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Contents.

(Illustrated articles are marked with an asterisk.)

Air compressors, etc., manuf. of* 376
American industries* 367
Arizona, history of 377
Binocular vision in telescopes* 370
Blast furnace, a great yield of 368
Boiler appliance, steam* 374
Ceiling and wall, new* 374
Chimney piece, porcelain* 377
Cotton Planters' Association 372
Crinoids, the, of Crawfordsville* 375
Desert of Sahara 378
Electric lamp, new* 371
Electric railway, future of the 368
Electricity, seeing by 373
Engineering inventions 374
Engineers' Club 378
Engine, steam, indicator 372
Enjoined from using his name 378
Filtering, extensive 378
Fire, going to a 376
Food adulteration 368
Fungi on glass 373
Human retina 369
Indicator, steam engine* 372
Industries, American* 367
Inventions, engineering 374
Inventions, mechanical 378
Inventions, miscellaneous 373
Inventions, new 376
Iron works, Norwalk* 367
Lamp, electric, new* 371
Mechanical inventions 378
Mill pick, improved* 374
Motor, new, a* 373
Moulding, new style of* 372
Notes and queries 379
Oysters at Quinnipiac 369
Prehistoric treasures 377
Railways and population 374
Sahara, Desert of 378
Steam engine indicator* 372
Street sweeper, new 378
Telephone call, improved 376
Telescopes, binocular vision in* 370
Treasures, prehistoric 377
Trees, girdled, persistent life of 378
Vennor's prophecies 378
Vision, binocular, in telescopes* 370
Water power, queer 376
Wheat production of the world* 378
Why the needle points northerly 372

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 282,

For the Week ending June 12, 1880.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ENGINEERING AND MECHANICS.—Rolling Mill Engine. 2 illustrations. Vertical Engine (Corliss system) for Rail Mill at Messrs. Krupp's Steel Works, Essen 3692
Benefits of Good Tools 3692
Steel making in China 3693
The Japanese Navy 3694
Double Boats. 21 illustrations of patented double boats 3694

II. TECHNOLOGY AND CHEMISTRY.—A New Adulteration of Jellies. Currant jelly without currants. 3 figures. Sea weed, diatoms, and pollen grains found in factitious currant jelly 3693
Intensifying Negatives 3694
Gallium in American Blendes. By H. B. CORNWALL 3694
Laboratory Notes: By WM. L. DUDLEY. A Modification of Bottger's Test for Sugar.—A New Test for Gallic Acid 3696
Bog Butter. Analysis of Bulyrillite from Galway, Ireland 3696
The Newer Artificial Coloring Matters Derived from Benzine. By R. J. FRISWELL. Lecture before the London Society of Arts, with discussion 3697
Sulphur in Coal. By Dr. W. Wallace 3698
Progress of Industrial Chemistry. By J. W. Mallet. The manufacture of glass, porcelain, and clay ware 3698

III. PHYSICS.—Physics Without Apparatus. 4 illustrations 3687
The Radiograph. An instrument for automatically recording variations in the intensity of solar radiations 3687
A New Method of Taking the Specific Gravity of Liquids. By H. SOMMERKORN 3699

IV. GEOGRAPHY, ETC.—Determinations of Longitude. Applications of the American method 3688
The Northeast Passage. Narrative of Captain Palander, Swedish Royal Navy, Commander of the Vega. Continued from SUPPLEMENT, No. 201. 1 large illustration. Reception of Prof. Nordenskjold at Stockholm 3688
Petroleum in Peru 3700
The Serapeum of Memphis. M. Mariette's remarkable discovery. 3700
Supposed Changes in the Moon. Dr. Klein's observations verified 3700
Distribution of Lakes in the United States. By Prof. JNO. LE CONTE.—Topography.—Great interior plateau.—Great basin.—Great Cal. valley.—Arid regions.—Cause of aridity.—Applications. 3691

V. ART.—Suggestions in Decorative Art.—Carved Casket in oak, Art Industry Museum, Berlin. Date, 1550. 3 figures 3696

VI.—SURGERY AND MEDICINE.—On the Removal of Particles of Steel or Iron from the Vitreous Chamber by Means of Magnets. By Dr. EMIL GRUENING 3669
Cats for the Study of Anatomy 3699
Dentistry in the United States 3699

VII. AGRICULTURE, ETC.—How Wheat Grows 3701
Athabaska Wheat Fields 3701
California Raisins 3701
Insects and How to Fight Them. Cut worms.—May beetles.—Slugs.—Ants.—Aphis.—Scale 3701
Forest Trees of North America. Prof. CHARLES S. SARGENT'S Catalogue. Continued from SUPPLEMENT, No. 231. 3701

THE FUTURE OF THE ELECTRIC RAILWAY.

