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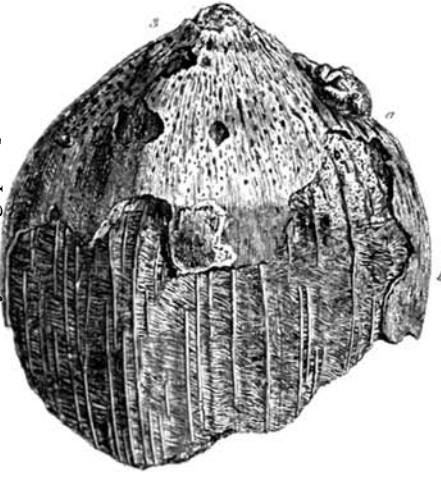
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XLIII.—*Remarks on Du Petit Thouars's Theory of the Origin of Wood.* By EDWIN LANKESTER, M.D., F.L.S., &c.*

THE origin of wood has long been a question of difference amongst botanists, and although the increasing attention paid to botany has rendered this subject much more intelligible, yet at the present time the most eminent men are divided upon the subject. In entering upon this question, it will perhaps be better to refer to the generally received views of botanists upon the formation of the tissues of plants, as upon these views the whole matter depends; and in these observations I shall refer to the last edition of Dr. Lindley's 'Introduction to Botany.' Adopting the classification of Meyen, Dr. Lindley divides the primary tissues of plants into five, viz. 1. Cellular Tissue (*Parenchyma*); 2. Pitted Tissue (*Bothrenchyma*); 3. Woody Tissue (*Pleurenchyma*); 4. Vascular Tissue (*Trachenchyma*); and 5. Laticiferous Tissue (*Cinenchyma*). These tissues are all of them composed of two primary elements, membrane and fibre, and the formation of the latter can be traced to an organic mucus (vegetable gelatin of Schleiden), supposed to be universally present in or between the cells of growing tissue†. "However different," observes Dr. Lindley, "these tissues may be from each other, in station, function, or appearance, there is no doubt that all are in reality modifications of one common type, the simple cell;" and the observations of Mirbel on the development of *Marchantia* seem to confirm such a view. Thus while the tissues

* Read in the Natural History Section of the Meeting of the British Association, Birmingham, 1839, and communicated by the Author.

† See Schleiden's *Beiträge zur Phytogenesis* in Müller's *Archiv*, No. 2, 1838, of which an admirable translation appeared in Part VI. of Taylor's *Scientific Memoirs*; also Lindley's *Introduction to Botany*, 3rd edition, p. 2; and Meyen's *Neues System der Pflanzen-Physiologie*, 1 Band.

are separated from each other for practical purposes, there can be little doubt as to their common origin.

But whilst botanists have admitted that the tissues are thus developed from a common form, there is still considerable difference among them as to the precise manner in which this is accomplished. This remark applies especially to the formation of the woody tissue, and the varied opinions of botanists on this subject have given rise to the interminable discussions on the origin of wood. Although much has been written on this subject, the whole question may be summed up in the words of DeCandolle, "Either there descend from the top of a tree the rudiments of fibres which are nourished and developed by the juices springing laterally from the body of wood and bark ; or new layers are developed by preexisting layers which are nourished by the descending juices formed in the leaves." The latter is the view adopted by DeCandolle, whilst the former originated with Du Petit Thouars, and these views are respectively advocated by Professors Henslow and Lindley in their works in this country.

In order to give a clear view of opinions on this subject I extract the following passages from Dr. Lindley's work. After referring to some experiments of Knight, he says, "An inference is drawn that the wood is not formed out of the bark as a mere deposit from it, but that it is produced from matter elaborated in the leaves and sent downwards, either through the vessels of the inner bark along with the matter for forming the liber by which it is subsequently parted with ; or that it and the liber are transmitted distinct from one another, the one adhering to the alburnum, the other to the bark. I know of no proof of the former supposition ; of the latter there is every reason to believe the truth."

