The Heathen Chinee Sparrow.

Passer domesticus has its place in nature; possibly monarchical Europe and monarchical individuals in other places can overestimate their worth, but in America they are out of place, and their introduction was a grievous mistake. Its disposition is very far from being republican, and its treatment of some of our native birds, which are of much more value than themselves, is tyrannical and despotic. Quarrelsome with and pugnacious toward the swallows, martins, wrens, and bluebirds, they take by force the houses put up especially for their use. Thanks for the love of liberty, right and justice, the swallow, martin, wren, or bluebird having possession of the house can, and usually does succeed in keeping it against the attack of a single pair of sparrows, but often this pair, unsuccessful in their house-breaking attempt, go off and solicit the aid of their fellows, and return with a dozen or twenty of their kind, lay siege to the place, and by united effort take it, after the rightful occupants have made a desperate defense against enormous odds.

It may be only a coincidence—it is a fact, however—that, as the sparrows have increased in numbers, the purple martins, *Progne purpurea*, have decreased in this locality.

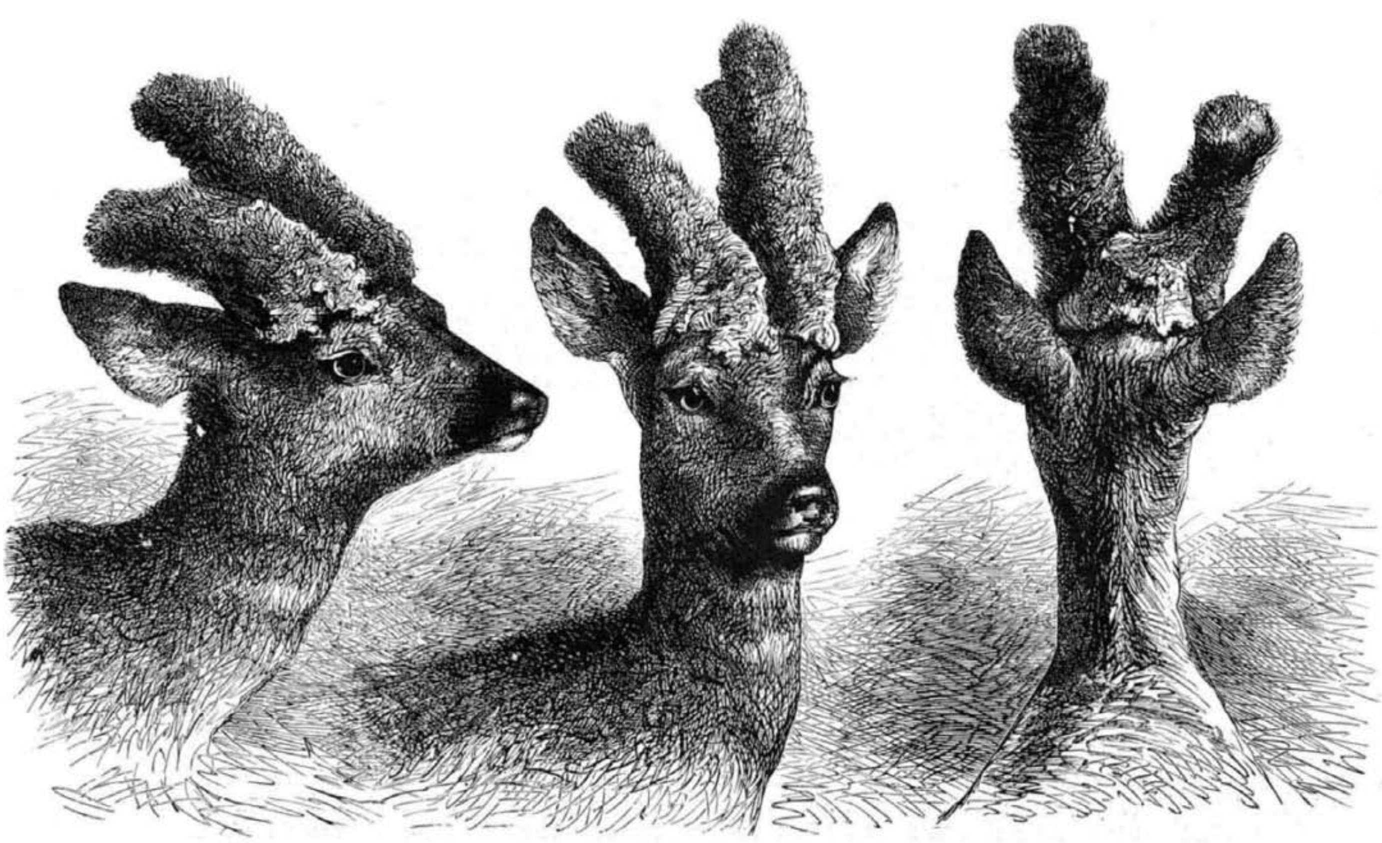
The sparrows are essentially graminivorous and frugivorous, and are not insectivorous in the legitimate use of the term. They are very destructive to garden and flower seeds, the small grain, and no species of fruit is free from their depredations. They are more dirty around the house than any of our native, social birds, dropping *en masse* their excrements about the door. I presume they have their good qualities. I cannot agree with Mr. Minot when he says of the purple grackles that he "would not hesitate to sign the death warrant of the whole race," but I would not hesitate to sign a warrant to banish the house sparrow from the United States to the place from which they came, and furnish a liberal supply of good food and clean water for the voyage.—*Elisha Slade, Somerset, Mass., in American Naturalist.*

Cymene from Turpentine.

Naudin has pointed out a reaction by which cymene can be prepared from turpentine with great facility. If two atoms of dry chlorine are absorbed by one molecule of turpentine cooled to —15°, there is no sensible evolution of hydrogen chloride, but the liquid becomes viscous and contains $C_{10}H_{16}Cl_2$. A slight elevation of temperature produces decomposition, and cymene and hydrogen chloride distill together. If to the mixture 4 per cent of phosphorus chloride be added, and the temperature be maintained at 25°, a regular evolution of HCl takes place until the conversion is complete. Washing with water, drying over calcium chloride, and rectification over sodium, gives pure cymene boiling at 175°, the yield being 75 per cent. The author has observed that at 100° traces of zinc dust violently decompose the body $C_{10}H_{16}Cl_2$.—*Bull. Soc. Ch.*

PERUKE-HORNED DOE.

Our engraving represents the head and horns of a doe, which was killed the first of last December in the hunting grounds of Herr Hugo Pönsgen, in the district of Aix-la-Chapelle. It differs in no respect from the abnormal horn formations which make their appearance in emasculated bucks, and are represented in most collections under the name of perukes, bishop-caps, etc. The appearance of such horns in a female has, until now, been rarely observed, although in old does smaller stunted horn formations have sometimes made their appearance.



