

of them, are coincident with the operation of the lymphatics. We have here two separate systems, the lacteal and lymphatic, which ramify from the intestines all over the body, and of which the anatomical and physiological actions and relations are at present an important subject of investigation for modern biologists, and not yet fully understood.

It is evident from the preceding that the blood vessels, which have received the material from the digestive apparatus, contain two distinct liquids, the original venous blood and the chyle; this mixture makes its way through the portal vein to the liver, which is a double structure, of which one function is to cause this mixture to undergo an enormous change, consisting in the formation of young blood cells, and the other is the economizing of the mineral ingredients of the disintegrated blood cells, which are also eliminated by the liver and of which iron is the principal ingredient.

The above outline may serve to give the general reader an idea of the highly elaborate complexity of the diverse operations belonging to the mysterious process by which foreign organisms are changed into the living tissues of our bodies, which tissues, by interstitial repair, take the place of the old ones; they do this so thoroughly that we may safely assert that, in the course of only a few years, not a single material atom is left of those of which the body originally was made up. In order to comprehend the truth of this, we have only to consider that the average amount of solid food required for each human being is 800 lbs. per year, of drink 1,500 lbs. and of oxygen, consumed from the air, 800 lbs., a total of 3,100 lbs., surpassing the weight of the body more than 20 times. The most wonderful fact to contemplate is that, with all this continual change of the material of which our bodies consist, we do not lose our identity.

MORDANTS FOR ANILINE COLORS.

While aniline dyes are remarkable for the ease with which they attach themselves to animal fiber, whether silk or wool, they are difficult to fix upon cottons and vegetable fiber in general. For this purpose albumen, the bichromates and other mordants have been used or recommended. The number of such mordants is not a small one; but the important question at present is which can be employed to the greatest advantage, and which will produce the most beautiful and cheapest colors. This cannot be answered by a series of experiments conducted on a small scale, but only by operating upon large quantities and in a practical workshop. The dye in fine colors will not usually have an opportunity to decide which is the most suitable mordant for cottons. In this question, the value of the bath after the operation and its capability of being turned to account must be considered, and in all calculations, its value must be deducted from the total cost of the materials employed.

To discuss at this time all the different methods employed in fixing aniline colors would lead us too far; almost all have been superseded by the methods in which tannin is employed. This is especially adapted to fuchsin and iodine green. Both of these dyes produce, with tannin, brilliant colored compounds which are totally insoluble, so that tannin most completely fulfils the ends required of a mordant. Tannin is, however, quite expensive, and hence we must seek some substitute which either renders the use of tannin entirely unnecessary or at least makes a saving in its use. The substances previously suggested, such as oleic acid or stearic acid, do not sufficiently fulfil the requirements, and it seems probable that a substitute for tannin, which shall entirely replace it, will be difficult to find. A long series of experiments on a large scale have led to the conviction that tannin, either pure or in sumach, is, in the mean time, still indispensable.

A German, named Austerlitz, has recently observed that a considerable saving of tannin can be effected by combining it with glue before using it, so as to employ both glue and tannin simultaneously as mordant. Under these circumstances, much less tannin is required to produce a given shade with fuchsin, iodine green or any other aniline color; in fact, the same results may be obtained with half the quantity of tannin required when no glue is used. Austerlitz says: "I have established this by a series of experiments on a small scale using weighed quantities of tannin with varying quantities of glue. A piece of cotton goods was first mordanted in a bath of tannic acid, and then cut in two, one half being drawn through a weak solution of glue or gelatin, the other immersed directly in a dye bath of known concentration at a given temperature. The half which had been through the glue bath was then dyed in a bath of precisely the same sort, and the two samples compared. The cotton on which glue had been employed was far more thoroughly dyed and of a deeper shade. It was also proved that the tannic acid bath might be much weaker, if followed by a glue bath, than when used alone. The amount of tannin saved in this way is not small.

By gradually diluting one of the tannin solutions and continuing the series of parallel experiments with tannin and glue and with tannin alone, a point is finally reached where both methods produce the same shade. When this point is arrived at, a comparison of the concentration of the two tannin baths will show how much is saved. This quantity, of course, depends greatly upon the quality of the tannin, so that my experiments have not given a result which can be expressed in figures. Samples from different sources gave different results, so that in some cases more was saved by the glue bath, in others, less."

The cause of these phenomena have not yet been ascertained but it is probable that a compound of tannin and glue is formed, which has an action upon aniline different from that of tannin alone.

FISH CULTURE BY FARMERS.

