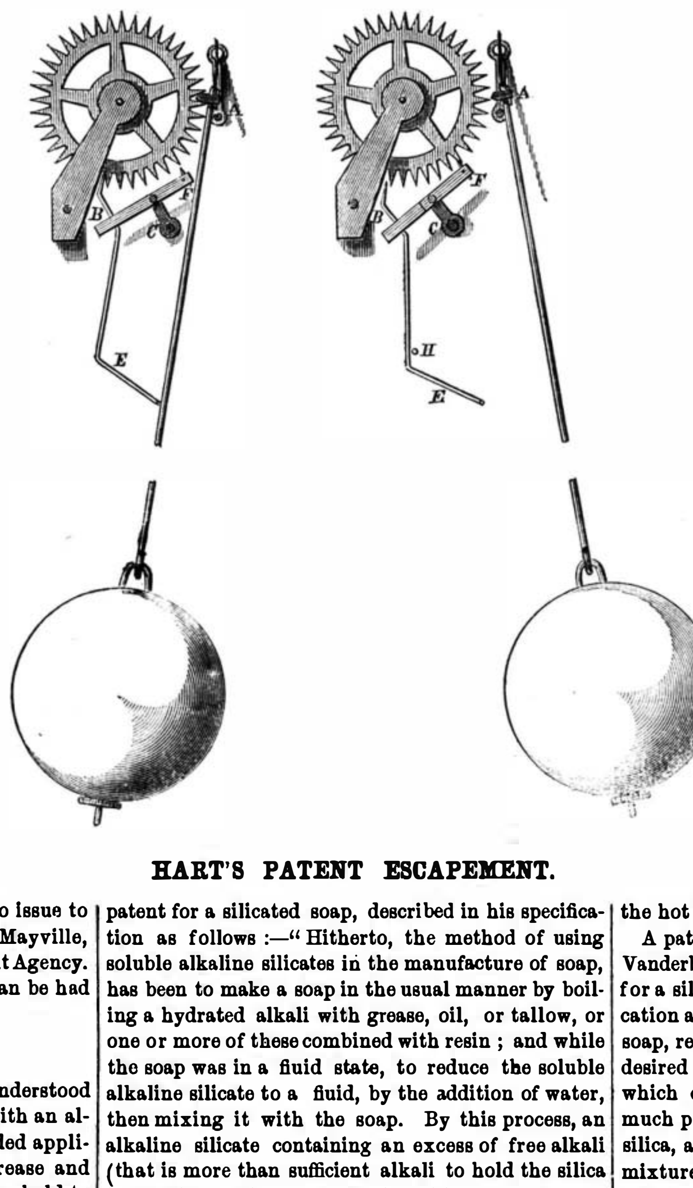
From the records of the Surgeon-General's office it has been conclusively proved that diseases prevalent in the army may be as efficiently treated without, as with, tartar emetic; hence its prohibition.

EFFECTS OF MERCURY ON SHEEP.—Professor John Gamgee, in the *Edinburgh Veterinary Review*, draws attention to the mischief arising from the reckless use of mercurial ointment as a dressing for scabby sheep. Sheep, he says, and ruminants are more readily poisoned by mercury than any other domestic animal; and, in some instances, mercury appears to be the cause of death directly, by its effects on the blood; in others it seems to kill by the varnish with which it covers the skin, which hinders the exhalations from that organ, and engorges the lungs; in others, again, it seems to produce an enfeebling of the digestive powers, so that a change to a better diet proves fatal. Severe salivation and loosening of the teeth are common occurrences.

Improved Escapement.