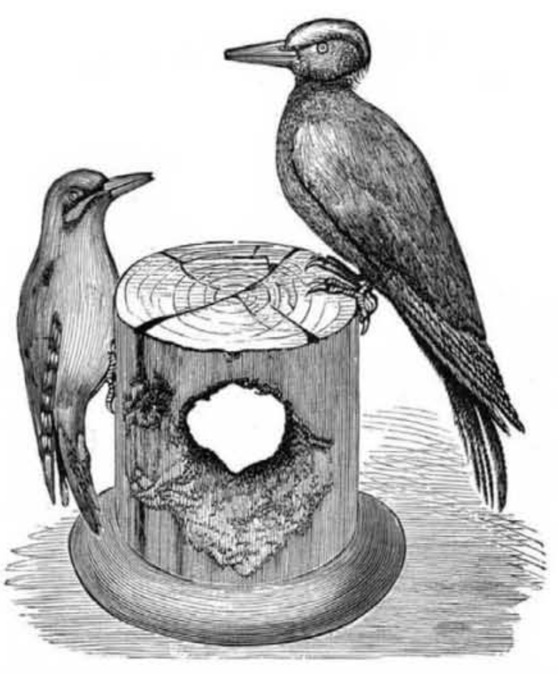
PERUKE-HORNED DOE.

The head and neck of the doe was sent, the day after the hunt, to Düsseldorf, to the well-known taxidermist, Joseph Guntermann. The height of the longest horn was 19 centimeters. The head from the point of the nose to the rosette 15·2 centimeters. The skin on the neck was extremely thin and parchment like in quality, while in the bucks at this time of year the skin is of considerable strength and thickness.

According to the statement of Herr Pönsgen, this doe, with the exception of the horns, differed in no respect in form from the wild does. It was in good condition, its weight being 16 kilogrammes. There were no traces of an earlier wound, and the doe in its lifetime was never seen by hunters in this or adjoining districts.—*Illustrirte Zeitung.*

THE ELECTRIC TELEGRAPH AND THE WOODPECKERS.

The section of wood shown in the engraving was sent by the Norwegian Government to the International Electric Exhibition at London. It was cut from a perfectly sound post impregnated with sulphate of copper. It is perforated with a hole, forming a circle of the diameter of about three inches and a half, which hole has been pecked out by the birds. Electric telegraph poles are frequently thus treated in Norway, in certain districts situated near pine woods, where the bird is found; the holes are, as a rule, at the top of the post. According to the opinion of an ornithologist, the motive should be attributed to the humming sound produced in the post by the vibration of the wire, which the



bird imagines to proceed from worms and insects working inside the post. The smaller bird depicted here is the green woodpecker (*Picus viridus*), the most common of our limited number of British woodpeckers. The larger bird is the great black woodpecker (*Picus martius*), whose native regions are the northern and eastern parts of Europe.

Pezzer's Accumulator.

This battery is constructed as follows: Narrow bands of lead, 10 to 15 millimeters broad and 500 in length, are obtained by cutting up sheets of a suitable thickness, and they are made to take a waved form by being passed between the rollers of a machine used for folding stuffs obliquely. Each of them is doubled in two, and they are placed in juxtaposition, fold upon fold. The free ends are then soldered together by the autogenous process, forming them into fringes. These fringes are introduced in place of the carbon and the zinc in a Bunsen element (Ruhmkorff's model), where some of them fill the porous vessel, and the others the interval between the porous vessel and the sides of the exterior vessel. The soldered ends are upward and the folds downward. Plates soldered to the upper part serve as electrodes.

How Beeswax is Made.

I presume that the majority of people who are not bee-keepers suppose that bees gather wax from some source, in the same way that they gather honey, pollen, and propolis. I once heard even a bee-keeper remark: "We had a nice spring day yesterday. My bees had a splendid 'fly,' and I noticed that some of them came in loaded with pollen and wax." That bees do not gather wax is easily proved by confining in an empty hive or box, and feeding them honey or a sirup made of sugar, when they will immediately commence the construction of combs. During the working season wax is secreted by the bees, and forms in thin white scales, or flakes, between the rings, or segments, of the abdomen. Such renowned scientists as Prof. Agassiz and Tyndall have made some very amusing blunders (blunders which showed they had never seen bees building comb) in attempting to tell how honeycomb is built. The exact manner in which these little pellets of wax are formed into beautiful white combs is well described in the "A B C of Bee Culture," and I give a short extract:

"If we examine the bees closely during the season of comb building and honey gathering, we shall find many of them with the wax scales protruding between the rings that form the body, and these scales are either picked from their bodies, or from the bottom of the hive or honey boxes in which they are building. If a bee is obliged to carry one of these wax scales only a short distance, he takes it in his mandibles, and looks as business-like with it thus as a carpenter with a board on his shoulder. If he has to carry it from the bottom of the honey box, he takes it in a way that I cannot explain any better than to say he slips it under his chin. When thus equipped, you would never know he was encumbered with anything, unless it chanced to slip out, when he will very dexterously tuck it back with one of his fore feet. The little plate of wax is so warm from being kept under his chin as to be quite soft when he gets back; and as he takes it out, and gives it a pinch against the comb where the building is going on, one would think he might stop awhile and put it into place; but not he, for off he scampers and twists around so many different ways, you might think he was not one of the working kind at all. Another follows him sooner or later, and gives the wax a pinch, or a little scraping and burnishing with his polishing mandibles, then another, and so on, and the sum total of all these maneuvers is that the comb seems almost to grow out of nothing; yet no bee ever makes a cell himself, and no comb building is ever done by any bee while standing in a cell. The finished comb is the result of the moving, restless mass, and the great mystery is that anything so wonderful can result at all from such a mixed-up, skipping-about way of working."

In every apiary should be a box or barrel in which to throw all waste comb, and the cappings that are shaved off the combs when extracting. When much transferring or extracting is done, considerable wax can in this manner be saved, and it is as easy to save it as it is to throw it away. During the hot weather these refuse combs and cappings should be melted up into wax quite often; otherwise they will become infested with the bee moth's larvæ, and thereby destroyed. There are several methods of melting up combs and cappings into wax, but I have tried none that is more simple, or better, than to make a bag out of some coarse sacking, fill it with pieces of comb, tie it up, and put it into a wash boiler. Set the boiler on the stove and fill it nearly full of water. When the water is almost hot enough to boil, take a stick and punch, poke, and press the bag until the wax is all melted and risen to the top. Now lay a narrow strip of board across the top of the boiler, and tie it fast to the handles; then take two or three sticks that are nearly as long as the boiler is deep, press the bag down to the bottom of the boiler with these sticks, and keep it in this position by putting the upper ends of the sticks under the strip of board that is fastened across the top of the boiler. Now set the boiler off the stove, and when its contents are cold, the wax can be taken off in one solid cake. In passing through the bag the wax is cleansed from all coarse impurities, while the fine particles of dirt that do escape will be found either upon the top or bottom of the cake of wax, from whence they can easily be removed.

