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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 416,

For the Week ending December 22, 1883.

Price 10 cents. For sale by all newsdealers.

IRRIGATION IN CALIFORNIA.

In 1871 the crops in the valley of the San Joaquin River, California, from a long drouth and severe north winds, were threatened with entire destruction. Some of the farmers then hurriedly cut a few ditches from the King River, and the flooding they thus obtained made the wheat yield from 30 to 55 bushels per acre, and land which had previously been hard to sell at $2.50 per acre rose in value to $25 and $30. From that time to this the system of regularly managed irrigation has steadily grown in all that valley section, lying about 200 miles southeast of San Francisco. There are now six companies organized for this purpose, with an estimated capacity to furnish water for the irrigation of about 650 square miles, although past experience tends to show that, after the system of irrigation has been once established, the water supplied will go further and probably make cultivable a much larger area. The farmers buy their water rights from the companies at the price of $10 an acre, for which they can take as much water as the area of ground requires, and draw at any time and as often as they choose. They have to make their own laterals, which are usually ditches four feet wide by one deep, and can be made cheaply by plow and scoop. Since this system of irrigation has been adopted, many thousands of acres of land, heretofore almost barren, have been turned into some of the most productive farms on the Pacific coast, and are especially valuable for the raising of grapes and other fruit.

IMITATIONS OF COSTLY LEATHER.

The custom of carrying lunch reticules, money purses, and traveling bags of leather has made an increased demand for the leather from rare animals, or for leather of attractive appearance. As the natural supply of alligator and the great python or boa skins is not sufficient to keep up with the demand, these skins—or the leathers from them—are imitated very largely by using the leather of commoner and cheaper skins. Even seal leather, goat leather, and kid leather, or morocco, are imitated. The surface of alligator leather consists of almost exact rectangles or squares, separated by deep furrows, the squares gradually diminishing in size as they recede from the center of the skin. The boa leather is in diamond shaped patches, forming a fine network, and is very elegant, the division lines being very fine. Sealskin leather is a fine diapered or arabesque pattern of irregular divisions raised and depressed. Goat leather is crossed in regular lines at acute angles, forming minute elongated diamonds.

As some of these leathers are too costly to be furnished at low prices, the million who desire the best, but cannot always afford the cost, are supplied by fair imitations which are not as durable as the genuine, serving in part the purposes of the costly leathers. These imitations are made by the aid of photography. A genuine seal, alligator, boa, or other costly skin is photographed, then printed on sensitive gelatine, the parts not acted upon by light dissolved out in water, and a cast or an electrotype plate then made in copper or type metal, as practiced in the reproduction of engravings, and then the metal plate and the smooth leather of some domestic animal are passed between rollers under pressure, and the figure on the plate is permanently fixed on the leather by great pressure. Any of these leathers may be stained, colored, or dyed to any tint desired; but plain black or the color left by the tannin is generally preferred.

THE CHINCH-BUG IN NEW YORK.

Dr. Lintner, Entomologist of the State of New York, has recently issued a bulletin stating that the much dreaded chinch-bug, which has caused so much destruction to the crops in the West, is present in alarming numbers in some parts of New York. We are pleased to note the commendable enterprise of Dr. Lintner in warning the Eastern farmers of their danger. The pest has been discovered in St. Lawrence County, and the State Entomologist desires every farmer in that part of the State to examine his meadows for patches of dead grass, which look as if winter killed. If such places are found and the bugs discovered, it is recommended to scatter straw over these dying patches, and afterward burn it. This work must be done with great care, and a favoring wind is important. The burned area should afterward be deeply plowed, and not in ridges. To the more effectually bury the chinch-bugs, the plowed land may be harrowed. If the meadow will not permit of being plowed, the next best thing is to apply gas-lime at the rate of two hundred bushels per acre. The gas-lime may be applied at any time during the coming winter, but, of course, the plowing must be done before the ground freezes and prevents the sod being turned.

