The Cause and Prevention of Apple Rot.

Mr. C. H. Peck, the State Botanist, in his recently issued annual report to the Regents of the University of the State of New York, says:

While on the way from Summit to Jefferson, in Schoharie County, an apple tree was observed on which much of the fruit was discolored, and appeared as if beginning to decay. Some of the passengers in the stage remarked that they "never before knew of apples rotting on the tree." Some of the fruit was procured and found to be affected by a fungus known to botanists by the name of *Sphæropsis malorum*, or "apple sphæropsis." It has been described as attacking "apples lying on the ground" in winter. Here was an instance in which the apples were attacked while yet on the tree, and that, too, as early as September. The apples attacked by the fungus are rendered worthless, and experiments recently made indicate that the disease is contagious, and may be communicated from one apple to another. For example, a perfectly sound apple was placed in a drawer with one which was affected by the fungus. In a few days the sound apple began to show signs of decay. Its whole surface had assumed a dull brown color, as if beginning to rot. Two or three days later small pale spots made their appearance, and in the center of each there was a minute rupture of the epidermis.

An examination of the substance of the apple in these pale spots revealed fungus filaments that had permeated the cells of the apple. In two or three days more numerous minute black pustules or papillæ had appeared. They were thickly scattered over nearly the whole surface of the fruit. These constitute the sphæropsis. When microscopically examined each one of these black papillæ is found to contain several oblong pale fungus spores, supported on a short stem or foot stalk, from which they soon separate. It would be well, therefore, whenever this fungus rot makes its appearance, to remove the affected apples at once from the presence of the others, whether they are on the tree or not. It is not enough to throw them on the ground by themselves, for this would not prevent the fungus from maturing and scattering its spores. They should be buried in the ground, or put in some place where it will not be possible for the fungus to perfect itself and mature its spores or seeds. In this way the multiplication of the spores and the spread of the disease may be prevented.

TADPOLES.

The chief interest of the frog lies in the curious changes which it undergoes before it attains its perfect condition. Every one is familiar with the huge masses of transparent jelly-like substance, profusely and regularly dotted with black spots, which lie in the shallows of a river or the ordinary ditches that intersect the fields. Each of these little black spots is the egg of a frog, and is surrounded with a globular gelatinous envelope about a quarter of an inch in diameter.

On comparing these huge masses with the dimensions of the parent frog, the observer is disposed to think that so bulky a substance must be the aggregated work of a host of frogs. Such, however, is not the case, although the mass of spawn is forty or fifty times larger than the creature which laid it. The process is as follows: The eggs are always laid under water, and when first deposited, are covered with a slight but firm membranous envelope, so as to take up very little space. No sooner, however, are they left to develop, than the envelope begins to absorb water with astonishing rapidity, and in a short time the eggs are inclosed in the center of their jellylike globes, and thus kept well apart from each other.

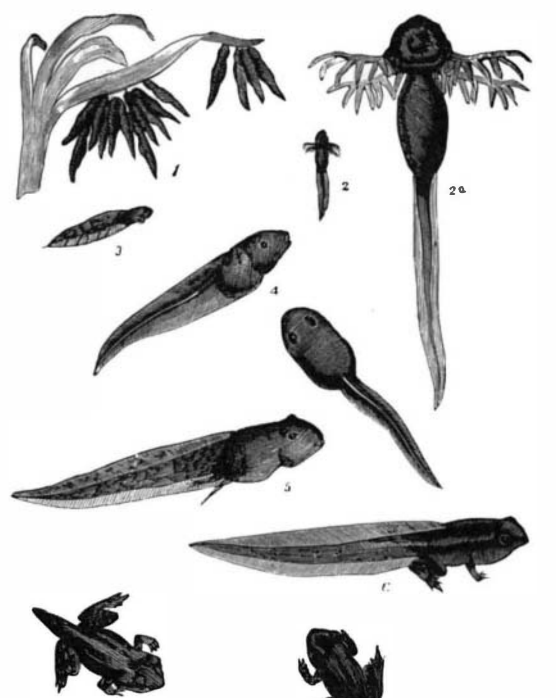
In process of time, certain various changes take place in the egg, and at the proper period the form of the young frog begins to become apparent. In this state it is a black grub-like creature, with a large head and a flattened tail (Fig. 1). By degrees it gains strength, and at last fairly breaks its way through the egg and is launched upon a world of dangers, under the various names of tadpole, pollywog, toe-biter, or horsenail (Fig. 2).

As it is intended for the present to lead an aquatic life, its breathing apparatus is formed on the same principle as the gills of a fish, but is visible externally, and when fully developed consists of a double tuft of finger-like appendages on each side of the head. The tadpole, with the fully developed branchiæ, is shown at Fig. 2 *a*, in the accompanying illustration. No sooner, however, have these organs attained their size than they begin again to diminish, the shape of the body and head being at the same time much altered. In a short time they entirely disappear, being drawn into the cavity of the chest and guarded externally by a kind of gill cover, as seen in Fig. 4.