When the combs and cappings have all been worked up, and the cakes of wax have been scraped free from all dirt or sediment, the cakes should all be put into the boiler, melted up together, and the wax run into neat cakes.

I made twenty-five pounds of wax, last spring, in the above manner, and the nicest wax I ever saw. To clean utensils from beeswax, they should first be scraped with a knife as clean as possible, and then rubbed with a cloth saturated with kerosene oil. Beeswax is sometimes adulterated with paraffine, ceresin, or tallow. To detect these frauds, a piece of wax should be chewed; if adulterated, even slightly, with either, it will chew like gum, while, if pure, it will crumble and break to pieces in the mouth, and will not make gum at all.—*W. Z. Hutchinson, in Country Gentleman.*

Man and Insects.

The only nerves (worth mentioning) in the human body which are not under the control of the brain, are those of the heart and other internal organs; and over these parts, as everybody knows, we have not any voluntary power. But all our limbs and muscles are moved in accordance with impulses sent down from the brain, so that, for example, when I have made up my mind to send a telegram to a friend, my legs take me duly to the telegraph office, my hand writes the proper message, and my tongue undertakes the necessary arrangements with the clerk. But in the insect's body there is no such regular subordination of all the parts composing the nervous system to a single central organ or head office. The largest knot of nerve matter, it is true, is generally to be found in the neighborhood of the sense organs, and it receives direct nerve bundles from the eyes, antennæ, mouth, and other chief adjacent parts; but the wings and legs are moved by separate knots of nerve cells, connected by a sort of spinal cord with the head, but capable of acting quite independently on their own account. Thus, if we cut off a wasp's head and stick it on a needle in front of some sugar and water, the mouth will greedily begin to eat the sweet sirup, apparently unconscious of the fact that it has lost its stomach, and that the food is quietly dropping out of the gullet at the other end as fast as it is swallowed. So, too, if we decapitate that queer Mediterranean insect, the praying mantis, the headless body will still stand catching flies with its outstretched arms, and fumbling about for its mouth when it has caught one, evidently much surprised to find that its head is unaccountably missing. In fact, whatever may be the case with man, the insect, at least, is really a conscious automaton. It sees or smells food, and it is at once impelled by its nervous constitution to eat it. It receives a sense-impression from the bright hue of a flower, and it is irresistibly attracted towards it, as the moth is to the candle. It has no power of deliberation, no ability even to move its own limbs in unaccustomed manners. Its whole life is governed for it by its fixed nervous constitution, and by the stimulations it receives from outside. And so, though the world probably appears much the same to the beetle as to us, the nature of its life is very different. It acts like a piece of clockwork mechanism, wound up to perform a certain number of fixed movements, and incapable of ever going beyond the narrow circle for which it is designed.—*Grant Allen, in Knowledge.*

Domestication of Wild Ducks.

In a paper "On the Domestication of some of our Wild Ducks," Mr. Charles Linden, the author, states, after efforts to domesticate several of the species, capturing them young or raising them from eggs, that none of those transferred to the barnyard "adapted themselves thoroughly to this state excepting the Mallard, dusky duck, and Canada goose, the progeny of which prospered well and attained a greater weight and size than the ordinary domesticated stock. Some of them are still living, and betray in many instances a tendency to revert in point of plumage to their original condition, while the majority have become completely metamorphosed into ordinary barn yard fowl. No hybrids from any two different wild species, which bred only within the inclosure, were ever obtained excepting from crosses between the Mallard and dusky duck." The crossing was readily accomplished "without any need of resorting to special inducements." He says: "It is evident that the dusky duck is fully as domesticable as the Mallard, which has been thus far supposed to be the originator of our common tamed ducks."—*Bulletin of the Buffalo Society of Natural Sciences*, vol. iv., No. 2.

Fat of the Old and Young.

The influence of age on the chemistry of the body is a department of physiology as yet very imperfectly investigated. The composition of the fat, however, at different periods of life, is obviously one of the simplest problems connected with the question, and it has been lately investigated by Lanquer. In newly born children the fat has a particularly firm consistence, constituting a peculiar tallow-like mass, with a melting point of 45° C. The fat of adults, however, separates, at the ordinary temperature of a room, into two layers. The upper layer is completely fluid, translucent, and of a yellowish color, and only solidifies at temperatures under zero Centigrade. The lower layer is a crystalline mass, which has its melting point at 36° C. Further investigations were made on about a kilogramme of each kind of fat. The fatty acids obtained from the fat of newly born children (after precipitation with hydrochloric acid) were found to melt at 51° C., and those obtained from the fat of adults had a melting point of 38° C. The former was found to contain three times as much palmitic and stearic acid as the latter. The palmitic acid preponderated over the stearic in each kind of fat, but much more in that of children than of adults, the proportion being in the former four to one, but in the latter nine to one. There are 86 per cent of oleic acid, 8 per cent of palmitic acid, and 2 per cent of stearic acid in the fat of an adult; whereas in the child the proportion of oleic acid is only 65 per cent, the palmitic acid 28 per cent, and the stearic acid 3 per cent.

Sugar in China.

From a report recently issued by the United States Consul at Canton, it appears that the cultivation of the sugar cane and the manufacture of sugar in China is at the present moment attracting considerable attention among the inhabitants of the Celestial empire, and statistics, published by the Inspector-General of Customs at Shanghai, show a considerable increase, of late years, in the export of sugar to foreign countries. The following method of cultivating the sugar cane is employed by the Chinese.

When the cane is cut down, the tops are removed, and bound in bundles, and the leaves of these top cuttings are taken off; the cuttings themselves, which usually have four or five joints, are placed in a pond of fresh water, where they remain in soak for some twenty days; at the expiration of this time the joints will have thrown out sprouts or buds, these sprouts are about four or five inches in length; the cuttings are then planted in rows, about two feet apart, and at an angle of about 60°. The cuttings, when planted, are slightly manured with bean cake, composed of compressed pulp of the yellow China bean, which grows abundantly in the northern portion of the Empire. It requires ten months, from time of planting, before the crop is matured and ready for harvesting. From the roots of this crop being well fertilized with the bean cake in a semi-liquid form, a second crop is produced; even a third is sometimes secured in this manner, but this is only when the soil is exceptionally rich. If the soil is not sufficiently fertile for a third crop, the roots are removed, the land cultivated and manured as for the first crop, and cuttings are planted every two years.

