Obituary.

Dr. Dukinfield Henry Scott.

DUKINFIELD HENRY SCOTT, F.R.S., died on the 29th January 1934 at the age of seventy-nine, after a remarkable career as an investigator spread over more than half a century. Born in London in November 1854 he was, till the time of his death, in full possession of his extraordinary vigour, producing, till as late as last year, work which involved a constant use of the microscope. For nearly thirty years after the death of Bernard Renault, he was the universally-acknowledged leader of the old anatomical school of palæobotanists, of which the foundations were laid just over a hundred years ago. With the passing of Dr. Scott is removed one of the last remaining links with the "old guard", who had helped the anatomical study of fossil plants to the high position it occupies to-day.

Apart from a few of his earliest works, which deal with the structure of living plants, Scott's original work lay entirely within the domain of Fossil Botany. After taking his B.A. degree at Oxford he worked for a Ph.D. for a couple of years under Sachs at Würzburg. In his dissertation, published in 1881, he described the development of laticiferous vessels and was able to show (without the use of a microtome) that they were formed by a fusion of specialised cells in the young tissues. His other notable works on living plants were a paper (with T. G. Hill, 1900) on *Isoetes* which confirmed the view that this aberrant genus is a reduced type of lycopod, without any special relationship to the ferns; and a slightly earlier paper (1897) on the vascular anatomy of the cone peduncles of the Cycadaceæ. In the latter, attention was drawn to the frequent occurrence of mesarch and concentric bundles; these fern-like features were till then known in the axial organs of only a very few living gymnosperms, though they had already been observed in several fossil types, such as *Lyginodendron* (now *Lyginopteris*), *Heterangium*, *Calamopitys* and others. Coming immediately after the Japanese discovery of ciliated sperms in *Cycas* and *Ginkgo* these facts seemed strongly to confirm the theory (which held almost undisputed ground until Scott himself relinquished it in 1919) that the Gymnosperms generally were derived from the ferns.

It was at Würzburg that Scott first met Goebel, of whom he writes: "I had a great regard for him from the first, both on his own account and because he was a pupil and ardent admirer of the great Hofmeister, who had long been my chief botanical hero." Those who have had the privilege of personal contact with both Goebel and Scott will appreciate the kinship as well as the contrast between these two leading spirits who, each in his own way, exercised such a marked influence upon the course of plant morphology. Botany has suffered sadly indeed to have lost both of them within about a year of each other.

It is a curious fact that practically the first that Scott had ever heard of fossil plants was, as he himself tells us, at Goebel's lectures at Würzburg; for Goebel, almost till the end of his life, evinced a strange antipathy against the study of fossils.[1] But it was not until ten years later that Scott seriously took to palæobotanical research. This was the prelude to that eventful though belated association with Williamson, who was already near the end of his brilliant career. Thenceforth, Scott was always "in the thick of it," and few have lived to witness such momentous developments in fossil botany or taken a more significant part in their shaping. That romantic quest after the "seed-ferns", and the question of their possible origin from the true ferns—in fact the origin of the seed-bearing plants as a whole—was the central pursuit of his long career, as it still remains one of the chief problems of Palæobotany to-day. In this, as in other directions, we are wiser now chiefly in a paradoxical sense: the progress of knowledge has but revealed our ignorance and the fallacy of our preconceived notions. In a remarkably frank statement published shortly after he had relinquished the idea of a filicinean origin for the seed-plants, he wrote: "It has been generally assumed, since Hofmeister's discoveries, that the seed-plants were derived from heterosporous Vascular Cryptogams......The idea got abroad that the Pteridosperms were ferns which had become Spermophytes.... The present writer is one of those responsible for this interpretation of the facts.... On a review of the evidence it appears that this view is unjustified." And then he goes on to explain: "It is easy to see how the current idea arose. We used to believe that half the Carboniferous plants were Ferns. Then it turned out that many or most of these 'Ferns' bore seeds. Yet we could not get it out of our heads that they were Ferns after all—they were so like them. We should have remembered 'that every like is not the same!'" Simplicity and directness of style was a marked characteristic of this great writer.