Other changes are taking place meanwhile. Just behind the head two little projections appear through the skin, which soon develop into legs, which, however, are not at all employed for progression, as the tadpole wriggles its way through the water with that quick undulation of the flat tail which is so familiar to us all. The creature then bears the appearance represented in Fig. 5.

Presently another pair of legs make their appearance in front, as in Fig. 6; the tail is gradually absorbed into the body—not falling off, according to the popular belief—the branchiæ vanish, and the lungs are developed. Fig. 7 represents a young frog just before the tail is fully absorbed, and Fig. 8 shows the perfect frog.

The internal changes are as marvelous as the external. When first hatched, the young tadpole is to all intents and purposes a fish, has fish-like bones, fish-like gills, and a heart composed of only two chambers, one auricle and one ventricle. But in proportion to its age, these organs receive corresponding modifications, a third chamber for the heart being formed by the expansion of one of the large arteries,



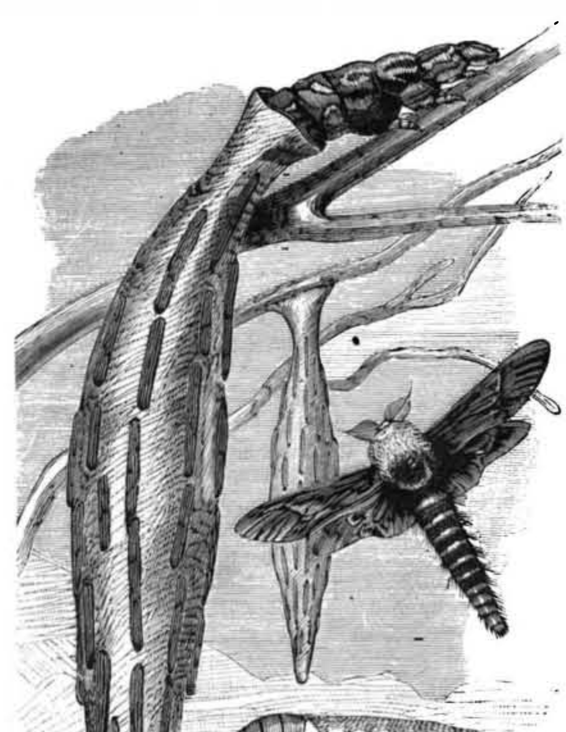
TADPOLES IN DIFFERENT STAGES OF DEVELOPMENT.

the vessels of the branchiæ becoming gradually suppressed, and their place supplied by beautifully cellular lungs, formed by a development of certain membranous sacs that appear to be analogous to the air bladders of the fishes.

HOUSE-BUILDER MOTH.

Perhaps the most curious example of the moth family is the species which is represented in the illustration, which we take from "Wood's Natural History."

The house-builder moth is common in many parts of the West Indies, and is in some places so plentiful as to do considerable damage to the fruit trees. As soon as the larva is hatched from the egg, it sets to work in building its habitation; and even before it begins to feed, this industrious



HOUSE-BUILDER MOTH.—*Oiketicus Sandersii.*

insect begins to work. The house is made of bits of wood and leaves, bound together with silken threads secreted in the interior. When the creature is small, and the house of no great weight, it is carried nearly upright; but when it attains size and consequent weight, it lies flat and is dragged along in that attitude. The entrance of this curious habitation is so made that the sides can be drawn together, and whenever the creature feels alarmed, it pulls its cords and so secures itself from foes.

In this domicile the transformations take place, and from its aperture the male insect emerges when it has assumed its perfect form, and takes to flight. But the female behaves in a very different manner. According to the ancient maxim, she stays at home and takes care of her house, from which she never emerges, nor indeed can she emerge, as she has no external vestige of wings, and looks more like a grub than a moth; the head, thorax, and abdomen being hardly distinguishable from each other. Love and courtship with this insect are carried on quite in an Oriental fashion, pushed to extremes; for whereas the Oriental in many cases never sees the face of his veiled bride until after the nuptial ceremony is completed, the house-builder never sees his mate either before or after marriage, and so is obliged either to love blindly or not at all. Perhaps, considering the peculiar ungainliness of his spouse, he is rather fortunate than otherwise in the fate which forbids him to contemplate the charms that lie hidden behind the dense curtain that shrouds the nuptial couch, and which, but for the mystery that surrounds them, might inspire any feeling rather than that of affection.

The grub-like female is seen lying on the ground, just below the flying figure of the male insect. It will be noticed that, except for the feathered body, the creature looks more like a larva than a perfect insect. Owing to the resemblance which these remarkable insects bear to the fasces which were borne by the lictors before Roman consuls, one species has been termed the lictor moth. The Singhalese appropriately call them by a name that signifies billets of firewood, and believe that the insects were once human beings who stole firewood while on earth, and are forced to undergo an appropriate punishment in the insect state. About five species of house-builder moths are known.

Injurious Insects Killed by Fungi.

