ZOOLOGY AT THE BRITISH ASSOCIATION.

BY arrangement between the Organising Committees, the presidents of the four biological sections gave their addresses at different hours, so as to make it possible for members to attend two or more. The address in Section D was given at 11.30 on Thursday, and followed Prof. Foster's address to the Physiological Section. After the address in Section D, some of the Reports of Committees were taken, and that of the Naples Zoological Station was most appropriately followed by a short statement, made by Dr. Anton Dohrn himself, as to the Naples Marine Station and its work. Dr. Dohrn dwelt chiefly upon his plans for the development of the station, how far they had been realised, and what still remained to be done. Prof. Ramsay Wright followed with a paper on a proposed lacustrine biological station, in which he gave a preliminary account of the microscopic fauna of the lakes of Ontario, pointed out the bearing of such observations upon problems of pisciculture, and the need of a biological station for the further study of the animals and plants in the great lakes. As a result of this paper, and of the discussion on the subject in Section D, towards the end of the meeting a deputation of biologists, consisting of Lord Lister, Prof. Ramsay Wright, Prof. Miall, Prof. Herdman, Prof. Poulton, Mr. Hoyle, Prof. Prince, and others, were received by the Hon. Mr. Hardie, Premier of Ontario, the Hon. Dr. Ross, Minister of Education, the Treasurer, and other members of the Cabinet, and spoke in favour of the establishment of a fresh-water station by the Government on one of the numerous lakes in the Algonquin National Park. The proposal was very favourably received by the members of the Government present, and the Committee of Section D appointed a Committee, with a grant of 75*l.* for the purpose of assisting in the promotion of the scheme. It may confidently be expected then that as the result of this action in Section D a biological institution of both scientific and practical importance will be permanently established in the province of Ontario.

None of the other reports of committees call for special attention, and the only remaining paper taken on Thursday was Prof. Minot's on the origin of vertebrata. This gave rise to considerable discussion, in which Dr. Dohrn, Prof. Osborn, Dr. Gaskell, Prof. T. Gill, and others took part

Friday, August 20.—The Section opened at 10.30 with an interesting description by Prof. Osborn, of the restoration of *Phenacodus primævus* and of the skeletons and restorations of Tertiary mammalia in the American Museum of Natural History at New York. Prof. Osborn illustrated his remarks by a remarkably fine series of large photographs of the actual fossils and of their artistic restorations executed in water colours by Mr. Charles Knight. Prof. Osborn has had the famous skeleton of *Phenacodus*, originally described by Cope, entirely remounted, with the result that he finds it to be as digitigrade as the tapir, with the hind limbs more powerful than the fore, the tail of great size and the head extremely small. Prof. Herdman then gave an address upon oysters and the oyster question, illustrated by lantern slides, in which he dealt with oyster culture, the connection between oysters and disease, the presence of copper in some oysters, and the nature of the various kinds of greenness which occur in certain oysters. Prof. H. F. Osborn then gave a paper on the origin of mammalia, in which he discussed the evidence as to primitive lines of descent afforded by American Tertiary mammals. He showed that probably none of the forms up to now made known, ought to be regarded as the original stock of the mammalia. The rest of the papers taken on that forenoon dealt with detailed questions of fishes and fisheries, and were :—Prof. Prince's description of specimens of sea trout, capelin, and sturgeon from Hudson Bay, and the Esocidæ of Canada with description of a new species of pike found in Ontario, Dr. P. Cox's recent additions to the fish fauna of New Brunswick, and Dr. Carl Eigenmann's interesting exhibition of the blind fishes of America in a living state.

The Section opened in the afternoon with a paper by Prof. E. B. Poulton, illustrated by the lantern, upon "theories of mimicry as illustrated by African butterflies." He showed how various distinct forms with offensive characteristics and warning colours tend to converge in appearance, so as to share the responsibility of keeping up their character and spread the inevitable loss over a greater number. This was made known by Bates and F. Müller for South American forms, and by Moore for Indian, and now Poulton completes the case by evidence derived from African butterflies. There were two papers by Mr. A. Halkett, the one on *Branchipus stagnalis*, and the other on large specimens of Unionidæ from Lake Huron.

Two papers were given on the surface plankton of the Atlantic, one on this afternoon by Mr. W. Garstang, the other on Tuesday morning by Prof. Herdman. Mr. Garstang had collected his material on board the steamer *Laurentian* by tying a fine net over the bath tap and running the water through it occasionally during the day; Prof. Herdman had worked on the steamer *Parisian* by using four silk nets of different degrees of fineness over pipes through which the sea-water ran continuously day and night during the voyage from Liverpool to Quebec. These nets were emptied morning and evening. Mr. Garstang's method gave gatherings taken intermittently during the day, while Prof. Herdman's gave each day and each night as a continuous gathering. The results differed a little, showing that both these plans should be adopted in future observations. One point brought out by these papers was the efficient and inexpensive character of this method of collecting plankton. To obtain any number of samples of the surface organisms of the great oceans, collected either periodically or continuously, little or no expense need be incurred beyond the naturalist's passage. It is not even necessary that the naturalist should make the voyage himself. The methods of collection and preservation are so simple that they can be carried out by one of the officers on board. This method, which was first introduced by Dr. John Murray, will probably be largely employed by biologists in the future.