The cane, when cut, is collected in bundles, and conveyed by men or boats, according to locality, to the mill or crusher; this consists of two granite cylinders about three feet in length by eighteen inches in diameter, placed perpendicularly, the lower ends revolving in a stone socket, the upper in a frame of wood set into granite uprights; attached to or let into the upper end of these cylinders, are wooden cogs, and to the end of one of these cylinders is attached a strong wooden shaft or spindle, to the upper end of which is fixed a strong cross beam or lever, and to the outer end is attached the propelling power, which usually consists of four or five small oxen. The cane is passed between the cylinders, the juice running down into a small trench, which opens into a receptacle in the ground holding about twenty or thirty gallons; the juice is then conveyed in buckets to the boiling pans near at hand, and the cane, after being crushed, is taken away to be used as fodder. It is sometimes dried in the sun, and is used for fuel for boiling the sugar. The boiling pans are of cast iron, the greater part of those used being made at Fat Shan, about fifteen miles from Canton. They are about eighteen inches deep by four feet in diameter, and are placed in brickwork side by side, usually four in number, with arches for fuel underneath, all covered with a mat or thatched shed. Three kinds of sugar are manufactured, namely: "rock candy," "green sugar," and "clayed sugar." The rock candy is made as follows: The sugar is placed with a sufficient quantity of water in a large boiling pan, similar to the ones already described, and boiled down to the proper consistency, which is ascertained by putting a small quantity into cold water; if it hardens at once, it is then time to run it off into earthen jars—these jars holding about fifty pounds each. They are always broken in three or four parts, and the parts are then bound together with a small quantity of lime cement and a few bamboo or rattan hoops. The hot liquid is then put into these broken jars, and a network of basket splints is placed over each, the ends of the splints extending in different directions through the liquid to the bottom of the jar. If the temperature is cold, it will crystallize in about fifteen days; if warm, it requires from twenty-five to thirty days. As it crystallizes it adheres to the splints, the portion not crystallizing settling at the bottom. The jars are then placed with the bottom part turned partly up over empty ones to allow the molasses to run out. When sufficiently drained, the jars are removed, the hoops taken off, and with a small hatchet the parts again broken asunder; the candy is then removed from the splints and spread out in the sun for a short time to purify or bleach. It is then assorted and packed into wooden tubs holding from forty to fifty pounds each.

Two qualities are always found in the jars; that at the bottom being darker and of less market value. The drainage from these jars is reboiled, and a poorer quality of brown sugar produced; from the refuse remaining after this last process a cement is made by mixing with lime. The process pursued in the manufacture of "green" sugar is as follows: The juice is boiled in the month of December, as it is taken from the crushers in buckets in one of the four iron boiling pans; a man is in attendance who pours the juice from one pan to the other. As soon as the liquid boils, a small portion of lime is put in, and the white of one or two eggs is placed in each pan. After a time the dirt and refuse come on the surface, which is all skimmed off from time to time, while the sugar is boiling. When sufficiently boiled, it is run off into a wooden cooler, about seven feet long, four feet wide, and one foot deep; and while in the hot liquid state, a man begins to stir it about with a piece of wood about a foot-and-a-half long, and an inch thick, attached in the center to a handle about four feet long. With this wooden instrument the liquid is kept in constant motion, until it begins to granulate and cool, and when cool enough, several men mix and rub it with their hands until all the lumps are bruised and the sugar becomes all of one color, which is a dark yellow. It is then put in baskets, and sold to sugar dealers, who put it up in mat bags, and bring it to markets for sale to merchants for shipment.

The sugar principally exported to foreign countries is what is known as "clayed" sugar, and is made as follows: When the juice is boiled to a proper consistency, the whites of two eggs are put into each pan, which serves as a clarifier; when sufficiently boiled, it is run off into conical-shaped earthenware jars, which are placed in rows either over trenches or empty jars. In the bottom of each jar containing the sugar is a small aperture in which is placed a wisp or bung of straw; when the sugar has become sufficiently granulated by cooking and an occasional stirring, the straw bung is slightly loosened, the portion not becoming sugar escaping into the trench or empty jars. When sufficiently drained, a thin layer of straw is placed over the sugar, and over this a thick layer of clay. The jars are then packed away in a dry place, where they remain from thirty to forty days, according to the state of temperature. The coverings and straw bungs are then removed, and each jar will be found to contain three qualities or grades of sugar, the upper part being white, the next light brown, and at the bottom a dark brown. The drainings are sometimes used for distilling purposes, and also for making cement. It appears that two distinct kinds of cane are grown in China, one being of a dark purple color, and this is better for sugar than the other, which is green, and quite tender; the latter is principally sold in pieces about eight inches to ten inches in length, to the natives, who eat it in its raw state.

An Improved Coffee.

The kola seeds, called also ombémé nuts, are the produce of *Sterculia acuminata*, belonging to the natural order Sterculiaceæ, and are known to us by the accounts of West African travelers, who state that when chewed or sucked, they possess the power of rendering the flavor of water, even if half putrid, agreeable, and they were believed to contain caffein. They have recently been made the subject of analysis by MM. Ed. Heckel and Fr. Schlagdenhauffen, who, according to the *Lancet*, have found that they do actually contain more caffein than the best samples of coffee that could be procured, and that this base is altogether free and uncombined—not, therefore, as in the coffee berry, united with an organic base; secondly, that they contain a very appreciable quantity of theobromine, which assists the action of caffein, and possesses similar properties to that base; thirdly, which is an important fact, that they contain a considerable quantity of glycose, of which cacao presents no trace; fourthly, that the quantity of starch present is three times greater than that contained in theobroma, which explains its nutritive value; fifthly, that there is but little fat, in which respect it differs notably from cacao; and, lastly, that they contain a special form of tannin, which approximates caffeotannic acid in its composition, and a red coloring matter, very similar to that named by Payen cacao-red. The physiological examination of this substance has shown that its properties are essentially due to the caffein and theobromin it contains. The seeds, it appears, have long been in use in Soudan and Western Africa, for the relief or cure of diseases of the intestines and liver, and especially in cases of atony of the digestive tract, and also as a masticatory and tonic, like the areca nuts, which are held in such high esteem by the natives of India. Medically they may come to occupy a prominent place by the side of coca and other anti-metabolic remedies, to which they would probably prove superior in consequence of the tannin they contain.

Solids into Solids.

Colson has observed that if an iron plate is heated in lampblack not only the carbon penetrates into the iron, converting it into steel and then into cast iron, but also considerable quantities of iron diffuse into the carbon. If the heating be sufficiently prolonged, this diffusion may be shown to take place even at 250°. If a piece of piano wire, embedded in lampblack, be heated to redness in the reducing flame, it loses weight. Platinum under these circumstances shows no change. Since platinum does not combine with carbon, it appears that a diffusion occurs between solids only when they can react on one another. Pure silver loses weight when heated in pure dry alkali chloride. But the product darkens on exposure to light; hence silver chloride must have been formed, free alkali having been produced by the oxygen of the air. If a polished piece of artificial iron sulphide be heated on a plate of copper in a current of CO_2, small quantities of sulphur go from the iron to the copper. If a piano wire be heated in a crucible lined with carbon and filled with lime, the wire increases in weight and shows on analysis the presence of calcium.

Logwood in Wine.