It is a well known fact that various insects are subject to the attacks of parasitic fungi which prove fatal to them. The common house fly is destroyed by one, the silkworm by another, and the pupæ of various moths by others. Two other noticeable instances of this kind were observed last season by Mr. C. H. Peck, the State Botanist, and are described as follows in his "Report to the Regents of the University of the State of New York," just issued:

It was found that the "seventeen-year locust" (*Cicada septemdecim*), which made its appearance in the Hudson River valley early in the summer, was affected by a fungus. The first specimen of this kind that I saw was taken in New Jersey, and sent to me by the Rev. R. B. Post. Examination revealed the fact that the cicadas, or "seventeen-year locusts," in this vicinity, were also affected by it. The fungus develops itself in the abdomen of the insect, and consists almost wholly of a mass of pale-yellowish or clay-colored spores, which, to the naked eye, has the appearance of a lump of whitish clay. The insects attacked by it become sluggish and averse to flight, so that they can easily be taken by hand. After a time some of the posterior rings of the abdomen fall away, revealing the fungus within. Strange as it may seem, the insect may, and sometimes does live for a time even in this condition. Though it is not killed at once, it is manifestly incapacitated for propagation, and the fungus may therefore be said to prevent to some extent the injury that would otherwise be done to the trees by these insects depositing their eggs therein. For the same reason the insects of the next generation must be less numerous than they otherwise would be, so that the fungus may be regarded as a beneficial one. In Columbia county, the disease prevailed to a considerable extent. Along the line of the railroad between Catskill and Livingston stations many dead cicadas were found, not a few of which were filled by the fungous mass. As the insect makes its appearance only at intervals of seventeen years, and consequently will not be seen here again till 1894, it will scarcely be possible to make any further observations on it and its parasite for some time to come; yet it would be interesting to know how the fungus is propagated, or where its germs remain during the long interval between the appearance of two generations of the insect. Do the fungus germs enter the ground in the body of the larva, and slowly develop with its growth, becoming mature when it is mature, or do they remain quiescent on or near the surface of the ground, waiting to enter the body of the pupa as it emerges seventeen years hence? Or, again, is it possible that the fungus is annually developed in some closely related species as the "harvest fly" (*Cicada canicularis*), and that it passes over from its usual habitat to the seventeen year cicada whenever it has the opportunity? These questions are merely suggestive. They cannot yet be answered. A very good account of this fungus was given by Dr. Leidy, of Philadelphia, in Vol. V. of the Smithsonian Contributions, but as he bestowed no name on it, Mr. Peck has created a new genus for its reception and called it *Massospora cicadina*. The other instance of the destruction of insects by fungi is given by Mr. Peck as follows:

While in the Adirondack region, numerous clumps of alders were noticed that had their leaves nearly all skeletonized by the larva of some unknown insect. The larva were black in color and scarcely half an inch long. They were seen in countless numbers feeding upon the leaves, and threatening by their numbers, even if but half of them should come to maturity, in another year to completely defoliate the alders of that region. Upon looking under the affected bushes for the pupa of the insect, in order, if possible, to have the means of ascertaining the species, what was my astonishment to find the ground thickly flecked with little white floccose masses of mould, and that each one of these tufts of mould was the downy fungus-shroud of a dead larva from the alders. Not a single living pupa could be found, but there were hundreds of dead and mouldy larvæ, killed without doubt by the fungus, which is nature's antidote to an over-production of this insect, and nature's agency for protecting the alders from utter destruction.

Manufacture of Menhaden Fish Guano.

The menhaden belong to the herring family, and appear on our coast in the latter part of April, and depart in November. The business of catching the fish for oil and guano has increased rapidly within the last 18 years. It is carried on from Maine to New Jersey, and is especially prominent in the northeast portion of Long Island. In 1873 there were 62 factories in operation on the coast of New York and New England, employing 383 "sailing gear" and 20 steamers, with 2,306 men ashore and afloat. Total capital then invested, $2,388,000; total catch, 1,193,100 barrels, yielding 2,214,800 gallons of oil, and 36,299 tons of guano; value of products, about $1,600,000. Since then the business has largely increased, especially in northeastern Long Island.

Mr. Edward J. Boyd, in the *Rural New-Yorker*, gives the following interesting account of the mode of converting these little fishes into guano.

Omitting here an account of the manner in which the menhaden are caught, let us begin with them when they arrive at the "fish factory," as the place where they are converted into guano is called. This is generally a two story building with a "run," which is an inclined plane supported by trestle work, upon which a dump car runs to convey the fish from the boat to the "receiving tanks." These are situated outside the factory, and from them a sliding door opens to the tanks in which the fish are boiled. These are long, water-tight uncovered boxes, having in the bottom a coil of perforated pipe for the admittance of steam for the purpose of boiling the fish, and a plug hole through which the water in which they have been boiled can be drawn off. They will each hold from 50 to 5,000 barrels of fish. In the factories south of Montauk, L. I., the fish are counted by the thousand; in those east of Montauk, by the barrel, which is supposed to contain 250, four barrels thus making a thousand fish. These fish sold during the past season for one dollar per thousand. In a certain sense the business is a monopoly, as the owners of the different factories meet every year and decide upon the price to be paid during the ensuing season.

