

WORK OF THE PHYSIKALISCH-  
TECHNISCHE REICHSANSTALT IN 1908.

FROM the annual report of the above institution for last year, recently published, we find that the same steady progress is made in research work of a varied nature; the following notes give some particulars of a few of the more interesting investigations completed or in progress in 1908.

The saturation pressure of water vapour between 50° and 200° was determined as a continuation of the experiments in the previous year, the resultant pressures being tabulated in the report. The limit of accuracy over the whole range depended on the measurement of temperature, and the greater part of the work was devoted to such measurements. In the neighbourhood of 100° the temperature scale could be considered as trustworthy to 0.01°, and at 200° to 0.02°. The platinum thermometers used were compared at 150° and 200° with the nitrogen thermometer, after the constants of the latter had been determined, the comparison being made in an electrically heated oil-bath.

The experiments on the heat of evaporation of water, which were previously made between 30° C. and 100° C., have been continued for temperatures above 100°. Up to the present it had only been possible to obtain the values for the evaporation-heat from Regnault's observations of the total heat by calculating the heat of the water. It therefore appeared desirable to make direct measurements of the evaporation-heat. The experiments were carried out between 100° C. and 180° C. The results show that in the first approximation it is admissible to extrapolate beyond 100° the formula

$$L = 94.210(365 - t)^{0.34229} \text{ Cal. } 15,$$

which has been drawn up for the evaporation-heat  $L$  between 30° C. and 100° C. as limits for  $t$ .

The work connected with the silver voltameter was brought to a conclusion, and a paper published dealing with the subject. The object of the measurements was (1) to compare with the aid of the voltameter and a resistance the E.M.F. of the Weston normal cell, which was last determined by means of the silver voltameter in 1898; (2) to determine the accuracy attainable in measurements with the silver voltameter (a) under conditions which are as regular as possible, and (b) with a variation of the factors in connection therewith. It was found (as at the National Physical Laboratory) that the differences obtained by Richards and by Schuster, attributable on the one hand to the influence of the anode liquid, and on the other to that of the oxygen, could not, within the errors of observation, be confirmed.

Particulars of the changes in shellacked manganin coils due to varying humidity were published in 1908. The changes in question are so slight in the German climate as only to be of importance for resistances equal to or greater than 100 ohms, and even then only for measurements of the highest precision. For resistance standards of 1000 and 10,000 ohms the changes during the summer of 1908 amounted to 5 parts in 100,000 only. By taking the precaution of keeping resistances in a hygrostat of 50 per cent. humidity the constancy of all resistances up to a 100,000-ohm coil was secured. A comparison of the mercury standards with the manganin coils is in hand.

Various institutions (e.g. the National Physical Laboratory, Teddington, and the Bureau of Standards, Washington) have issued specifications for the setting up of standard cells, and detailed instructions are given for the preparation of the mercurous sulphate. It is directed that this salt shall not be washed with water, but with dilute sulphuric acid or with a saturated solution of cadmium sulphate. The Reichsanstalt is of opinion that the manner of washing the preparation is without influence on the result. It follows from this that the same E.M.F. results whether the salt be hydrolysed or not.

In connection with the research on anode rays mentioned in the last report, it was found that when in the presence of substances which emit intense anode rays the electro-negative bodies such as iodine, bromine, &c., considerably favour the formation of the rays. It was found that the red and blue fluorescent tints of glass which can be produced by slow cathodic rays can also be caused by

sufficiently dense cathodic rays. For the blue fluorescence it was shown that they are connected with the emission of negative electrons. A fixed point for the presence of the positive electrons could not be ascertained.

The experiments commenced in 1907 on the electrolytic properties of silver and copper were concluded, and show that silver in the aqueous solutions of HCl, HBr, and HI, and copper in the aqueous solutions of HF indicate an electrolytic valvular action which does not appear, as in the other metals, to be caused by a gas stratum, but by a solid stratum.

For the determination of the absolute values of standards of self-induction, which are made by comparing with capacities measured absolutely, a standard air condenser was constructed. The new air condenser consists of 107 magnalium discs of 20 cm. diameter, 1 mm. thickness, and 1 mm. apart. It has a capacity of about 0.03 mfd. Amber is used for insulating, the insulation resistance being of the order  $10^{15}$  ohms.

The work done in the magnetic laboratory includes a comparison of the methods of testing magnetic materials and experiments on initial permeability. An exhaustive series of measurements of self-induction was carried out with high-frequency alternating currents, and papers bearing on this subject have been published. A rotating interrupter for absolute capacity measurements by Maxwell's method is described.