It is now nearly forty years since Professor Page's discoveries in electricity suggested to him the possibility of an electric railway; but in those days the costly galvanic battery was the only source of electricity available for such purposes, and his experimental electric locomotive was a practical failure. His power cost too much, and his machine labored under the disadvantage of having to carry a considerable load of battery cells, the action of which was materially interfered with by the jarring and oscillation of the train when its speed approached three or four miles an hour.

The development of dynamo-electric machines during recent years has so lessened the cost of electricity as a motive power as to remove the most serious obstacle to the success of Professor Page's experiments. During the same time the transmission of powerful currents of cheaply generated electricity, through conductors of considerable length, and the re-conversion of such currents into working force by economical motors, have become a matter of every day occurrence. It is quite natural and appropriate therefore that the problem of electrical propulsion should again come to the front, this time with every prospect of a speedy solution.

The problem had so long been in abeyance that when Dr. Siemens set up his electrical merry-go-round in Berlin last year, most men were disposed to look upon him as the propounder of a radically novel idea, and the electric railway as the product of the latest speculative thought in this direction. And when Mr. Edison adopted the system for practical use not a few people thought that he had switched off from the line of practical work to play with a novel toy, the outcome purely of his experiments in electric lighting.

The electric railway, however, is not a plaything. It is a practical reality, though just now entering upon the stage of useful and economical development. It opens a field of invention and improvement as wide and profitable probably as was opened up by the first steam locomotive; and we have no doubt that during the next fifty years it may work as great changes in the processes and economies of life as steam railways have during the half century just past.

On the little electric railway set up by Dr. Siemens in Berlin, the locomotive obtained its power from a special electric conductor running between the car rails, the current being returned through the rails. Mr. Edison has simplified matters by throwing out the central cable as a needless expense. He makes the track itself the conductor, sending the current up one rail and down the other, the locomotive being operated by the current forming a circuit through it when proper connections are made, as described in the SCIENTIFIC AMERICAN last week.

For readers unfamiliar with electrical motors it may be necessary to say that the power for the running of the electric locomotive is generated by a stationary boiler and engine, and transformed into electricity by an electric generator at the central station. As was suggested by the elderly lady fearful of boiler explosions, the water is boiled at home, and that source of danger is removed from the list of traveler's risks. And as the efficiency of a stationary engine is several times greater than that of a locomotive engine, it is possible to convert the power of a stationary engine into electricity, transmit it to the locomotive upon the track, and there reconvert it into working force as economically as (if not much more economically than) power can be directly evolved by the combustion of coal in a locomotive furnace.

In the present stage of his experimental apparatus, Mr. Edison claims that he can realize in his locomotives seventy per cent. of the power applied to the electrical generator. The track is spiked to ties, as in the construction of an ordinary railway, and the loss of electricity in transmission is not more than five per cent., even when the track is wet. If there is no error in these figures, and we see no reason to suspect them, the economy of the electric railway is established. Its apparent advantages over steam roads are numerous. In the first place, the locomotive is light, comparatively inexpensive, and does not require a fireman or a skilled engineer to run it. The lightness of the locomotive greatly relieves the track, which need not be nearly so strong and heavy for a given service. The wheels of the locomotive can be given any desired traction upon the rails, so that a light engine can pull a train up grades which are entirely impracticable with the ordinary locomotive. The track may therefore follow any ordinary road; and when the road is used purely for freighting, as in conveying ores from mines, the road may run where other roads would be quite impracticable.

For city use, the electric railway promises to be exceptionally useful, both for the conveyance of passengers and for carrying packages. Cars propelled and governed by electricity might supersede horse cars on the surface roads; and, even if no cheaper, the sanitary advantages of the electric road, resulting from the disuse of horses, would be considerable. Indeed, it is not impossible that the city of the future may dispense with horses entirely for general trucking as well as for passenger traffic, the roadways being laid with numerous lines of flat rails transmitting the power required for propelling carriages of every sort. The absence of noise, dust, friction, and the inevitable filth attending the use of horses, promises in the new dynamo-electric period a wonderful mitigation of the present evils of city life. On the elevated roads the lighter electric engines would be comparatively noiseless, and, unlike steam locomotives, would not be constantly pouring into the air sparks, cinders, and other offensive products of combustion; and the same power which propelled the cars would light them.

