the specimens sent by Sergeant Applegate with those collected by Lieut. Stoney, and found them to be the same, hornblende andesite.

When we compare the lava from Bogosloff with the volcanic sand which fell at Unalashka, we find them identical in mineralogical composition. Both are composed of triclinic felspar, with prominent zonal structure, augite, hornblende, magnetite, and groundmass, with microlites and a small proportion of amorphous matter.

Dr. T. M. Chatard, of the geological survey, made a partial analysis of the volcanic sand from Unalashka as well as of the lava from Bogosloff. The former contains 52.48%, and the latter 51.65%, of silica. Fearing that an error had been made in the analysis of the lava, Dr. Chatard repeated the determination, and obtained the same result. That the percentage of silica contained by each should be nearly the same, can be readily understood; but that the lava should contain less than the volcanic sand which is composed of the same material, apparently with a larger proportion of basic minerals, was unexpected. Hornblende-andesite lavas rarely occur with such a low percentage of silica, and in this respect the one from Alaska is closely related to those in the Siebengebirge and Hungary. It is evident that the felspar contained must be very basic, probably anorthite. The optical properties of the felspar point in the same direction for the angle of extinction when symmetrical is over 30°. Hypersthene, which is such an important constituent of the lavas in the Cascade Range, has not been discovered in any of the lavas yet examined from Alaska. J. S. DILLER.

U. S. geol. survey, Washington, D.C.

Action of pollen on seed-coats and pericarps.

I am confounded by a statement, given as if of a well-known fact, which I read in the 'Science bulletin' of No. 101. At a meeting of the Academyof natural sciences, Philadelphia, Dec. 16, —

"Mr. Thomas Meehan called attention to an ear of Indian corn received from Mr. Landreth, the grains on one side of which were of a rich brownish-red color, while those on the other side were of the usual pale yellow tint. On the boundary-lines several of the grains were partly red and partly yellow, thus proving that the result was not the effect of cross-fertilization, as had been asserted in other instances of change of color. It would indeed be strange if corn were the only plant in which such change of color was produced by cross-fertilization; *yet in the case of no other species had any such change been observed.*"

The sentence I have italicised is the confounding one. It is hard to believe that such a veteran horticultural editor and copious writer as Mr. Meehan is not acquainted at first hand with some of the horticultural literature upon this curious subject (extending from the year 1729 down to our own days), and which asserts that in various instances just such change has been observed. It is harder to believe that a writer who has shown such a critical familiarity with Mr. Darwin's writings should have entirely overlooked a section in chapter xi. of 'Variation under domestication,' vol. i., beginning on p. 397, in which the principal observations (convincing to Darwin's mind as to the facts) are brought together, and the sources referred to. One wonders how the fact that some of the grains of corn were party-colored in the case described, *proves* 'that the result was not the effect of cross-fertilization,' party-coloration in the flowers being a well-known effect of cross-fertilization, according to good authorities. A. G.

THE PEABODY MUSEUM AT NEW HAVEN.

THE Peabody museum in New Haven stands on the corner of Elm and High streets, just without the *campus* of Yale college. Like most buildings devoted to science in America, it occupies only a part of the large lot, — a fact not designed to typify the unfinished state of zoölogy, but merely resulting from lack of funds. In the present case there would, perhaps, have been no building at all, and the collections, had any of consequence been accumulated at Yale, would have remained stuffed into garrets and cellars, had not the philanthropic George Peabody given a sum of money, in 1866, to erect a house for them. Thanks to the financial prosperity of Massachusetts, the bonds for a hundred and fifty thousand dollars had greatly increased, and those set aside for the first wing of the building had become worth a hundred and seventy-five thousand dollars when the trustees began to build. With that sum they have erected one of the finest buildings, for its purpose, in the United States, — a lofty and ornamental structure of red brick and cream-colored stone, whose broad and numerous windows express the desire of the investigators within for all the light they can get.

Let us begin our survey at the bottom. Entering the basement-door, a blind man, or at any rate a blind naturalist (if such there be), would know where he was by that smell of old alcohol with which biologists are so familiar. It is safe to wager, ten to one, that every visitor to these lower regions will remember and quote a certain line from 'The tempest,' act ii. scene 2.

This pungent odor rises chiefly from the possessions of the U. S. fish-commission, deposited for sorting and examination under the eye of Prof. A. E. Verrill, who is chief of the zoölogical part of the museum, or by some of his associates. Duplicates of these submarine and littoral specimens, secured in the government's deep-sea dredgings, go to Professor Verrill, and large quantities deposited by him in the museum have been arranged for exhibition.

