## 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

$$L = 94{\cdot}210(365 - t)^{0{\cdot}34129} \text{ Cal. } 15,$$

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 kathodic rays can also be caused by sufficiently dense kathodic 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 palæontology. 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