Why should not farmers and others raise fish for the market and for their domestic uses, as well as cattle, fowls or any other living stock? For so staple and healthy an article of food, it seems as absurd to be dependent upon chance capture in a wild state as it would be to rely for our poultry upon the fortune of the hunter or for our vegetable supply upon the finding of suitable esculents in localities in which a knowledge of botany may tell us they ought to grow. The efforts of the fish commissioners in this and other parts of the country, in stocking the waters with the spawn of valuable species of fish, will undoubtedly largely increase the numbers of the finny denizens of our rivers and streams; but the labor of securing an abundant and readily obtainable supply is thus only begun, and it seems to us that it may be continued by every dweller in the rural districts having the simple facilities requisite for the construction and maintenance of suitable fish receptacles.

Artificial incubation and the stocking of private ponds are of course no novel idea. History tells us of the vast sums expended for such purposes during the decline of the Roman empire; and pisciculture, especially in the monasteries, seems to have flourished through the middle ages. The success which has attended all modern efforts in a similar direction, even in the propagation of the trout and other delicate species, leaves little doubt but that, at a very moderate outlay of time and money, every farmer could provide himself with a well stocked pond, which he would find a constant source of valuable remuneration.

Dr. J. H. Slack, the New Jersey Commissioner of Fisheries, writes to the *Tribune* a letter containing many useful hints relating to this subject. Referring to the preparation of the ponds, he says that two points must not be overlooked: proper proportions of the banks and freedom from surface water. For the former, with ordinary loam, the following proportions will be found correct: Let the base of the tank equal three times its height, and let the width of the top equal the height. Thus, if the tank be 10 feet high the base should be 30 feet and the width at the top 10 feet. The sluices and overflow should be made of stone laid in cement. Wood, it is stated, will rot very rapidly and prove of no value. The services of a competent engineer may be employed to advantage, and the money expended for such supervision will save much trouble and vexation. Surface water is a fertile source of trouble, as it carries with it brush and leaves, which clog the screens, allowing the contents to overflow and permitting the escape of the fishes. In most cases, a series of ditches, entirely surrounding the ponds, will carry off the surface water, a gate being placed at the head of the ponds with an opening only allowing as much water to enter as can be readily conducted away. At the sluice gates screens of wire gauze must be placed to prevent the egress of the fish. These should be made of galvanized wire if of large mesh, and of copper if fine. A screen of coarser mesh, placed a few inches up stream from the fish screen, will arrest much of the floating trash and prevent clogging. This second screen, called the leaf screen, should be placed at an angle of about 60° that a greater surface may be exposed to the water.

As regards stocking the tanks, it can hardly be expected that every farmer can enter into the careful operations of trout culture, but there are plenty of other varieties of fish suitable for food which may be easily and profitably reared. The ordinary cat fish (*pimelodus*) will thrive and breed in almost stagnant water, and is hardy and enduring. The female takes care of her young, which, for some weeks after they are hatched, follow her about as chickens do a hen. For large ponds, through which a gentle current can be made to flow, the best fish for the south is the southern bass (*grystes salmoides*). It has a variety of names and is known also as the yellow and black bass, trout, chub, and growler. The adult fish is of a greenish brown color with a bluish black spot upon the gill, the young having in place of the spot from two to four longitudinal bars; the back fin is spinous and high, and the tail is similar to that of the trout. Besides the above two varieties mentioned as examples, there are scores equally valuable as food, some indigenous to northern, others to southern waters, which will probably suggest themselves to our readers interested in the subject.

The temperature of the water in the tank is an important matter, as fishes respire not water but air mingled with water. At the temperature of 50°, six cubic inches of air are contained in each gallon of aerated water, while at 32° none is present. With a supply of 1,000 gallons per minute at a temperature of 50°, fish could be maintained in a tank of about 8,000 cubic feet sufficient for a small village.

If the pond be well supplied with aquatic insects and plants, the fishes will need no food; but generally overstocking is the case and hence a certain quantity is required. Any kind of animal food, cooked or uncooked, is suitable; the entrails of fowls, lights of beef, oxen and hogs, if thrown in in small pieces, will be eaten with avidity. Curd or "smear kase" should only be given with animal food, being apt to cause disease. For the small fry of trout, the larvae of the common mosquito are stated to form excellent nutriment, a better utilization, by the way, of that tormenting insect than the Yankee project of capturing them in large quantities and using their bodies as manure. It is estimated that about two barrels of rain water will be required for each thousand fry, the insects being strained out from time to time as fast as they are developed, and thrown into the trout pond.

A SHOWER of frogs, which darkened the air and covered the ground for a long distance, is the reported result of a recent rain storm at Kansas city, Mo.

THE RECENT ARCTIC EXPEDITION.