In another part of the basement, Prof. O. C. Marsh keeps 'greate store' of fossils, cleaning the gigantic bones from Rocky-Mountain quarries preparatory to study and display. Considerable paleontological property of the U.S. geological survey is under inspection here also. A score of expert helpers, with Oscar Harger as chief of staff, assist; one of whom

has a little building to himself, where he is constantly employed in making restorations and casts of novelties, which are distributed with great liberality.

Only favored visitors go to the basement, or care to go. The public entrance is above, opening underneath a magnificent rose-window into a spacious court with tiled floor, and walls of variegated bricks. This region is garnished by great slabs of the celebrated footprint sandstones from the Connecticut valley, and a huge stump taken entire from a coal-bed. Iron staircases, clinging to the wall in spiral flight, lead to the top story, and the court is roofed with glass.

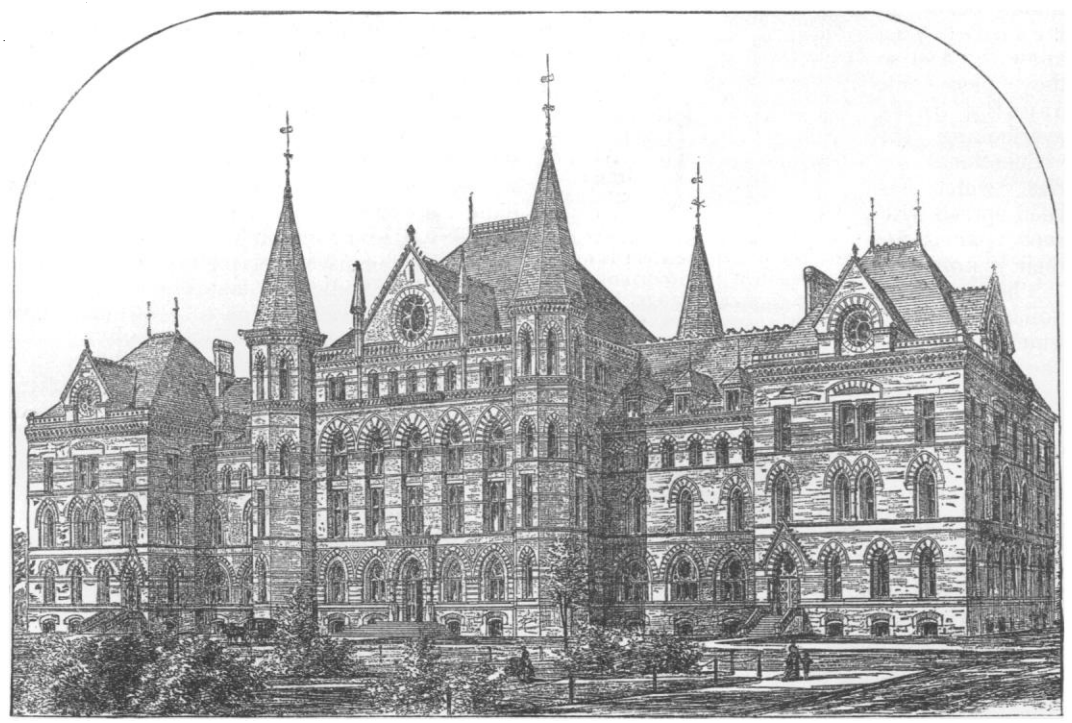

Fig. 1. — The Peabody museum as it will appear when completed.[1]

On the right and left of the entrance are doors leading to business offices, the blow-pipe laboratory, and the lecture-rooms of the Professors Dana (father and son), where large audiences frequently gather to hear the instruction designed for undergraduates alone; and in the rear of the court, on the ground-floor, is the exhibition hall for minerals, of which the museum possesses an almost unrivalled collection. This might be expected, considering the men — Dana, Silliman, Brush, and others — of whose labors it is the result.

To mention half of the notable minerals here, would exhaust the space set apart for the whole of this article. There were formerly several thousand dollars' worth of diamonds in one of the cases; but on account of their theft, though they were afterwards recovered, the labels now state that the present specimens are glass facsimiles. The only thing in this room not locked up is a meteorite weighing sixteen hundred pounds. The metal in one spot has been sawed off, and polished until it looks like burnished steel, and has been engraved with an historical inscription, from which it appears that this meteorite fell in Texas, presumably the only state in the Union large enough to receive it safely. In an adjoining case are a peck or so of small meteorites, picked up within a narrow area of Iowa, and of suitable size to be rained down upon a more thickly settled region.