But, without attempting to forecast the distant future, it is easy to foresee abundant immediate applications of the new, silent, wholesome, and economical method of transmitting and applying energy. The mining regions of the West, as well as our Eastern coal mines, present unlimited opportunities for its employment in hauling ores out of the mines along the mountain ravines and over their precipitous sides. The experiment of plowing by electricity transmitted from a central generator was tried last year with encouraging success. The same plant would answer for the operation of cultivators and harvesters; and with a light, movable railway track, the same power would suffice to do the heavy hauling incident to farm work; and one of the great advantages of electric carriage would be shown here, as elsewhere, in the facility with which it can be operated from a distance. The wagon, loaded or empty, would need no driver, and could be trusted alone to pursue an even course between stations. By means of suspended cable-tracks the roughest regions could thus be safely and economically traversed either by small passenger cars, mail bags, or freight carriers; and the constant flow of evenly distributed small loads along such a line would aggregate as large a tonnage as is now transported over solid and costly roads in long but widely separated trains.

We have already experienced in the telegraph and the telephone the advantages of electricity as a carrier of thoughts and sounds. Who can tell but, when its capacities as a carrier of men and things have been fully developed, the electric telegraph and the telephone will be eclipsed in scope and utility by the electric road? Its possibilities are infinite; and it is the disposition of the men of these days to crowd the possible in every direction.

DEEP MINES IN NEVADA.

The depth attained is as follows: The Utah 1,980 feet, the Sierra Nevada 2,500, the Union Consolidated, Mexican, and Ophir, each 2,500, Consolidated Virginia and California 3,300 each. Best and Belcher 2,000, Gould and Curry 2,200, Hale and Norcross and Savage 2,400, Chollar 2,400, Ward vertical shaft, 2,168, Combination shaft 2,440, Yellow Jacket 3,000, Belcher 3,000, Crown Point 2,800, Overman and Caledonia each 1,900, Alta and Benton each 1,950, Silver Hill 1,300, Consolidated Imperial 2,800, Bullion 2,300 feet.

FOOD ADULTERATION.

The Chicago *Inter-Ocean* introduces an official report of an examination of the vinegar sold in that city, with the startling headlines: "*Adulterated Vinegar. Results of Analyses of Twenty-four Samples by the Health Department Chemist. Discovery of Foreign and Unwholesome Ingredients Wholly Unfit for Food.*"

Nothing short of wholesale and dangerous adulterations could be looked for under such a heading; an expectation, we are happy to say, not at all justified by the report which it covered. After a number of preliminary statements with regard to the specific gravity, color, odor, etc., of vinegar, the chemist says:

"Vinegar should contain at least three per cent. of acetic acid. Three samples, Nos. 9, 10, and 22, do not come up to this standard, and should therefore be looked upon as adulterated.

"Here, again, I find sample No. 22 has been adulterated by the addition of hydrochloric (muriatic) acid, and its use should not be permitted. The vegetable acids, as I have termed them, are not necessarily hurtful.

"The examination for the poisonous metals, lead and copper, was made in the acid solution of the ash of the vinegar. It has been exceedingly carefully conducted, as it is well known that the habitual use of any food or drink, containing even very minute quantities of these metals, has a very deleterious effect upon the human system. Sample No. 17 is the only one containing a dangerous metal, namely, copper, and its sale should at once be prevented.

"Looking at these samples of vinegar as a whole, they are very good, and will compare very favorably with the general run of vinegars. No objection can be taken to any but those that I have already individually mentioned, namely, Nos., 9, 10, 22, and 17."

That there should be four objectionable samples of vinegar out of twenty-four, is certainly to be deplored; still more that one of the four should contain a trace of copper, due probably to the use of improper utensils in making or handling the vinegar. But is it not even more deplorable that a reputable newspaper will cater to popular ignorance and prejudice, and intensify them, by such misleading displays of lying type?

We are much inclined to believe that, in the majority of cases, the general adulteration of food-stuffs by grocers and manufacturers, as charged by certain uncritical writers, will be found to rest upon as small a basis of fact as the *Inter-Ocean's* alleged "war upon vinegar venders" by the Chicago Board of Health.

THE AMERICAN CHEMICAL SOCIETY.