When a steamer or "sailing gear"—the name given to sailing vessels engaged in menhaden fishing—is sighted, the preparations at the factory begin. The tanks are filled half full of salt water; the "hydraulics," or hydraulic presses used to press the fish, are supplied with water, and everything is got into "ship-shape" order. On the arrival of the vessel, the fish are loaded into the dump cars by means of "tubs." These are the barrels by means of which the fish are counted. The freighted cars are then run up to the receiving tanks and unloaded; the slide is opened, and the cooking tanks are filled; steam is admitted and the process of cooking begins. When the fish have been "cooked," so that they fall readily apart, the water is drawn off; but, instead of being thrown away, it is conducted, by means of gutters, to an oil room situated on the ground floor of the factory. When the water has all been drawn off, a slide in the end of the tank is opened, and the pomace—the name given to the cooked fish—is raked into perforated cylinders, fitted with hinged bottoms, called "curbs." When these are full, they are set under the "presses," and hydraulic pressure is applied to them. The water and oil thus forced out through the perforated "curbs" fall on the floor, which is water-tight and divided by gutters leading to the oil room. After having been cooled there, the water, owing to its greater specific gravity, settles at the bottom, and the oil floats on top, and is skimmed off, like cream from milk. The oil is then placed in vats and boiled to free it entirely from water, after which it is put into bleaching tanks, where it is clarified, and then it is barreled.

The oil and water having been pressed out, the "curbs" are run into the "scrap" house and are emptied of their contents through the hinged bottoms. The fish is now worth $10 per ton as "green scrap." In from 24 to 48 hours a fermentation takes place, which produces a darker shade, caused by the escape of ammonia, and it is then called "old scrap." The next step toward "curing" it for the farmers now takes place by removing it to the "dry works," as the factory in which the fish is dried is called. Here the first process is "picking" it. This is done by putting it through the "picker," a cylinder armed with teeth revolving against set teeth, like the cylinder of a thrasher. The fish comes from the "curbs" in hard masses that sometimes require considerable exertion to break up; but when it comes out of the picker it is very fine—completely shredded.

The next step, "drying," now begins. This is effected either by the sun or by artificial heat. In drying by means of the sun, the scrap is spread out, early in the morning, on a platform, made like a floor inclined just enough to allow any rain that may fall on it to run readily off. During the day the scrap is constantly stirred by means of a wooden harrow drawn by a horse, until four o'clock, when it is gathered by means of a "loot." This is made exactly like a sled, but with a sliding tailboard, which is held down by the driver until the space between the runners is full, when it is lifted and the scrap laid off in windrows, like hay in the field. It is next gathered into the "cure," which is simply piling it into a heap, into which perforated pipes are inserted for the purpose of conducting away the latent heat that may be developed. Next day the "cure" is "turned;" that is, merely shoveled over and made into another heap. About four "turnings" generally cool the scrap enough to fit it for shipment. It is now worth from $35 to $40 per ton to manufacturers of fertilizers.

In rainy weather, "platform curing" is, of course, impracticable; so artificial heat is employed. This is a quicker process, but by its use about one-tenth more of the scrap is lost than by sun curing. The driers are revolving cylinders, like boilers, with shelves running spirally through them. A very hot fire is built in the fire box at the front end, and the heat passes under each cylinder to the back, and then through the cylinder to the front end, where stands the smokestack. The drier is fed at the front end, and as it revolves, the scrap is carried up by means of the shelves until it reaches the top, when, the shelves being inverted, their contents fall to the bottom, to be carried up again in the same way. Every time the scrap falls it falls a little further on in the cylinders, on account of its being pitched forward a trifle at each revolution of the drier, until, finally, it passes out at the back, and down a chute, to be caught up by means of elevators and deposited in the carts placed to receive it.

The length of time it takes a charge of scrap to pass through the drier, depends upon the length of the latter and the number of times it revolves in a minute. In a 25 foot drier, revolving eight times a minute, each charge takes about half an hour to reach the back end, during which time it alternately comes in contact with the hot cylinder and the hot air in it, all its moisture being thus evaporated. Very wet scrap requires from two to five dryings before it is ready for the "cure." The moisture is carried off by means of the natural draught, and with it go the fine particles of the scrap, a loss not incurred in platform drying; although a heavy thunder shower, when the platforms are "charged"—that is, covered with scrap—will wash away many dollars' worth of it. Indeed, I have seen four or five tons of scrap washed away by a heavy rain. After the scrap passes through the driers, it undergoes the "curing" process in the same way as "platform" scrap. Green scrap is mostly used for platform drying, and is very bulky when dried. Old scrap, too, is generally placed on the platform for 12 or 24 hours, if very wet, to dry the excessive moisture, because if it were put into the driers in its soaked state, instead of drying, it would make "pills," or round, hard balls. One "dry works" can dry he scrap from several "fish factories," as the fire is kept up constantly as long as operations last or there is work to be done.

For export, the scrap is ground and bolted. For this purpose a special mill is used—the only kind of mill that will grind the scrap so that it can be drilled in with grain. It has two cylinders, with cone-shaped bearing faces. One of these makes about 2,500 revolutions per minute; and the other, which is the feeder, about 800. Marvelous is the speed with which one of these mills grinds up the scrap. I have seen two men shoveling it in as fast as they could, while a torrent of ground scrap poured out like a stream of water. Pieces of iron, or anything short of a young anchor, cannot choke its greedy throat. The ground scrap is worth from $45 to $50 per ton.