The importance of producing a correct movement for time-measurers cannot be overrated, since so many of the important duties and avocations of life are dependent on their fidelity and general accuracy. Herewith we illustrate a novel escapement, which possesses decided advantages over any others that we have examined. In it, A, is the impulse pallet, and B, a guard to prevent injury from carelessness; this comes in contact with the wheel only when the pendulum and detent are both withdrawn. The detent, F, is supported by the arm, C, and this latter, as also the one, carrying the pendulum, can be adjusted as required. The pendulum lifts the detent by the wire, E, and there is also another wire, H, riveted to the plate, which the wire, E, drops against; the depth or hold upon the detent is regulated by bending the wire above this pin. This escapement has been thoroughly tested, and found to possess many advantages not hitherto attained, some of which are herein set forth:—It is claimed that clocks thus fitted will keep more accurate time than others not so constructed: that they are much more durable and will not get out of order so quickly as ordinary escapements: that as the pendulum receives its impulse directly from the crown wheel, the friction produced in transmitting power from the crown wheel through many connections to the pendulum, is obviated: and that consequently no oil is required on it, and there is less wear on the whole machinery of the clock. It is also constructed much more cheaply, and the pallets can be quickly removed, if necessary, for examination. Clocks constructed with this attachment have sweep-seconds—a good feature in time-pieces with short rods. This invention can be applied to any clock, new or old.

The patent on this invention is ordered to issue to William Hart, a practical horologist of Mayville, Wis., through the Scientific American Patent Agency. Licenses to manufacture this escapement can be had by addressing the inventor as above.



HART'S PATENT ESCAPEMENT.

SILICATED SOAPS.

Soap, strictly speaking, was formerly understood to mean a composition of oil, or grease, with an alkali; but the term has now a more extended application. Various other substances than grease and oil have been employed as mixtures, and are held to be legitimate constituents of soap. Formerly, resin was extensively employed for this purpose; but owing to its scarcity since the war commenced, and the high price thence resulting, its use has been almost abandoned, and silica—the chief ingredient of sand and quartz—is now largely substituted. When pure, it is insoluble in most acids, or in water; and it is actually infusible in fire. Yet it can be converted into a liquid; and it is used to mix with soap; hence originated the term "silicated soap." Quartz sand subjected to a high degree of heat, and mixed with a caustic alkali, such as soda, or potash, becomes soluble: and this is the substance now largely employed as a substitute for resin in soap making.

The application of the silicate of soda, as a soap mixture, has been long known; but several patents have recently been obtained for improved modes of treating and mixing it.

On Oct. 14, 1862, Dudley B. Chapman, of Milford, Mass., obtained a patent for making a silicated soap which is described in his specification as follows:—"One part by weight of an alkaline silicate (such as silicate of soda), one part by weight of vegetable flour or farina, and one half part by weight of sal soda. The sal soda is to be melted with a little water, in a kettle, over a slow fire; the flour is then thoroughly mixed with it; after which the alkaline silicate is added, and the whole thoroughly incorporated together. This composition is to be mixed with soap made of grease or oil, and alkali, when it is in the liquid state, and the whole of the ingredients boiled together for a few minutes." It is stated that vegetable flour assists the silicate in combining with the soap, and a larger quantity of the silicate may thus be used with a given quantity of soap. It also makes a firmer soap, and prevents it from efflorescing. The claim is for "the combination of a carbonate, or caustic soda, an alkaline silicate, and vegetable flour, with soap, or a saponified oil or fat substance."

On Jan. 20, 1863, Mr. Dudley obtained another patent for a silicated soap, described in his specification as follows:—"Hitherto, the method of using soluble alkaline silicates in the manufacture of soap, has been to make a soap in the usual manner by boiling a hydrated alkali with grease, oil, or tallow, or one or more of these combined with resin; and while the soap was in a fluid state, to reduce the soluble alkaline silicate to a fluid, by the addition of water, then mixing it with the soap. By this process, an alkaline silicate containing an excess of free alkali (that is more than sufficient alkali to hold the silica in solution, which most alkaline silicates do) cannot be used to advantage, because the excess of alkali in the silicate granulates or opens the soap in such a manner as to precipitate the silicated solution to the bottom. Therefore the use of highly alkaline silicates in soap has been generally abandoned. By my process, I can use in soap, a silicate containing any quantity of free alkali; and in such proportions, that in some cases the quantity of alkaline silicate used will exceed in weight all the other ingredients combined; thereby materially cheapening as well as improving the quantity of soap.