On Saturday the Section did not sit, as a natural history excursion had been arranged in conjunction with Section K.

Monday, August 23.—Prof. Poulton gave a paper on mimicry as evidence of the truth of natural selection, illustrated with the lantern. He described cases where very different butterflies and moths had converged in their characters, to a dark-coloured type of insect having certain clear spots upon the wings. These clear spots have been acquired independently in the different cases by entirely distinct methods—by loss of scales, by the conversion of scales into hairs, and in other ways. He also cited cases of various insects which mimicked ants, and which had acquired the resemblance by quite distinct methods.

Other papers taken this morning were :—Dr. L. O. Howard on economic entomology in America; Mr. J. F. Whiteaves on New Sepiadæ from the Lower Cretaceous of the South Saskatchewan; Prof. F. Y. Edgeworth on the statistics of bees: an inquiry into the time occupied by the successive journeys of workers; and by Prof. J. H. Panton on the appearance of the army-worm in Ontario during the summer of 1896.

In the afternoon Prof. Miall gave an account, with lantern illustrations, of a supposed new insect structure—a cellular organ found in connection with the heart and of doubtful function; Mr. W. Garstang had a paper on recapitulation in development, as illustrated by the life-history of the masked crab (*Corystes*); and Prof. G. Gilson gave a detailed description of the musculo-glandular cells in Annelids. Prof. Gilson's chief results are: (1) That the subepidermic part of the body-wall of *Polygordius*, *Owenia*, and many other Annelids consists of only one layer of mesodermic cells. These are much elongated and divide into an outer part, which becomes differentiated into muscular substance, and an inner one containing all the nuclei, and which has been erroneously regarded as cœlomic endothelium. The cœlom has no proper membrane on its parietal surface; and the myotomic sacs remain monodermic on their outer face. (2) That in *Owenia* the elements which constitute the monodermic outer wall of the cœlom, are musculo-glandular cells which may be classified with the neuromuscular cells of Cœlenterates. The author shows that the use of the secretion formed by the inner glandular processes of the cells is to produce a plasma in which the genital products float and are carried away.

The Section then adjourned to a natural history excursion at Ashbridge Bay, in conjunction with Section K.

Tuesday, August 24.—First came Prof. Herdman's paper "on the plankton collected continuously during a traverse of the Atlantic" (see above), and then a series of papers on vertebrate morphology; Prof. Theodore Gill on the determinants for the major classification of fish-like vertebrates, and on the derivation of the pectoral member in terrestrial vertebrates; Dr. W. H. Gaskell on the morphological significance of the comparative study of cardiac nerves, and Dr. Elliot Smith's observations upon the morphology of the cerebral commissures in the vertebrata.

The remaining papers before the Section were :—Prof. J. P. McMurrich on some points in the symmetry of Actinians ; Prof. Lloyd Morgan on the natural history of instinct ; Mr. W. G. McCallum on the hæmatozoon infections of birds ; Mr. J. Stafford on the post-embryonic development of *Aspidogaster conchicola*, and Mr. G. P. Hughes on the antlers of the red deer, and on the evolution of the domestic races of cattle. Prof. Lloyd Morgan, in his paper on "instinct," replied to certain criticisms of the biological treatment of instinctive activities as relatively definite organic responses. Mr. Rutgers Marshall had argued that the "instinct of self-preservation," the "play instinct," and so forth, could not be regarded as in any sense definite. Prof. Morgan contended that these are group-terms under which a number of responses, each in itself relatively definite, are roughly classified. If we speak of "mimicking instincts" the group is so varied as to be quite indefinite as organic response. But when we study the particular cases which fall within the group, we find that each example shows an activity of a relatively definite kind.

The Section did not meet on Wednesday, as another natural history excursion was planned for that day in conjunction with Section K. It seemed desirable, to the biologists, on an occasion when the meeting was held out of Britain, that every opportunity should be taken of studying the more or less novel fauna and flora. This field work has been continued by some naturalists on the excursions which concluded the meeting. Thus Prof. Miall and Prof. Ramsay Wright have gone to examine the Algonquin Lakes ; Prof. Herdman has been dredging and tow-netting in Puget Sound on the Pacific coast ; while Profs. Bower and Marshall Ward have been collecting plants ; and Prof. Poulton insects at many points along the line from Toronto to Vancouver.

PHYSICS AND CHEMISTRY IN RELATION TO MEDICINE.

THE advances of medical science due to the adoption of the methods and results of physics and chemistry have recently been generously acknowledged by several foremost members of the medical profession, in addresses delivered before congresses, and at the opening ceremonies of various medical schools on October 1. From the reports of a number of these addresses, the subjoined expressions of opinion have been collated. It is gratifying to be able to put on record these authoritative views as to the assistance which the physical sciences have given to medical progress.