A more widespread attack of the chinch-bug may be looked for next June, when it will be time to use other means of destroying this enemy to our grass and grain crops.

Professor Riley, the Government Entomologist, in the last issue of *Science*, states that he thinks that Dr. Lintner is wrong in his opinion that the chinch-bug was brought in a freight car from the West. Fitche's record of having found this bug in northern New York leads to the belief that it has long been in the East, and the present outbreak is due to an increase in numbers from some favoring condition instead of an invasion. However this may be, the importance of taking all precautionary measures remains the same. A bug which will destroy millions of dollars' worth of crops in a single State, as it has done in Illinois and elsewhere, is one not to be desired.

ADULTERATIONS OF FOODS—GLUCOSE IN SUGAR AND IN SIRUPS.

The fact is so well known as to be admitted by all, that a considerable part of the articles which we consume for food and for drink are open to the belief that "things are not what they seem." Meat and fish cannot very well be imitated, and we probably buy real beef, and veal, and chickens, and codfish, and halibut, though they certainly may be all of them so wonderfully fitted up for the purposes of sale as to impose on the purchaser sadly. But butter, and sugar, and coffee, and tea, and vinegar, and spices of every sort, we purchase in a state of purity in only exceptional cases. Wherever an imitation can be made that costs less money than the article which is the original, we may be sure that on an average our chance is good for getting the counterfeit.

We are apt to think that if we select a grade of high price in any special line, we are sure of getting what we profess to get, and perhaps it is a good plan to lay that flattering unction to our souls, for we feel better after it; but the simple fact is, that in general the higher the cost the better the adulteration pays, and as human nature is open to influences, the larger money brings us a more elegant style of imitation only.

Inasmuch, then, as the admixtures are so very common, it becomes for us a question of almost vital interest to know whether they are injurious to health, or whether they are harmless. If we barely lose our money, because we do not get what we think we do, that is bad enough; but if, on the other hand, we are at the same time poisoning or at least injuring ourselves and our families, the case assumes a very different aspect.

Our attention has been recently called to one form of adulteration which is so exceedingly common that we cannot go a single day free from it. We allude to the presence of glucose in sugars and in sirups, and we take up the subject in the hope that we may dispel some groundless fears. That the glucose is there is as sure as the sun rises daily. There may be *some* sugars and sirups that are pure and honest, but there are many which are not. We are not speaking at random in this, we are only testifying to what we know by experiment. We have purchased sample lots, here and there, in New York and in other places, taking care to get them only from dealers where we were likely to get our articles of as good quality as could be found. Chemical trial showed in almost every instance the presence of glucose.

An apothecary submitted to our examination a sample of sugar from a lot he had just purchased for his pharmaceutical use, which had been recommended to him as absolutely pure; it showed over *five per cent of glucose!* We have seen barrels opened, found the maker's guarantee of perfect purity lying under the barrel-head, taken samples from directly beneath the printed falsehood, and found them rich in glucose!

We do not, therefore, dispute the presence of the admixture, but it is a perfectly harmless substance and need never cause alarm to any one. This is what we meant by saying that we hoped we might allay groundless fears. We may eat and drink glucose all our lives, our children may take it down *ad lib.* in their candy, as they are doing every day, we may have our delicious maple sirup on our buckwheat cakes, and they will not hurt us any more than the cakes are bound to any way; we may revel in glucose, and live and die happy.

Let us look at it chemically. There are, as natural products, two forms of sugar everywhere diffused; they are known as cane sugar, and grape sugar. Taken as a rule, it may be said that cane sugar exists mostly in the sap or juices of plants, and grape sugar in the fruits, though there are many interchanging exceptions. They are composed of carbon, oxygen and hydrogen, the proportions being in cane sugar $C_{12}H_{22}O_{11}$, and in grape sugar $C_{12}H_{12}O_6$. They are both harmless and nutritious to the human system; they are both sweet, the sweetness of grape to cane being about as one to two. Chemically, cane sugar is a saccharose, and grape sugar is a glucose, the latter retaining this as a market name.

