BOTANY AT THE BRITISH ASSOCIATION.

The President's Address.

IN accordance with the custom that is growing up of arranging for a minimum of clashing between the various presidential addresses, Prof. Trail delivered his address (which was printed in full in NATURE of October 6) at 12 noon on Thursday, September 1. The address dealt with the subject of field botany, and the president particularly urged the need for the preparation of a really great national flora. As a direct outcome of the address, a committee was subsequently appointed, with Dr. Trail as chairman, to consider what steps should be taken towards organising and preparing the materials for such a flora.

As regards the rest of the proceedings, the outstanding features of the Sheffield meeting were the sittings devoted respectively to physiology, cytology, and morphology. Judged by the keenness of the discussions and the numbers attending the section, the meeting must be pronounced to have been distinctly better than the average. It will be convenient to deal first with the subject of physiology.

Physiology.

On Monday morning, September 5, there was a joint sitting of the botanists, chemists, and physiologists in the meeting-room of Section K, the subject being the biochemistry of respiration. A report of this discussion will be found in the account of the proceedings of Section I (p. 26), so it is unnecessary here to do more than mention the botanical contributions to the discussion. Dr. F. F. Blackman, who opened the subject, by way of introduction outlined our present knowledge of the respiration of plants in respect to:—(1) the nature of the reaction (or reactions) which constitutes respiration; (2) the physical chemistry of the respiration reaction; and (3) the influence of protoplasm upon the progress of the reaction. Mr. D. Thoday dealt with the effect of chloroform on the respiration of plants.

Tuesday morning, and to some extent Wednesday, were also devoted to physiological papers. Mr. S. Mangham read an interesting paper on the paths of translocation of sugars from green leaves. Using Senft's method of testing for sugars by the precipitation of osazones, the author was able to obtain definite evidence that the sieve-tubes (and not the parenchymatous vein sheaths) provide the main paths for the translocation of free sugars from the lamina of the leaf. He was thus able to confirm Czapek's theory, which had been disputed by Haberlandt and others. Mr. D. Thoday followed, and discussed assimilation and translocation under natural conditions. His experiments show that in detached leaves the increase of dry weight, due to assimilation, is surprisingly small in bright diffuse light as compared with bright sunlight. Leaves still attached to the plant show a smaller rate of increase than detached leaves; this is probably largely due to translocation. Dr. F. Darwin demonstrated a new method of observing in living leaves, while still attached to the plant, the degree to which the stomatal apertures are open or closed. The instrument (which he calls a *porometer*) consists of a small glass chamber cemented on to the stomatal surface of a leaf, and connected with a suction tube and manometer. By diminishing the air-pressure in the chamber a flow of air through the stomata is induced, the rate of flow indicating the condition of the stomatal apertures. Dr. Darwin then discussed some actual results obtained by the porometer. On comparing the readings of the latter with the loss of weight by transpiration, it was found that the two curves rise and fall together, but the transpiration readings have a much smaller range than those of the porometer. This is perhaps what might have been expected, taking into account Dr. Horace Brown's work on diffusion.

Miss N. Darwin and Dr. F. F. Blackman contributed a paper on germination conditions and the vitality of seeds. If the vitality of seeds is lowered by exposure to, *e.g.*, high temperatures, they do not germinate well, and become more sensitive to any unfavourable modification of the environment. Failure to germinate when too little water is present is due to purely physical causes, while the injurious effects of excess of water are due to the water acting as an oxygen excluder. Mr. A. S. Horne next discussed the absorption of water by various leguminous seeds. Prof. Bottomley showed that the Cyanophyceæ endophytic in the apogeotropic roots of cycads and in the cavities of Azolla and Anthoceros are invariably accompanied by nitrogen-fixing bacteria. He suggested that this may really be a symbiotic association of the algæ and the bacteria.

Ecology.

In contrast to the Winnipeg meeting, ecology was represented this year by only two papers. Mr. J. H. Priestley gave an account of the distribution of halophytes on the Severn shore. In this district the halophytes exhibit three well-marked zones:—(1) the low-lying Salicornia zone; (2) the Sclerochloa and Aster zone; and (3) the rarely submerged *Juncus Gerardi* and *Festuca rubra* zone. Apparent anomalies of distribution are probably referable to differences of drainage and salinity. Mr. M. Wilson discussed plant distribution in the woods of north-east Kent.

Cytological Papers, &c.