Medical Progress due to Physical and Chemical Methods.[1]

All recent progress in medicine has depended on research and discovery carried on by physical and chemical methods. The mechanical principles that were first applied in anatomy, the mother science of medicine, to the explanation of the construction and movements of bones and muscles have been carried by the physiologist into every organ of the body and into the arcana of the tissues, and have been shown to be essential to the understanding of the changes that take place in them during the performance of their functions. And at the same time the aid of chemistry and electricity has been invoked to drive back step by step, and if possible to banish altogether, that vitalism which was at one time all but supreme in the domain of animal physiology. And now, not content with this corporeal conquests, the physiologist is pushing his mechanical methods into the realm of psychology, and is seeking by means of them to investigate the data of consciousness. Having by electrical stimulation and other experimental procedures localised sensory and motor centres in the brain, having shown that there is a definite order of development in the nerve tracts, and having disentangled to a large extent the paths of nervous impulses of various kinds, their halting points and goals in nerve cells, he is now eager to catch ideas on the wing and to examine them in the usual manner. Helmholtz, in his great works on vision and hearing, was the first to show how physics mount into physiology and psychology, and after him Weber, Fechner, Lotze, and Wundt have step by step pushed forward the parallels of the material accompaniments of thoughts and feelings. And quite recently a movement has sprung up in Germany to advance still further mechanical explanation of the facts of mental life, and to bring psychology, which has always been scientific in as far as it has observed and classified and analysed phenomena, into line with the exact sciences of external nature. Experimental psychology has been inaugurated, and research laboratories, in which the physical and vital changes that are associated with mental processes are to be measured and tested, have been established. Originating in Leipzig, experimental psychology has taken root in several other centres on the continent, has spread to America, where it has been eagerly adopted, and has at last made its way into England. The University of Cambridge has voted a sum of money to be devoted to investigations in connection with it, and a few months ago a meeting was held in London to promote the establishment of a laboratory for its study in University College. The names of those who attended that meeting are a sufficient guarantee that the project which it approved will be successfully carried out. I have little doubt that suitable arrangements will be made for instruction in the new methods of psycho-physical research in University College, and that in course of time other schools and colleges—Mason College amongst them—will follow its example and afford facilities for studies in anthropometric psychology. I have little doubt, too, that such studies will be fruitful of useful results, by widening the scientific basis of psychology and supplying us with standards by which to gauge the speed and duration of certain neural operations, the variations in these in different individuals, and the depth of certain mental defects. But at the same time I am disposed to think that exaggerated notions are entertained as to what experimental psychology can actually accomplish. Its field is, after all, a narrow one. It can never supplant self-observation and introspection as means of mental analysis, and must indeed always to a large extent lean on these. It is practically restricted to the measurement of sensations and movements and the gaps between them, or the simplest mental processes ; and hitherto it has, it must be admitted, been somewhat ambiguous and indefinite in its declarations. For my own part I look with more sanguine expectations of light on the obscure problems of mind to comparative, ethnical, developmental, and pathological psychology—which may all, of course, be investigated by experimental methods—than to the new experimental psychology strictly so-called.

We all gratefully acknowledge the immense debt we owe to experimental physiology with its exact mechanical methods. It has dispelled myths and errors, supplied us with a body of precise and well-organised knowledge, and revolutionised our treatment of disease ; and it promises in the future not only to augment our healing power, but to afford trustworthy guidance in education and in the regulation of some social relations. As it stands to-day physiology, it seems to me, offers a liberal culture to all who study it. An independent science itself, but in touch with all other sciences, it brings into exercise observation, judgment and memory, while it passes in review questions of surpassing interest to every human being, and thus confers an admirable intellectual discipline while storing the mind with information that must prove useful in the conduct of life.

Scientific Method in Medicine.[1]

Various spheres of activity have exercised their influences in bringing medical science to its present position.

We must, in the first place, ascribe the greatest importance to the study of anatomy. Gradually our knowledge of every detail of naked-eye anatomy has been gained, and at the present time every one practising medicine must have a competent knowledge on the subject gained by dissection. The same systematic study has extended to comparative anatomy, and great, for its time, as was the knowledge of Aristotle, it has undergone an entire revolution by the application of scientific methods to increased data of information by such workers as Cuvier, Darwin and Owen. It is now taught as a branch of medical education. Physiology could have no scientific basis until anatomy was fairly advanced The facts on which it was at first based were founded on medical observations, but in the seventeenth century direct investigations and observations were commenced by Haller, Hunter, Spallanzani and Hewson. It has since been prosecuted with the greatest zeal and success, and the position of physiology

[1] Extracted from an address on "Ethics and Individualism in Medicine," delivered at the opening of the winter session of the Queen's Faculty of Medicine, at Mason College, Birmingham, on October 1, by Sir James Crichton-Browne, F.R.S.

[1] "The Influences that have determined the Progress of Medicine during the preceding Two and a half Centuries." Abridged from an address delivered at the opening of the Section of Medicine, at the annual meeting of the British Medical Association at Montreal, September 1897, by Dr. Stephen Mackenzie.