HAECKEL ON INFUSORIA

IN this communication* Prof. Haeckel discusses the different views which have been entertained as to the structure of the Infusoria, and adopts that of Prof. Siebold, that they are unicellular. This constitutes in his opinion a fundamental distinction betweent hem and the rest of the animal kingdom, although, strictly speaking, some species, as for instance, *Loxodes rostrum*, and *Enchelys gigas*, have more than one nucleus, and must, therefore, be regarded as physiologically consisting of more than one cell. Prof. Haeckel, however, does not attach much importance to these exceptional cases, because the multiplication of the nuclei involves little change of organisation in other respects.

The difficulty of conceiving a single cell with such complex properties becomes lessened, if we remember the nerve-cells of the higher animals, the thread-cells of many Acalephæ.

Considering, then, that the true Infusoria are unicellular, as first maintained by Prof. Siebold in 1845, Prof. Haeckel denies that they have any near connection with either Cœlenterata or the worms. In all the higher groups of the animal kingdom the organism is multicellular, and develops itself from the original egg-cell by the characteristic process of segmentation, and the cellular mass thus formed differentiates itself into two epithelial layers, from the inner one of which the digestive canal, with all its appendages, develops itself; while from the outer layer are formed the skin, nervous system, &c. In his monograph of the Calcareous Sponges, Prof. Haeckel has developed his views of the relations of these two primary layers in the principal groups of animals, and from this fundamental homology has enunciated the theory of a common original form, which he proposed to call "Gastraea," and from which all the higher forms of animals are derived. This theory, which he calls the Gastræa theory, is based upon the consideration that all the six higher animal classes, from the sponges to the lowest vertebrates, pass through a similar stage of development, which he proposes to call the Gastrula stage, and which he considers to be the most important and instructive embryonal form of the animal kingdom. In the calcareous sponges, for instance, this Gastrula law forms a simple generally egg-shaped body, surrounding an ample hollow, the primitive stomach, or digestive cavity, and with an orifice at one end, the primitive mouth. The wall of the digestive cavity consists of two layers, the entoderm, and the ectoderm, which, as Prof. Huxley was the first to point out, are homologous with the outer and inner layers of the vertebrate embryo. Similar larvæ occur in other sponges, and in many zoophytes, while as examples of embryonal forms in other groups he refers to the researches of Kowalevsky in Phoronis, Sagitta, Euaxes, Ascidia, &c.; and of Ray Lankester in Mollusca. He considers that the larval forms of Arthropods can be reduced to the same type; and finally that the researches of Kowalevsky have shown that the same is the case with the lowest vertebrata (Amphioxus). The Infusoria, on the contrary, have no yolk-segmentation, no blastoderm, and consequently nothing which corresponds to the Gastrula stage, nor any homologue of the digestive cavity of other animals. The resemblance of many ciliated larvæ to the Infusoria is therefore merely superficial, the latter being unicellular, the latter multicellular. He regards this difference as so fundamental that he proposes to divide the animal kingdom into two great groups, the Protozoa, and the Metazoa, Blastozoa, or Gastrozoa. The Metazoa, to use his first name, he again divides into two; the Zoophytes, or Cœlenterata on one side, and the Worms, from which again the Molluscs, Echinoderms, Arthropods, and Vertebrates have sprung, on the other.

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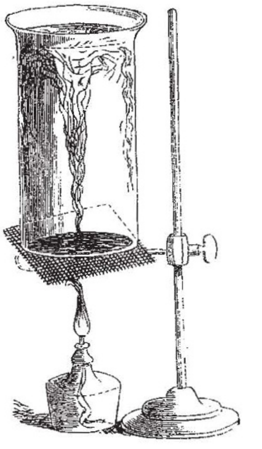
A LECTURE EXPERIMENT

THE ordinary experiment described in books for demonstrating the heating of a body of fluid by convection currents consists in throwing bran into a vessel of water, to the bottom of which a source of heat is afterwards applied. Mr. Clowes's experiment, given in NATURE, vol. ix. p. 162, is no doubt more effective. I have, however, found that the ordinary experiment admits of being made quite satisfactory for the purpose of clear demonstration, and the hint may be useful to those to whom it has not already occurred.