Friday morning was occupied with papers dealing with cytology and heredity, the first two being taken jointly with Section D (Zoology). In a paper entitled "The New Force, Mitokinetism," Prof. Marcus Hartog further developed his views on the formation of the spindle and other structures observed during karyokinesis. Discussing the various theories put forward, Prof. Hartog contended that neither diffusion currents on one hand, nor electrolytic or electrostatic force or magnetism on the other, are sufficient to account for the formation of the mitotic spindle. As an alternative the author postulates the existence of a new force, which he terms "mitokinetism," and which, so far, is unknown outside the living cell. Dr. E. Hindle followed with an account of artificial parthenogenesis in the eggs of a sea-urchin (*Strongylocentrotus purpuratus*). The author described the process of artificial fertilisation in these eggs by treatment with a monobasic fatty acid, and subsequently with hypertonic salt solution. The cytological changes undergone were carefully described, including the formation of an artificial fertilisation membrane and the various nuclear changes. Under suitable conditions free-swimming larvæ were produced. These, though their dividing nuclei contained only the reduced number of chromosomes, were identical in form and behaviour with those developed from normally fertilised eggs. This concluded the joint sitting of Sections D and K, and the remaining papers were communicated to Section K alone.

The next two papers dealt with the behaviour of the chromosomes during mitosis, and particularly with respect to the stage at which longitudinal fission is initiated. Prof. Farmer and Miss Digby found in Galtonia that during the archesporial divisions the longitudinal fission begins by a condensation of the chromatin on the edges of the chromosomes during the telophase of the preceding division, and the duplicate character can thus be detected very early. Similarly, in the heterotype division of mitosis, the longitudinal fission is prepared for, as in the somatic mitoses, during the telophase of the last archesporial division. Dr. Fraser and Mr. Snell obtained very similar results in *Vicia faba*. They found that the chromosomes which are separated from each other in any given division are the product of a longitudinal fission which is initiated in the preceding telophase. This was stated to be the case in both the sporophyte and gametophyte generations, the resting chromosomes in both cases exhibiting a double structure. Prof. V. H. Blackman, in a very interesting short paper, described the vermiform male nuclei of Lilium. The author brought forward evidence that, although purely nuclear in structure and possessing no cilia, these structures are capable of active movement. It seems probable that the activity of these nuclei, and not the streaming movements of the surrounding cytoplasm, is responsible for their entrance into the ovum and passage to the polar nuclei.

The remaining two papers taken on Friday dealt with problems of heredity. Mr. R. P. Gregory offered some further observations on inheritance in *Primula sinensis*,

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and Prof. F. E. Weiss described some experiments on the inheritance of colour in the pimpernel. The latter author crossed *Anagallis arvensis* and *A. coerulea* (the red and blue pimpernels). The red colour proved to be dominant, while in the f_2 generation there was complete segregation into red and blue forms. This is another interesting case of a recessive blue in the Primulaceæ.

Fungi.

The fungal papers were taken on Thursday morning before the president's address. Prof. Buller discussed the function and fate of the cystidia of Coprinus. The author confirmed Brefeld's view that the cystidia act as props to keep the gills from touching each other. He pointed out that this is necessary to allow for the free escape of the ripe spores. The cystidia themselves disappear by a process of autodigestion just before the basidia in their immediate neighbourhood are ready to discharge their spores. In the discussion on this paper Mr. Wager suggested that the cystidium must be regarded as having been phylogenetically derived from the basidium. Mr. A. E. Lechmere read an interesting paper on the methods of asexual reproduction in a species of Saprolegnia. In hanging-drop cultures great variation was found in the behaviour of the zoospores, the method of discharge, and the shape of the sporocyst. Variations of form, &c., supposed to be characteristic of distinct genera of the Saprolegnieæ were found within the limits of this single species. Prof. V. H. Blackman described a form of nuclear division intermediate between mitosis and amitosis in *Coleosporium Tussilaginis*. A spindle is formed on which granular chromatin collects, and is then drawn apart towards the poles. The chromatin is not aggregated into definite chromosomes. Mr. Harold Wager, in a paper on chromosome reduction in the Hymenomycetes, maintained that normally only two nuclei (each containing four chromosomes) fuse in the basidium. During the division of the fusion nucleus the spireme breaks up into eight chromosomes, reduction being brought about in a simple manner by the distribution of the chromosomes to the two daughter nuclei. Mr. F. T. Brooks described his investigations into the cause of the silver-leaf disease of fruit trees. These experiments are still proceeding, but, although not absolutely proved, the available evidence points, as previously suggested by Percival and Pickering, to *Stereum purpureum* as the probable cause of the disease.

Morphological and other Papers.