The May Conversazione of the society was held at the University building, Washington Square, on Thursday evening, May 20. Among a number of very interesting exhibits, the following are worthy of notice:

Dr. Arno Behr exhibited a solution of copper sulphate, containing an abundant growth of filamentous fungi. This solution contained about three and a half per cent of ordinary pure copper sulphate; and the fact that copper salts are usually considered inimical to living organisms makes this exhibit interesting.

The same gentleman also exhibited a remarkable leather-like deposit found in a dust flue of a sugar refinery. It was made up of layers of filamentous tissue, and was probably formed by the growth of fungi, which exude a kind of glue-like material that cements the various layers together. This material was quite tough, like thin leather, and of a nut-brown color. It often occurs covering a surface several feet in area, and has the appearance of a coat of paint.

Some black scale from the interior of the retorts used in making bone-black was also exhibited by Dr. Behr. This material appears to eat into, and, finally, through the retorts, making it necessary to replace them occasionally. It consists of some carbon, together with sulphide of iron, and appears to act by giving up its sulphur to the metallic iron of the retort, becoming reduced to a lower sulphide, which in turn acquires new sulphur from the sulphates in the bones burnt, and also from the albumen which they contain.

A filter-press of Wyelin & Hubner, to be used in laboratory experiments, was also exhibited by Dr. Behr. It consisted of a filter-press with Montejus' attachment; which latter is simply a large vessel to hold the liquid to be filtered. The liquid is forced from the bottom of this vessel by means of compressed air, from the pump attached, acting on its surface.

In answer to a question as to the kind of industries in which these presses were used, it was stated that they could be adapted to every conceivable want, and that they were now being used in the United States to filter beer.

Dr. Behr said that the advantage of this press with the Montejus' attachment was that the flow of liquid through the press was steady; while by using the simple pump press without Montejus' attachment the intermittent action of the pump often caused a turbidity in the filtrate.

A specimen of the new metal gallium made by the discoverer Lecoq de Boisbaudran was exhibited by Dr. C. T. Chandler. It was only a few millimeters square, but was interesting as the first specimen seen in this country. It is a hard white metal, melting at the heat of the hand.

Dr. Chandler also exhibited a specimen of naphthaline taken from the main leading from the retorts to the gasometer of the Municipal Gaslight Company. This company makes gas by passing steam over red-hot anthracite coal, and the resulting mixture of carbonic oxide and hydrogen is carbureted by passing it through petroleum naphtha, and then through red-hot retorts again. The naphthaline deposit exhibited shows the conversion of the hydrocarbons of the paraffin series into those of the aromatic series by heat.

Prof. A. R. Leeds, of the Stevens Institute, exhibited a beautiful piece of glass work by Prof. Richards, of the Massachusetts Institute of Technology. It consisted of a very ingenious regulator, to maintain a constant temperature in a hot-air oven for laboratories. It was made entirely of glass, and much admired for its fine finish. Dr. Leeds said that this apparatus worked very satisfactorily.

ARTHUR H. ELLIOTT,
Recording Secretary.

OYSTERS AT QUINNIPIAC.

The original purchasers of the territory of New Haven County, Conn., found a tribe of Indians on the ground called Quinnipiacs. In selling to the English they still retained their rights to fishing and hunting. The river Quinnipiac, which is the eastern boundary of the city of New Haven, had long since been a famous place for oysters. These bivalves were also abundant along the shores east and west of New Haven. The Indians had depended much upon them for food. The new settlers did the same also. The banks along the shore are lined, several feet deep, with shells left by many generations of oyster eaters.

The shore at Fair Haven, which is the eastern part of New Haven, was once a favorite resort for seals. To the excited imagination of the first white settlers these aquatic beasts seemed like "dragons," hence they named the locality "Dragon," a title it long held. The present name is explained in a letter written by Rev. John Davenport, first minister at New Haven, to Lady Mary Vere, in England, in 1639. "After ye ship came in, guided by God's own hand, ye sight of ye harbor did so please ye captain of ye ship and all ye passengers, that he called it the Fayre Haven."

For nearly two hundred years the dependence of the people seeking this shore of Long Island Sound with its bays and estuaries for oysters, was upon the natural supplies. These seemed inexhaustible, as the habits of use then were. The Indians who came from the interior at certain seasons and remained for weeks, living mainly upon shell and other fish, carried none away with them. The whites only visited the shores for an occasional "salting." No restraints were imposed by the towns until about one hundred years ago. Then, and for many years, the restraint was only upon certain very accessible localities and for certain months.

