the size of peas, if any of the gangue of the powdered ore remains floating on the top of the metal and is not slagged and absorbed by the litharge. As soon as the ring of slag closes over the metal remove the scorifier, let it get cold, then break it, and by pounding separate the slag from the button of metal.

Put a dry bone-ash cupel, weighing about the same as the button of metal obtained from the scorification, in the muffle, let it get red hot, then drop in the clean button and close the muffle until the metal has liquefied, then open it partly.

Lead under such slags off into litharge, the latter carrying with it all base metals and impurities. It is absorbed almost as soon as formed (if the muffle is properly heated) into the porous bone-ash cupel. The button gradually decreases in size, and as it gets small it must be watched, so that when the last of the lead passes off into slag and the silver (if any is present) "brightens" or assumes the luster and color of the pure metal, the cupel may be removed to avoid loss by volatilization. If the ore contained any silver a small bead of that metal will be found in the cupel; if none the cupel will be empty. Sometimes, in poor ores, the bead will be almost microscopic, so that the cupel must be carefully examined before setting it aside. Weigh the bead if found on a fine balance and multiply the weight in grains by 291,600, the result being grains of silver (with possibly a little gold) in a ton of the ore. Error may arise from the presence of silver in the test lead, so that it is always best to test it for that metal (by scorification and cupellation as above). If it is found to contain silver, and a purer sample cannot be readily procured, determine by duplicate tests as accurately as possible the amount present, and make proper allowance for this in calculating other assays in which the lead is used.

Good scorifiers and cupels can be obtained from any dealer in chemical apparatus, etc. In some instances a large French clay or even Hessian crucible with a hole knocked in the bottom can be made to serve as a good muffle for such tests instead of the clay pipe. In this case the side of the crucible becomes the bottom of the muffle, and if a little dry sand or bone-ash is spread over it, it can be made level enough to support the scorifier without tipping.

Under favorable conditions such tests can be made in an hour or an hour and a half.

RURAL DRAINAGE AND DISEASE.

BY H. C. HOVEY.

It has been estimated that more than half the deaths occurring in cities are due to preventable causes. The vital statistics of farming regions are not so easily obtained, but statements of responsible physicians, having each a large country practice, in widely separated portions of the United States, prove the importance of judicious sanitary measures in rural as well as municipal localities. One observes that "one-third of the autumnal sickness of this region might be prevented by systematic drainage of farm lands, without detriment to their agricultural value." Says another, "about fifty per cent of our sickness might be obviated by suitable sanitary precautions." All agree that a large proportion of the maladies coming under their notice are attributable to the insidious poison emanating from decomposing animal and vegetable matter.

The purest country air is less pure than is commonly supposed; a fact demonstrated to visitors of Mammoth Cave, who, on emerging after breathing for several hours the air of the cave, which is almost absolutely free from noxious gases, find the outer air laden with oppressive odors, and depressing in its influence on the system.

Miasmatic exhalations arise from every swamp, and wayside pool, from the decaying forest leaves, and many other objects that are hardly thought of as prejudicial to good health. This particular form of the evil reaches its minimum in hilly regions, where the tilted strata supply natural drainage; while its maximum is found in such extensive areas as exist in Indiana, Illinois, and other portions of the West, where vast deposits of alluvial and lacustral soil cover nearly level sedimentary beds, allowing but very sluggish removal of marshy accumulations.

The cultivation of the surface soil, and the drainage made for agricultural purposes, have gradually redeemed large tracts of wet land in the regions mentioned; yet much remains to be done, and it is gratifying to see that steps are being taken by some of the States embracing prairies and broad river bottoms, to investigate the relation between the hydrographical features of the country and the prevalence of malaria and zymotic diseases.

State and local health commissions are instituted with authority to collect vital and sanitary statistics, and to have charge of public measures for removing the causes of disease from all parts of the State; omitting, however, two very important links from the chain of a perfect organization; namely, police power to enforce good health laws in rural districts, and means to defray expenses of straightening crooked streams, to increase the velocity of the current, digging canals to relieve wet lands from overflow, and doing other things that might cost a considerable sum of money, but would add largely to the reputation of the State for salubrity, and thus bring a rich reward.

