There is not a feature connected with the aërial echoes which cannot be brought out by experiments in the laboratory. I have recently made the following experiment:—A rectangle, 22 inches by 12, is crossed by 23 brass tubes, each having a slit along it from which gas can issue. In this way, 23 low, flat flames are obtained. A sounding reed, fixed in a short tube, is placed at one end of the rectangle, and a sensitive flame at some distance beyond the other end. When the reed sounds, the flame in front of it is violently agitated, and roars boisterously. Turning on the gas, and lighting it as it issues from the slits, the air above the flames becomes so heterogeneous that the sensitive flame is instantly stilled by the aërial reflection, rising from a height of 6 inches to a height of 18 inches. Here we have the acoustic opacity of the air in front of the South Foreland strikingly imitated. Turning off the gas, and removing the sensitive flame to some distance behind the reed, it burns there tranquilly, though the reed may be sounding. Again lighting the gas as it issues from the brass tubes, the sound reflected from the heterogeneous air throws the sensitive flame into violent agitation. Here we have imitated the aërial echoes heard when standing behind the syren-trumpets at the South Foreland. The experiment is extremely simple, and in the highest degree impressive.

March 28, 1878.

Sir JOSEPH HOOKER, K.C.S.I., President, in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

Notice was given that the name of Dr. Radcliffe had been withdrawn from the list of Candidates for the Fellowship.

The following Papers were read:—

I. "On Putrescent Organic Matter in Potable Water. II." By GUSTAV BISCHOF. Received February 18, 1878. Communicated by E. FRANKLAND, F.R.S.

Referring to the paper which I communicated to the Royal Society last session*, I have to add, that after passing water continuously for six weeks through one of the vessels there described, filled with spongy

* "Proceedings," vol. xxvi, p. 152.

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iron, and on the bottom of which meat had been placed, the latter was still in a perfectly fresh and hard condition.

This result encouraged me to try in a similar way the action of spongy iron upon hay infusion. The hay, steeped in water, was heated for two days to about 35° C. The infusion then showed, under the microscope, an abundance of organic life. I could not obviously test the action of spongy iron upon this infusion, in the manner described in my last paper, namely, by passing it continuously for weeks through a vessel containing spongy iron and meat. However, I believe the result will be considered equally conclusive as to the absence of any putrefactive agents in hay infusion after filtration through spongy iron, should the meat remain fresh on being immersed in the filtered liquid for several weeks.

The following arrangement was adopted:—

A large vessel was filled with the ordinary filtering materials employed in spongy iron filters, namely, commencing at the bottom, with gravel, sand, pyrolusite, and spongy iron. The three first materials were introduced to prevent the filtered solution containing any iron. The vessel was provided with a neck at the bottom, and a volume of the hay infusion, equal to the bulk of spongy iron in the filter, was passed through it every 45 minutes.

Into the neck of the vessel I fixed some tin tubing by means of an india-rubber stopper. The tubing was connected with six tins, or cylindrical vessels of tin-plate, holding about 500 cub. centims. each. After placing a piece of fresh meat in each tin, a lid was soldered on air-tight. The tubing was so arranged, that the inlet tube passed to the bottom of each tin, an exit tube carrying the water off from the top. By first pressing the tubing together, and then cutting it, all the tins could be readily separated without exposure to air. Each tin was provided on the top with a short piece of tubing, to serve later on for the escape of steam.

In order to wash the apparatus and materials, I passed, in the first instance, water of the New River Company continuously through them for 24 hours. The tins and contents were then immersed for two hours in boiling water to destroy any putrefactive germs adhering to the meat. After closing the tubing, which served during boiling for the escape of steam, the tins were cooled, and then the filtration of New River water continued for two more hours.

The last two tins, which, it will be understood, contained filtered water and meat, were now detached, and into one of them I passed 100 cub. centims. of filtered air, after connecting under alcohol with a glass tube, 6 feet long, containing compressed cotton wool, through which the air was forced. These two tins were kept for comparison with those in which the meat was to remain in contact with filtered hay infusion. The infusion was passed for six hours through the

apparatus, including the remaining four tins. These being then also detached, 100 cub. centims. each of filtered air were passed as before into two of the tins.

