

gamic Lycopod, and the other a Gymnospermous Sigillaria. The remarkable peculiarities characterising the central axis of these specimens make it absolutely certain that they all belong to one species of plant.

The typical *Lepidodendron Harcourtii* is then examined in a similar manner. In the details of its organisation it differs materially from *L. Selaginoides*; nevertheless, as its growth progresses, it displays typically similar changes. It attains to much larger dimensions than the latter plant does before developing its exogenous zone, corresponding in this respect with the Arran plant. Its earlier changes are chiefly seen in the rapid development of the bast or prosenchymatous layer of the outer bark and in the increase in the size and number of the vessels constituting its vasculo-medullary cylinder or medullary sheath—the “*strai medullaire*” of Brongniart; but in more advanced specimens a cylindrical zone of centrifugally developed vascular wedges begins to make its appearance in a quasi-cambian zone of the cells of the inner bark, these cells being arranged in more or less regular radiating lines. In this state the rudimentary vascular zone corresponds very closely to what is seen in young stems and roots of Cycads.

The author shows that, contrary to the views of M. Renault, very marked changes take place in the development of the vascular bundles destined for the secondary branches of the plant. In the first instance, each of these is but a concavo-convex segment of the entire vasculo-medullary cylinder, whose detachment leaves a large gap in the continuity of that cylinder, which, however, soon becomes closed again by the convergence of the disconnected ends of the broken vascular circle. The concavo-convex detached segment undergoes a similar change. Its two extremities meet, and before it escapes from the outermost bark it has assumed the cylindrical form of its parent stem.

The rootlets of *Stigmara ficioides*, now well known to belong alike to *Lepidodendron* and to *Sigillaria*, present some peculiarities of structure which are only found in the Lycopodiaceæ and the Ophioglossæ, amongst living plants.

The vascular bundle in the interior of each Stigmarian rootlet is inclosed within a very regularly circular cylinder, composed of the cells of the innermost bark; but the position of the bundle in relation to the cylinder is always, unless accidentally disturbed, an eccentric one. This position has not escaped notice, but it was regarded as accidental; it now, however, proves to be a normal one. The bundle begins to appear in very young roots, as one or two very small vessels developed in close union with the innermost cells of one side of the cylinder within which it is located; newer and larger vessels are gradually added centripetally, until the bundle occupies a considerable portion of the area inclosed by the inner bark cylinder. The remaining space is usually empty, but occasionally specimens are found in which it is filled with small delicate cells that have escaped destruction. These represent what in the living Lycopods are liber-cells. The outer cortical layer of the root, composed of well-preserved and rather thick-walled cells, is usually separated from the inner cylinder by a similar lacuna; but in a few specimens the cells of this usually destroyed middle bark are retained in good preservation. They consist of very delicate thin-walled parenchyma, separated by a sharp line of demarcation equally from the innermost and outermost cortical cylinders. The number of the vessels in each of the vascular bundles given off from any one section of a Stigmarian root is found to vary but little, but they steadily increase, both in number and size, with the size and age of the root. Young specimens of Stigmarian roots are described, the smallest of which is not more than one-fifth of an inch in diameter, and the vascular bundles of its small rootlets consist each of from three to five minute vessels. In the largest rootlets from old roots they number about forty, most of the additional ones being of larger size; intermediate examples exhibit a regular gradation on all these points.

The only living plants which possess rootlets with this structure being Lycopodiaceæ and Ophioglossæ, and it being sufficiently clear that the *Lepidodendra* belong to the former and not to the latter order of cryptogams, the existence of this Lycopodiaceous feature in the rootlets of *Sigillaria* is another indication of the Lycopodiaceous affinities of these plants.

Many of the Diploxyloid forms of the Lycopodiaceous stems of the coal-measures have an abundant development of spiral or barred cells in their numerous medullary rays. Amongst living plants this characteristic seems to be almost, if not wholly, confined to the Gymnosperms.

Two important additional observations have been made in reference to the structure of the curious strobilus, *Calamostachys Binneyana*. The exact mode of the attachment of its sporangia to the Equisetiform sporangiophores has been ascertained; but what is still more important, it has also been discovered that it is provided with both micro- and macro-spores—an additional indication of its probable Lycopodiaceous affinities, already suggested by other features of the fruit.

The recently discovered Fungi of the coal measures are investigated, especially the *Pernosporites antiquiorum* of Mr. Worthington Smith. The author finds, in the specimens he has examined, including that described by Mr. Smith, no traces of septa in the hyphæ or of zoospores in the Oogonia. He concludes that its affinities are probably with the Saprolegniæ, and not with the Pernosporææ.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

THE Professorship of Zoology in the Royal College of Science, Dublin, is vacant by the resignation of Prof. Bridge. The salary is 200*l.* a year, and at present the professor is only required to lecture during one term, commencing in February and ending in June.

THE University Court of St. Andrews have elected Mr. Arthur Stanley Butler, B.A., of Exeter College, Oxford, to the Chair of Natural Philosophy in the United College, St. Andrews, in the room of Dr. William Swan, resigned.

THE Calendar of the University College of Wales for 1879-80 shows that that institution is fairly well equipped in its various departments, science occupying a prominent place in its curriculum.

AT the end of the Legislative Session the French Chamber of Deputies voted a law establishing free primary education. It must go through the Upper House before becoming a definitive Law of the State.

SCIENTIFIC SERIALS

THE *American Naturalist*, June.—A. E. Brown and J. D. Caton, the domestication of certain ruminants and aquatic birds. J. S. Lippincott, the critics of evolution (concluded).—C. E. Bessey, the supposed dimorphism of *Lithospermum longiflorum* (the large flowers appear from April to May, the cleistogamous flowers from then until the autumn frosts).—Dr. J. Leidy, on some aquatic worms of the family Naides (describes and figures *Dero limosa*, perhaps = *D. digitata*, Oken; *Aulophorus vagus*, this forms a tube of the statoblasts of a species of Plumatella, and *Pristina flagellum*).—W. H. Dall, American work in the department of recent mollusca during 1879.

July.—G. Brown Goode, the use of agricultural fertilisers by the American Indians and the early English colonists (contains some interesting facts about fish manures).—C. S. Minot, sketch of comparative embryology (The Sponges).—O. B. Johnson, the birds of the Willamette Valley, Oregon.—J. F. James, a botanist in Southern California.—J. S. Kingsley, American carcinology in 1879.—A. S. Packard, jun., the structure of the eye of trilobites, with figures; concludes that the hard parts of the eye of the trilobites and of *Limulus* are throughout identical, while the nature of the soft parts of the former must ever remain problematical. There is good evidence that the retinal mass was like that of the king-crab; if so these forms as to their eye-structure will stand near each other and far apart from all other arthropods.

THE *Journal of the Royal Microscopical Society*, June, contains: Prof. Duncan, on a parasitic sponge of the order Calcarca (Plate 10), *Allobiusispongia parasitica*, growing within *Carpenteria raphidodendron*, from the reefs of Mauritius.—Dr. Cooke, on the genus *Ravenelia* (Plate 11).—Dr. H. Gibbes, on double and treble staining. An excellent suggestion is incidentally made by Dr. Gibbes, that the covering glasses used by microscopists should be of a known thickness. We would even go further, and advise that a fixed scale of thickness might be adopted. Dr. Gibbes uses two thicknesses, '006 and '004.—Dr. A. Grunow, on some new species of *Nitzschia* (Plates 12 and 13).—James Smith, on the illumination of objects under the higher powers of the microscope.—The most useful record of current