The scrap will pay for the fish and the cost of working, leaving the oil a clear profit. A thousand fish, costing $1, will yield about five gallons of oil, worth 40 cents a gallon. This oil completely fills the place of "boiled oil" in the composition of paints. Nearly all the chemical and prepared paints are mixed with fish oil. Fish guano forms the base, or principal part, of the so-called complete manures, as well as of some sorts of Peruvian guano, etc., one ton of fish guano being "worked up" into six tons of many of the fertilizers sold to farmers. Sand and clay are the chief adulterations of fish guano. These make weight. Nothing, I believe, is so rich in ammonia as fish scrap, certainly not so far as the odor it emits is an indication. In my experience, on a Sunday when the platforms were being charged with scrap six months old, the windows of a church two miles away had to be closed. Fancy how persons stand it who have to work among it. But from my own experience, I can say that the odor is never noticed by a person after he has been a week or so in the factory; but so powerful is the perfume he carries about with him, that while he remains there, he is debarred from all social relations with the outside world.

Anti-Fat.

The subject of obesity and its treatment has of late years received much attention both from doctors and their patients. The interest excited by the appearance of Mr. Banting's "Letter on Corpulence" will not be readily forgotten. The medicinal agents most commonly employed in the treatment of this condition are acids—chiefly in the form of lemon juice and vinegar—strong alkalies, and iodide of potassium. Of late, however, a preparation known as "anti-fat" has been extensively advertised, both in this country and in America, possessing, if we may accept the statements of the proprietors, very remarkable powers in removing that superabundance of fat which is so frequently a source of anxiety and discomfort to those who indulge too freely in the pleasures of the table. Anti-fat is said to be a fluid extract of *Fucus vesiculosus*, a common sea weed, known in this country as sea wrack or bladder wrack, and in France as *Chêne marin* or *Laitue marine*. It is largely employed on the coasts of Scotland and France in the preparation of kelp; while in Ireland, curiously enough, it is found to be invaluable for fattening pigs. It contains, as might be expected, large quantities of iodine, chiefly, according to Gaultier de Claubry, in the form of iodide of potassium.

Fucus vesiculosus was at one time officinal in the Dublin Pharmacopœia, and is by no means a new remedy. Pliny describes it under the name of *Quercus marina*, and says that it is useful for pains in the joints and limbs. In the eighteenth century it was largely employed by Gaubius, Aunel, Baster, and others, in the treatment of scrofula, bronchocele, and enlarged glands, and even for scirrhous tumors. Its charcoal, known as *Æthiops vegetabilis*, was used in the same class of cases. The fucus has also been found useful in skin diseases and asthma. On the discovery of iodine, in 1811, by Courtois, the salpeter manufacturer of Paris, it for a time fell into disrepute. In the year 1862 its use was revived by Professor Duchesne-Duparc, of Paris, who, while using it experimentally in the treatment of psoriasis, found that it possessed the singular property of causing the absorption of fat.

The fucus can be taken either as an infusion, made by steeping half an ounce or a small handful in a pint of boiling water, or in the form of pill or liquid extract. The dose of the infusion is about a cupful, but it is so abominably nasty that few people can be induced to take it. The pills contain each three grains of the alcoholic extract; and, to begin with, one is taken in the morning, an hour at least before breakfast, and another in the evening, about three hours after dinner. The dose is increased by a pill a day, until the patient is taking ten every morning and evening. It is directed that the ten pills should be taken *dans la même séance*, and that a greater interval should not be allowed to elapse between each pill than is necessary for the process of deglutition. The fluid extract may be given in drachm doses, and it is said that the best results are obtained when both the solid and liquid extracts are taken. In favorable cases the sufferer may expect a reduction in weight of from two to five pounds in the week. Unfortunately, however, the fucus appears to be somewhat tardy in its action, and the patient should lay in a good stock of the drug before commencing treatment. In successful cases one of the earliest effects is an excessive diuresis, and the urine is said to become covered with a film of a beautiful nacreous aspect. In one carefully recorded case the patient did not observe this, but noticed that his water was very high-colored, and that its odor was extremely offensive. The next action of the drug is usually on the bowels, and the patient has many calls to relieve himself, without, however, being able to pass anything more than a little mucus. Sometimes the feet and body exhale a peculiar fusty smell, so that the patient is a nuisance both to himself and friends. After this, as a rule, the reduction in weight takes place. Occasionally, however, the opposite effect is produced, and the patient gets stouter than ever; in fact, fucus has been recommended as an "anti-lean."

By some authorities it is stated that the fucus should be gathered at the period of fructification, about the end of June, and that it ought to be rapidly dried in the sun; while other and equally eminent authorities insist that it should be gathered only in September, and that it should be allowed to dry slowly in the shade, a high temperature, according to them, destroying its active properties. It is generally agreed, however, that the roots and stalks should be rejected, and that the fucus gathered on the west coast is superior to that of the east. We understand that as a matter of fact most of our fucus comes from Billingsgate market, it being extensively employed for packing fish.