Twenty c. c. of the wine are shaken up with two grammes manganese peroxide and filtered. The liquid produced, which is brown even if no logwood is present, is treated with zinc and hydrochloric acid. The humic compounds are thus reconverted into hæmatoxylin, which may be detected by the usual reagents.—*Giornale Farm. Chim.*

Sash Windows.

The sash window is one of those modern inventions which persist in spite of tastes and numerous modifications. It seems to have been introduced about the period of the Classic revival in England, and to have maintained its position as the most convenient kind of window fitting. Architects have never been very partial to it; during the Gothic mania it was abused more than any other feature of modern houses, and was pronounced one of the ugliest remnants of Classic taste. The French casement and the mullioned window have been always more popular. One of the stock arguments used by the Gothicist during the "Battle of the Styles," was the use of so prosaic a form, while on the other side the Classicist was not inclined at all at that time even to defend a feature which he had been endeavoring to improve. As every one knows, there was, and is still, a strong desire to conceal the framework, either by painting the woodwork black or some dark shade, or by inserting plate glass in the frames. We have lived to see a very opposite fashion set in. The Queen Annist rejoices to make the frames a visible part of the window, and to fill the sashes with as many small panes of glass with thick white bars as he can. But it is with the various improvements that have been made in the mechanism of the sash window that we are now concerned. Several modifications have been made and patented for opening window sashes and for cleaning them. Though the casement window has been admired, it has had a bad reputation for failing to keep the wet out, in spite of numerous ingenious appliances for fastening. The recent patents that have been brought out for lifting windows, and for enabling the sashes to be opened for cleaning, are evidences of a desire to improve and perfect an appliance that has met with public approval, and which is now a pronounced feature in modern houses. The chief mechanical drawbacks of the sash window are the difficulty of raising heavy sashes, the want of a lifting power, the tendency of the sash to hang on one side, difficulty of cleaning the sashes, the breakage of the cords, the inefficiency of the usual window fastenings, and the rattling of the sashes in windy weather. Many, if not all of these drawbacks have been made the subjects of patents. Thus we have the admirable arrangement of Mr. R. Adams, the "anti-accident window," by which the sashes are balance pivoted, so that either of the sashes can be turned round so as to enable the outside to be cleaned without risk of accident; another (Philips') "reversible" window, constructed on a similar plan, and for the same purpose, by which the ordinary sashes can be made to swing round for cleaning from the inside. In this case the sashes are hung clear of the slips and inside bead; the check to the wet being made by rabbeting the side of the sash and fixing in it a metal bar with a screw, the latter being made to form the pivot for turning on. Other various patents have been introduced for hanging the sashes, so that they may be removed from the frames without taking off the inside beads. Gurman's sash pocket is a simple method, though not now generally known, by which the weights can be easily taken out and the sashes cleaned. Bullivant's patent is another well known modification. Messrs. Leggott are the patentees of a window lift and fastener which command approval. By the action of a screw working into a rack in the sash frame both sashes can be opened simultaneously, or only the bottom sash. Sash cords and weights are thus dispensed with, and a source of trouble and expense avoided, and no sash fastener is required, as the sashes are locked by the screw and rack motion in any position. Another invention recently patented, the "imperial window," facilitates ventilation and cleaning. The top sash is made longer to run up into a casing about 12 inches, so that it can be lowered for ventilation at the meeting rails, and other improvements are made by which the sashes can be readily taken out and cleaned. The old fashioned sash lines and weights are certainly behind the age; the inconvenience, difficulty of removing the beads, taking out the pocket pieces, and repairing the lines, are well known by all householders, and any suggestion for hanging the sashes without cords and weights is worthy of consideration. There is, of course, a mechanical difficulty in doing this so as to allow only one sash to be opened at a time, but it is easy to devise means of getting at the weights and cords without the trouble it now entails. It is an advantage, too, to make the sashes so that they can be balanced on pivots, or raised in a horizontal position. The air-tight tongues which are withdrawn into grooves by turning a key enable either of these positions to be attained very quickly, as in Mr. R. Adam's reversible window; and windows with these movable tongues can be made very air and dust tight—not a small advantage in crowded town streets.

Many devices have been proposed for opening and closing sash windows, particularly wide heavy sashes with plate-glass. One of the best of these is Meakin's "self-acting sash fastener and opener," too well known to need description here. In the same class of appliances the architect ought not to lose sight of Adam's patent fanlight opener, or the rack and screw adjustment of Messrs. Leggott. It is unnecessary to name other ingenious appliances of the same kind, our object being merely to indicate a few of the principal aims, in all of which the advantages of the sliding sash window are preserved and maintained. The simplest of these appliances are the best. The advantage of the sash window over other forms is that it does not occupy room; it can be opened or closed in its own area (a great consideration in town houses), the sashes can be regulated at pleasure to allow any amount inlet and outlet of air, one of the best forms of ventilation, and, if properly constructed, it is the securest form of window, and the most water-tight. The present style of building has brought the sash window into repute again, and the villas and suburban dwellings of the metropolis are now all filled with them. Few of these, however, are fitted up in a style superior to that of windows of fifty years ago. Very seldom we find any attempt made to introduce improvements of the kind we have mentioned. The sash lines and weights are of the commonest description, the pulley stiles have no arrangement for easy access to the weights, the sashes shake about, and the window sill is seldom properly double sunk or grooved; the fastenings are of the most trumpery kind, and there is no plan by which the sashes can be cleaned except by getting outside. It may be asked, why are not these inventions now more generally adopted? The speculative builder has no inclination to introduce specialties in building; so long as the tenant is satisfied with the old arrangements, he does not feel himself justified in going in for fittings of an expensive character. The smaller class of tenants have not the desire or inclination of saving trouble to themselves or promoting their own comfort; but the architect has no such excuse to plead for not specifying the best means of saving the domestic labor and insuring domestic completeness. Some of these appliances have been disregarded by the profession on account of their complexity, or that they are too cumbrous for everyday use; and this is a fault which inventors are very apt to commit, and which a little more thought would have enabled them to avoid.—*Building News.*

Ammunition in Recent Great Campaigns.

SOME interesting statistics have been lately compiled relative to the amount of ammunition provided and expended in some of the greater campaigns of the present century. At the time of the outbreak of the Franco-German war of 1870-71 the small-arm ammunition equipment of the Prussian infantry amounted to 169·5 cartridges per rifle, exclusive of 6,000,000 rounds, or about twelve cartridges per rifle stored in the army reserve ammunition part, which brought up the number of cartridges per rifle to nearly 180. The French infantry was even more amply supplied with ammunition at the beginning of the campaign, taking with it 143 rounds per rifle, while in the great part there were 137 rounds per rifle, thus raising the total supply per rifle to 280 cartridges. Unfortunately, only very scanty official statistics are forthcoming as to the actual expenditure of cartridges during the war, but official returns show that during the whole campaign the 2d Bavarian army corps expended 2,050,260 cartridges, or an average of ninety-one rounds per rifle, and this expenditure is believed to be as high as that of any other corps of the German army, since, according to statistics collected in the Prussian Ministry of War, the twelve Prussian army corps and the Hessian division only expended together 12,000,000 cartridges, or about the same quantity that, according to report, was consumed by the French infantry, 180,000 men strong, during the three days' fighting at Leipsic in 1813.