Latterly he was engrossed with the old question as to whether certain synangium-bearing fronds (*Scolecopteris*, *Acitheca*, *Asterotheca*) belonged to Marattiaceæ or, as Kidston was inclined to believe, to seed-bearing plants. The question had recently been brought up in a critical form by Professor Halle's discovery of seed-bearing fronds of *Pecopteris wongii*, a Chinese species almost identical with the well-known *Pecopteris miltoni*, which bears fructifications of the *Asterotheca* type. Till the end, Scott was impressed by the Marattiaceous resemblances of *Scolecopteris* (1932, 1933), though he did not regard the question as closed. It is, however, significant of the marked change of outlook since the discovery of the first undoubted Pteridosperms, that even *Psaronius*, a plant so completely fern-like in its anatomy, cannot now be regarded as quite above suspicion in this respect.

It is impossible here to attempt anything like a fair estimate of the influence of Scott's career upon the progress of palæobotany. His original contributions dealt chiefly with the anatomy of palæozoic plants. This was in itself a vast field, but his breadth of outlook was better evidenced by his masterly reviews of contemporary work; for he was an acknowledged leader in the art of reviewing the situation whenever anything new had happened. Like all cautious workers he was difficult to convince, and in this sense he was a conservative but, as we all know, by no means of the type that clings to pet theories.

Scott's numerous special memoirs, some of which were published jointly (with Williamson, F. W. Oliver, Jeffrey and others) ranged through nearly all the important palæozoic groups, and several will rank among the classics of palæobotanical literature. The "seed-ferns" naturally claimed the largest attention: *Lagenostoma* (1904) and *Trigonocarpus* (1907); *Sutcliffia* (1906), *Medullosa* (1899, 1914) and the Heterangiums (1917); lastly, the Calamopityeæ (1914, 1918, 1924).

Substantial advances were also made in the Cordaitales (1902), in which important resemblances were demonstrated with the Cycadofilices, particularly in the genus *Mesoxylon* (1910, 1912, 1918). One of the most interesting discoveries (1919) was that of the fertile shoots of *M. multirame* which were shown to be essentially a *Cordaianthus*, possibly bearing seeds of the type already known as *Mitrospermum compressum*. Shoots of a similar nature were recently described under the new generic name *Gothania* by Hirmer, whose work confirmed the identification of these shoots as a *Cordaianthus*. In

[1] I believe it was Hirmer, now in Goebel's chair at Munich, who softened the latter towards palæobotany.

one of his last papers (1933) Scott reverted to that peculiar Lower Carboniferous genus *Archæopitys* Scott and Jeffrey (1914) founded nearly twenty years previously and forming, with *Pitys* and *Callixylon*, a compact little group provisionally included among the Cordaitales. Mention should also be made of the problematical shoots *Cladites bracteatus* (1930) which may eventually turn out to be the fertile shoots of another member of the Cordaiteæ.

On the Zygopterideæ the most notable papers were those on *Botrychioxylon* and *Zygopteris* (*Ankyropteris*) *Grayi*, both published in 1912. It was Scott's work on *Botrychioxylon* that first clearly indicated the Ophioglossaceous affinities of this family, already long suspected. The genus has since turned out to be very closely allied, if not identical, with the old genus *Zygopteris* of Corda. Scott was the first to demonstrate the sporangia of *Stauropteris*, a plant which had long been a puzzle to palæobotanists but is now, probably rightly, classed among the Zygopterideæ, though still as an aberrant member. This was in 1905, during those exciting years when the seed-ferns were rapidly emerging into recognition. One after another, several supposed ferns had been proved to be in reality seed-plants: *Lyginopteris oldhamia*, *Neuropteris heterophylla*, *Aneimites fertilis*, *Pecopteris pluckeneti*; while a host of others were already under suspicion. With these discoveries as a background it is easy to understand the caution with which Scott concluded his remarks on *Stauropteris*: "On present evidence the systematic position of *Stauropteris* must remain an open question. That it shows affinities with the Ferns is certain, but it would not be surprising to find that, like so many other Fern-like plants of its period, it had crossed the Spermophytic frontier, so that its sporangia .... were in reality of the nature of pollen-sacs." Indeed, even to-day, if the truth must be confessed, the position remains essentially the same, for the petiolar anatomy of this, as of most other Zygopterideæ, is too distinct from anything we know among undoubted ferns to leave us in absolute security as to the real nature of these plants. Palæobotany is a veritable store-house of surprises, even for the wariest worker, as has been frequently witnessed during the life-time of D. H. Scott.