It must be confessed that we know little or nothing of the mode of action of this remarkable drug. We are told that it "stimulates the absorbents," but that is throwing very little light on the subject. What we want is a real sound systematic study of its uses and properties, both in the physiological laboratory and at the bedside. When it has been thoroughly and carefully worked out, as so many drugs have been of late years—pilocarpine and gelsemin, for example—we shall be able to form an opinion as to its value, but at present we are quite in the dark.—*London Lancet.*

Saws.

Much depends on the hanging and lining of a saw. First, examine with a straight-edge the collars; sometimes it will be found that the iron, around where the steady pins are driven, will be raised so as to cause a bunch around the pins; if so, either file or cut it off with a sharp cold chisel. A true mandrel will help a bad saw, but a bad mandrel will soon spoil a good saw. The mandrel must be level, so to allow the saw to hang plumb, and be as tight in the boxes as it will run without heating, and little or no endwise motion. (We are aware that the latter will not agree with all sawyers' views, for sometimes endwise or lateral motion has to be given to favor a bad saw, but we are alluding to saws that are in a proper condition.) The saw should hang on the collars so as to be perfectly flat on the log side. Most saws are thickest in the center, and for this reason the fast collar attached to the mandrel must be a little concaved and the loose collar may be nearly flat. This cannot be looked after too closely, as one half the portable sawmills that are made at the present day are just the reverse, and when the saw is hung it will be found too full on the log side. When this is the case don't try to run the saw until after the fast collar has been properly turned up.

There should be great care taken to see that the saw does not bind on the pins, or that the eye does not fit too tightly on the mandrel; if it does, the least warmth of the mandrel will be sure to cause it to expand, bind, and spring the saw. It is not expected that every saw will hang perfectly true, or all hang the same even on the same collars. Although the saws may be perfectly true, any deviation from perfection in the collars, or the saw, is multiplied as many times in the saw as the saw is larger than the collars. When a saw is found to be rounding or crooked on the log side, after fastening between the collars, loosen the nut and collars, and put a straight edge upon the log side of the saw and ascertain whether the fault is in the saw or in the collars. This should be done before it is used. Saws are often pronounced crooked when the fault is in the collars. We do not wish to be held responsible for the various shapes that bad collars may put a saw into; these imperfections may, however, be adjusted by packing writing paper between the saw and the collars.

The greatest care should be taken to keep the saw on a line with the run of the carriage. The saw should run nearly on a line with the carriage, the front of the saw inclining a little to the log, so that the back may rise without the teeth cutting or scratching the timber. A badly running carriage is ruinous to saws. The guides should be run as closely as they can without pinching the saw, so as to heat it on the rim and below the bottom of the teeth. It is not well to move the guides when the saw is warm, as the warmth may change its position. The practice of throwing water on the saw when warm is very bad, and should never be done. It may, however, be used to prevent pitch and gum from adhering to the saw—it keeps it clean and lessens the friction when used in a proper manner, and has no injurious effect on the saw. When used it should be applied on both sides, and put on when the saw is cool, near the eye, in a very small stream. The motion of the saw throws it over the surface to the verge, thereby producing the effect above mentioned.

Great care should be taken to keep the box next the saw from heating, as the heat is conveyed to the saw. The least heat in the center of the saw will make it limber and cause it to dodge. A saw that is in a proper condition should never have anything to cause friction in the eye, or on the rim, that can be avoided. The journal next the saw should not have any shoulders or collar to bear against the box, leaving everything free and clear. The mandrel can be as well and better secured with collars on the outside and inside of the opposite box.

The motion of the saw is one of the most essential things to be observed, and no one can give this too much attention. If the speed of the saw is too high, it cannot do good work, besides rendering it liable to many accidents. It generates heat in the saw, makes it touchy and limber, and it will only run and do good work on light feed, and while the teeth are in the best of order, and have a keen, sharp, cutting corner; as soon as this is gone the saw will run or dodge whenever it comes in contact with the least obstacle. And again: Too low a speed has its objections, but it is not attended with such ruinous effects upon the saw. These difficulties can be remedied to a limited extent by the hammering of the saw, but cannot be entirely overcome.

By carefully observing these rules respecting the care and attention due a circular saw, there will be labor and money saved. A circular saw is not unlike any other tool which has a great amount of work to do; it has its peculiarities, and needs to be kept in good order to do good work.—*Northwestern Lumberman.*

New Australian Railway.