What we buy as *sugar* professes always to be cane sugar, made hitherto almost exclusively from the sugar cane. If now our grape sugar or glucose had been a natural product, say from fruits, there would probably never have arisen the prejudice against it which now exists. But it is not so; it is altogether a factitious article, and few people are sufficiently familiar with chemical principles to realize at once its real nature. All the glucose and grape sugar in the market is made by the action of sulphuric acid (oil of vitriol) on some vegetable material. In this country starch is used chiefly, as being the cheapest and most convenient, but linen rags are equally serviceable and produce an equally pure and excellent *sugar*.

That is one of the wonders of chemical combination—as much a wonder to the most thorough chemist as to any one else. He sees the work grow under his fingers, and what is done he does not know; he knows nothing but the result. He boils starch with sulphuric acid and water. The mixture instead of being very sour is sweet to a certain extent, that is to say, sugar is there, but the acid is also there, for the acid has changed the starch to sugar and yet has itself not been affected in the least. He throws in powdered chalk, which unites with the acid and settling to the bottom leaves a beautiful, clear, sweet solution of *grape sugar*.

The acid is gone, the starch is gone, and pure, harmless

sugar remains. No one need fear it because oil of vitriol by magical catalysis compelled the starch from being $C_{12}H_{20}O_{10}$ to become $C_{12}H_{12}O_6$; that is, to lose four atoms of water (which is H_2O) from its composition and become glucose.

No, no! It is true, when we start to buy sugar we naturally would be glad to get what we had in mind; but if adulterations were no worse than this, we well might think little of them.

"FISH CULTURE FOR PROFIT."

In our paper of September 1 we printed a communication headed "Fish Ponds for Farms," and we wish to add to it here some items which we hope may make it of more direct and immediate value, as bringing it within the range of more speedy returns for the money and labor invested. We have selected the title above given, because any one can turn to the *Bulletin* of the United States Fish Commission, for 1881, page 382, and see that we are not talking at random. "Fish Culture for Profit" is discussed there by authority.

We have long had the belief that the worthless swamp lands, found along so many of the brooks and streams, throughout the country, might be made, by means of an outlay which would be almost nominal, to pay a more certain and a greater return annually, than any parts of the same farms devoted to corn, grain, or hay, counting acre for acre, so that Mr. Hiester's article in the *Bulletin* interested us greatly, and our correspondent of September 1 gives us occasion for calling the subject up here.

The fish to which so much attention has been given of late years for pond-growth we must set aside, every one of them. Trout have had the greatest name of all, but in the waters which we propose to utilize they will never thrive, in fact can scarcely be made to live at all. They must have either a running stream or a pond which is fed with clear cold water. They bring, it is true, a fine price, but they are very delicate, subject to many vicissitudes, and they require constant care, and much attention to their supply of food.

Black bass, yellow perch, and pickerel have all been used for stocking ponds, and with more or less of success, but they are all such voracious brutes that they speedily clear the water of every living thing that can swim, including even their own young, and the consequence is that only a very limited supply can be secured from a given amount of space. Their remarkably healthy appetites ruin them for profit.

German carp have been now extensively introduced, and their value is beyond question very great. We have nothing to say against them, and they will doubtless retain a strong hold on popular favor, for they deserve it. But we have that which is decidedly to be preferred, when we are looking for *profit*. The carp grow to a fine size, and it is a grand sight to watch them cruising about on a warm summer's day, in a pond—great fellows, six, eight, ten pounds and more, close to the surface, dorsal fin perhaps out of water. No, we have no charge against the carp, and we are almost ashamed and afraid to bring up our little protege in comparison. But then it is the dollars for which we are looking, and we propose to show how a swamp meadow can turn out more money to the acre from *bull heads* than the same space will readily pay in any other manner, wet or dry.