Special mention must also be made of Dr. Scott's memoirs on the spenophylls and on *Lepidocarpon*. In this direction, as in his work on the "seed-ferns", he proved a worthy successor to the great Williamson. The memoirs on *Cheirostrobus* (1897), *Lepidocarpon* (1901) and *Sphenophyllum fertile* (1905) bear testimony to his great skill in the elucidation of complex fossil structures, not often preserved under the most favourable conditions. At one time Scott shared the view (for which he was himself largely responsible) that the modern Psilotaceæ were the nearest known relations of the sphenophylls. But we all know the reaction which the Rhynie discoveries brought about in his attitude on this question.

It is difficult to say whether Scott's work was great chiefly on account of his brilliant expositions of the structure of extinct plants or because of his more general, synthetic, writings in which, with the skill of a great painter, he recorded from time to time the repercussions of current work upon the theoretical background of Palæobotany. But all will agree that he was a writer with a rare gift, which he displayed alike in that elementary text-book, "Structural Botany" as in his classical "Studies in Fossil Botany" undoubtedly his greatest work. In "Extinct Plants and Problems of Evolution" (1924), an authoritative summary remarkable for its clarity and perspective, are recorded what may be taken as his latest views on the broader questions of phylogeny.

Scott was not a voluminous writer, but his writings had the impress of sound judgment, based upon a strict adherence to

facts. He has left a fine monument of original work, which he built nobly, in the true spirit of Science, with no claim to finality. There is a certain element of triumph in a bold recantation of long-cherished ideas, and that triumph probably few men of Science knew better how to win than Scott. The following words of Alexander Pope, which Dr. Scott was fond of quoting, truly describe his own attitude of mind:

> "And spight of pride, in erring reason's spight,
> One truth is clear; whatever *is*, is *Right.*'

Of his personal qualities, and of the reminiscences of the 'grand old man', let the elders speak, for that is their privilege. This little sketch is a slight tribute from one who, working in distant isolation, received from him much kindness and inspiration in a field of research which he so richly adorned.

The portrait is reproduced from a photograph dated Liverpool, September 1923. The snapshot, with G. R. Wieland on the left, was taken at Cambridge in August 1930, on the occasion of the Fifth International Botanical Congress. Those who attended the Palæobotanical Section under the inspiring presidency of Dr. Scott will recall happy memories of an unusually successful meeting.

B. SAHNI.

Lucknow, India,
March 1934.

An Automatic Electric Tower Clock Made in India.

By Dr. H. P. Waran, M.A., Ph.D., D.Sc., F.Inst.P.
Presidency College, Madras.

THE science of Horology (clock making) is one of those departments of applied physics which has had scant development in India. May be, it is because of a belief that it is a specialised line to which large industrial concerns have devoted themselves on mass production lines in the West and hence out of reach of small-scale individual effort. However, the fact remains that it is a subject receiving no attention whatever at the hands of our routine laboratory physicists. This is really deplorable as a physics laboratory and the average workers in it can contribute so much to the science of horology if only they will turn their mathematical, experimental or technical resources to this fascinating and useful study.

The work on large clocks of the type put up on towers for supplying accurate time to the public does certainly border on heavy engineering. But the smaller sizes of such clocks are certainly not beyond the capacities of any average physics laboratory equipped as most of them are with a workshop for the repair and manufacture of scientific instruments. The average physicist, however, seldom realises how interesting the design and construction of such clocks can be and what excellent opportunities there are in this domain for the exercise of all his faculties. Even if one considers only the single factor of costs the very large savings one is able to effect in these days of economy by making the clock oneself ought to recommend such activities to institutions in need of such services. At a modest estimate the saving works out at about 75% of the commercial quotation.

In recent years electricity coming to the aid of man has found extensive application in horology and many are the systems in vogue now by which large clocks are rendered quite automatic in action. One such clock of novel design, constructed at the Presidency College in 1930, has already established its reputation by its excellent performance for the last three years and it is shown in Fig. 1.

The clock has an illuminated dial six feet in diameter the frame being of cast iron one inch thick with a central star shaped webbing to stand the heavy wind thrust in the exposed situation right opposite the sea. The panels are filled with plate glass $\frac{1}{4}''$ thick frosted and painted inside with white enamel to get a translucent finish. The hands are of ribbed aluminium casting $\frac{1}{8}''$ in thickness and four inches wide each weighing about 2 lbs.

The interesting novel features incorporated in the design of this clock are the following indicated in Figs. 2 and 3 which are line drawings showing the circuit details for purposes of explanation only.

The isochronism of the pendulum is ensured by the employment of a gravity lever escapement Fig. 2. This being new to many physics people may require an explanation.

The driving weight of about 100 lbs. is urging the escape wheel W to rotate in the direction of the arrow and it is prevented