Although only an afternoon session (on Monday) was available for morphology, the papers proved so attractive that the section sat for nearly three and a half hours. Prof. F. O. Bower led off with two papers. The first was a short note on *Ophioglossum palmatum*. The divided character of the leaf-trace supports the conclusion, previously arrived at from its external morphology, that *O. palmatum* is one of the more extreme and specialised types of the Ophioglossaceæ. The second paper, on two synthetic genera of Filicales, dealt with some very interesting problems of phylogeny. The two genera in question are Plagiogyria (formerly included in Lomaria) and Lophosoria (usually grouped with Alsophila). The author not only put forward strong reasons why these respective genera should be kept separate, but suggested that both are probably important intermediate synthetic forms. Thus he regards Plagiogyria as a transitional form related on the one hand to the Gleicheniaceæ and the Schizæaceæ, and on the other to the whole series of Pterideæ. Similarly in the case of Lophosoria, a probable sequence may be traced from forms also having affinities with the Gleicheniaceæ through Lophosoria to Alsophila and other Cyatheaceæ.

Dr. Kidston and Prof. Gwynne-Vaughan described the structure of the "false stems" of the fossil genus Tempskya. This plant had an extraordinary habit. Its erect "stem," which grew to a height of 9 or more feet, really consisted of an aggregate of branching stems embedded in a compact mass of their own adventitious roots. The individual stems were slender, and possessed a dorsi-ventral symmetry. The authors think that in this case the erect habit had been only recently acquired, the particular method adopted being one which could be evolved with great rapidity. They further suggest that the erect habit of modern tree-ferns may be a secondary character derived from Tempskya-like forms, in which the original axis has developed at the expense of the lateral branches. Dr. M. C. Stopes read a paper in which she further described the fossil flower *Cretovarium japonicum*, dealing especially with the structure of the ovary. Mrs. Thoday, in a communication on the morphology of the ovule of *Gnetum africanum*, instituted a comparison between this and the ovules of Welwitschia and Lagenostoma. She regards the ovule of Gnetum as probably more primitive than that of Welwitschia on account of its radial structure, the presence in the young ovule of a well-developed pollen chamber, and the small development of the free portion of the nucellus. Prof. F. W. Oliver next discussed the pollen chambers of various fossil seeds. He showed that in certain seeds (*e.g.* Conostoma spp.) the structure of the nucellar apex is much more complex than in forms such as Lagenostoma, &c. In these more complicated forms a second pollen chamber was excavated below the primary one (which alone is found in Lagenostoma), the latter becoming merely vestigial. In the light of this discovery it seems possible that the nucellar beak of Trigonocarpus, Ginkgo, &c., may represent a vestigial primary pollen chamber, which had been functionally replaced by a more deeply seated cavity.

Prof. W. H. Lang concluded the afternoon's sitting with a very interesting account of the morphology of the stock of Isoetes. He produced evidence that the stock grows regularly in two opposite directions. Leaves are produced at the upper end, the stem apex being situated at the base of a deep depression. Similarly, the roots are borne in regular sequence on a downwardly growing region. In this case, too, the apex is at the bottom of a deep depression, but the growing point is obscured by the congenital union of the sides of the depression. The young roots are finally freed by the gradual and partial separation of the united lobes of the stock. Although greatly modified, the axis of Isoetes is strictly comparable with that of Lepidodendron or Pleuromeia.

The Semi-popular Lecture

this year was given by Prof. F. O. Bower, the subject being "Sand-dunes and Golf Links." The lecture, which was greatly appreciated, dealt chiefly with the part played by vegetation in the formation and fixing of sand-dunes. Perhaps the prominence given to this part of the subject caused some mild disappointment to the golfers present, who wished for practical hints on the keeping of greens. Prof. Bower showed a number of beautiful photographs, amongst the most interesting being some of shifting dunes.

ENGINEERING AND CIVILISATION.[1]

IN order rightly to appreciate the share taken by our profession in bringing about the present state of civilisation, a comparison should be made between the conditions prevailing, say, in the Greek states during the fifth and fourth centuries before Christ and those existing now in the twentieth century after Christ.

In indicating the state of knowledge at that period of Greek history, it is enough to remind you that it was the age of Themistocles, Aristides, and Pericles, the statesmen; of Æschylus, Sophocles, Euripides, and Aristophanes, the dramatists; of Phidias, Scopas, and Praxiteles, the sculptors; of Apollodorus, Zeuxis, and Apelles, the painters; of Ictinus, the chief designer of the Parthenon, and Dinocrates, who rebuilt the temple of Diana at Ephesus and laid out the city of Alexandria, the architects; of Herodotus, Thucydides, and Xenophon, the historians; of Socrates, Plato, and Aristotle, the philosophers.

Can we say that there have been many since that time who are worthy to be mentioned as equals of the men I have just named? The fact alone that we use the adjective "classical" to indicate perfection in literature and art shows what a standing had been attained more than 2000 years ago, and in many respects we feel down

[1] From the Presidential Address delivered at the Institution of Civil Engineers on November 1, by Mr. Alexander Siemens.

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