A number of tests were made on various forms of flicker photometer which could be used on a straight photometer bench, with the view of determining whether the use of the flicker photometer is to be advocated for tests. It was found, however, that the flicker photometer offered to the skilled operator no advantage over the usual method of measurement as regards rapidity and certainty of adjustment.

Nearly seventy official and private papers of a scientific nature by members of the staff were published during 1908, particulars of these being given in an appendix to the report.

ZOOLOGY AT THE BRITISH ASSOCIATION.

BY arrangement between the organising committees, the presidents of the biological sections gave their addresses at different hours, so as to make it possible for members to attend them all. The address in Section D was delivered by Dr. Shipley on Friday, August 27.

The programme for Thursday, August 26, was opened by Dr. E. Goodrich with a paper on the origin of the vertebrates. The object of this paper was to show that none of the theories of the origin of vertebrates hitherto brought forward, deriving them from some existing class of the invertebrates, was satisfactory, because the theories violated the sound principles of phylogeny based on the combined evidence of comparative anatomy and physiology, embryology and paleontology. This evidence enables us to trace back the Gnathostomes to a primitive shark-like fish, the Gnathostomes and Cyclostomes to a common form of much more uniformly segmented structure, and, finally, the Craniata and Cephalochorda to an ancestor of very simple structure, without dermal skeleton and without pronounced cephalisation, which probably became extinct even before the Silurian age.

Mr. C. L. Boulenger followed with a paper on certain subcutaneous fat-bodies in Bufo. These structures are to be found in a number of different species, and consist of masses of adipose tissue situated at the junction of the hind-limbs with the trunk.

On Friday, August 27, after the presidential address, Prof. H. Jungersen read a paper, illustrated by lantern-slides, on the osteology of the Lophobranchii. The author pointed out that the skeletons of these fishes have hitherto been most unsatisfactorily examined, and the cranial structures, especially the suspensory apparatus, the gill-arches and the scapular arch, have been incorrectly interpreted by all previous authors. In the skull, parietals and opisthotics are wanting, the pterotics are greatly developed, reaching below to the basioccipital, and preventing the exoccipitals from meeting the prootics. These two features, together with the prolongation of the anterior part of the skull (mesethmoid and vomer), the Lophobranchii have in

common with the Solenostomidæ, the Fistulariidæ, the Aulostomidæ, and the Centriscidæ, these families forming with the Lophobranchii a natural group, the "Solenichthyes" of Regan.

The scapular arch is cartilaginous to a much greater extent than is the case in other Teleosts, but a small ossified scapula is to be found as well as a coracoid.

The three anterior vertebræ are immovably joined together, their neural arches being firmly bound by sutures with long dentations; in addition, the two anterior ones are fixed to the expanded clavicle. The vertebræ bearing the interspinous bones for the dorsal fin are provided with secondary transverse processes behind the primary ones, thus enlarging the surface which gives attachment to the powerful muscles of the dorsal fin, the chief agent in swimming.

After a paper by Dr. S. Hadwen on Texas fever in cattle, and its cure by the use of drugs, the day's programme closed with the reports of the special committees on grants.

The meeting on Monday, August 30, was opened by Prof. A. B. Macallum, who read a paper, illustrated by numerous lantern-slides, on palæobiology and the age of the earth.

Prof. C. J. Patten followed with two papers:—(1) on the pre-nuptial plumage in *Calidris arenaria*, illustrated by lantern-views of the sanderling at different periods; (2) on the germinal disc in naturally incubated eggs of *Passer domesticus*. Due reflection of the facts that nests (or, in the case of those birds which make no nest, the soil on which the eggs are deposited) vary to an extraordinary extent in their heat-retaining properties; that the protecting egg-shells vary strikingly, not only in their thickness, but in their porosity and other structural peculiarities; and, lastly, that avian embryos vary to a considerable extent as regards their vitality when heat is withdrawn from the shell, has led the author to think that the method of studying avian embryology by means of the artificial incubator is not always the most trustworthy. He therefore described the changes which he observed during the first six hours in a clutch of naturally incubated eggs of the house-sparrow (*Passer domesticus*).

The next paper, on the rôle of visual function in animal and human evolution, was, in the absence of the author, Dr. G. M. Gould, taken as read.

