The dilutions of the tincture change to a lighter shade of color on standing, therefore it is necessary to compare the dilution with the standard the day it is made. The standard changes to a deeper shade of color on aging. This necessitates the preparation of the standard the day it is used. The tenth normal cobalt chloride and two hundredth potassium dichromate are stable, so these solutions can be kept for a long period.

We believe the formula given above can be used for a standard color for Tincture of Cudbear though it may be necessary to modify slightly the amounts of cobalt chloride or potassium dichromate to conform to the average of a large number of samples of cudbear.

LABORATORY OF PARKE, DAVIS AND CO.,
DETROIT, MICH.

SPONGE.*

ITS HISTORY IN MEDICINE WITH A BRIEF ACCOUNT OF ITS HABITS AND STRUCTURE.

BY J. T. LLOYD, PH.D.

The rapidity with which iodine and its compounds have recently sprung into prominence in therapy is apt to lead one to believe that the remedy is of modern introduction. Study of the literature, however, reveals that in many of its present-day uses, iodine in combination is about as old as traditional medicine. True, the isolated chemical element was not known to the ancients, but preparations of sponge (its richest natural source) were known and dispensed in substance partly burned, or by extraction of the ash in solution. By either method a concentration of natural iodides and other salts in complex combinations was obtained.

Even before the beginning of the Christian era, when the civilization of Greece was at its zenith, sponges occupied a recognized place in medicine. More remarkable still, considering the lack of lenses for observing minute structures, they were even then classed in the animal kingdom. At least, about 320 B.C., Aristotle, "founder of zoölogy," and probably the first Greek to state that the earth must be a sphere, placed them among the animalcula.

In medicine the Greeks used sponge, both fresh and burned. According to Dioscorides,[1] Greek physician and author of a treatise on materia medica—

"Fresh sponges, and those most free from oils, are helpful for wounds, and to check tumors. With water or vinegar, they bind up (literally, glue together) fresh wounds, while cooked with honey, they join together old wounds. Old sponges are useless. But even these are of value in softening up callouses and separating ulcers that are growing together, if bound upon them, dry, with a linen cloth. Fresh sponges placed upon old ulcers full of corruption dry them up. They also check the flow of blood.

"Burned with vinegar, they are useful in inflammation of the eye; also where there is need of a detergent or astringent. But it is better to tincture the ashes with the remedies to be used for the eye. The ashes of sponges burned with pitch check the flowing of blood."—*Dioscorides, V:* 138.

If, as seems quite possible, the term translated "tumor," referred to the disease known to us as goiter, one present-day use of Spongia and its derivative,

* Section Historical Pharmacy, St. Louis meeting, 1927.

[1] Translated and condensed by Miss Margaret Stewart, A.M.

iodine, is traced back to the first or second century after Christ. It is also interesting to note that even so far back, the tincture of burnt sponge was employed.

At the time Disocorides lived in Greece, sponge seems to have been well established in Syriac medicine. The Syrian physicians used it much as did the Greeks and also employed it in diseases of the respiratory system. For this purpose, "The Syriac Book of Medicines," 200 or 300 A.D., directs—"burn a sponge in the fire and crush it in wine mixed with water and administer as a draught." Interesting comparisons may be made with the works of many modern authors, such as Felter, who more than fifteen hundred years later (1922) wrote of *Spongia usta* (tinctured burnt sponge), "Spongia is much employed as a remedy for laryngeal irritation, and it seems to have been remarkably effective in croup and croupal types of cough." Thus it may be seen that since the time of Dioscorides, although countless medical preparations have flourished and become forgotten, for some reason Spongia continues to hold its place in medicine.

Through the Middle Ages and well into the nineteenth century, *Spongia usta* occupied a place of prominence among the most important remedial agents of Europe. Sometimes the burned sponge was macerated in wine or vinegar, sometimes it was dispensed as a powder. The following quotation from Lewis' Materia Medica described the method of burning sponges and also gives the most common uses of the preparation:

> "Burnt in a close, earthen vessel, till it becomes black and friable, it has been given in doses of a scruple against scrophulous complaints and cutaneous defecations; in which it has sometimes been of service, in virtue, probably, of its saline matter, the proportion of which, after the great reduction which the other matter of the sponge has suffered in the burning, is very large. By virtue of this saline matter also, the preparation, if ground in a brass mortar, corrodes so much of the metal, as to contract a disagreeable taint, and sometimes an emetic quality:[1] hence the college expressly orders it to be powdered in a mortar of glass or marble."—*Lewis' Materia Medica, London,* 1768.

