THE MONOCOTYLEDON THE UNIVERSAL TYPE OF SEEDS*

IT must be evident to those who heard my paper on "Adnation in Coniferæ" at the Chicago meeting of the Association that the observations there detailed could scarcely be accounted for, if the belief be true which is generally held by botanists, that the leaf originates at the node from which it seems to spring. It is not, however, an object with me to attack existing theories, or establish new ones, but simply to present facts as I see them. The origin of the leaf will no doubt prove a question which will in time take care of itself. But this generalisation cannot be avoided by the readers of that paper, that the whole plant is originally a unity; and that the subsequent formation of elementary organs, and their complete development, or absorption into one another, is the result of varying phases of nutrition. The leaves in Coniferæ were found to be free or united with the stem in proportion to the vigour of the central axis. Following up the subject, I now offer some facts which will show that all seeds are primarily monocotyledonous; and that division is a subsequent act, depending on circumstances which do not exist at the first commencement of the seed growth.

It is well known that in some species of Coniferous plants the number of cotyledons varies. I have noticed in addition to this that whether the cotyledons are few or many, there is no increase in the whole cotyledonous mass. In the Norway spruce, *Abies excelsa*, there are sometimes as many as ten cotyledons, in others only two. In the latter case they are broad and ovate, while in the former they are narrow and hair-like; in short, when in the two cotyledoned state it is not possible to note any difference between a seedling Norway spruce and a Chinese arbor vitæ, *Biota orientalis*, except by the lighter shade of green. The two-leaved condition is not common, but specimens of threes and others I exhibited to Drs. Torrey and Gray at the Troy meeting. Any one who will examine sprouting seeds of the Norway spruce will agree to the proposition that the cotyledons are not original and separate creations, but a divided unity. My next observations were on some acorns of *Quercus agrifolia*, the division into cotyledons were numerous and irregular. Cut across vertically, some represented the letter C, others the letter N, and again, with four cotyledons the letter M. Here again it was clear that whatever the form and number of the cotyledons, there was no increase of the original cotyledon mass. Examining sprouting peach kernels, the variations in form and number were of the most remarkable character. I need not repeat them in detail here, as they are reported in the April and May "Proceedings of the Academy of Natural Sciences of Philadelphia." In addition to the fact of no increase in the whole cotyledon mass, it was here clear that when the cotyledons were duplicated, the duplications at least were subsequent to the original ones. Still so far nothing had been seen to indicate when the first pair of cotyledons were formed. *Quercus macrocarpa* and *Quercus palustris* were silent to my questions. In a large number I found no variations whatever. Each mass was divided smoothly and exactly into two cotyledons. *Quercus robur*, the English oak, however, gave some curious evidence. Two germs under one seed coat were numerous, and often three, and the cotyledons took on a variety of forms. But there was never any more increase in the cotyledonous mass than if but two lobes had been formed, and there was no more rule in the division than there would be in the sudden breakage of a piece of glass. A detailed account of these will also be found in the "Proceedings of the Academy of Natural Sciences of Philadelphia" for May. *Quercus rubra*, the American red oak, furnished the one link wanting to connect the first division into lobes with the other phenomena. All the acorns examined had three or four sutures in the cotyledon mass, and extending all along the longitudinal surface externally, without any reference to cotyledonal divisions. These sutures extended sometimes but a line in depth, at others almost to the centre of the mass, always accompanied by the inner membrane, as is the case in ruminated seeds. The whole mass was divided only in two parts in any that I examined of this species, but the division was always in the direction of the sutures. Hence each cotyledon was very irregular. Sometimes one-third the mass only went to one while the other had two-thirds of the whole mass. It was easier to burst in the weaker line of resistance. But the interest for us is to note that ordinarily the cotyledonous mass was a unit—then the sutures or fissures were formed, and ultimately the two divisions of the lobes followed in their direction. The division was the last condition, not the first. I know how much we should guard against generalising on a limited supply of facts, but it requires an effort to believe that oaks, pines, and peaches, as we have seen primordially monocotyledons, are in this respect different from other so-called dicotyledonous plants; and if we grant that all seeds are primarily monocotyledonous, may we not ask why in any case they are divided? We have seen that there is no increase of mass in the division, the same amount is furnished in one as in many. Would it in any way injure the Indian corn to have its mass divided into two lobes? or would not the plantlet be as well provided for if the acorn were in one solid mass? Division would seem to be a necessity occurring subsequent to organisation, and existing from the position of the plumule alone. In monocotyledons, as we know, the plumule is directed parallel to, or away from, the cotyledonous mass, when, of course, on this theory, it remains an undivided mass. But in the dicotyledonous section, the plumule is directed towards the apex of the mass; and as we know in the case of roots against stone walls, or mushrooms under paving-stones, the disposition in the growing force of plants is to go right forward, turning neither to the right nor the left; so in this mass of matter the development of the germ would make easy work of the division; and no doubt often at so early a stage as to give the impression we have been under hitherto, that the division is a primary and essential process.