Prof. S. H. Reynolds read a paper on the British Pleistocene Canidæ. Three species are found, the wolf, the fox, and the Arctic fox. There is no evidence of the existence in Britain in Pleistocene times of any animal that could be called a dog. The jaw described as *Lycaon anglicus* is thought by the author to be better regarded as a somewhat abnormal wolf. While, apart from any difference in size, the skull of a fox is readily distinguished from that of a wolf or dog by the depressions in the post-orbital processes of the frontals, it is extremely difficult, if not impossible, to find any valid distinctive character between dogs and wolves. The most useful character, for which we are indebted to Studer, is the orbitofrontal angle. He regards as belonging to wolves skulls in which this angle measures 40°–45°, and as belonging to dogs skulls in which the angle is greater than 45°. The author's measurements, while confirming Studer's contention that the angle in question tends to be decidedly less in the wolf than in the dog, show that the distinction is not absolute, and cannot be relied on in all cases.

The programme for the last day of the meeting, Tuesday, August 31, opened with a paper by Mr. C. F. Rousselet, on the geographical distribution of Rotifera. The author showed that the results of recent investigations point more and more to the fact that the Rotifera enjoy a cosmopolitan distribution, which is not limited to continents, but extends to all places on the surface of the earth where suitable conditions prevail. Wherever search has extended in Europe, America, Africa, India, China, Australia, and even the north and south polar regions, the same genera, and even species, have been met with, and it is not possible to speak of any typical or peculiar rotatorian fauna for any continent, zone, or region.

The very erratic appearance of rare or uncommon species in widely separated places seems to show that distance is no obstacle to their distribution, provided only that they

find suitable conditions. To account for such a distribution over the whole of the globe, it has been supposed that most species of Rotifera can be dried up and their bodies carried by the wind, as dust, for long distances, and then come to life again on landing in suitable surroundings. This Mr. Rousselet showed to be a very erroneous generalisation of the fact that a very few species of bdelloid Rotifera, and in particular *Philodina roseola*, are capable of secreting a gelatinous envelope in which they can resist drought for many months, and come to life again on being placed in water. The author's experience has shown him that the vast majority of rotifers die immediately on being dried, and do not revive after complete desiccation; but their eggs, and in particular their resting eggs, can stand a prolonged state of desiccation and also freezing, and can therefore readily be transported by the wind or by aquatic birds and other animals, and will hatch when deposited in suitable pools of water. In his opinion it is by this means that the cosmopolitan distribution of the Rotifera over the world has in the course of time been brought about.

Dr. J. Pearson read a paper on the processes of autotomy in the Crustacea, and Prof. H. Jungersen communicated an account, by Dr. J. Schmidt, of the distribution of the fresh-water eels (*Anguilla*) throughout the world.

The following papers were, in the absence of the authors, taken as read:—Dr. F. A. Dixey, on the parallelism between the nymphaline genera *Adelpha* and *Chlorippe*; and Mr. W. J. Dakin, histology of the eye of *Pecten*.

In the afternoon Mr. J. Stanley Gardiner delivered a lecture on coral-reefs, illustrated by numerous lantern-views.

Two resolutions were passed by Section D during the meeting at Winnipeg:—

(1) "The zoological section of the British Association wish to record their sense of the danger caused by the approach of the Norwegian rat, which threatens the wheat industry of western Canada, and to urge the Governments concerned to take immediate steps to organise the extermination of this dangerous pest."

(2) "In view of the enormous importance of the fisheries of Canada in connection with her prosperity and her rapidly developing position as the great source of the food supply of the Empire, and appreciating the danger of exhaustion which menaces certain of the fisheries, the members of the zoological section of the British Association for the Advancement of Science, now in meeting in Winnipeg, desire to congratulate both the Dominion and the Provincial Governments upon the work already accomplished in connection with the study of the food-fishes, upon the establishment of a marine biological station on both the Atlantic and Pacific coasts, and upon the cooperation with the Government of the United States in an International Commission from whose labours much may be expected. At the same time, the members of the section are of the opinion that further and more extensive efforts in all these directions are urgently needed if certain of the fisheries, notably that of the Pacific salmon, are to be maintained even at their present condition of productiveness. For the framing of satisfactory and effective regulations for the utilisation and conservation of the food-fishes a complete knowledge of their life-history is absolutely necessary, and the section desires to impress on the Governments concerned the immediate need for an extensive prosecution of investigations along this line, for greater facilities for the scientific study of the fisheries, especially those of the Pacific coasts, and for a continued cooperation of the Dominion Government with the governments of the provinces and also those of the United States in all efforts looking towards the conservation of the fisheries, one of the most valuable natural resources of Canada."

#### GEOGRAPHY AT THE BRITISH ASSOCIATION.

THIS section was presided over this year by Colonel Sir Duncan A. Johnston, K.C.M.G., C.B., formerly director-general of the Ordnance Survey of the United Kingdom, and, as usual, the opening address dealt with matters of which the president had been made intimately cognisant through his life-work. After briefly referring to