The belief that spongia owed its medicinal virtues to ordinary "saline matter," ended in the failure of an attempt to substitute a mixture of alkali and charcoal. That this attempt to displace Spongia was a failure and so accepted before iodine or its compounds were known is evidenced by the following quotation from the Royal College of Physicians, London, 1809.

> "Burnt sponge appears practically to produce effects which no mixture of the alkali and charcoal does, especially in the removal of bronchocele; and it is therefore retained."

In 1812, Courtois, of Paris, while manufacturing soda discovered iodine in the mother liquors of kelp. This was followed by its detection in other marine plants as well as animals and led many physicians and pharmacists to conclude that to iodine alone the virtues of Spongia should be attributed.

The "Pharmacopœia," of which two editions were published in Boston, 1808 and 1828, "by authority of the Medical Societies and Colleges," recognized Spongia. The first edition of the United States Pharmacopœia, published in Boston in 1820, gave it a place. It was also made official in the second edition of the United States Pharmacopœia, published in Philadelphia in 1830, as well as in the single New

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[1] The emetic quality mentioned by this and other authors may have been due to a compound of copper produced by contact of iodine with the brass mortar.

York edition of the same date. In 1830 iodine and its compounds received their first official recognition, being mentioned in both the Philadelphia and New York issues. Following editions gave place to iodine but failed to mention Spongia which soon became almost obsolete in the practice of many physicians. At the present time, however, there is an increasing demand for the pharmaceutical preparation Spongia.

Pharmaceutical Constituents of Spongia.—John Uri Lloyd comments on the constituents of Spongia as follows:

"Sponge contains a large amount of combined iodine, also bromine, phosphorus, sulphur, silica and other elements in unknown combinations. Whoever reasons concerning the action of compounds made up of such substances as unknown combinations of the elements that theoretically may be formulated into sodium chloride, calcium sulphate, sodium iodide, magnesium and iron oxides, unknown sulphides, and phosphates reorganized from organic tissue and reconstructed by heat into complex organic bodies, presumes much in asserting that such combinations depend solely for their qualities upon a single substance that may by destructive chemical processes be isolated from the original product. The intermolecular constitution of burnt sponge is to-day unknown. The uses of this preparation by physicians who employ it in contradistinction to iodine or its definite artificial compounds, are accepted as logically applying to a structural something that must be very different from pure iodine or a single iodine compound."

That such inorganics as are present in spongia (burnt sponge) though often considered practically inert, may under certain conditions exert a profound influence is well illustrated in the following quotation from Dr. S. P. Kramer,[1] Ex-President of the Cincinnati Academy of Medicine.

"The reaction between lime and silica is very interesting and important. If one add a small quantity of lime water containing 1.4 per thousand of Calcium Hydroxide to a solution of colloidal silicic acid (containing 0.7 per cent) a jelly is immediately formed. This is probably an adsorption compound and not a true chemical compound. The amount of lime adsorbed varies very greatly and if one keeps on pouring water over such a jelly, an increasing amount of lime is taken up.

"This calcium silicate or adsorption compound is exceedingly toxic. Thus an amount of this jelly solution containing 5 mg. (.077 grains) of calcium silicate when injected into the jugular vein will immediately kill a rabbit weighing 1500 grams (23,148 grains). When this jelly is examined under the ultra-microscope, it is seen to be made up of amorphous clumps much larger than the minute particles that are found in the colloidal solution of silicic acid.

"If to a solution of sodium silicate there be added lime water, instead of colloidal jelly there is formed a definite aggregate or precipitate of calcium silicate. This form is not at all toxic. One may inject 100 mg. (1.5 grains) of this form of calcium silicate into the jugular vein of an animal without producing any effect whatsoever."