On opening the tins, which contained filtered water, the one with, the other without filtered air, the meat was, after four to five weeks' standing, found to be quite fresh. Nevertheless, when, after some time, a drop adhering to the meat was examined under the microscope, moving organisms were detected.

The tins which contained meat and the filtered hay infusion gave similar results. One pair of the tins, the one with, the other without filtered air, was opened after nine weeks, and the other after nine months' standing. In both cases the meat remained fresh.

The hay infusion after filtration had a peculiar smell, reminding me of some kinds of cheese. This obviously imparted to the meat a similar smell, which, however, was quite distinct from that of putrid meat. After the samples of meat had been standing for 24 hours, the smell decreased considerably, and the following day it was hardly perceptible. Between the third and sixth day the several samples exhibited gradually the characteristic smell of putrid meat; those samples which did not contain filtered air resisting putrescence, apparently, longer than the others. The filtered hay infusion, which had not been in contact with meat, had, after several months' standing still, the same peculiar smell.

The conclusions which I drew in my last paper as to the antiseptic properties of spongy iron upon putrefactive agents in ordinary water apply therefore equally to hay infusion. However, those samples to which filtered air had been supplied, prove more conclusively than my experiments last year that the bacteria, or their germs, are not revived when supplied with oxygen after the filtration. This, in my opinion, is a result of some importance, as it demonstrates that, by filtration through spongy iron, putrefaction of organic matter is not only suspended for a time, but that it ceases entirely until reinstated by some putrefactive agent foreign to the water.

Since communicating my last paper, I have also continued the inquiry, how the peculiar action of spongy iron upon organic matter is to be explained. If a rod be inserted into a body of spongy iron, which has been in contact with water for some time, gas bubbles are seen to escape. This gas is sometimes explosive, sometimes not. I collected a quantity of the gas from two different filters, one of which had been in constant operation with ordinary water for ten months. It was free from any carbonic anhydride, but contained carbon and hydrogen. The hydrogen obviously results from the decomposition of water by spongy iron. The carbon might be due to the decomposition of carbonaceous organic matter, or it might be produced similarly to the carbo-hydrogen obtained, when dissolving ordinary iron by an acid.

To decide which of these explanations is correct, a vessel was filled with spongy iron and distilled water, the air being expelled from the former as far as practicable. After three months' standing, I analyzed the gas, collected as before by inserting a rod into the spongy iron. I found that it neither contained hydrogen nor carbon, therefore most probably consisted only of atmospheric nitrogen. This appears to indicate that the carbon, which was obtained in the previous experiment, is actually the result of the decomposition of organic matter.

The connexion between disease and impure water, more especially if it be contaminated by putrescent organic matter, has been strongly urged by various authorities, such as Drs. Buchanan, Frankland, Sanderson, Simon, Tyndall, and others. This has led me to attach such importance to the demonstration that "living ferments" are absent from polluted water after filtration through spongy iron. Analytical figures, in their turn, have proved that even Thames water can by filtration through this material be made, chemically speaking, purer than some of the best deep well waters. As the latter are mostly more or less supplied by polluted surface water, which is purified by filtration in passing downwards, there is no reason why they should be preferred to artificially filtered water, provided the physiological character of both proves to be alike. This inquiry is at the present moment being officially instituted in several countries. Trustworthy evidence in the form of actual experience may thus ere long be expected to settle the final question, whether and how far the artificial purification of impure water by spongy iron can be considered a safeguard against the propagation of disease.

II. "On the Modifications of the Simple and Compound Eyes of Insects." By B. THOMPSON LOWNE, F.R.C.S., Lecturer on Physiology at the Middlesex Hospital Medical School, Arris and Gale Lecturer on Anatomy and Physiology in the Royal College of Surgeons. Communicated by Professor FLOWER, F.R.S. Received February 27, 1878.

(Abstract.)

The simple eyes of insects have been so accurately described by previous observers, that little need be said on their structure. I have described the simple eye of *Eristalis*, chiefly for comparison with the compound and aggregate eyes. The close relation of the recipient rods to the inner surface of the cornea in this insect is most noteworthy, since, combined with the great convexity of the cornea and the highly refractive nature of the rods themselves, this renders the formation of an optical picture impossible. These facts with the small