"In manufacturing by my process, I first ascertain the quantity of free alkali which the silicate to be employed contains. I next by the addition of water, reduce the silicate to a fluid, or gelatinous condition; and when ready for use, have it heated to about forty degrees (centigrade). I next take a quantity of any one or more of the following ingredients, sufficient to completely neutralize the excess of alkali which the silicate contains:—To wit, grease, oil of any kind, tallow, resin, or any of these, combined with flour, or starch of any kind; and prepare them by heating the grease, oil, tallow, or resin, as the case may be, to about seventy degrees, centigrade; at which heat I add the alkaline silicate prepared as above, and mix thoroughly, by stirring for a short time. Next I mold the mixture in frames and allow it to cool. If I use flour or starch in the combination, I mix it in a dry state with the melted grease, or fatty matter, before adding the silicate. If the excess of alkali in the silicate is mostly caustic, the soap thus made, will, in the course of three or four days, be fit to cut up, or to be formed into bars, either for use or sale. Should the alkali be mostly a carbonate, the mass should be re-heated, in a day or two, to about eighty degrees centigrade, and next it should be framed, after which (in about two days), it will be ready to be cut or formed into bars. In this way I obtain a very fine neutral soap, in a much cheaper manner than by any other process.

"The excess of alkali in the silicate completely saponifies the ingredients used to neutralize it, and these ingredients in the process of saponification absorb all the excess of water with which we are obliged to dilute silicates in order to render them sufficiently fluid to combine with soaps. Therefore a soap made in this manner will not shrink in weight as much as a soap in which silicate is mixed after the soap is finished; for such soaps have already taken up about forty per cent of water from the hydrated alkali with which they are boiled, and the extra water in the silicate only tends to impair their value. Another advantage which this process ensures to the soap, is, that the glycerine having an affinity for the moisture contained in the atmosphere, prevents the soap from becoming too hard, by age, as silicated soap is liable to do.

"I claim, as my invention, and as an improved manufacture, a soap made in the improved manner hereinbefore described, viz., of a hot, fatty matter or matters; and a solution of alkaline silicate, combined at one operation, without the process of being boiled after the addition of the solution of silicate to the hot fat."

A patent (re-issue), was also granted to George E. Vanderburgh, of New York City, on March 10, 1863, for a silicated soap, which is described in the specification as follows:—"I take any kind of common soap, reduce it to a fluid state, and add thereto any desired proportion of dissolved alkaline silicate, which contains by analysis less than one-half as much potash, or less than one-third as much soda or silica, and then after thoroughly incorporating this mixture of soap and silicate, whilst they are kept at a proper temperature, I run the mixture into frames to harden, and afterwards cut the same into merchantable shapes.

The claim is "the use of a dissolved alkaline silicate as an ingredient in and component of soap; but this I only claim when the dissolved alkaline silicate thus employed contains, by chemical analysis, less than one third as much soda, or less than one-half as much potash as silica."

The soap manufacture is of great importance as a branch of the useful industrial arts. Some philosophers have held that the quantity of soap consumed by a nation may be taken as an index of its civilization; and this is not a chimerical idea, when it is considered that it is chiefly employed to promote cleanliness, in person and clothing. But whether the use of silicates, resin, and other substances, or mixtures, with genuine soap, composed of oil, grease, or tallow and alkali, is an improvement, is another question. Many persons believe that these are foreign mixtures, which only increase the quantity.

Mr. Graw, a French physician, proposes to destroy the taste of intensely-bitter medicines by mixing chloroform with them in certain proportions. He claims that the taste and odor, even of assafetida, can be annihilated.