The fish to which we refer is the *Amiurus nebulosus*, and is called bull head, horned pout, and, in some parts of New England, minister. It is a catfish. There are many American species of catfish, but this is the only one common in the regions of New York and New England; and it is a fact worthy of note that though we have nine or ten species of *Amiurus*, the only type of the genus which is found beyond the limits of North America is more closely allied to the *nebulosus* than any one in our own waters; it is the *A. cantonensis*, a native of China.

The horned pout is never a large fish, one weighing a pound being much over the average, and in raising them for the market they will afford the greatest profit when not exceeding half a pound. The advantages which they afford over the other fish mentioned, for remunerative cultivation, are that they are perfectly hardy, not liable to disease, thrive to the best advantage in sluggish and warm waters, need no care or feeding, live on aquatic plants and insects, and can thus secure abundant food from a small space, multiply rapidly, and are ready for market at the age of a year, which is much earlier than any other fish.

The demand for them, a small pan fish without bones, is almost unlimited and the price good. Mr. Hiester quotes them as selling by the ton at ten cents a pound. His estimate is that ten feet square of pond area will yield annually over ten pounds of fish. On these data, an acre will return $420 dollars at the least. This seems too great for belief, and yet he assures us that it is done; a half or even a quarter of it would satisfy most land owners, especially as the land needed and taken for this purpose is that part of the farm which for other uses is without value.

The preparation of the pond involves very small expense, for it is best that the water should be shallow, not over four or five feet deep. In most cases a spot can be selected where a dam of but a few rods in length across one of our swamp streams will be sufficient to overflow from one to two acres to the depth required. The only expense beyond building the dam is to so far smooth the bottom that a net can be dragged over it. The removal of bushes and rocks, and perhaps a little work with plow and scraper, will do this, and the pond is ready for stocking. It is easy to procure the catfish in most localities, and nothing further is required. That acre of swamp land was before this worth practically *nothing;* it might perhaps yield a nominal amount of pasturage. It is best to leave it two years, so as to allow the fish to increase and grow. After that time they can be taken out at convenience. A net should be used which allows the small ones to pass through. None under five inches (preferably six) should be caught, and it is wise always to retain in the pond a good proportion of full grown fish, for the sake of more rapid increase in numbers. The fish can readily be taken at such times as to scarcely interfere at all with the labor of the farm. They can be sent to market as they are caught, or they can be skinned and packed in boxes ready for use, according to what the sale demands.

Every other acre of the farmer's land which yields him a crop involves the expense of fertilizers and labor, for weeks and months. This acre of pond surface on worthlesss swamp land costs not a dollar of expense annually beyond that of drawing the net and preparing the fish for market, and on the faith of the *Bulletin's* estimates it will yield $400 and upward. What part of his fertile land will pay as well?

DIPTEROUS LARVÆ IN THE HUMAN BODY.

BY PROF. C. V. RILEY.

Several papers on this interesting subject have recently been published by American and European authors, partly from the entomological standpoint. De Franz Loew, in a paper on myiasis and its originators (in Dr. Wittelshoefer's Wiener Mediz. Wochenschr., vol. xxxiii, pp. 972–975, 1883) corroborates by further testimony his views expressed in a former article, viz., that the disease known as myiasis is caused not by larvæ of Œstridæ, as has been and is still so frequently assumed, but solely by species belonging to the "flesh flies" (Sarcophagidæ and Muscidæ). In fact, so far as reliable observations and determinations have been made there are but two species concerned, viz., *Sarcophila wohlfarti* Portsch (= *magnifica* Schin.) in Europe, and *Compsomyia macellaria* Fabr. in America. The latter species is distributed throughout North and South America, and has an extensive synonymy, as not only the *Calliphora anthropophaga*, Couil, *C. infesta* Philippi, and *Lucilia hominivorax* Coquerel, but no less than 23 other "species" have proved to be synonymous. On the synonymy and on the geographical distribution of *C. macellaria* two papers were published some time since by E. L. Arribalzaga (in Anu. Soc. Cientif. Argentina, vol. vii., p 253, 1879; and vol. x., p 248, 1880), but M. F. Bigot, the well known French dipterist, hesitates to accept the synonymy (Ann. Soc. Ent., France, 1883, Bull., p. cliv.), and further thinks that myiasis in America may also be caused by other species of Lucilia and Pyrellia.