In giving the views of Du Petit Thouars, he uses the following passage : "It is not merely in the property of increasing the species that buds agree with seeds, but that they emit roots in like manner ; and that the wood and liber are both formed by the downward descent of bud-roots, at first nourished by the moisture of the cambium, and finally imbedded in the cellular tissue, which is the result of the organization of that secretion". From these passages I think we must infer that

these observers suppose that woody fibre is not formed but by the aid of buds or leaves. Here then occurs the question as to what is woody fibre. And can any essential difference be pointed out between it and the cellular tissue in which it is imbedded? The most prominent features of woody tissue are its length, and the hardened secretions which are deposited in its interior. But these are not positive differences, as cellular tissue, as it is called, is frequently found elongated as in the tissue called "pitted" or *Bothrenchyma*; whilst on the other hand we frequently find it in a state as hard as that of the most hardened woody tissue, as in the endocarp of many fruits. If then the term wood in these passages is intended to apply to all hardened lengthened tissue, we ought to be able to trace its origin to leaves or buds wherever it is found. But in many instances we have lengthened and hardened tissue, or both combined, in cryptogamic plants, which develop no buds or leaves, as in some species of fungi belonging to the genera *Thelephora*, *Boletus*, &c.

There are also many parts of phanerogamous plants which possess hardened and lengthened tissue, which do not appear to come under the descending influence of the fibres from leaves or buds, such as the endocarps of amygdalaceous fruits, and the pericarps of a great variety of other fruits. The peduncles or flowerstalks in many plants possess woody tissue, but have no leaves, as also the stems of many endogenous plants which have no regular leaves.

Among the stems of exogens and endogens we shall find that there are many instances in which wood is formed without leaves. I have examined the stems of leafless monotropas, and find they possess woody tissue. In the stems also of leafless *Cactaceæ* woody tissue is deposited in abundance. If we examine also trees that have been wounded, we shall find that the lower lips of the wound have been filled up with woody tissue, and in such a manner as not to be explained upon the supposition that the wood at this point has been formed by the descent of fibres that had been formed and sent down from the leaves.

Another point to which I would wish to direct attention is the formation of woody fibres in tissue formed after trees have

been cut down. During the early part of this summer I found upon the stems of several elm trees that had been cut down a development of hard new matter between the bark and the wood of the tree : on submitting portions of this secreted matter to the microscope, I saw distinctly delicate fibres running in the direction of the fibres of the bark and wood. On the stumps of the trees on which this matter was found there were no branches or buds ; and as the stems had been removed the preceding year, these fibres must have been formed independent of either buds or leaves.

In order to satisfy myself of the correctness of these observations on the exudation of wood from the stumps of trees, in the latter end of the month of March of this year, I cut away an entire ring of bark about an inch in length from the branches of several young beeches. At this time the sap was rising and the bark was easily removed from the alburnum on which it lay. On the 6th of this month (Aug. 1839) I removed some of these branches, which presented the following appearances. The lips of the wound both above and below presented a hardened exudation, which on being cut into was softer than the surrounding tissues. This exudation was most abundant on the upper lip of the wound. On removing the bark from around the edges of the denuded surface a portion of the exuded matter came away with the bark, whilst another portion was left in connection with a layer of alburnum that had been formed subsequently to the removal of the bark of the trees. The section of the bark on the upper edges of the wound presented the same appearances, but the layer of alburnum was thicker. On examining the exuded matter by the microscope the external portions consisted of cellular tissue, but it was distinctly fibrous where it united with the wood of the liber and the alburnum. From these experiments it will be seen that woody tissue as it existed in the exuded matter from the lower edge of the cut, and in the alburnum under the bark at the same point, must have been formed independent of the descent of any fibrous matter between the bark and alburnum from the leaves on the tree above the wounded part.

The last occurrence which I shall mention in the organization of vegetables, which appears to offer an argument against

the views of Du Petit Thouars, is the existence of woody excrescences in the bark of trees. They present themselves most frequently on the beech in the form of a nodule projecting from the bark of the trunk of the tree. On examining them it will be found that they have no connexion with the wood of the tree, and consist of several layers of contorted woody tissue enveloped in a bark of their own, consisting of liber and cellular integument. They are of all sizes, from those commencing existence not bigger than a pin's head, to some that attain the size of an orange. The smallest appear to consist of nothing but cellular tissue; but as they increase in size a little spot can be seen in the centre, which appears to be the commencement of the formation of woody tissue. As they increase an obvious separation takes place into a central nucleus of woody tissue, and an enveloping integument consisting of woody and cellular tissue. In the spring, when the cambium is found to exist between the bark and wood of the tree, it is found in these excrescences; the nucleus of wood is then easily removed from its bark, and frequently falls out when the bark is broken. On some of them, and especially the smaller ones, buds are observed at the beginning of the year, but these seldom produce leaves. They are more abundant on the beech than any other tree, but are frequently met with on the elm, oak, walnut, crab, sycamore, &c. On cutting into the nucleus several layers of wood can be distinguished, which by maceration can be separated from each, indicating undoubtedly their yearly growth.