After the brilliant and many tinted ores, the endless variety and beauty of the quartz crys-

[1] The right-hand third is already constructed.

tals, and the substantial interest inspired by the metals, visitors always pause with new gratification before some curious rosetted crystals of a form of lime; and a look of deep wisdom comes into their faces as they read the label. "Ah!" they exclaim, "I told you so. These are imported. I knew there could be nothing so pretty as that on this side. They do these things better in France, you know." And so they pass out, usually quite overlooking the 'educational series,' which has been spread with such pains for their instruction.

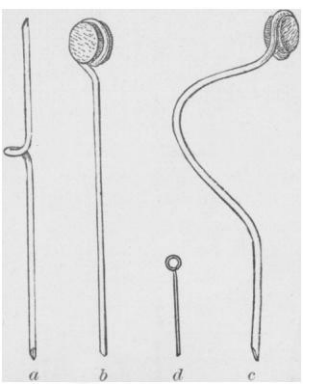

FIG. 2. — WIRES FOR MOUNTING MUSEUM SPECIMENS.

a, wire twisted so as to form a shoulder to prevent the specimen from slipping down; *b*, wire with the end bent around a disk of leather to which objects can be glued; *c*, a similar wire bent to fit inside a spiral shell, as in fig. 6; *d*, spiral label-holder used as in fig. 3.

This educational collection, which seems to be extremely apt and well selected, concentrates in a single case a practical glossary and text-book of mineralogy. To this epitome of the science all the rich and rare examples in the wall-cases are only attractive illustrations; and, the further to help the inquirer understand them, several copies of Dana's 'Mineralogy' will be found upon little tables near by. Here persons may sit and read, acquire and carry away the information, but not the *book*, for that is chained to an iron pillar.

The third floor is that most popular with the public, since it is devoted chiefly to modern animal life. The first thing to strike the eye in the south room is a fine series of comparative skeletons of primates, from civilized man down to the humblest of monkeys, all hanging in a beautiful row by hooks screwed into the tops of their heads. The set is usually spoken of as Professor Marsh's sunday-school class, but an unprejudiced mind can see that really there is no truth in this irreverent comparison. Beyond them, the whole side of the room is filled with cases containing an orderly succession of skeletons illustrating all the vertebrate orders; while the centre of the room is occupied by the skeletons and stuffed hides of the larger mammals, like the camel, rhinoceros, a very dejected polar bear, etc.

In the same room several cases are filled with stuffed skins of mammals, birds, and reptiles. Beside most of the land birds are placed their nests, with the eggs; or else the eggs are glued upon upright tablets of ground glass, in which position they show to excellent advantage. One large case is devoted to a collection of New-England birds alone, excellently mounted upon the branches of a tree. This is the work of Prof. W. D. Whitney, who, before he became prominent as a linguist, was known as a good ornithologist; as, in fact, he still is.

Passing to the west room on the same floor, one sees invertebrate preparations most attractively displayed. They are confined almost wholly, however, to the crustacea, mollusks, radiates, and marine protozoa. Of insects there is a very small showing, — only enough to represent scantily the classification of that immense class. This is partly because it is unwise to display insects freely, since exposure to the light causes their colors to fade, but is due chiefly to lack of material, owing to the fact that no entomologists of note have been especially interested in the progress of this museum.

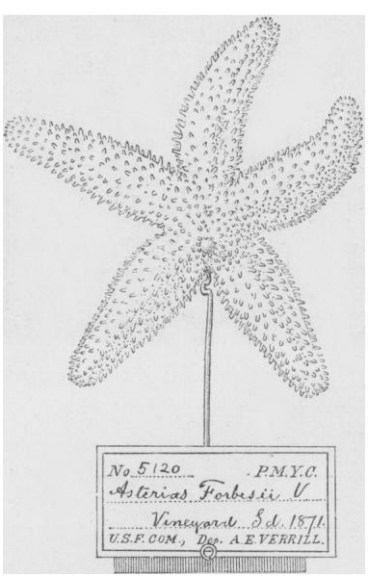

FIG. 3. — STAR-FISH MOUNTED ON WIRE FASTENED IN A BLOCK OF WOOD, WITH HOLDER AND LABEL OF THE USUAL PATTERN.