A railway recently undertaken over the Mount Lofty range of hills, South Australia, will in years to come be regarded as one of the greatest engineering works at the Antipodes. However insignificant gradients of 1 in 45, and ascents of 2,000 feet may now be, any one who travels on the future line, or inspects the earthworks and tunnels as they are now being made, cannot fail to regard the line as a bold step for a small community to take. Nearly £750,000 will be spent on the 33 miles between Adelaide and Nairne. Within a trifle the railway is estimated to cost £22,000 per mile; and that, too, through a country where the cost of the land is a mere bagatelle. In some parts the expenditure will be fully £30,000 per mile, owing to the large amount of tunneling to be done and the height of the viaducts and embankments to be formed. The summit of the range will be reached in 18¾ miles from Adelaide, at a point about a mile to the west of Chafers, and at an altitude of 1,630 feet above sea level. Here a station, to be named after the range, the Mount Lofty Station, will be built. The ruling gradient, 1 in 45, will be between Government Farm and this point, and the descent from the summit to the Aldgate pump will be by a similar gradient. Powerful engines will have to be used, and they will come down to Mitcham without the aid of steam. The mountain section begins about Mitcham, and with but small exceptions the gradient is 1 in 50 until the Government Farm is approached. But in order to secure even this gradient creeks have to be crossed, steep hillsides hugged, mountains tunneled, sharp curves made, and ravines spanned by viaducts of great height.

The Largest Coastwise Steamer.

There was recently launched at Cramp's ship yard, Philadelphia, for Morgan's Louisiana and Texas Railroad and Steamship Company, the Chalmette, described as the largest coastwise vessel ever built in this country. She is 338 feet in length over all, 320 feet between perpendiculars, 42 feet beam, and 31 feet in depth. She has three decks and a cargo capacity for 8,000 bales of cotton. Her custom house measurement will exceed 3,000 tons.

With regard to machinery, she will have compound engines with high pressure cylinders 35 inches in diameter, and 70 inches diameter low pressure, with a stroke of 4½ feet. Four main boilers for 80 pounds working steam pressure. Her machinery is of an entirely new pattern. She will be provided with five independent cargo engines, two steering engines, two anchor, windlass, and capstan engines, together with quite a number of auxiliary pumping engines and pumps, and will be fully equipped for security against fire and sinking. Her appliances for handling freight are so complete that, it is claimed, only 30 hours will be required for discharging a cargo and receiving another.

Ice in the Arctic Regions.

Lieutenant Karl Weyprecht has lately given to the public an interesting work relating to ice and its metamorphoses in the Polar regions, from which the following, as given by Professor H. N. Moseley in *Nature*, is taken:

As an example of the mighty size of the Polar glaciers, the parents of the icebergs, the author cites the Humboldt glacier of Smith Sound, which, pushing itself into the sea in Smith Sound, forms an unbroken ice coast line composed of perpendicular cliffs 300 feet in height above the sea level and 60 miles in length, a single solid ice wall split only by vertical fissures. The fresh water ice is clear as crystal, and so hard that the Norwegian walrus hunters who run their small vessels in their voyages against all other ice obstacles, of whatever size, are careful not to charge even comparatively small pieces of this. This kind of ice is, however, scarce in the polar regions; it is the third kind of ice, that of salt water, or "field ice," which forms by far the greater part of floating ice, and with which the book is mainly concerned. The Tegetthoff was shut in for a year in field ice, and the author watched the incessant changes in the ice with great care throughout this period.

A simple smooth sheet of sea water ice is no sooner formed than it begins to be subjected to a variety of influences, which speedily convert its smooth expanse into a complicated rugged surface, covered with ridges, valleys, and irregularities of all kinds, render its thickness everywhere unlike, and split up with innumerable fissures. Most important among the causes of these changes are the variations of temperature to which the ice is exposed from the variation of that of the water below and the air above, and which are more or less local, and affect the ice differently wherever its thickness varies. From these differences of temperature ensue complicated strains in all directions, due to the unequal expansion and contraction of the mass, and the ice is rent by the tension; to these forces is added the pressure of surrounding ice fields, driven by the action of winds or currents; long fissures are formed, the edges of which grind together with mighty force.

After a while the edges separate, and the water between pulsates with the throbbing of the surrounding floes. Again they come together, and forced against one another with ever-increasing power, they are crushed and break up, huge blocks are piled above on the ice surface, resting at all angles upon one another, and other huge blocks are forced under the ice below. Hence the ice becomes rugged above, and by the freezing to it of the blocks forced under water, equally so below, the variation in thickness is increased, and with it the amount of strains caused by variation of temperature. The drifting snow hangs against the ridges and pinnacles on the surface, and forms banks and mounds which not only increase the effects due to temperature by protecting the areas on which they lie from change, but also by their immense weight, combined with that of the projecting ice masses by which they are formed, press down the ice which supports them, while the blocks below in other regions press it up. Throughout the mass gravity acts as a disturbant, no part being water borne at its natural level, the mass is strained, and gives way in all directions, and fresh complications ensue.