No information is obtainable as to the expenditure in the other corps of the German army; but even assuming that their expenditure was as great as that of the 2d Bavarian Corps, the average number of cartridges expended per rifle throughout the whole of the German forces during the whole war would only amount to fifty-six. No trustworthy records at all are obtainable as to the total expenditure of ammunition by the French army; but, according to General Rivière, the French army, during the fighting in the neighborhood of Metz on the 15th and 18th August, 1870, expended 1,561,722 cartridges, or on an average thirteen rounds per rifle; while, according to another authority, the total expenditure during the battles of Forbach, Borny, Gravelotte, St. Trivat, in fact, during all the actions fought by the army of the Rhine before it was finally imprisoned in Metz, amounted to, in round numbers, 3,500,000 cartridges, or about thirty rounds per rifle.

Going back to the war of 1866, we find a most striking disparity between the consumption of ammunition by the two belligerents. The supply of small arm ammunition per man in the Austrian army when the war began was about 137 rounds per rifle; while the expenditure in Bohemia is stated to have reached sixty-four cartridges, and in Italy fifty-seven cartridges, per infantry soldier. In these numbers, however, the ammunition lost and spoilt is included, and it is very certain that the quantities lost and spoilt must have been enormous. On both theaters of war the campaigns were virtually decided in a very few days; on neither was there any prolonged fighting, so that it is incredible that anything approaching the number of rounds said to have been expended can have been actually fired. In the Prussian army, indeed, only 2,848,556 cartridges, or on an average seven rounds per man, were expended.

In the Crimea enormous amounts of ammunition were provided and expended. The equipment of the French army at the outset of the operations included 150 cartridges for each musket, and this supply was afterwards increased by the formation of large ammunition depots at Varna and Gallipoli to 360 rounds per musket; while, before the conclusion of the war, 1,000 rounds per musket had been collected, the total stores amounting to 80,000,000 cartridges, while the average effective of the French infantry was in round numbers 80,000 men. During the war 28,500,000 cartridges were either fired, lost, or spoilt by the French army, giving an average expenditure of 350 rounds per musket; but of the total amount a very large proportion was lost by the foundering of transports and storeships and by the explosion of magazines, while the waste of ammunition in the trenches was notoriously very great. On the other side the Russians, according to Gen. Todleben, used 16,500,000 cartridges in the defense of Sebastopol, and since the garrison numbered at the termination of the siege 115,000 men, and the siege lasted for 349 days, it is probable that this number is no exaggeration.

Going back again to the wars at the beginning of the present century, we find that in 1809 Napoleon's army was provided with 200 cartridges per infantry soldier, while in the Austrian army 31,000,000 cartridges were provided for an army comprising 250,000 infantry, the supply being therefore at the rate of 124 rounds per musket, while the expenditure amounted to 42 rounds per man.—*Broad Arrow.*

Sound Shadows in Water.

In experimenting, long ago, on the velocity of sound in water, Colladon noticed incidentally that when the end of the hearing tube plunged in the water became screened, by a projecting wall, from the immersed bell, the sound was remarkably lessened in intensity. These "sound shadows" are known to be much more distinct in water than in air. An interesting contribution to this subject has been lately made by Professor John Le Conte, of Berkeley, California, who got his son a few years ago to watch the blasting with "giant powder," or dynamite, of a sandstone reef 15 feet below low-water level in the harbor of San Francisco. The suddenness of the shock of each explosion had striking effects. At a distance of 300 feet two distinct shocks were experienced—one came through the water and was felt (in a boat, or on a wooden pile) as a short concussion or blow before the water sensibly rose over the point of explosion; the other came later by the air (to which it was evidently communicated by the water when the elastic pulse emerged at the place of explosion) and was heard. The gases generated came to the surface much later than this second shock, raising a column of water 25 feet to 30 feet. The concussion caused by the explosion killed or stunned the fish within a radius of 200 feet or 300 feet. The "sound shadow" experiments consisted, first, in lowering in various positions soda-water bottles attached to rigid rods from the top of a vertical pile about one foot in diameter and about 40 feet from the explosive cartridge, which held about 15 pounds of the compound. The bottles were shivered when outside of the geometrical shadow of the pile, but protected when within it; and it was so whether they were filled with water or air. Next, cylindrical glass tubes (6 feet long, 1½ in. in diameter, and half an inch thick) were attached to frames and plunged in a horizontal position behind the pile. In each case the portions projecting beyond the limits of the shadow were shattered, while the middle of the tube, in the shadow, was saved. A tube being lowered 12 feet beyond the pile, its protected portion was sensibly equal in length to the diameter of the pile; showing that the shadow extended back between sensibly parallel vertical planes. It is noted that the surface of the water just over the explosion exhibited numerous jets of water rising about 3 inches in the center of the area. The distinctness of "sound shadows," like those of light, should depend (according to theory) on shortness of wave length, and Professor Le Conte endeavors to show that this must apply to water as well as air (in which acute sounds cast more distinct shadows than grave ones). Where the time of a blow or explosive impulse is exceedingly brief, the wave-length must be proportionately short. Now the efficiency of surface blasting under water with nitro-glycerine compounds depends on the extraordinary suddenness of detonation, and the wave generated in an elastic medium like water must be very intense and very short, so that an obstacle will give a sharply-defined shadow. The author thinks that waves from the less sudden explosion of gunpowder should therefore give less definite shadows.

Sulphite of Soda for Development.

For preserving from discoloration we have found two ounces of sulphite quite sufficient for one ounce of pyro. The formula then will run: Pyrogallic acid, one ounce. Dissolve in water containing thirty grains of citric acid, and add solution of sulphite of soda, as above, four ounces. Then make up the whole to ten or twenty ounces, according to the operator's usual plan. We have then a stock solution easily made, always in order after the lapse of months, and capable of developing a negative perfectly free from the well-known yellow color of pyro.

We will conclude by stating that we have experimented with various samples of the sulphite, and have not found much difference in their respective effects; but it is well to point out that, as this salt is not found in every chemist's shop, stress should be laid upon the fact, when ordering, that *sulphite*, not *sulphate* or *sulphide*, is wanted. Chemists are so used to their customers' ignorance of chemical nomenclature that they might think an error had been made in asking for a little known chemical.