On the other hand, the special tastes of Professors Verrill, S. I. Smith, J. H. Emerton, and others, and the intimate relations the museum (through these gentlemen) has sustained with the Smithsonian institution and the U. S. fish-commission, have brought the department

of marine invertebrates to an almost unrivalled perfection. Case after case, all splendidly lighted, of rare and brilliant shells from every part of the world, vie with one another in attractiveness; while a magnificent series of crabs, sea-urchins, star-fishes, worms, corals, corallines, hydroids, and sponges, illustrates the classification, and exhibits the vast variety, of more lowly life alongshore and on the bottom of the deep sea.

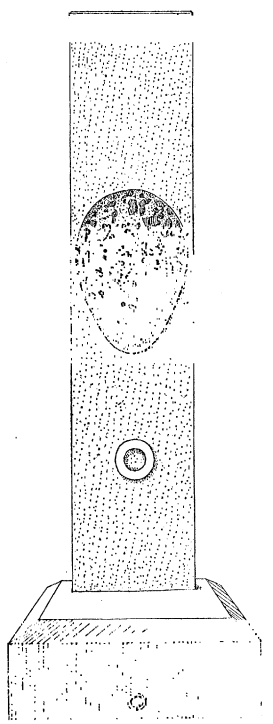

Fig. 4.—Bird's egg glued to a strip of ground glass standing upright in a wooden block.

(To make the attachment stronger, a leather ring is first glued to the glass, as seen in the figure on the lower part of the strip; and to this the egg is fastened.)

In no room does the casual visitor linger longer than in this one; while its contents are unusually interesting to specialists, because of the large proportion of type-specimens included. In many instances these are unique; as, for example, some of those beautiful orange and scarlet gorgonias or 'sea-fans,' — flat, branchless, mossy growths of calcareous matter, which resemble great masses of pressed seaweed. One case is wholly filled with these corallines; and it is doubtful whether any museum in the world can make a better showing of them.

The corals, also, are very fine, embracing many rare and even unique forms, as might be expected, remembering Prof. J. D. Dana's labors in that direction; so that only the Museum of comparative zoölogy equals this part of the cabinet.

In the way of deep-sea forms of crustaceans, and echinoderms also, a great number of novel species are publicly displayed, which were procured in recent dredgings by the fish-commission. Among them stand large jars holding alcoholic remains of the giant cuttlefishes upon which Verrill has written so many learned pages; and overhead hang Emerton's paper models of Architeuthis and a huge Octopus, which half the visitors take to be real devil-fishes stuffed, and gaze at with fearful curiosity.

The system of mounting dry objects of small size, adopted here, is perfect. It consists in using a small standard of wire set in a block of wood sufficiently firm to stand upright with security, upon the top of which (that is, on the tip of the wire) the specimen is fixed in any attitude desired by means of a bit of leather or cork glued to it at some inconspicuous point (see figs. 4–7).

In the case of shells, this produces a singularly handsome effect. They are poised upright, and can be viewed from all sides without handling, while the label attached to the foot-block is neither hidden by the object, nor hides it. The wires, often requiring much ingenious twisting and looping to adapt them to the needs of the irregular specimens and positions, are of brass; but, after each piece has been bent into the proper shape, it is silver-plated. The crabs are mounted in an equally attractive and accurate manner, these brittle and otherwise difficult preparations being treated by a combination of the method described above, with the twisted-wire arrangement familiar to osteologists. Upright tablets of ground or colored glass, to which specimens are glued, are also made use of for many objects. Here, too, as in the vertebrate hall, there is a synoptical collection of the invertebrates of New England, instructively epitomizing the local fauna.

Fig. 5.—Spiral shells glued to a strip of wood, painted black, fastened by a pin in a wooden stand.

The remaining rooms on this floor are occupied as laboratories or lecture-rooms by Professors Verrill and Smith of the Sheffield scientific school.

The fourth story contains storerooms filled with fossils; a collection (on exhibition) of about two thousand antiquities of great value from Central America; and a fair show of archeological relics, the most notable part of which is the pottery from the mounds of the Ohio valley.