Attacks on man by Œstridæ are of very rare occurrence. There are but three well authenticated cases known caused by hypoderma, two in Europe and one in this country,* while a few others have been caused by *dermatobia*, all in the tropics. Quite recently Dr. Laboulbène (Ann. Soc. Ent. France, 1883, Bull., p. cxxvi.) observed a case in France caused by *Dermatobia noxialis*, but this was imported from Brazil by the person infested with the larva. Œstrid larvæ in man are always found singly in various parts of the body under the skin, which may otherwise be in a healthy condition. Moreover, Œstridæ, which, like gastrophilus and œstrus, infest internal organs, are never known to attack man. The occurrence of œstrid larvæ under the human skin must be looked upon as accidental, and the celebrated "*Œstrus hominus*" as a myth. The removal of the larva is neither difficult nor attended by any serious consequences.†

The larvæ of flesh flies, on the other hand, always occur in large numbers, and only in diseased or injured places in the skin or mucous membrane. The parent fly is attracted to such places, and especially to sores. Thus persons suffering with ozæna are liable to be affected with myiasis; and as the flies oviposit during the daytime, the disease has, with few exceptions, been observed in persons who have slept outdoors during the day in summer.

IMPOVERISHMENT OF LAND.

M. Deherain, in his interesting discou ses upon the exhaustion of the soil by cultivation, makes some statements that are striking and suggestive.

In speaking of the evaporation of water from the leaves of plants, he says that in one hour, exposed to the sun, a leaf of barley exhales a weight of water equal to its own; and calculating upon these figures, a hectare (2·5 English acres) of maize will lose, under the same circumstances, 25 cubic meters of water. Hales, an English observer, has said that a hectare (2·5 English acres) of cabbages loses each day 20 cubic meters of water, and Lawes and Gilbert, in their studies on this subject, proved that a plant which has formed one kilogramme of substance within itself has carried in circulation through its tissues 250 to 300 kilogrammes of water.

Humus or decayed vegetable matter is the body which is most efficacious in retaining and keeping in a pure state the terrestrial waters. It can absorb an amount of water greater than its own weight, holds it more tenaciously than clay and infinitely better than sand. Analyses show that humus abounds in the prairies, or unused lands, and that it diminishes greatly in cultivated districts. M. Boussingault found in a pasturage of Argentan, in a kilogramme of soil, 40 grammes of carbon belonging to organic matters, and only 28 and 24 in the same quantity of cultivated land. M. Truchot found 10, 12, 14, 18 grammes of carbon in the districts of Limagne and Auvergne, which were highly cultivated, while he reports 110, 120, 148 grammes in the prairie lands of the high mountains which were roamed over by cattle, but never received fertilizers. The reasons for this difference are not difficult to determine. In the unused fields the earth is not broken up or exposed to the oxidizing and destructive action of the air, and the decaying roots, sprays, and scapes of the grass or herbs constantly increase or maintain unchanged its percentage of humus.

M. Deherain has demonstrated the cause of this loss. He divided his experimental land into parcels, and devoted many of them to a continuous cultivation. Some from 1875 to 1879 have borne potatoes, others corn, others each year beets. In 1878 the land planted with maize, in one kilogramme contained 16, 15, 13 grammes of carbon; at the end of 1879, 18 months later, the same weight of soil gave 14·4, 10·4, 13·1, 12·3, and at the end of 1881 the amount had been reduced to 8·0, 7·6, 6·1 grammes of carbon per kilogramme of soil.