On the Habits of Sponges.—Sponges occur in all oceans, in fresh water lakes, ponds and rivers of all continents. In the ocean they are found from tidewater to the greatest known depths. The deep water Hexactinellida whose delicate siliceous skeletons are objects of such marvelous beauty, do not reach their maximum numbers until a depth of more than one thousand fathoms (more than a mile) is passed.

Reproduction among sponges is accomplished by three distinct methods. The simplest of these, "budding," takes place in nature when a portion becomes broken from the sponge colony and starts life as a separate individual, much as a

[1] Read and demonstrated with specimens, before the Cincinnati Research Society, February 1, 1927.

branch broken from a willow tree may take root and grow into a separate tree. This form of reproduction by fragments of the colony is now being used to serve the commercial interests of the sponge fisheries. For this purpose living sponges of the most desired kinds are cut into fragments, which are planted on the sponge beds where they grow into mature sponges. This is the only manner by which the depleted sponge beds can be replenished by man. By this method seven years are requiied to develop a sponge of commercial size.

Sexual reproduction is the most usual mode of natural propagation. The young sponge, or larva, developed by the union of the two sex elements, is a minute creature which swims free in the ocean, feebly propelled by minute vibrating hair-like processes, termed cilia. The larva resembles the parents so little that no flight of the imagination could conceive of their relationship. After a period of free life, the larval sponge, if fortunate enough to settle on some solid support becomes fastened and completely alters into the well-known adult form; after once becoming sessile, it is never again capable of moving from place to place. Probably the larva's own power of locomotion could carry it but a short distance from its place of birth. However, when one considers that some ocean streams move almost a hundred miles in a day, the wide distribution of sponges can be readily comprehended.

The third form of reproduction is found among the fresh water sponges, and perhaps a few marine species. It is termed "gemmulation," and is a provision Nature makes in many of the lower plants and animals that live in environments which undergo radical changes, such as drying or freezing. The gemmules are egg-like bodies which ordinarily form in the body of the parent when its environment starts to change. Unlike true eggs, the gemmules are multi-celled and development does not require the union of sexual elements. Each gemmule is surrounded by a hard shell and can withstand freezing temperatures or long periods of desiccation in hot sunshine. It is largely through the agency of gemmules or "winter eggs" that the repopulation of temporary pools formed by the freshets of springtime takes place.

For the most part sponges show but little preference for the nature of the support on which they spend their lives. Any enduring hard object, washed by fresh clear currents will do. There are, however, a few species which have become dependent upon other organisms for their existence. Conspicuous among these are the small sponges that tunnel in the shells of oysters and other mollusca, and one species that is found nowhere except on the backs and legs of certain crabs. The first of these finds protection in the oyster shell, doing little or no harm to its host, while the other in return for transportation offers an effectual, portable hiding place to the crab.

Sponges are now quite generally regarded as animals, although until a generation or so ago most people, with the possible exception of the ancient Greeks, thought they were marine plants. Some scientists of the past generation though unwilling to separate them from the vegetable kingdom, preceived that they had many of the characters of animals. To these men they were known as zoöphytes or animal-plants.

Before the microscope made observation of minute protoplasmic structure possible, it is remarkable that even the most critical observers should have even suspected the animal nature of these collapsible masses of felt-like fiber. Motion, the popular distinguishing character for separating plants from animals, is entirely lacking or limited to the power of contraction possessed by certain species. Even this contractile power is less than the movement of some sensitive plants. Lacking as they do, all perceptible organs, it is, as remarked by Dr. Sollars, "by negative characters that sponges may most easily be recognized."

In form there is wide variation among the different species. While some maintain a fair degree of adherence to a general type, others are profoundly influenced by the contour of environment. Some species spread over or around their supports while others grow upward in stemmed cups or branched bunches of finger-like stalks. Some, like the bath sponge, approximate spheres, while others assume forms of the greatest variety.

The supporting skeleton of sponges is composed of calcium or silica or, like the bath sponge, an elastic felt-like network of spongin, an organic material akin to silk. Some have siliceous spicules cemented with spongin, while in a few the skeleton is entirely absent. The calcium and silica of sponges is formed into spicules, often having beautiful and complicated forms.

