XIII.—ON CERTAIN PHENOMENA OBSERVED IN THE GENUS *NITELLA*,
AS ILLUSTRATIVE OF THE PECULIAR STRUCTURE RECENTLY DIS-
COVERED BY MR. BOWERBANK IN A FOSSIL WOOD FROM THE LONDON
CLAY.*

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THE observation of a new form of vascular tissue occurring in the fossil wood from the London clay, as detailed by Mr. Bowerbank in his paper,† has induced me to offer a few remarks on an apparently analogous *recent* structure, which I several years ago observed in some specimens of *Nitella flexilis*, kept for the purpose of examining the circulation in that plant.

Before proceeding to detail the result of my own observation, I may be allowed to quote that portion of Mr. Bowerbank's paper in which this new fossil tissue is described. The author observes, that in the Herne Bay fossil "some of the vessels contain large vesicular globes, which appear to have been freely floating within their parietes; when not in contact with each other, they are perfectly globular and uncompressed. They vary very considerably in size, in some cases filling nearly the whole diameter of the vessel, while in others they do not occupy a tenth of that space. They are frequently so numerous that they fill the whole of the vessel. The structure of which these globular bodies is formed is thin and very pellucid, and no fibre or other organic structure is apparent upon its surface. There are also in some of the vessels exceedingly small vesicles, interspersed among the larger ones. A portion of these are opaque and black, but the greater number of them are transparent like the larger ones. These very minute vesicles do not exceed in size the globules of circulation in *Valisneria*, and as we find vesicles of every size, intermediate between these minute ones and the largest of the vesicles, it appears probable that the whole of them may be attributed to a more than ordinary development of globules of circulation, analogous to those observed in *Valisneria* and other plants." The author further remarks, that he has "never seen this curious form of tissue in any other wood, either recent or fossil; though he had occasionally observed very similar, large pellucid globules slowly moving in the great central cavity of the stem (of

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† An abstract of this paper will be given in a future number.

Chara), while the circulation of the smaller globules in its parietes has been proceeding with a much greater degree of rapidity."

These particulars with reference to the structure of the fossil wood, and the resemblance to *Chara*, so happily conjectured, are so completely borne out by what I have observed in *Nitella*, that the description of the one might almost serve for that of the other.

In some specimens of *Nitella flexilis*, the circulation was observed to be going on vigorously up to the 4th of April, 1835. On the 6th, two days after the last observation, the circulation had entirely ceased. The green particles lining the interior of the stems and branches had shrunk from the parietes, and, together with the green circulating matter of the interior, were collected together in irregular masses within the tubes; but none of the brown bodies afterwards observed, were as yet apparent in any of the pieces.

On the 11th, five days after the preceding observation, and no intermediate one having been made, the same specimens were again examined, and were found to present characters which I had not before observed. In many of the joints, the irregular masses of green matter had resolved themselves into globular bodies of variable size, but definite form, and had changed from a green to a rich brown colour.

About half of the joints had undergone this change—the other half remaining in the green state as at the last observation; but the circulation had entirely ceased in all, and the plant was evidently dead.

In the greater number of those joints which contained the brown

bodies, the green matter had entirely disappeared, leaving the tubes as transparent as glass, with the brown globules like rows of beads irregularly scattered in their interior—(fig. a.) These varied very considerably in number. In one long joint of the plant, about eighty of them were collected, while in one of the short branches there were only five. Some of the larger bodies were about half the diameter of the tubes in which they were contained, while others were only one-eighth of the diameter.

Those which were completely formed, had all the same character.

They consisted of tolerably regular spheres, except where their form had been slightly altered by lying in contact with each other. In almost all of them, however, and especially in the larger ones, there was a slight flattening, or a cup-like depression at one point (fig. *b, c*), which was generally observed to be directed towards the surface of the tube, and might have been produced by the globules coming in contact with the parietes of the tube, but was, nevertheless, retained after they were extracted from it. In the centre of this flattened portion, or cup-like depression, there was always observed to be a small collection of granules, which were of the usual size of the globules of circulation, but also of a brown colour. The brown bodies, on account of the now transparency of the containing tubes, could be examined as readily *in situ* as when extracted from the joints. In either case they appeared to consist of an enveloping membrane, which was probably formed by the aggregation of the green granules of the plant, assisted by the condensation of the mucous fluid of the interior; and thus forming an investing capsule, which, when torn open, was found to be filled by the *green* granules of the plant, mixed with mucous fluid—(fig. *d*). The investing capsule was very thin, and presented no other traces of structure than that which would arise from the formation of a membrane by the aggregation of granular matter.

In those joints in which the brown bodies had been formed, the green matter of the plant had in most cases entirely disappeared. In others, where they appeared to be in process of formation, they were observed to be mixed with the green matter, and in other parts again, they had not yet undergone the change from green to brown, but shewed themselves in the form of irregular masses of green matter approaching the spherical form.

It appears, then, that this remarkable change had taken place within a week after the circulation had been observed to be going on vigorously in the plant. And the nature of the change appears to be this:—The green granules which lined the internal surface of the joints when living desert the parietes, and, together with the green circulating granules of the interior, collect together in irregular masses in the centre of the tube, which then resolve themselves into irregular spheres, still retaining the granular outline, indicative of their formation by aggregation, but which they afterwards lose on assuming a more perfect spherical form, and become bounded by an investing capsule which turns of a rich brown colour, while the contained granules retain their original green.

It is difficult to imagine what purpose is intended to be answered by such a change taking place, after the circulation, and other evidences of

life in the plant have ceased. Yet, the idea of such a change being the result of a merely fortuitous arrangement of the component particles of the plant, attendant on decomposition, is negatived by the circumstance of the remarkable uniformity and symmetry of the resulting globules, which appear to possess the most definite characters, differing from each other only in size. Nor is the change by any means uniform for the whole plant; for in some parts two of the joints were observed to be in the green state, while the joint situated between them was free from green matter, and contained the brown bodies; but this might have resulted from the circulation ceasing earlier in the central joint, and, consequently, allowing more time for these changes to take place. It would appear that the enveloping of the granules by an investing membrane, was a means of preserving the organic particles in a green, and, probably, therefore, in a living state. But whether for the purpose of regeneration under a different form, (thus affording an example of equivocal generation), or whether the phenomenon was in any way connected with the reproduction of the plant, did not appear from any observation that I could make, as no further change was observed to take place in the brown bodies, beyond that which has been described, though they were kept in water for a considerable time. An appearance similar to what appears to be the first stage of this process is not unfrequently observed in living *Chara*, where a number of the green granules collect together in a mass, which either passes along with the general circulation, or remains revolving at one extremity of the tube. But I am not aware that the brown bodies now described, have been ever seen in the living plant, nor have I met with any observations which at all illustrate the point. The phenomenon, however, appears to me to bear very closely upon the remarkable form of tissue described by Mr. Bowerbank as occurring in the Herne Bay fossil, and I have therefore been induced to bring it before the Society, together with the original drawings, which were made at the time of the observation, and the preparation of those portions of the plant from which they were made, and which, though it has suffered from being kept for more than five years, during which time it has become dry, will still, I believe, afford a fair idea of the structure alluded to.

These brown globules, contained in the stems of *Nitella*, appear to differ from the globules found in the vessels of the fossil wood, chiefly in the circumstance of their being hollow spheres in the fossil, but capsules filled with green matter in the recent plant.