Sometimes a large number of these nodules are developed together, forming one large knob: this occurs particularly in the elm and acacia, the wood of the latter of which is frequently used for ornamental cabinet-making, on account of the beautiful markings which the central points and the concentric lamellæ of the nodules afford. These large knobs seldom develope branches, and although in these cases they lie in contact with the wood of the trunk of the tree, yet a distinct separation can be observed between the wood of the knobs and the wood of the tree. This separation is so evident in many cases, that it is obvious the wood of the knobs had not a common origin with the wood of the trunk. The bark of the knobs and the trunk are continuous.

Since the greater part of these observations were made, the third edition of Dr. Lindley's 'Introduction to Botany' has appeared, in which I find he has noticed these formations under the name of *embryo-buds**, a name given to them by Dutrochet. In his remarks, Dr. Lindley observes, that he cannot reconcile the statements of Dutrochet, that they secrete an independent cambium, and are "certainement" connected with the wood of the tree. I have not seen Dutrochet's notice of these bodies, but I can so far confirm his remarks, as to say, that in most which I have examined there is a secretion independent of the wood of the trunk, and that in others there is a connexion, or rather a conjunction with the wood of the trunk. This latter occurrence takes place occasionally where the buds have been developed into branches, which is very seldom.

The existence and growth of these bodies cannot be easily explained on the theory of Du Petit Thouars, and Dr. Lindley admits them to be one of the greatest objections.

The only explanation that I can imagine the advocates of this theory could offer, would be that the wood in the knobs is formed by leaves which are occasionally developed, and not every year with the leaves of the branches. To this I would answer, that although I examined hundreds of these knobs during the spring and summer of 1838, I never found any leaves upon them; and it was only by a much more extensive examination this year, that I found five or six knobs with leaves upon them.

The preceding observations have been made in the hope that they might not prove uninteresting to those engaged in botanical inquiries, and especially as the facts related have led me to doubt the correctness of that theory which at one time I considered as firmly established.

Campsall, near Doncaster, Aug. 1839.

NOTE.—Since the foregoing remarks were written some valuable contributions to this department of inquiry by Dr. Schleiden of Berlin have been published in the 'Annals of Natural History,' and other publications in this country. His paper on the Anatomico-Physiological Differences in the Structure of Stems, in the December Number of this Journal,

* From a further examination I think a more appropriate designation for these bodies would be *abortive branches*.

points out the unsatisfactory nature of the present views of botanists on this subject, and will, it is to be hoped, open the way for further investigations on a very important branch of inquiry. From Dr. Schleiden's "Contributions to Phytogenesis" I am happy to make the following quotation in support of the views I have advanced. "The spiral vessels," he says, and the same remark would apply to woody fibre, "begin to be visible in the newly formed parts, and also in the entire bud, always in the immediate vicinity of old already formed spiral vessels, and they proceed in this manner away from the stem into the new parts. I do not understand therefore what is meant when the fibres of the stem are regarded as proceeding from the buds; one might just as well consider the river as running from the ocean to its source." (Taylor's Scientific Memoirs, vol. ii. p. 303.) I have also lately received Meyen's Neues System der Pflanzen-Physiologie, and to those who are interested in this subject, I would recommend the observations made by that able and laborious botanist 'on the formation of the new wood and bark,' in the first volume of the work. "The Theory" (of Du Petit Thouars), observes Meyen, "on the formation of the new wood is truly very intellectual, and although many have given their word for its correctness, it is yet nothing more than a pretty picture with many defects."

XLIV.—On the *Teucrium regium* of Schreber. By CHARLES C. BABINGTON, Esq., M.A., F.L.S., F.G.S., &c.

THE determination of a doubtful species must always be a subject of great satisfaction to botanists, and I am therefore much pleased that it has fallen into my power to do a little towards the elucidation of a plant considered as a "species dubia." The plant to which I refer is the *Teucrium regium* of Schreber, which is stated by that author to be a native of Spain, and, by Morison, of Italy; but of which Mr. Bentham (*Labiatae*, p. 683) appears not to have seen a specimen. A plant bearing that name has been in my possession for several years, having been gathered by M. Fleischer for the *Unio Itineraria* "in fruticetis Smyrnæ;" and upon comparing it