The first annual report of the Health Commission of one of our largest and most populous interior States has lately appeared, full of facts as to the deficient sewerage of cities, and its almost utter neglect in smaller towns and villages, and in rural localities; also showing the inevitable connection between these causes and the prevalence of forms of sickness that might be entirely avoided by a comparatively small outlay. And what is true of Indiana would also be found to be true of other States similarly situated as to a lack of natural drainage.

Look at the still more level State of Illinois, with its vast prairies and fertile bottoms. The sewage of all the cities is emptied into the adjacent streams, which have usually a sluggish flow, and it is hardly asked whither the reeking mass is distributed.

Often this seems to be the only available mode of getting rid of it, all experiments looking toward other methods meeting with but slight success. It is to be hoped that some apparatus like the "garbage destructor and carbonizer" described in a late number of the SCIENTIFIC AMERICAN, will be introduced into all large cities for the consumption of refuse without sending it down some stream to contaminate the surrounding country.

About ten years ago the course of the Chicago River was artificially reversed, so that instead of running as it had done for ages into Lake Michigan it emptied itself and its accumulation of street filth and offal into the Illinois River, coursing completely across the State. The beneficial result to the city was very great; but for 150 miles down the Illinois River loud complaints were made of a marked increase of zymotic diseases, and a remarkable mortality among the fish in that stream seemed to prove that the water had been poisoned. The fact is worth noting, in passing, that the fish appeared to grow used to the changed condition of affairs; but during the past winter the ice bound water not being properly oxygenated for a long time, many fish died, while others in immense numbers congregated below the dam at Henry, where the constant agitation of the falling water would favor aeration. And at the same time there was an alarming prevalence of diphtheria at Peoria and other places along the river.

This illustration shows the importance of State regulation of general drainage, so that what is borne away as a nuisance from one locality shall not be cast as an offensive burden on another.

But suppose all to have been done that can be effected by public health organizations, much will remain to be accomplished by individual effort, in response to appeals to an enlightened instinct of self-preservation.

Many farmers, otherwise well informed, do not seem to realize the fact that gases arising from stables, pigpens, and out-houses may poison the pure country air as effectually as the atmosphere in cities may be spoiled for breathing by the same effluvia spreading from neglected alleys or cesspools. And the thrifty wives of farmers, who, forgetful of cleanliness, saturate the door yard with wash water and kitchen sewage through all the winter months, should be taught that when that ground sours and festers under the summer sun, the heat will ripen the germs of disease as surely as it will ripen the grain in the harvest field.

Maladies mysteriously affecting families residing in what are regarded as healthy localities, are often explainable on opening the cellar door, whence an intolerable odor of decaying vegetables proceeds; or on lifting a board in the kitchen floor, beneath which is a shallow pool of standing water; or on observing that the well is so situated as to drain into itself some of the substances that are thrown away as utterly unfit to be retained in proximity to human beings.

The latter point is one very frequently overlooked. For example, a certain Western city, finely located and attractive, gained the reputation of being an exceedingly unhealthy spot, and was of course much retarded in its prosperity by that fact. Finally it was noticed that underlying the city, at a depth of about twelve feet, is a stratum of impervious blue clay, above which lies an extensive quicksand, affording an abundant water supply by means of numerous wells, and into that same quicksand all the vaults and cesspools of the place were also dug, thus mixing their foul contents with the drinking water that every one used! The amount of sickness was materially diminished by the proper attention being given to this one point. Every careful farmer will see that the compost heap, and other refuse stored as food for the roots of grasses and vegetables, shall be at such a distance from the house and well as not to contaminate the air and the water essential to the preservation of life and health.