For present purposes a sponge may be likened to a thick-walled vase, with its entire surface perforated by small holes leading into its interior cavity. Of course, only a few sponges are this simple. More complex canal systems are the rule, but these are formed by the union of many of the vase-like systems. In life, the never ceasing lashing of minute, delicate, protoplasmic threads, termed flagellæ, scattered over the lining of the channels, keeps up a constant flow of water. The current always enters the many small, incurrent canals and leaves by the large excurrent channel, corresponding to the mouth of the vase. In passing it bathes the epithelial lining of the sponge with an ever fresh respiratory current. It carries in food material in the form of minute, organic particles and also eliminates waste. It supplies the inorganics which the protoplasm extracts with a nicety that is unparalleled by the most delicate methods that man has invented. According to Professor Sollars:

> "The quantity of silica present in solution in sea water is exceedingly small, amounting to about one and one-half parts in one hundred thousand. Hence, it would appear that for the formation of one ounce of spicule, at least one ton of sea water must come in contact with the body of the sponge. Obviously from such a weak solution the deposit of silica will not occur from ordinary physical agencies, it requires the unexplained action of living organisms."

It is probable that the accumulation of shells thus formed is responsible for the deposits of certain siliceous rocks. While many different marine animals have left their remains in these deposits, sponges, according to Professor Geikie, "appear to have mainly contributed to the formation of the important accumulations of flint and chert." Speaking on the same subject, Professor Sollars says:

> "This may account for the fact that deposits of flint and chert are always associated with organic remains, such as Sponges and Radiolaria. By some process, the details of which are not yet understood, the silica of the skeleton passes into solution. In calcareous deposits, a replacement of the carbonate of lime by the silica takes place so that in case of chalk the shells of Foraminifera are converted into a siliceous chalk. Thus a siliceous chalk is the first stage in the formation of flint."

In medicine, calcareous and siliceous sponges have never found a place. Only the felt-like sponges, such as the familiar bath sponge, have been employed. These have skeletons of spongin, which is remarkable for its large content of iodine. In some tropical species, according to published reports, the iodine content may run as high as 8 to 14 per cent, while seaweed from which commercial iodine is obtained, does not exceed 1.5 per cent. If, as is estimated by Stanford in Thorpe's Dictionary, the water of the Atlantic Ocean contains only one part of iodine in 280,000,000 parts, each pound of those sponges contains the total iodine content of almost forty million pounds of water. That this enormous amount of water could be circulated by the delicate flagellæ seems beyond the limits of reason. It has been suggested by John Uri Lloyd that the abstraction of iodine from the water may form an "iodine vacuum," so to speak, which is filled by the inrush of iodine extending from afar in the surrounding water. Thus the iodine may be depleted from water far from that which touches the sponge. Another theoretical explanation is the possible, increased iodine content of water in localities where sponges grow by the disintegration of the remains of kelp, sponges and other marine plants and animals. Or, it may be that sponges do not themselves abstract iodine from the water, but obtain it from the organisms they consume as food. Perhaps plants alone possess the power of abstracting iodine from the sea. Whatever the explanation, it seems beyond comprehension to understand the power of these animals to abstract such quantities of iodine or silica from the dilute sea-water solution.

SOME OF THE EVILS OF THE DRUG BUSINESS AND THEIR REMEDIES.*

BY JOSEPH JACOBS, PH.M., SC.D.

The business side of a pharmacist's life and career must ever be a subject of interest to our profession. Success or failure marks the difference between a condition attended by the contentment of recompensed labor and one that is "bound in shallows and in miseries."

If the measure of our service to society is the true criterion of the financial success deserved, may we not say that the "wavering balance" is not "rightly adjusted?" If so, what are the causes? What may be the remedies?

My observation is that no other business requiring such special preparation, difficult study and hard work is more meagerly repaid than that of Pharmacy. The commercial agencies accredit less than half of the retail pharmacists with a rating over $5000.00, and should you tour our cities and towns you would observe few fine homes in the best residential districts owned by druggists. Your guide could easily point out many owned by lawyers, physicians, department-store owners, grocers, hardware merchants, bankers and contractors. Nor do many of their names appear on financial boards of directors.

The reasons for this condition are numerous. They grow out of adverse influences operating from the outside and from faults and errors existing within.

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* Read before Section on Commercial Interests, A. PH. A., St. Louis meeting, 1927.