As most of the oysters gathered were taken from ground left bare at low water, or in very shallow water, no special ingenuity or skill was called out in obtaining them. It being found that these shallow water beds were unreliable, deeper water was sought after a while. Cold weather often killed the oysters left bare by winter tides. Storms covered them with sand. Moreover, increasing numbers of people seeking oysters soon cleaned the beds that were so easy of access. Then invention and mechanical skill were active in contriving rakes, boats, etc., to enable the oystermen to secure a supply. It would greatly interest the archæologists to visit one of these shores and note the specimens of contrivance and art to facilitate the taking of bivalves.

One of the results of an increasing love of oysters was the growth of a class who sought a livelihood by selling as well as catching these shell-fish. Hence a business began to be developed. But there were no private grounds. The various natural beds were open to all persons in the State who wished to take oysters therefrom. The only restriction put upon the people was the reserving of several months as "close" months each year, during which no oysters could be caught. These were the summer months, when the bivalves were known to be giving off their spawn.

The "law was off," as the expression was, about November 1st. In anticipation of that time great preparations were made in the towns along the shore, and even for twenty miles back from the seaside. Boats and rakes, and baskets and bags were put in order. The day before large numbers of wagons came toward the shore from the back country, bringing hundreds of men with their utensils. Among these were not unfrequently seen boats borne on the rigging of a hay cart, ready to be launched on the expected morning. It was a time of great excitement. So eager were men to be first on the ground that many could not wait till morning dawned. As soon as the clock tolled the midnight hour a great number of men rushed to the shore and into the boats and began operations. In a few hours the crowd was such, on some beds, that the boats were pressed close together. They were all compelled to move along as one, for none could resist the pressure of the multitude. The more thickly covered beds were quickly cleaned of their bivalves. The boats were full, the wagons were full, and many had secured what they called their "winter's stock" before the day was done. Those living on the shore usually secured the cream of the year's crop. They knew just where to go, they were better practiced in handling boats, rakes, etc.; they formed combinations to help one another.

That first day was the great day. It presented an exciting scene. Often crowds of spectators came to look on, as at a fair or Fourth of July parade. Sometimes in the pushing, crowding, and eagerness of getting there, would result wrangles, and even fights; but generally the men kept good-natured and made the best of all the discomforts and hardships of the day's crabble. The oysters were very poor then compared with what are now obtained. Such indiscriminating raking caught them before they were half grown Nor were there many to be caught after that first day. In a week or two later a bushel of oysters could not be bought for less than four dollars.

It was apparent to thoughtful minds that a new policy must be pursued if the people were to continue to have oysters. There were fitful gleams of hope as new beds were occasionally discovered. But the same process of speedy exhaustion followed. Some tried to preserve what they had obtained until they grew larger by laying them down again. But all oysters found in the water were treated as common property. Whoever found them felt free to help himself. Two young men having gathered a few hundred bushels, spread them on the flats near where they lived at West Haven. They tended them carefully, hoping to realize quite a sum as a reward. Just as they were bargaining to sell them a plot was carried out thus: Several parties came from ten miles in the country, by night, with rakes, baskets, and wagons, and carried the oysters all away. When the owners sought their property in the morning it was far on the road to the cellars of certain persons in Woodbridge and North Orange.

For thirty years past efforts have been persistently made to enable men to own ground under water, that they might preserve and grow oysters. Considerable progress has been made through both legislative and town acts. But it has been a slow and difficult process. People have been very reluctant to grant to individuals what they felt should be reserved for all. The towns of New Haven County and the State of Connecticut are at present most forward in measures for encouraging oyster farms under their waters.

The Quinnipiac River, New Haven Harbor, and the waters adjacent have for some years been all assigned to private parties.

The first use made of such grounds was to lay down oysters brought from other waters, especially Southern bays. A very large trade grew up in Virginia and Maryland oysters, brought to Fair Haven to be opened and sold over the New England and other Northern States. For some late years as many as one million bushels have been brought annually to this place from the South. Such oysters are greatly improved by even a few weeks' feeding in the waters of our bays and river mouths.