The special kinds we tried were the commercial and the recrystallized sulphite, the latter costing four or five times as much as the former. The latter is a nicer looking and a purer salt, but we failed to find any superiority in its color preventing properties. We, however, decidedly recommend the recrystallized on the grounds of its probable greater uniformity—a consideration which we consider is too often lost sight of, but which for the best results it should always be the photographer's aim to attain.—*British Journal.*

The Value of System and Drill.

The danger to which the pupils of public schools in large cities and towns are constantly exposed, on account of the crowded condition of such buildings and the liability of a panic occurring in the event of an alarm of fire being raised, has, in only exceptional cases, been fully appreciated, and even when the danger has been recognized, little or nothing has been done to provide for or counteract the same. This state of affairs may, perhaps, be accounted for by the fact that members of school boards, as a general thing, know a great deal more about the contents of ancient histories than they do about the practicalities of life in the nineteenth century. School houses are now seldom built as they should be built, and, as a consequence, danger continually menaces their inmates. A fire is liable to break out at any moment, and owing to the presence of innumerable flues for hot and cold air, which are almost always made of wood, flames are apt to seize upon such a structure in a very short time. Wooden staircases, which make an angle every few feet, and long halls or passages lead to the various rooms, and it is a mystery that more lives of school children than are lost by fire are not sacrificed. Few boys or girls have passed through the public schools without having been more than once disturbed by an alarm of fire, usually false, we will admit, but none the less dangerous. Boys like excitement, and, glad of excuse to vary the wearisome monotony of school life, accept the slightest intimation of a fire, and try to induce a panic. A puff of smoke from a register is enough to send them rushing pell-mell downstairs. Some school buildings are naturally less likely to burn than others, although none are any too well constructed; but there is no reason why lives should be lost when a fire does break out. By employing some system in the management of the inmates, nearly all danger from this source can be obviated, and there is sufficient cause to employ system of this kind. The fire hazard in school buildings is very great, and few last many years before they are swept away by flames.

A resolution has been offered before the New York Board of Education that the principals of the several schools and departments shall, under the direction of the superintendent, train the pupils in their charge, so that they may be able to leave the building, in an emergency, in the shortest possible time, without confusion or panic. Ever since the occurrence of a lamentable panic, which was caused in one of the largest schools of the city, many years ago, by an alarm of fire, and whereby many children lost their lives, the teachers have done more or less on their own responsibility to drill their scholars in marching in regular line, so as to prevent confusion. The panic referred to was unnecessary, there being no fire; but it was exceedingly disastrous in its results. In the schools of Louisville, we believe, an admirable system of fire drill exists. The same practice obtains elsewhere in a few places, and indeed we described some months ago the fire extinguishing brigade which had been organized among the older scholars of a large Western school. A regular fire company was maintained on each floor, under the control of the usual officers, and all under the authority of the teachers. This corps had been organized to fight a fire should one break out. The idea was, of course, well intended, but its value is to be doubted. The most that can be expected of the pupils is to so conduct themselves that their safety may be assured. It would be a very simple matter for the teacher of a school to make his or her pupils adopt some method of marching to and from classes and from the building after the work of the day has been done. Then, should a fire break out, if, instead of raising a general alarm, announcement of the fact was conveyed to the superintendent, every teacher might speedily be informed, and by some ruse the scholars dismissed without a suspicion of what was occurring. The first knowledge the majority of them would obtain of the fact that the building was on fire would be after they had reached the ground and were beyond all danger. Should a school of three thousand pupils be dismissed without order, the weak would inevitably be trampled upon by the strong.

Chiefs of fire departments in towns where no system of this kind is in force should earnestly recommend its advantages to the school authorities. The same plan might be enforced in large factories where numerous girls and women are employed. If it is possible, and it undoubtedly is, to preserve the safety of children and unsuspecting girls and women by the exercise of a little ingenuity and patience in drilling them to observe order in their going out and their coming in, it is a pity that grown folks will sacrifice their lives when a modicum of self-possession in the presence of danger would, in nine cases out of ten, enable them to escape unharmed. Self-possession and method will frequently accomplish wonders. The great trouble in protecting mill property and similar establishments from fire is in obtaining well-directed labor in the time of danger from the employes. Private fire brigades are almost useless, unless they are thoroughly organized and composed of cool-headed men of judgment, who will not become panic-stricken at the sight of a little outburst of flame. The principal reason why private fire brigades do not do good work, as a general thing. is undoubtedly because they are composed of men who are directly interested in the preservation of the property endangered. That is, they will always be affected financially by the destruction of the premises. It is paradoxical to say so, but it is nevertheless true, as every fireman knows, that when a person is himself concerned in the result of a fire he is usually unfitted for doing much toward extinguishing it. Take the average member of the best fire department in the country, and we venture to say that he would become "rattled" if his own house caught fire. A man entirely disinterested can do much better service, provided he understands his duty, than a man, just as good at other times, who would be out of pocket should the fire gain headway. It is, perhaps, too much to expect that everybody will become so constituted that self-possession will at all times be maintained. However, training will do much toward overcoming this difficulty.

The proprietors of a large carpet-weaving factory in New York have adopted a novel idea to protect their property from fire, and at the same time lessen their rates of insurance, for such indemnity against possible loss by fire can seldom be dispensed with entirely, no matter what efforts are made. The establishment is one of the largest of its kind, and the process of manufacture is more or less hazardous. Several times much damage had been caused by fire, and much financial loss occasioned by the loss of time as well as by the destruction of property. Spontaneous combustion was the great foe to be dreaded, and after having been burned out more times than they thought necessary they went to the Board of Fire Commissioners for advice. The ordinary dangers of such establishments were made evident to them, and several changes were made in the buildings so as to make them less apt to burn. Then, upon the recommendation of the Commissioners, a former member of the fire department was employed and given power to organize such a corps of fire-fighters and watchmen as he deemed proper. A half dozen men of experience as firemen were engaged, and now, at six o'clock every evening, this little band of men go on duty. The factory is thoroughly equipped with all requisite fire apparatus, and the first thing done is to unreel all the hose and lay it upon the floors. Of course it is constantly fastened to the pumps, and steam is always raised. Tours of the various departments of the factory are made at regular intervals, and in case fire is discovered, the facilities for informing the men and massing them at the required point are such that no delay of any kind is ever caused. An alarm is also sent to the regular fire department of the city at the same instant. Numerous fires have broken out in this establishment since this plan of self-protection has been in operation, but not one has got beyond the control of the men in charge. The same plan, on a modified scale, is in use during the day, all the employes being regularly drilled by the head officer. Putting out fires has come to be a business by itself, and method has taken the place of the "go-as-you-please" style formerly in vogue everywhere. Organized labor, well applied, will accomplish much more than the best intended individual efforts.—*Fireman's Journal.*

Causes of Fires.