Take a large beaker filled with water, and introduce down to the bottom the end of a burette filled with a strong indigo solution and closed at the top by the finger. If necessary, the solution may be driven out by the application of the mouth to the other end, and gently blowing. The burette must be carefully withdrawn without producing upward currents; this can be easily managed with a little care. The dark fluid now lies at the bottom of the clear water, with which, during a time sufficient



for the experiment, it does not appreciably mix. But when a spirit lamp is applied it rises in slender streams, which can be rendered very visible by placing a sheet of white paper behind the beaker. W. T. T. D.

A SCIENCE LECTURE AT THE CHARTERHOUSE

A LECTURE on one who was once a Brother of the Charterhouse, and who laid the foundations of scientific electricity, could not fail to be of interest when delivered within the walls of that building, where indeed many of the experiments of the original investigator in question were conducted. This pleasant duty devolved on Dr. Richardson on Thursday, January 22, when he gave to the brethren of the Charterhouse, and to many eminent friends, an experimental demonstration of the work of the early electrician, Stephen Gray.

The lecturer opened his discourse with an exposition of the personal history of Mr. Gray; of this, he said, he could gather little. He discovered Gray first at Canterbury, in 1692, making an observation of a mock sun, in the afternoon of February 6. At this time Gray was evidently engaged on physical and astronomical research. In 1696 he was busy constructing a water microscope; in 1698 he was engaged making a microscope with a micrometer for measuring the height of mercury in the barometer more exactly; in 1699, on April 7, between 4 P.M. and 5 P.M., he was observing an unusual parhelion and a halo; in 1701 he was studying the fossils of Reculver

Cliff and inventing a method for drawing the meridian line by the Pole star and finding the hour by the same; in 1703, on June 15, 16, and 18, he was making some observations on spots on the sun; and in 1706, on May 12, in conjunction with Flamstead at Greenwich, Captain Stannyan at Berne, and Mr. Sharp at Bradford, he was taking observations of the great solar eclipse of that day.

From his various reports on these subjects it is clear that Mr. Gray, while at Canterbury, had a good observatory; he had three telescopes, one of which was of 16 ft., an astronomical table, a theodolite, a pendulum clock, and various other instruments, with the use of which he was quite familiar; but what his occupation was, otherwise, there is no record.

We now lose all sight of Gray until 1717, when we find him being recommended to the Charterhouse by Prince George to become a pensioner there. The letter of recommendation is signed by the Prince, but says no more than that the applicant is a proper person to receive the advantage of residence. In 1719 he entered the building as a pensioner and remained there until his death, seventeen years later.

With his entrance into the Charterhouse a new career of scientific research seemed to have opened itself to Mr. Gray. He became an electrician, and, said Dr. Richardson, his experiments led to such extraordinary results that, but for them, electrical science might have waited for centuries, or for ever, in the state in which he found it. That the audience might know upon what pre-existing data Gray proceeded, Dr. Richardson traced back the origin of experimental electricity to the reign of Queen Elizabeth and to her physician, William Gilbert. He reviewed from this source, briefly and succinctly, the labours of Boyle, Otto de Guericke, Wall, Newton, and Hawksbee, introducing a model of Hawksbee's revolving cylinder, and Sir Isaac's simple experiment of making light bodies move between an excited plate of glass and a table.

In 1720 the first electrical work of Mr. Gray saw the light in a paper entitled "An account of some new electrical experiments," which appeared in that year in the Philosophical Transactions. In this paper the communicability from one electrified substance to other substances not previously electrified is described.