In 1879 he examined the land planted with beets and corn, having yielded three harvests of beets and one of corn, and found the quantity of organic substances oscillating around 13 grammes per kilogramme. He then sowed this ground with sainfoin, which remained undisturbed for three years, and yielded excellent crops. At the end of the experiment he found the amount of carbon per kilogramme of soil had scarcely changed, being in fact 11·4, 13·0, 13·3, 12·8, 12·1, or a mean of 12·5, contrasting to great advantage with the reduced amounts in the harrowed and turned up grounds.

Apart from the reduction of organic matter in soils upon being turned up, the oxidation which removes the organic matter M. Deherain attributes to chemical change, by contact with air and to fermentation, but also largely to the activity of living organisms, plants and animals; for he observes, "The soil is not simply a mass, porous and inert, of clay, sand, and humus, but rather a center of organic activity."

Although MM. Schlœsing and Muntz have shown that the formation of carbonic anhydride goes on in a sterilized soil, it is yet probable that microscopic germs and other living occupants of the earth are the principal agents in its production ordinarily.

These inferior beings play an important role, and MM. Lawes, Gilbert, and Warrington have shown that the mushrooms, which at some seasons appear in such numbers, decompose and assimilate large quantities of the organic contents of soils. The well known "fairy circles" in fields are due to a luxuriant growth of grass following the disappearance of the musbrooms, which first formed them. These chemists found that outside of these circles the ground contained 3·30 per cent of combined carbon, while within, and after the occupancy of the space by these parasites, the samples yielded 2·78 per cent. This difference corresponds to almost 9,000 kilogrammes of carbon to 1 hectare (2·5 English acres) of land!

The Locomotive Whistle.

We bave given a number of statements from observers who certify to hearing the whistle for distances of over 15 miles. Here are others: Mr. J. J. Stranahan states that the whistle and the noise of the train on the trestle at Erie were formerly heard at Boeuff, Pa., a distance of 19 miles, air line.—W. J. McC., of San Pablo, Cal., writes that on calm, clear days, especially in the fall, they hear the rumble of the cars on a trestle located 18 miles distant.—J. H. S. says he has frequently heard the railway shop whistle at Grand Island, while living at Orville, a distance of 28 miles, and has seen moving trains with the unaided eye 12 miles.—Mr. C. V. Swarthout, Cape Vincent, N. Y., frequently hears the railway whistle at Kingston, Ont., 18 to 20 miles, also the rumbling of the trains; also musketry firing at Fort Henry, same place, while the sound of the cannon fired there sometimes is so strong as to shake his house.

Aniline Dye Adulterated with Sugar.

In a paper read at the November meeting of the Dublin Scientific Social Club, Mr. H. C. D aper said that a sample of magenta dye, purchased from an English firm, was found to contain crystalline matter insoluble in alcohol. The writer, on examination of the bulk of the dye, found that, mixed with the characteristic crystals of rosaniline chloride, was a large number of small cubes of a darker color. These, on further examination, proved to be crystals of *sugar* "faced" with roseine, and many of them so slightly coated that the dye was easily removed by rubbing them with the fingers. As the sugar crystals could be readily distinguished by inspection, they were picked out by hand from a weighed quantity of 10 grammes, and it was found that they amounted to no less than 95 per cent of the whole. A fresh quantity of 10 grammes of the dye exhausted with absolute alcohol left a sugar residue equal to 59·5 per cent.

It would be interesting to know to what extent this somewhat ingenious form of adulteration is carried.

A Steam Magnet.

C. Thouvenot, as did previously Tommasi, obtains an electro-magnet by passing steam of the pressure of two atmospheres through a copper tube of 1·5 millimeters in diameter coiled round an iron core.—*Weidemann's Beiblätter.*

*C. H. Allen, in Proc. A. A. A. S., Detroit meeting, vol. xxiv., p. 230.

† See Dr. J. L. Le Conte's remarks in his edition of Say's writings, vol. ii., pp. 37-38.