In closing, I may mention a curious illustration, given in a paper by Prof. E. T. Cox, on the "Influence of Geology on Local Diseases," showing what has actually been done by rural drainage to eradicate a dreaded malady that used to prevail extensively in Kentucky and Indiana, known as "milk sickness," because, first attacking cattle, it was communicated to human beings through the milk, butter, and beef of the infected animals. Many a brave pioneer lost his life by this malady, which almost always proved fatal; and recovery was usually lingering and imperfect. At first it was supposed that the cattle had eaten some poisonous plant; but every suspected grass and weed proved harmless on scientific examination. Then it was held that mineral poisons must lurk in the springs and brooks; but hundreds of samples were analyzed without detecting the presence of the enemy. At last an investigation of the clay shales, soft rocks formed from ancient mud beds, and which are microscopic in an eminent degree, revealed the secret. These formations abound in every infected locality, and it now seems clear that they exhale some sort of miasma, when saturated with water, that originated or aggravated the disease, just as other kinds of malaria bring on chills and fever. Proceeding on this discovery, thorough drainage of the wet lands adjacent to the shale beds dried them sufficiently to terminate the conditions favorable to the spread of milk sickness, so that it has now almost entirely disappeared from regions that once were cursed by that plague.

The opinion is now established that a large proportion of diseases are of germ origin; and the obvious mode of prevention is the destruction of the germs or their timely removal.

VACCINATION IN SMALLPOX.

Jenner's great discovery of vaccination for prevention of smallpox has not been wanting in opposition, and a few persons are still so stupid as to object to vaccination. These people, who refuse to be vaccinated themselves or allow their children to be, endanger not merely their own lives, but the lives of their neighbors. They furnish the fuel on which the flames feed, and render epidemics of smallpox possible. If vaccination were universal it would be as difficult to get up a smallpox pestilence as it is to start a great fire in those cities where all the buildings are practically fireproof.

While the efficacy of previous vaccination with good virus is well known to be a preventive, the uses of vaccination after the disease has been contracted are less understood. Some years ago a Virginia physician, Dr. Alban S. Payne, conceived the idea of vaccinating a smallpox patient with the kine-pock. It took at once. The next day he repeated the vaccination, and that also took effect. And what was the effect upon the smallpox of having another similar disease in the system at the same time? The eruption was less extensive, but few pustules appeared, no scars were left, and in a surprisingly short time (three or four days) the patient was able to be about the room. In hundreds of cases where the system of daily vaccination was practiced by Dr. Payne, the duration of the disease was shortened, and *no deaths occurred.* Why, one would ask, is not this simple precaution always taken, if by its means life may be saved, pitting prevented, and suffering diminished? We should be glad to hear from other practitioners who have tried the method above described.

Institute of Mining Engineers.

The American Institute of Mining Engineers met at Staunton, Va., May 30. The members present included President William Metcalf, of Pittsburg, Penn.; Dr. R. W. Raymond, of the School of Mines, Columbia College, New York; Dr. Thomas Egleston, of the School of Mines, New York; Dr. Dudley, chemist of the Pennsylvania Railroad Company; Professor P. Frazer, of Philadelphia; Dr. T. Sterry Hunt, of Montreal; J. A. and J. T. Burton, of Troy, N. Y.; W. P. Ward, of Savannah, Ga.; and F. S. Witherbee, of New York.

In his annual address President Metcalf spoke of the advance of science and its results, and of the education of engineers. Special stress was laid upon the continuous study of the higher mathematics and practical observation as means of self education and professional success. A paper by J. H. Mackintosh, on "The Electrolytic Determination of Copper," was read by Prof. Egleston, and discussed by several members. Dr. Frazer read a paper on "The New Geological Map of Chester Co., Pa."

The opening paper of the second day was by Professor Egleston on "The Ore-Knob Copper Process," employed at the mines of the Ore-Knob Copper Company in North Carolina. The belief was expressed that a great amount of copper lay dormant in the South, which, if properly worked, would be as profitable as the lake copper. Major Hotchkiss, of Virginia, thanked Professor Egleston for drawing attention to the copper deposits of the South. Very few persons are aware of the great wealth in this mineral with which this State abounds. Forty years ago Richard Taylor made explorations and reported on this class of ore. The only difficulty in its development then was the lack of transportation facilities. That objection does not now exist, and this industry may be expected to be seen coming prominently to the front.