Formerly these oysters were sent around to private houses to be opened. Different members of the family, men, women, and children engaged in this work. A large part of the rapidly growing population found remunerative employment in this way. In later years shops have been built along the shores, in which this work is done. Still later, many oysters are opened on the Southern shore before being brought North. These opened bivalves were first put up in small wooden kegs, holding from one to two gallons each. They were shipped to different parts by railroad or stage or private teams. Before the building of the New York and New Haven Railroad the dealers sent large teams, drawn by two and four horses, loaded with these little barrels of oysters, as far west and north as Albany, N. Y. Of course this could be done only in the colder months. While still using the same means of packing, other forms have been introduced. The most common receptacle now is a strongly made tub, with a lid which securely fastens. Each, containing a number of gallons, is furnished with handles, with which it can be easily lifted. In warm weather ice is put in with the oysters. Tin cans are used to a considerable extent. These are filled and soldered, then packed in wooden boxes with ice between. Thus, as with the tubs, oysters are carried long distances in good condition even in summer. Several ingenious contrivances have been patented that are in use to pack, fasten, carry, and preserve this widely popular article of food. An extensive tub, barrel, and pail making business is carried on in Fair Haven itself.

Perhaps the most important changes and improvements are now being made. Necessity has compelled the oysterman to learn many things. As in nearly everything besides, it is found that natural sources of supply are not adequate to the increasing demand. Hence the great attention is directed to the duty of artificial production. The oyster is wonderfully prolific. Each mother sends out millions of her young every season. How to secure this increase from destruction, that it may grow to be useful, is now the study. This involves the necessity of having suitable ground on which the young will "set," can be protected from enemies in the water and out of it, and still be within reach of the cultivator. The old methods have mostly "had their day." The conclusion reached is: that cultivation must be the great resource; it needs deep water for assured success, and it must have the aid of steam power. All these results are being successfully worked out in the Fair Haven oyster industry. There are serious natural obstacles, and some artificial. Among the latter I would name injudicious, because hasty, legislation. This hinders instead of fostering enterprise. But as our citizens become more satisfied of the value of this means of food supply that obstacle will disappear.

Among the natural I would name, first, *the expense.* A deep water planter must have a large amount of land; he must employ steam power; he must have a number of helpers; he must have a large market; he will be especially exposed to the ravages of "five fingers," "drills," and other vermin which are liable to assail oyster beds; he must try some expensive experiments; he will be in danger of spending much upon ground that after all may prove unsuitable.

Formerly, when there were natural sources of supply, any man with a boat and rake could start a business. Many men beginning thus have attained a comfortable competence. Now, there is not this opportunity. One must first secure a piece of ground. He must then cover it with shells, and wait for a "set." It will then be three or four years before his oysters will have grown large enough for market. Shells that once could be had for the carting must now be bought.

Oyster spawn when thrown off by the mother soon seeks some clean shell or gravel on which to fasten or "set." This is why new ground needs to be covered with clean shells or stones. Oyster spawn will not "set" on mud or muddy, dirty, or greasy matter, even if on shells. Hence shells are much in demand for preparing new ground. Shell lime has become more costly, because shells have risen in price. Once they cost the lime makers nothing.

All shell-fish are improved by an infusion of fresh water. This explains the superiority of the shell-fish of the northern coast of Long Island Sound to those on the southern coast of the same water. Many fresh water streams flow in from the north; none flow in from the south.

Oysters brought from the South, or from the deep waters of the Sound are usually quite salt, and should spend a few days in fresher water to be in good condition. Cultivators now have "floats," which are rafts of timber, in which they place their oyster near or within the mouth of some river for a short time before using. One reason of the fine flavor of Fair Haven oysters is the flow of fresh water from the Quinnipiac, Mill, and West rivers.

Changing oysters from their place of "setting," in a year or two, benefits them. They have more room and take a better shape.

Cultivation has greatly increased the supply of good oysters. In New Haven, ten years ago, it was difficult to secure ten bushels at short notice. Now five hundred bushels can be obtained in a few hours.

Two causes are giving cultivation here a new inspiration: the recent laws in Virginia and Maryland, which are likely to greatly diminish the supplies from the South, and the great call for seed oysters to be taken to Europe.

Science is giving much assistance toward understanding the nature, habits, needs, and possibilities of the oyster as a means of food supply. It has also greatly facilitated the invention and construction of machinery for the prosecution of the oyster trade. Prof. Verrill, of the Peabody Institute in New Haven, has done good service to the cultivators in this vicinity as well as elsewhere. All feel that the business is only in its infancy as yet.

The Human Retina.

In a recent note to the Vienna Academy, Herr Salzer offers an estimate (based on numeration) of the probable number of optic nerve fibers and of retinal cones in a human eye. The number of the former he supposes to be about 438,000, that of the latter 3,360,000. This gives seven or eight cones for each nerve fiber, supposing all fibers of the optic nerves to be connected with cones, and equally distributed among them.