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Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 448,

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CONDITIONS OF LIFE IN THE DEPTHS OF THE SEA.

One of the most striking of recent scientific explorations is that undertaken by the Travailleur and the Talisman, conducted by M. Milne Edwards and other savants chosen by the Government and Academy of France. The fact which attracts attention on reading the narrative of these interesting dredgings is that the ocean appears to have two superimposed faunas. At the surface we encounter all the species that we know at present; they live at this point in a limited area, but at 2,500 to 3,000 meters below (8,188 to 9,825 feet), we meet individuals more and more rare, according as we descend. Beneath we find an abyssal fauna composed of singular creatures which never rise, and are seldom encountered lower down than 3,000 to 4,000 meters. The ocean thus seems to contain two regions, one over the other, and both characterized by a peculiar fauna.

The question arises, What result might we expect if the inhabitants of either zone were transported into the conditions and home of their neighbors? We know already that the animals of the very great depths reach the surface dead, and that their tissues are soft, friable, and readily torn. The reverse of this, though easily experimented upon, has not as yet been examined, viz., the removal of a surface form to the great depths. In view of this possible inquiry, M. Regnard has made some interesting experiments in his laboratory on this subject. He has utilized an apparatus furnished to him by MM. Cailletet and Ducretet, which permitted him to obtain a pressure of more than 1,000 atmospheres, corresponding to a marine depth of more than 10,000 meters, and he has subjected to varying pressures numerous forms of life.

In a tube provided with a capillary opening he first placed examples of ferments, for example, the yeast of beer, and suddenly increased its pressure to that of 600 to 1,000 atmospheres. It was left in this condition some hours and was then withdrawn. The ferment was then introduced into a glass with sugared water at a proper temperature. For more than an hour it remained inactive, but at the end of that time it revived, and started its normal action. The ferment was then taken, reintroduced in the apparatus with grape sugar, and subjected to a pressure of 600 to 700 atmospheres. The ferment under the normal atmospheric pressure began its work in less than a quarter of an hour, but that under pressure remained dead and inert. But released from its excessive pressure, it resumed its ordinary functions.

Thus the great pressures of the ocean depths induce inaction if not death in the unicellular organisms of the surface, and in fact the naturalists of the Talisman have never brought to the surface any substances in process of fermentation or decomposition. But soluble ferments are unaffected by these high pressures. Thus cooked albumen mingled with saliva was put under 1,000 atmospheres, and all the albumen was converted into sugar. This might have been anticipated, as otherwise all the beings of the great depths would have different physiological natures from our own.

Plants followed in these experiments the ferments. It is known that below 60 meters they are scarcely found. There is no abyssal flora. Sea weeds were put under pressure, and then exposed to the sun. They slowly evolved oxygen, then died, and fell to pieces in some hours. Some seeds, under 1,000 atmospheres, remained torpid a week after being released, then began to germinate, while others not put under pressure had in two days thrown out their cotyledons.

The same phenomenon is noticed with the infusoria. Under 600 atmospheres pressure the creatures, subjected to this excessive pressure, of all species fall to the bottom of the experimental tube, and others, upon liberation, scarcely move over the surface of the microscope slide. But in a short time they resume their vitality. Mollusks submitted to great pressure act in the same way as do annelids and crustaceans. Death ensues in all these instances upon a too prolonged exposure to these enormous pressures.

As regards the higher vertebrate forms, the experiments assume a more interesting character. A golden cyprin was subjected to a pressure of 100 atmospheres (1,500 pounds to the square inch), the precaution being first taken of emptying its swimming bladder under an air pump, as excessive pressure would have forced the contents of the bladder into the blood, and these again suddenly disengaged, upon the removal of the pressure, would have killed the subject.

Under 100 atmospheres the fish did not seem incommoded; under 200 it came out a little stunned, but soon revived. Under 300 atmospheres it was dead or dying, and under 400 atmospheres, corresponding to more than 4,000 meters (13,000 feet) in depth, it was dead and absolutely rigid.

The fish of the surface may penetrate the depths of the ocean as low as 6,550 to 8,188 feet, but beyond that death must follow their migration. One remarkable feature was noted in the case of these dead fish—the extreme rigidity of the muscle. In order to better examine this matter, the thighs of frogs were submitted to different pressures, and at 400 atmospheres the rigidity was so extreme that it was easier to break the frog in two than to bend its members. This rigidity, assumed almost instantly, persisted up to the moment of putrefaction.