But the glory of the Yale museum is its paleontological treasures, brought together wholly

by Prof. O. C. Marsh. The few representatives of this collection visible in the second-floor rooms and in the hall-ways are alone sufficient to stamp the museum as pre-eminent in this line; but they are merely an advertisement of what cellar and attic contain. It is not too much to say, that in respect to vertebrate paleontology (outside of fishes), this museum is not surpassed in the world. Where other collections own fragments or single skeletons, Professor Marsh boasts scores or hundreds of individuals, while many extinct races are known only by their fossil remains in his possession.

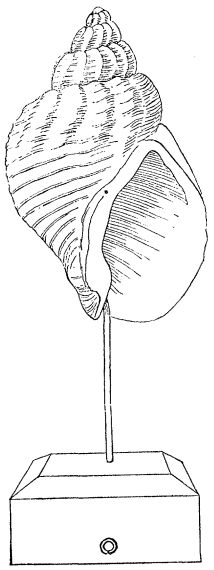

FIG. 6. — SPIRAL SHELL MOUNTED ON A WIRE LIKE FIG. 2, *c*, GLUED INSIDE, AND STANDING UPRIGHT IN A BLOCK OF WOOD.

This is the result of wisely directed energy, and the ability to spend money promptly and liberally. Marsh's frequent expeditions to the far west are well known to geologists. Many carloads resulting from these were not only shipped home by himself, but his agents have been forwarding enormous quantities ever since, from Wyoming and Colorado 'quarries.' Just before the holidays, a single instalment of two hundred and seventeen large boxes filled with bones from the western tertiaries arrived at the museum, and were stored in the basement lobby for lack of space in any apartment.

In respect to mammals, a series of fragmentary remains, chiefly jaw-bones from the eocene, represent the first primates, cheiropters, and marsupials discovered in North America. No more popularly interesting deduction is likely to be drawn from a study of them, than that which traced the genealogy of the horse from the diminutive five-toed progenitor of the early eocene to the present friend and servant of mankind. There are hundreds of specimens of these little horses at Yale.

In the class of birds, still rarer treasures may be catalogued. Along the eastern foot of the Rocky Mountains, certain strata of the middle cretaceous period have been exposed, corresponding to Meek and Hayden's 'Number three,' but termed 'Pteranodon beds' by Professor Marsh. These beds consist of fine yellow chalk, well adapted to preserving the remains of delicate structures; and here were gathered the skeletons of those remarkable 'birds with teeth' (Hesperornis and Ichthyornis), upon which Professor Marsh has published an elaborate memoir. These were collected during his expeditions of 1870, 1871, and 1872, under the greatest perils and hardships; and they have gradually been added to, until now the museum contains a hundred or more individuals, including twenty species of nine or ten genera. There are fifty specimens of Hesperornis alone. Several of the most perfect of these are on exhibition; and, as any intelligent person can comprehend their peculiarities, they never fail to interest thoughtful visitors.

Another fossil, appealing strongly to popular fancy, is the fine pterodactyl, — that same 'first specimen brought to light' which showed the bat-like flying membranes attached to the wings and tail. This came from Europe, where these winged lizards are so great a rarity in museums, that a fragment of one is highly prized; but Marsh now possesses from American rocks no less than six hundred individuals. Some are of great size, spreading wings that

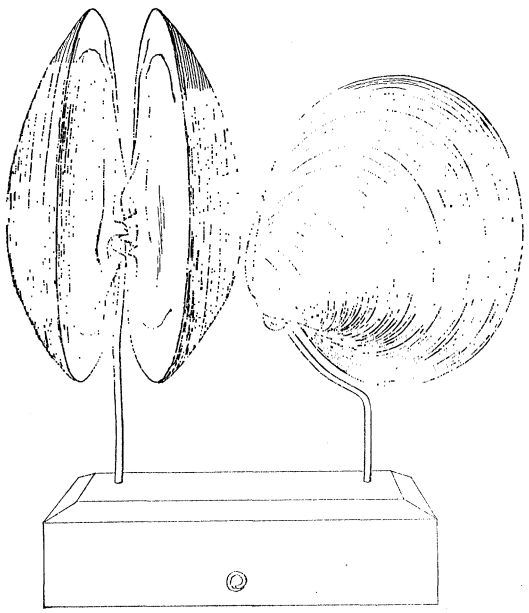

FIG. 7. — BIVALVE SHELLS MOUNTED ON WIRES GLUED BEHIND THE HINGE.

measured from fifteen to twenty-five feet from tip to tip. These huge pterodactyls form the new order Pterodontia, and their remains were

gathered in the same middle cretaceous strata of 'western Kansas' referred to a moment ago.