A paper prepared by F. H. Williams, of St. Louis, Mo., on "A Volumetric Method of Estimating Manganese in Pig Iron and Steel," was read by the secretary. It was an adaptation of the known processes. In connection with it was presented a paper on "Manganese Determinations in Steel," prepared by William Kent, of Pittsburg, Pa. These papers were discussed by Drs. Drown, Sharpless, and Dudley. In reference to the subject of steel rails letters were read from Richard Akerman, of Stockholm, Sweden, and C. P. Sandberg, of London, England. The latter showed a preference for the mechanical over the chemical tests of steel rails, though he recognized the full importance of both. Considerable discussion ensued upon this subject, the principal participants being Drs. Raymond and Dudley.

At the afternoon session Dr. Sharpless, of Boston, made a statement with reference to the black band iron ores of West Virginia. F. P. Dewey, of Tennessee, read a paper on "Rich Hill Iron Ores." O. J. Heinerich, of Drifton, Pa., explained the practical working of the ammonia soda process, and Stuart M. Buck, of Virginia, read a paper "On the Hard Splint Coal of the Kanawha." After an explanation of the geology of the valley by Major Hotchkiss, the institute adjourned.

At the night session Professor Frazer, of Philadelphia, read a paper on "Observations on some of the Ores of the Upper James River." This was followed by Major Hotchkiss in a description of the topography and geology of the Virginia Valley.

The programme for June 1 was devoted to an excursion over the Shenandoah Valley road to the Luray Cavern, with an examination of the rich mineral deposits of the valley.

Luckhardt's Process of Photo-Engraving.

This process, which has been rightly called a "Columbus' egg," like so many others, owes its origin to chance. Being requested, at a few hours' notice, to draw a portrait for a circle of friends, I intended to use as a guide a photograph, the printing of which was, however, delayed. The idea then occurred to me to coat the negative, which was at hand, with yellow varnish, and to etch the portrait with the needle on that ground. As I wished to make a caricature, the salient characteristics of the negative were retained as a foundation, the transparent parts etched out, and the clothing altered. In this way the photo engraving was produced, the further use of which, I believe, is not to be undervalued. In view of the circumstance that the drawings and wood cuts of portraits which appear in the illustrated papers have frequently lost the likeness of persons whom they represent, and that notwithstanding they are costly and require a long time to produce, would it not be advisable to use engraved photographs instead, even when the original negative, taken from nature, is not to be had, but only a negative reproduced from it?

The yellow varnish—consisting of common negative varnish to which a suitable quantity of aniline yellow has been added until it has assumed a dark sherry color—may be graved very well for a few days; but the older the varnish film the more brittle it becomes, and, therefore, a few drops of castor oil are added to it to render it elastic. The action of light upon sensitive paper placed beneath the negative is effectually suspended by the yellow varnish, so that only the transparent lines, produced by the graver, print. When once the principal lines of the original picture have been faithfully laid down, even an untaught draughtsman may produce an engraving of the portrait that shall at least have some resemblance; while a draughtsman skilled in cross-hatching or a xylographer should furnish a work which, placed beside a good woodcut, should exhibit a superiority recognizable even by the unprofessional eye. Besides the rapidity with which the engraving can be made, the possibility of the utmost correctness is offered, since lines which have been too deeply graved or wrong lines may be filled up again with yellow varnish and engraved anew, a printing frame and silvered paper offering a convenient method of watching and controlling the progress of the work. Where broken lines are desired a pencil may be passed over them, and then they may be pricked and so on. By transfer paper an impression from an engraved, yellow varnished negative plate may be transferred to zinc, and in this way a plate suitable for printing with the letterpress printing press will be produced.

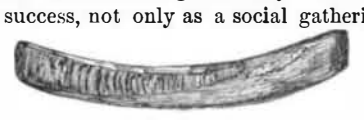
The portrait of Dr. Emil Hornig, the President of the Photographic Society of Vienna, issued with the current number of the *Photographische Correspondenz*, was engraved in about an hour, the faultless zinc *cliché* being produced in a surprisingly short time, in the chemigraphic establishment of Herren Angerer and Goschel, so that in a single day a negative, the engraving, and the *cliché*, ready for printing from, may all be produced with ease.

As I never before made a drawing for a woodcut nor engraved a portrait, I must add that I by no means consider the portrait of my honored friend as a work of art; but my first attempt having attracted some attention in the Vienna Photographic Society, I was induced to prepare the present portrait for its organ. I hope the process may soon meet with extensive application at the hands of capable artists.—*Fritz Luckhardt, in Photographische Correspondenz.*

FEAST OF STRANGE FISH.