With the frog at 100 atmospheres, the contractility and excitability of the muscle are not sensibly diminished. At 200 atmospheres there is a slight decrease in these functions; at 300 atmospheres the nerve is scarcely excited; and at 400 there is a complete disappearance of any sensitivity.

On examining this closer, it was found that the parts subjected to pressure had increased in weight. The paws of the frogs, which weighed 15 grammes, weighed 17 after five minutes' pressure under 600 atmospheres.

The question arises, Was there penetration of the water into the muscle, or was there a chemical hydration? And this singular result is exactly the reverse of what is observed when the inhabitants of the deep sea are brought to the surface. Whereas the surface animals become dense and rigid under the abnormal pressures encountered in the abysses of the sea, the denizens of these latter are rendered soft, friable, and excessively flaccid. These investigations are being pushed further, and cannot fail to attract attention.

FROM BROADWAY TO THE FERRIES.

More than one hundred thousand persons cross the North and East Rivers every day from Brooklyn, Jersey City, and Hoboken to New York, on the different lines of ferry boats.

All the streets fronting the rivers and those streets which afford approach to the docks and piers are thronged with trucks, market wagons, horse cars, etc., to a degree which renders the approaches to the ferry houses sometimes almost impossible for pedestrians.

The public markets are located in the vicinity of a number of the ferry landings, and early in the morning the market wagons with their stock of meat, vegetables, fruits, hay, etc., add to the crowd of other vehicles on these river streets, and increase the obstruction at the crossings.

Another serious evil is the filthy condition of the streets which border the river front, and also those upon which the vegetable and fruit markets are located, with barrels full of rubbish all along the curb, and with the gutters stopped and dammed with refuse and decaying fruit and vegetables. After a rain the accumulation of mud renders the streets so sticky in some places and slippery in others, that walking becomes very difficult, even after a policeman has made a passageway for the pedestrian between the carts, market wagons, and trucks.

There are a great many men doing business in New York who reside a portion or the entire year on Long Island and in New Jersey, and their universal complaint is the difficulty of getting from the ferry terminus, across the river streets, to their places of business, and back to the ferry again.

It is not an uncommon remark that "I do not mind traveling by rail twenty or thirty miles every day between my home and place of business, but the mud at the crossings, and the crowd of vehicles blocking up the streets around the ferry, is the great drawback," and to those going back and forth daily this is no doubt the most objectionable part of the journey.

How to obviate the difficulties above set forth is a problem which must be sooner or later solved. Why our enterprising capitalists have not undertaken some measures before this for accomplishing it, is hard to understand. It would not seem to be a difficult matter to do.

Among other plans it has been suggested that a balcony wide enough for foot passengers might be constructed along the second story of the warehouses, fronting each side of the streets leading from the ferries to Broadway, and extend bridges across the transverse streets. By this plan the second story of the buildings might be as available for retail stores and more convenient for offices than the ground floor of the stores as now constructed.

But it is somewhat doubtful if all the owners of the buildings on the streets would consent to such an innovation. We believe, however, that if such a scheme could be carried out, the value of the property along such thoroughfares would be enhanced, and the benefit to the public would be very great.

On another page of this issue we reproduce from a recent number of the SCIENTIFIC AMERICAN SUPPLEMENT a view of an elevator and iron bridge recently constructed in the suburbs of the city of Stockholm, the capital of Sweden. The grades from our water fronts to Broadway are not as steep or the distance as great, but an elevator at each of our ferries, with a bridge extending over the streets to intersect with Broadway, something after the plan of the Stockholm elevator and bridge, could easily be constructed and without great cost.

Stairs leading from the intervening streets up to the roadway of the bridge could be readily arranged, for the accommodation of persons doing business on streets between the ferries and Broadway.

Of course it would not be necessary to raise a structure as high as the elevator represented in the illustration, but with a properly constructed tower and broad promenade, and with elevator cars of sufficient size to accommodate a large number of people at a time, a means of communication would be afforded between the ferries and Broadway such as would make the heart of the Jerseyman and Long Islander leap with joy.

Mr. Heath's "Gun Experiments."

Mr. W. McK. Heath emphatically protests against our criticism on his experiments relative to "bursting of gun barrels," in the SCIENTIFIC AMERICAN of May 10. He says he has simply confined himself to observing and stating facts, and has had no theory relative thereto, but only quoted in this connection from a distinguished army officer, his own opinion being that "facts are the great, grand, glorious things, while theories are cheap."