Prized more highly than even these, however, are the hundreds of skeletons, or parts of skeletons, of gigantic walking and swimming reptiles, herbivorous and carnivorous, which inhabited the cretaceous ocean, and basked upon the shores of the islands of that age, now forming the heights of the Rockies.

Among the earliest were disclosed wonderfully preserved bones of the class of mosasauroid reptiles, — a group, which, though rare in Europe, here attained an enormous development, both in numbers and in variety of forms. Nearly seventeen hundred individuals, of this kind of giant-reptile alone, stand on the museum's catalogue.

The land-forms were even more terrible to the imagination, though their food was vegetable, and their disposition probably peaceful. One such sauropodan dinosaur shown to the public was sixty feet in length, and in general form came nearer to a crocodile than any thing else. A thigh-bone, lying in an exhibition case, measures six feet in length and is solid; so that it was well able to support the weight of the monster as it rose, kangaroo-fashion, on its hind-legs, to browse its food or to look about it.

In another colossal reptile (Apatosaurus) of nearly equal proportions, one of the neck-vertebrae is shown which is three and a half feet in diameter; while the ponderous bones of Brontosaurus prove, that, when living, the animal must have weighed twenty tons or more. The smallest part of it is the head; the skull and brain being more diminutive, in proportion, than in the case of any other animal now known. It had no weapons of offence or defence, nor even any armor; but in another genus (Stegosaurus) approaching it in bulk, though of more compact form, the body was protected by massive plates, and armed with long spines. This exaggeration of a cross between a snapping-turtle and a hedge-hog possessed a singularity in structure, since in one of the vertebrae of the haunch is a large nerve-cavity, which contained a second or posterior brain, supplementing the extraordinarily small nerve-centre in the skull. This feature has no parallel in the animal kingdom.

To Professor Marsh's personal collection somewhat has been added at the museum by the U. S. geological survey, which will become the publisher of the outcome of his studies now in progress. A score or so of assistants are constantly on duty, either in study, or in the mechanical work of skilfully extracting fossils from the rocky matrix; in matching and mounting by the aid of wire, clay, and plaster, for permanent preservation, the often badly broken bones of some antique brute whose extinction most of the world can accept with resignation; or in making casts, models, and drawings of fossils, original and 'restored.'

Several quarto volumes are already under way; and scarcely an issue of the *American journal of science* appears, without an advance note of some special discovery in vertebrate paleontology, anticipating the completer descriptions to be made from this museum's rich materials. ERNEST INGERSOLL.

RIVER-POLLUTION IN ENGLAND.

AFTER a delay which is much to be regretted, the English government has printed the reports left by Dr. Angus Smith on the working of the Alkali-works regulation act and the Rivers-pollution prevention act. As we mentioned at the time of Dr. Smith's death, he attached great importance to his examination of polluted waters. Great improvements have been effected in lessening the injurious vapors from chemical works. The new works registered are engaged chiefly in the manufacture of sulphate of ammonia and chemical manure. The smaller gas-works have found that they can more profitably manufacture and sell sulphate of ammonia than send their gas-liquor to a distance. The directions in which improvements have latterly been most marked have been in the treatment of sulphuretted hydrogen evolved in the manufacture of sulphate of ammonia, and in the washing of the gases evolved in the treatment of coprolites and other materials at the chemical works. In the former case, oxide-of-iron purifiers have been erected as the best means of preventing the escape of sulphuretted hydrogen; and in some works this gas is now completely burned, instead of being allowed to escape unburnt, up the chimney, as formerly. At others, Claus's method of burning so as to form sulphur, which is collected, and not sulphurous acid, has been adopted. Dr. Smith maintains, that, whatever process be used, the limit of sulphurous acid allowed to escape should not exceed five-tenths of a grain per cubic foot, including the acidity of the coal-smoke itself, which latter varies from a quarter to half a grain. The escapes from sulphuric-acid works have been considerably reduced, in consequence of the introduction of regular testing by manufacturers; and condensers to absorb the nitrous fumes have been put up in a number of nitric-acid works.

Dr. Smith's new method of testing with sugar the amount of organic activity amongst the microbes (at least, of a certain class) which exist in waters was mentioned nearly a year ago in the technical journals. He found that in nearly all natural waters sugar ferments, and hydrogen gas is then given off. So far as