All these changes are accompanied by a noise. The unlucky prisoner in the field ice during the imposing unbroken loneliness of the long Arctic night, when the wind is calm, can hear the crackle of the snow under the stealthy tread of the polar bear at an astonishing distance, and hear what a man, speaking loud, says at 1,000 meters distance. It can, therefore, be well understood how the sound of the ice pressures must travel to his ear from enormous distances. "Sometimes," the author writes, "the noise of the ice movements was scarcely to be heard—a mere murmur—and came to our ears as does the play of the waves on a steep coast from the far far distance. Sometimes it hummed and roared closer to us, as if a whole column of heavily laden wagons were being drawn over the uneven ice surface." In the sound were combined all manner of noises caused by cracking, grinding, falling of blocks, crushing, and many other phenomena of ice life. "It is astonishing how far and how clearly every noise is conducted in the ice. The noise at the very margin of the field on which we were seemed to occur immediately at our feet. . . . If we placed our ears to the ice the sound was heard so loudly that we might have expected the ice to open under our feet the next moment. The whole dry ice covering was as a vast sounding-board. Whenever, as I lay down to sleep, I placed my ear against the dry wooden ship's side, I heard a humming and buzzing which was nothing else but the sum of all the noises which occurred in the ice at great distance from the ship."

A curious fact is described by the author, that the surface of an expanse of young salt water ice on which no snow has yet fallen is soft, so that the footstep is impressed upon its white covering as in melting snow. This is to be observed even at a temperature of —40° C. The unfrozen fluid is not water, but a concentrated solution of salt thrown out by the freezing of the ice beneath.

When summer begins, the thawing that occurs is very local and unequal. Any dark body, such as a heap of ashes, or the droppings of bears, eats its way into the snow, absorbing the rays of heat which are reflected off again by the general white surface. The bear droppings eat their way into the snow, and then into the ice, and the conical hole thus formed fills itself with water. It may, at last, eat its way right through the ice where not very thick. Thus are formed the greater part of those holes in drift ice which are usually ascribed to seals. The author never saw a seal's hole in winter.

A number of interesting experiments were made on ice phenomena. For example, on March 5, a cube of ice was sunk under the ice field to a depth of five meters. After the lapse of twenty-four hours it was found that a crust of new ice had formed itself over it about 1 cm. thick. This was caused by the low temperature of the block itself and, from a similar cause, ice crystals had formed between the edges of the hole, owing to the coldness of its walls. On March 10 very little increase in the added layer of ice on the cube was to be observed. On March 20 this newly formed ice was found to be softened, so that it was easily impressed by the finger; by April 2 it had become harder again, though porous and apparently a little increased. From thence onward the block dwindled regularly, especially on that part of its surface which was turned upward; on July 18 it was only a third of its original size; nevertheless, the hole through which it was sunk had, during the last period, become entirely closed by young ice at its lower margin. This experiment shows the loss of ice from below by the action of the warmth of the water. The author concludes from his experiments and measurements that compact salt water ice can never attain a greater thickness than 10 meters.

Icebergs are subjected to disintegration after somewhat the same manner as rocks so commonly are. They are full of crevasses, into which the water formed by melting penetrates; in winter this water freezes, and by its expansion all through the glacier a rupture of the mass ensues. "It is highly probable that most of the icebergs afloat in winter are in such a condition that a very slight cause is sufficient to make them burst because of their state of internal tension. . . . Every polar traveler can tell how a shot, the driving in of an ice anchor, or any other sudden vibration, has brought about the catastrophe; cases have even occurred in which the sound of the voice alone was sufficient. An iceberg is always an unpleasant neighbor." So many are the causes which tend to destroy icebergs that the author concludes "no berg exists which could withstand them more than ten years, and that commonly the life of a berg is much shorter." However this may be, doubtless the much larger Antarctic bergs last very much longer, as must necessarily occur because of the much greater uniformity of the climate to which they are exposed.

With regard to glaciers, the author quotes an interesting observation of Kane's to the effect that even in lat. 78° 20′ during the entire winter, however low be the temperature, the glacier streams never dry up. The melting which supplies them with water can only derive its requisite heat from the friction of the ice masses.

The chapter on the ice movements is full of interest Every field acted on by winds and currents has its own peculiar velocity, depending on the dimensions of the irregularities above and those of the resistances below, in which no two fields are alike. From these differences of velocity arise the irresistible pressures between contiguous fields. The iceberg deeply sunk drifts but slowly, while the ice field may travel very fast. If the field catches up a berg in its course, it is broken and torn by the berg; and as it proceeds on its course its broken fragments are piled up block upon block on the coast of the iceberg. To a casual observer it appears as if the iceberg, driven by a counter current below, were being forced in the opposite direction to the ice field, so as to plow it up. Many groundless accounts of the existence of such counter currents thus observed have been circulated.

Another cause of pressure between ice fields is that, owing to the irregularities on their surfaces, they are twisted round by the action of the wind, which takes hold more on some regions than others. Every field is differently thus acted upon for each direction of the wind. A similar effect is caused by the currents beneath acting upon the irregularities of the under surface. So various are the movements in the ice fields that even when the ice lies all the while closed, it is very seldom that any two pieces remain for any length of time in the same position alongside one another. Two ships beset together by the ice are sure sooner or later to be separated.

Charleston's Great Fire of 1861.

Mr. Wm. L. King, of Charleston, S. C., calls attention to an omission from the list of great fires, given in our issue of October 25. The most extensive conflagration from which Charleston has suffered occurred in 1861. It was the work of an incendiary, and swept over 540 acres of ground. There were 358 sufferers, many of them having more than one house destroyed.