A number of the leading insurance companies of London have been trying to discover the causes of fires which occur in dwellings. The *Fireman's Journal* says: It is estimated that twenty per cent of such fires are the result of gas or other light coming into contact with curtains or window blinds. Of course this proportion applies only to fires in cities. Clothes or other articles drying at fires in stoves or fire places are thought to be responsible for sixteen per cent of the fires which destroy the homes of the people. To defects in stoves, flues, etc., is due about a like percentage. These are the principal causes of fires in private houses. making at least one-half of the whole. Carelessness in one form or another is undoubtedly responsible for at least three-fourths of all fires that occur, be they in dwellings, warehouses, stores, on ships, or in powder mills.

Cæsium.

Setterberg has worked up the tons of alums obtained in Marquart's laboratory as a by-product in the preparation of lithium salts from lepidolite, with a view to obtain larger quantities of the salts of cæsium and rubidium, and if possible metallic cæsium itself. Three or four hundredweight of the alums were dissolved in so much water that at the boiling temperature the liquid marked 20° B. The solution was decanted and allowed to stand 12 to 14 hours. The mother liquid contained no trace of cæsium or rubidium salts, but the crystals were rich in these metals; the author having found that each of the different alums is insoluble in saturated solutions of the more soluble ones. Hence so long as the solution of the alums was saturated with potassium alum it contained scarcely a trace of the other alums; and the solution showed no trace of cæsium, so long as it was saturated with rubidium alum. By repeating this process the alums were obtained pure. Search for other alkali metals gave a negative result. In 14 days, Setterberg prepared 40 kilogrammes rubidium alum and ten kilogrammes cæsium alum, both pure. At 17° C. 100 parts of water dissolved 1·42 parts of rubidium alum and 0·38 part of cæsium alum. For the preparation of other salts, the alums were decomposed with barium hydrate, and the filtrate neutralized with the acid whose salt was desired. In this way the acid tartrates and the cyanides were prepared. For the preparation of metallic rubidium, 1,500 grammes hydrogen ubidium tartrate, 150 grammes calcium carbonate, and the required quantity of sugar were mixed and calcined, and the mixture transferred to a mercury flask and distilled. The yield was very satisfactory. A kilogramme of hydrogen cæsium tartrate similarly treated afforded no result. The electrolytic method was then employed, first with the chloride, and then with the cyanide of cæsium. Finally a mixture of 4 molecules of cæsium cyanide and one of barium cyanide was found to give a satisfactory result, the metal prepared showing in the spectroscope only a trace of sodium as an impurity. Cæsium resembles closely the other alkali metals. It is silver white, malleable and very soft at ordinary temperatures. Thrown on water it bursts into flame, and swims about on the surface like potassium and rubidium. It inflames in the air when not protected. It fuses about 26·5°, passing through a pasty condition. Its specific gravity is 1·88 at 15° C.—*Liebig's Ann.*

A Contortionist.

Mr. Charles H. Warren, an American acrobat and contortionist of some fame in his own country, is at the present time, says the *Lancet*, in London, exhibiting his remarkable power of dislocating many of his joints by voluntary muscular action. He is the child of healthy parents, and the first indication of any abnormality was that he was frequently tripped up by some displacement of the hip joint, when quite a young child; the fall, however, served to replace the bone. After two or three years he grew out of this tendency. At eight years of age he began to train as an acrobat. He does not make use of his power of dislocation to aid him in his performances, nor does dislocation now ever occur involuntarily. He is the father of two children, a son and a daughter, both of whom showed the same peculiarity, so far as the hip joint is concerned. He is a tall, well-developed, finely-proportioned man. His muscular development is uniform and great. By voluntary muscular contraction he dislocates forward either or both condyles of the lower jaw, downwards (partially) the head of each humerus, forwards or backwards (partially) each carpus, upwards and backwards (completely) the head of each femur, and backwards and forwards (partially) each of the phalanges of the fingers and thumb. With the aid of his hand he partially dislocates to either side the carpus, and forwards and outwards the ankle joint; when the knee is flexed he can rotate the tibia very freely, and make the inner condyle project an inch in front of the femur. Each of these displacements is accompanied by a distinct snap, but the replacement of the bones is noiseless and without effort. The most remarkable, as also the only complete, of these dislocations, is that of the hip. He stands at ease with the toes turned further out than is usual, and has unusual freedom of eversion of the lower limbs. When the femur is displaced, the great trochanter is raised and drawn back on the pelvis, and is still very prominent; the limb is shortened and inverted, and knee and hip joints are flexed; the head of the bone cannot be felt.

The explanation of these facts is that the man's ligaments are unusually lax, while his muscular power is very great, and probably also the rim of the acetabulum is less prominent than usual. In addition, Mr. Warren shows other illustrations of his remarkable power over his muscles, which are of fully as much interest as the foregoing. Thus he can contract at will the two pillars of the fauces, the platysma myoides, and the pectoralis minor, and can fix the elbow joints by strong contraction of either the arm or forearm muscles, or of both simultaneously. He voluntarily produces the deformity of talipes equinus and talipes equinovarus. Equally interesting is his control over the muscles of the trunk. Thus he can contract his recti abdominis in a wave-like manner, and illustrate capitally the formation of phantom tumors. He can contract his abdominal muscles quite back on the spine, so that the abdominal aorta is seen, as well as easily felt, pulsating. He also expands his chest to an enormous size, and can contract it so completely that the front becomes quite concave. These are merely examples of muscles unusually developed, and brought under the influence of the will to a most remarkable extent; they do not betoken any congenital peculiarity.

Benjamin Franklin Delano.

Captain Benjamin Franklin Delano, formerly U. S. Naval Constructor, died of old age at his residence in Brooklyn, N. Y., April 29. He was born near Boston, Mass., in 1809, and came of a historic family. His grandfather built the famous Constitution, long known as Old Ironsides. Mr. Delano came to Brooklyn in 1825, as apprentice to his uncle Samuel Hartt, then naval constructor at the Brooklyn Navy Yard. After acquiring proficiency in his business, Mr. Delano was sent by a Boston company to Grand Island, above Niagara Falls, where he draughted and constructed the first and several of the largest merchant vessels of that day for use on the great lakes. In 1847 he was appointed naval constructor, as the service was then constituted, and built the steamer Saramac at the Portsmouth Navy Yard, that being one of the vessels to introduce steam into the service. The Fulton and Powhatan were the only steamers previously built. He supervised at the same time the floating dry dock and basin in that yard. Late in 1849 Mr. Delano was ordered to the Brooklyn Navy Yard, which then employed about 1,200 men. The demands then made upon the Government for vessels were caused by the African slave trade, Commodore Perry's expedition to Japan, and by Dr. Kane's polar expedition. The Iroquois. of the same class as the Hartford, which became famous, was built by Mr. Delano, and was pronounced one of the finest specimens of naval architecture ever designed. During the civil war Mr. Delano constructed many vessels. He took a personal interest in the Tennessee, the Wampanoag, and the Miantonomah, the latter being the first iron clad to cross the Atlantic. In 1863 he was retired with the relative rank of captain, which he held at the time of his death.