From this point in Mr. Gray's career Dr. Richardson traced him step by step through his experimental researches, making each of his (Gray's) experiments a matter of direct demonstration to the audience, and using only the simple kind of instruments the original investigator himself had at command. Thus were demonstrated the experiments of the cork and the excited tube, the ivory ball on the wooden rod, and the pack-thread experiments, by which Gray discovered that electricity could be conducted long distances. Next were demonstrate the famous loop experiments and those with bridges of pack-thread, silk, and wire, by which silk was discovered to be an insulator, and the new fact of insulation was recorded. The audience, at this point, were carried, by description, to the Mansion of Mr. Granville Wheeler, Otterden House, near Faversham, and were shown by a beautifully simple diagram, drawn for the occasion by the distinguished George Cruikshank—how Mr. Gray, putting up poles in Mr. Wheeler's grounds, insulated a pack-thread line on silk supports, and on July 14, 1729, sent by the line a communication through a distance of 650 ft.

Another series of experiments showed how Mr. Gray discovered induction, the conducting power of water and of metals; the fact that electricity arranges itself upon the surfaces of bodies; that attraction will take place *in vacuo;* and that an insulated, pointed iron rod, when electrified by induction, will yield a brush at its extreme point, will charge another insulated conductor, will give a spark to the knuckle when tha is brought near, and will pass through a chain of animal bodies, if they be insulated.

A beautiful experiment with a soap-bubble, showing how, when insulated and charged, it will attract, closed the experimental part of the lecture. The experiments throughout were highly successful, and were so rendered as to be distinctly visible to all the observers.

A few more points in the personal history of Gray were introduced. It was told that he gained the first Copley Medal of the Royal Society in 1731, and the second in 1732, and that he was admitted a Fellow of the Society on March 15 of the latter year. A graphic description was given of a meeting of the Royal Society on November 25, 1731. At this meeting Prince George was present with the Duke of Lorraine, and the Duke was admitted a Fellow. Afterwards a model of a fire-engine, used at York, was exhibited; then Dr. Frobenius lectured on phlogiston, and on the transmutation of phosphorus, using several pounds' worth of that now common element. Finally, the company ascended to the library, where Mr. Gray showed some experiments, proving how electricity travels along conductors, and succeeded well, notwithstanding the largeness of the company.

Two remaining subjects relating to Gray were briefly touched upon. One was his prediction that what he was doing *in minimis* would some day be so extended, that electrical phenomena would be made to resemble those of thunder and lightning; and the other, his belief that he had invented what he called a Planetarium, that is, a method of making a pith-ball suspended by silk move in circles or ellipses round a metallic centre set in a cake of resin, while the resin was excited by friction of the hand. The first of these observations of Gray had been fulfilled; the latter had appeared as an error of the last days of this wonderful man, and might well be forgiven.

The death of Stephen Gray afforded the lecturer an opportunity for a touching description of a man of science struggling to the last with his labours. On February 14, 1735-36, he was visited by Dr. Cromwell Mortimer, the secretary of the Royal Society, who took from his lips the account of the Planetarium by which, "if God spared his life," the electrical philosopher would create, he thought, much astonishment: but the following day, experiment, speculation, and hope, lay alike low in death.

NOTES

THE report which reached England a few days ago of the death of Livingstone, and which Dr. Kirk was able to characterise as possibly unfounded, as it closely resembled a discredited one current in Zanzibar before he left, received important confirmation yesterday morning. We are enabled, however, to state that a letter seems to have come from Lieut. Cameron at Unyanyembe, reporting that a man named Chumas, who was with Livingstone, had arrived there with a circumstantial story of his death, which Lieut. Cameron, with his slight knowledge of Suabili, had to turn into English. It now depends upon the veracity of Chumas, of which at present there is no means of judging. The circumstantiality is nothing, for the tale of the lying Johanna man was quite as detailed. There is, however, we are bound to confess, much reason to fear that we have lost one of the most unselfish, noble, and devoted investigators the century has produced.

THE Council of the Geological Society has awarded the Wollaston Medal for the present year to Prof. Oswald Heer of Zurich, and the balance of the Proceeds of the Wollaston Donation Fund to M. Henri Ngst of Brussels. The Murchison Geological Medal was awarded by the Council to Dr. Bigsby, F.G.S., and the balance of the Proceeds of the Murchison