Secretary Robeson's report of the official investigation regarding the Polar expedition, based upon the testimony of the survivors rescued from the ice floe, has at length been given to the public. As far as the record of the voyage extends, the account is substantially the same as that already published in detail in our columns. Considerable information, however, has been elicited regarding incidental topics and that bearing upon the mysterious portion of the recital, notably the death of Captain Hall; while that relating to the separation of ship and crew is of especial importance and interest.

The circumstances attending the decease of the commander are fully detailed, and as far as possible the statements of the witnesses reconciled and carefully compared. From all the testimony, the examining officials are inclined to reject the poisoning theory, so eagerly grasped by sensational journals, and arrive at the unanimous opinion that the death was due to natural causes. This view is qualified by the statement that none of the survivors are capable of giving an accurate account of Captain Hall's symptoms, nor of his last illness, and consequently the true state of the case must remain indefinite until the return of the *Polaris*. There seems little doubt but that the breaking adrift of the ship was purely the result of accident. The vessel was suddenly beset by a tremendous pressure of ice, which was driven against her from the southward, throwing her on her beam ends. To ease her, the provisions, stores, etc., were being removed when, during the darkness of the night and in a fierce gale, she parted her hawsers and disappeared. The sighting of the *Polaris* on the next day and her non-response to the signals of the abandoned crew, even when, from the distance intervening, they must have been clearly seen, are carefully considered. It is believed that, from a dispassionate point of view, the apparent indifference of those aboard must be ascribed to both inability and caution. The vessel had been so roughly handled the night before that both captain and crew might readily believe she would be lost; hence the removal of articles to the floe was attempted. Then when she broke adrift, her steam pipes, valves and connection were solid; and she was for hours without steam, unmanageable amid the floating ice. Moreover she was leaking badly and totally destitute of boats, so that it appears to have been the duty of the commander, Buddington, to get her in a place of safety, such as was the shelter of Northumberland Island, as speedily as possible. Furthermore, he knew that the ice party had boats and consequently could have believed their safety assured; and at all events, whatever his doubts might have been, a severe gale decided the question, driving the ice floe out of sight of ship and land. From this array of considerations, the final judgment is reached that the entire circumstances of the separation were accidental and unavoidable.

The *Polaris*, it is stated, had a broken stem and was leaky. She had plenty of provisions but not much coal, and probably remained in winter quarters at Northumberland Island. There is a difference of opinion as to whether she will be able to reach Upernavik or Disco under sail if she gets free this season, and it is believed that she will need assistance to escape from the ice.

The scientific results of the expedition are better than first imagined. The records of the astronomical, meteorological, magnetical, tidal and other departments are extremely full, and extensive collections of objects of natural history have been made. Specimens of drift wood were picked up near the shores of Newman's Bay, in which walnut, ash, and pine were recognized. The dip of the needle amounted to 45° and its duration to 96°, being less than at Port Foulke and Rensselaer Harbor, as given by Drs Kane and Hayes. Auroras were frequent but not brilliant, consisting sometimes of one arch and sometimes of several. Streamers were quite rare and shooting stars almost constantly visible. The average of the rise and fall of the tide was about 5½ feet, and the greatest depth of water noted 100 fathoms. The existence of a constant current southward was also noted, its rapidity varying with the season and locality. The winter temperature was found much milder than was anticipated, the minimum being 58° below zero in January, though March proved to be the coldest month.

The open polar sea of Kane and Hayes was found to be a sound of considerable extent, and it is believed, communicates with Francis Joseph Sound, and thus defines the northern limit of Greenland. Its length was not ascertained.

Pursuant to the recommendations of the investigating committee, the Secretary of the Navy has completed the purchase of the sealing steamer *Tigress*, the vessel which rescued the party on the ice field, and has ordered her prompt fitting out for a voyage in search of the *Polaris*. The *Tigress* is constructed especially for encountering the heavy ice of the arctic regions, and will be equipped in the most thorough manner so as to be ready for sea by the early part of July. She will be commanded by Commander James A. Greer, a well known officer of the navy. The *Juniata*, another naval vessel, has been got in readiness with the greatest rapidity and has sailed for Disco to carry supplies of coal and provisions for the *Tigress*, and also to seek information regarding the *Polaris*. The ship was fitted out at the navy yard in Brooklyn, and is heavily sheathed with iron. It is expected that she will return during the autumn, bringing the latest news and leaving the *Tigress* to penetrate to Northumberland Island.

"THE PRO-IRONISTS IN COUNCIL" is the heading of a report, in the New York *Herald*, of the proceedings of a convention of gentlemen engaged in the iron trade, lately assembled at Cleveland, O. Rather a scaly sort of irony, that.