BY A. W. ROBERTS.

The second annual dinner of the Ichthyophagous Club, which was held on the evening of Friday, the 28th ult., was a complete success, not only as a social gathering, but for



Razor Clam.

the more important and practical object of developing hitherto neglected varieties of fish for human consumption.

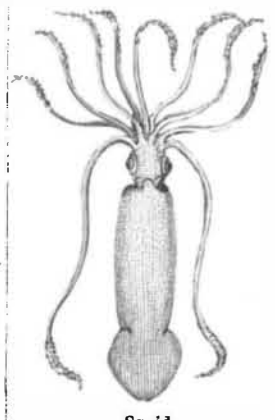
Among the company, which numbered nearly one hundred guests, were men distinguished in the world of arts, of letters, and of science, and not a few who are deeply versed in the mysteries of the ocean. The tables were ornamented with flowering plants, and designs composed of materials collected from the sea, the most noteworthy being a pyramid, twenty feet high, consisting of the empty shells of the horseshoe crabs, between which were introduced sharks' fins and sea robins' heads.

King Crab.

While the gathering was naturally social in its character, the practical result accomplished was the utilizing for food of certain fishes which have been considered the very refuse of the ocean. Strange and repulsive-looking creatures (the most striking of which I have figured) were served up during the evening as the choicest of viands. These various dishes of strange fish were partaken of with a relish, which, until the experiments of last year and this were made and proved successful, were considered valuable only for fertilizers or curiosities for aquaria.

The consomme of moss-bunker was very palatable and entirely free of all oleaginousness.

The "Bisque of razor clams" was as delicate in flavor as



Squid.

Hell-bender.

oyster soup. "Gray snapper a la Blackford" was another equally palatable dish. Although the gray snapper is not equal in flavor to the red snapper, there is no reason why it should be neglected by our fishermen, as it generally is, as a marketable fish.

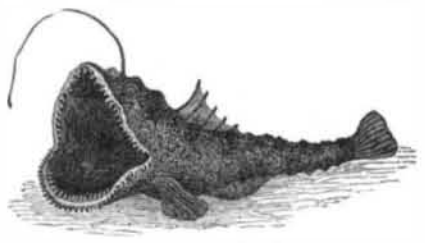
"Horseshoe crabs a la diable" were served from dishes composed of the empty shells of the horseshoe or king

Sea Robin.

Blow Fish.

crab. The flesh of this crab was found to be coarser and more stringy than that of the ordinary crab, and the flavor more pungent, but not sufficiently so as to make it unpalatable.

"Drumfish a la Cope" was very suggestive of sheepshead. The drum fish is never to be found in our markets,

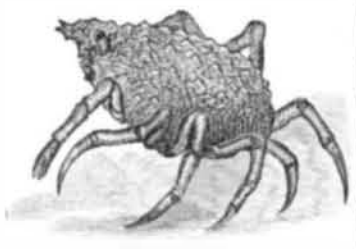


Lophius a la Beard.

and in the severest sense is looked upon as an "evil" fish by the fisherman, it being one of the greatest enemies to the oyster.

"Saute of shark, Chinese style," was not very successful, as the portion that I partook of left a disagreeable taste in

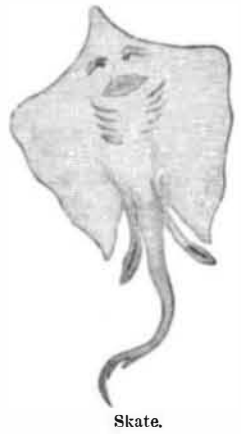
Sea Lettuce.



Spider Crab.

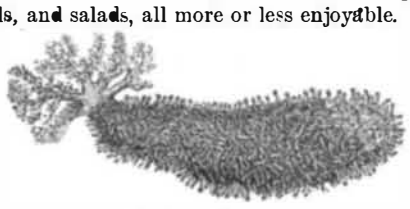
the mouth, though others declared it equal to halibut steak; perhaps I got the evil part of the beast.