* Abstract of a Paper read at the Indianopolis Meeting of the American Association for the Advancement of Science, August 1871, reprinted from the *American Naturalist*. By Thomas Meehan.

SCIENTIFIC SERIALS

THE *Monthly Microscopical Journal*, No. 35, November 1871. "On the Form and Use of the Facial Arches," by W. Parker, F.R.S., is chiefly occupied by observations on embryo salmon. "Another Hint on Selecting and Mounting Diatoms," by Capt. Fred. H. Lang, details the method employed by the author for remounting diatoms, either previously badly mounted, or from which it is desirable to select certain forms.—"The Monad's Place in Nature," by Metcalfe Johnson, M.R.C.S.E., has for its object to show a connection between the earlier forms called Monads, and those higher and more complicated organisms at present recognised under the name of Infusoria, Mucedinæ, Confervæ, Oscillatoriæ, &c. The conclusions deduced from some of the experiments are that the author looks upon Monas in its earliest forms to be the starting point whence several products may result, and among the number are Infusoria, Mucedinæ, Englenæ, Oscillatoriæ. He is induced to believe that the Pin-point Monad, when developed under absence of light and only a limited quantity of air, gives rise to the class of plants known as Mucedinæ. Again, he maintains that during the watching of the liquids under experiment the Monads presented various forms, evidently transitional, from the round Pin-head Monad to oval young Paramœcia, until we come to sufficient size to give it a name such as *Kolpoda Cucullus*, &c.—"Infusorial Circuit of Generations," by Theod. C. Hilgard, deals with a similar subject, but in a very different style. It is often very difficult to gather the author's meaning from language such as the following:—"And from each little dot in these 'clouds of life' a separate vorticella can be seen to develop! It is here, indeed, at this first *visible* advent or exordium of animate life, and the resurrection of millions of germs through the spontaneous dissolution of a single one, that the last nubecular *microscopic* perceptions closely resemble the last nebular telescopic as well as the *theoretic* ones of Laplace's cosmogony." The concluding portion of this paper, which is reprinted from *Silliman's Journal*, appears in the succeeding number, and is interesting as a contribution to the "curiosities of scientific literature."

THE *Monthly Microscopical Journal*, No. 36, December 1871.—"Notes of Prof. James Clark's Flagellate Infusoria, with Descriptions of New Species," by W. Saville Kent, F.Z.S. An entirely technical paper, consisting of the diagnostic characters of new species, with those of previously-described ones amended. Eleven forms are figured and described, all of which were found in fresh water at Stoke Newington.—"On Bog Mosses," by R. Braithwaite, M.D., F.L.S., Part II., is occupied chiefly with the anatomy of the leaf and development of the plant.—"On the Conjugation of Amœba," by J. G. Tatem, is a note serving to strengthen the supposition previously advanced by this author, "that these large Amœbæ so frequently met with in the autumn months are actually the incorporation of two individuals in a