"Squid a la Starin." Without exception the squid is one of the most repulsive-looking animals of our coast, and yet



Skate.

from it was produced a black colored and gelatinous soup, which, if you could forget the disgusting form of the creature, was very pleasant to the taste. Next on the menu came hell-benders, sea robins, "Lophius a la Beard," and blow fish, with sea-lettuce salad, from which were produced fries, broils, and salads, all more or less enjoyable.



Sea Cucumber.

On last year's menu were spider crabs, gar fish, skate, and sea cucumber, of which strange looking creatures some idea can be formed by the accompanying illustrations.

In some future number detailed accounts of the habits and uses of many of these fish will be given.

The New England Exhibition.

The New England Manufacturers and Mechanics Institute are making a special effort to secure this year an adequately representative exhibit of the products of New England industry and skill. The Exhibition building, now nearing completion, is the largest building in New England, covering five acres of ground and offering over eight acres of flooring available for exhibition purposes. It is situated in Boston, on a spur track of the Boston and Providence Railroad.

Space has already been assigned to a considerable number of prominent industries. The exhibit of the boot and shoe trade is expected to be more extensive and complete than has ever been made before. It will comprise a model factory with 129 distinct machines in operation.

The office of the Institute is at No. 5 Pemberton Square, Boston.

Prof. Carhart's Lecture.

In the notice of Prof. Carhart's recent lecture before the New York Electrical Society it was incorrectly stated that the Crookes experiments had not before been publicly repeated in this country. The same lecture, with illustrated experiments, was given by Prof. Carhart before the Chicago Electrical Society, last winter, January 24.

Carlyle and His Dyspepsia.

In his "Reminiscences," Carlyle tells how he once rode sixty miles to Edinburgh, "to consult a doctor, having at last reduced my complexities to a single question. Is this disease curable by medicine? or is it chronic, incurable except by regimen, if even so? This question I earnestly put; got response: 'It is all tobacco, sir; give up tobacco.' Gave it instantly and strictly up. Found, after long months, that I might as well have ridden sixty miles in the opposite direction, and poured my sorrows into the long, hairy ear of the first jackass I came upon, as into this select medical man's, whose name I will not mention."

Discolored Brick Walls.

The white saline substance that "comes out" upon brick walls, and which has been a source of annoyance to a great many, may, according to the *American Architect*, be remedied. In reply to a query on the subject, it says: The "saltpetring" of brickwork can generally be prevented by adding oil to the mortar, at the rate of a gallon to the cask of lime. If cement is used in the mortar, an additional gallon of oil must be allowed for each cask of cement. Linseed oil is generally employed, but any kind which does not contain salt will answer. The incrustation, once formed, can be removed with hot water, or by the muriatic acid generally used for cleaning down brickwork, but it will reappear again by exudation from the interior of the wall, and usually leaves a permanent black or brown stain.

Another Large Casting.

The large iron bed plate for the Fall River steamer Puritan, cast at the foundry of John Roach & Son, in this city, May 17, will be, when trimmed and completed, 21 feet 9 inches long, 12 feet 6 inches wide, and 3¼ inches thick. The mould was 37 feet long, 14 feet wide, and required 2,000 feet of timber for the frame. It was roofed with brick.

AGRICULTURAL INVENTIONS.

An improved corn sheller with which an ear of corn can be shelled very rapidly and perfectly without crushing or bruising the kernels and without any great exertion of power on the part of the operator, has been patented by Mr. Charles F. Shaw, of Boston, Mass. It consists of two semi-annular sections, each provided with an arm, the arms being pivoted to each other at the outer ends, so that the sections can be swung open or closed. These sections each have a series of teeth, all tapering toward the same point, fastened to the inner sides, so that an ear of corn is passed in between the semi-annular sections, and the latter are held tightly while the ear is being rotated to and fro. The teeth will tear the kernels from the cob.

An improved butter worker has been patented by Mr. John McAnespey, of Philadelphia, Pa. The invention consists in a body having rim and boss, a shaft passing through the body and connected by a gear with a hand crank shaft, a cross piece provided with a median square hole fitting a squared part of the body shaft, and beveled rolls arranged on journals of cross piece.