dle position between them." He has based his determination of the species upon the sterile fronds only; but in the figure of Lesquereux we have the fertile frond, or a portion of it, of the same species. This fragment was found at Erie, Col. Should not the Caulinites fecundus be considered Onoclea sensibilis?

On plate lxiii. of the same volume we have a fossil called Zamiostrobus mirabilis, and on p. 70 is the description. Mr. Lesquereux has referred the fossil to the Gymnospermae, and considers it probably to be the cone of one of the Zamieae. Compare, now, the copy of his figure (fig. 2) with that of the longitudinal section of the fruit of Nelumbium luteum (fig. 3), and the resemblance is striking, — so striking is it,

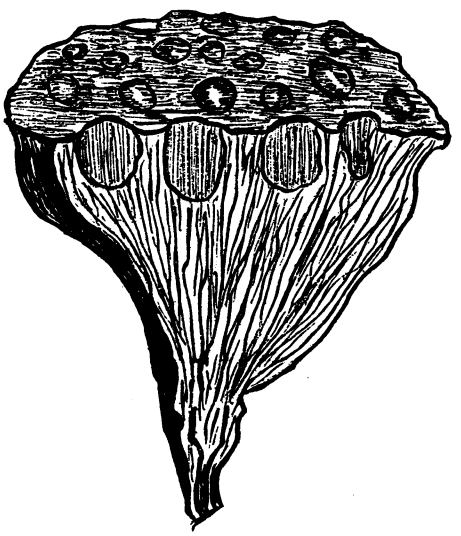

FIG. 3. — Longitudinal section of Nelumbium luteum.

in fact, that I do not hesitate to say that both belong to the same genus. Mr. Lesquereux's specimen was found on the surface at Golden, Col.

Turning to p. 252 of the same volume, we find two species of Nelumbium described from the leaves. One was found at Golden, and the other at Sand Creek, Col. The fact of finding leaves of a Nelumbium in the same locality as the fossil here figured, strongly comfirms the idea that the Zamiostrobus is only the capsular fruit of a Nelumbium, probably that described as N. Lakesii. It differs only slightly from the other species, N. tenuifolium; and the two should probably be united. JOS. F. JAMES.

Spool-shaped ornaments from mounds.

As the spool-shaped copper ornaments occasionally found in mounds — one of which is figured by Dr. Rau (*Arch. coll. U. S. nat. mus.*, p. 61, fig. 235), and others by Professor Putnam (*Rep. Peabody mus.*, xv. 110, figs. 18 and 19) — have attracted the attention of archeologists, it may not be amiss to notice some additional specimens of the same kind, recently obtained by the assistants of the bureau of ethnology.

Three of these were obtained by Dr. Palmer, of Mr. J. D. Miller, Marshall county, Ala., who discovered them in an ancient grave in that county. As yet no description of the grave, nor any further statement as to the conditions under which they were found, has been obtained.

These copper spools, as also the others to be mentioned, are of the form represented in the figures alluded to, consisting of two concavo-convex disks joined together by a hollow cylindrical axis. One of the specimens is quite perfect. The disks are one and a half inches in diameter, formed of copper plate that is very smooth and even throughout. The hollow cylindrical axis is about seven-tenths of an inch long, and a little less than two-tenths of an inch in diameter, and has the ends slightly expanded outside of the disks, so as to hold the latter in position. The other specimens found by Mr. Miller are of larger size; being about two inches in diameter, and closely resembling that figured by Professor Putnam. The plate is not more than half the thickness of that of which the preceding specimen was made, being almost as thin as writing-paper; but the cylindrical axis is of the same form and dimensions.

The method of connecting and fixing the disks in these, as will be seen from the description, is slightly different from that described by Professor Putnam. The cylindrical axis is simply passed tightly through the holes made in the centre of the disks, and the ends expanded, as though done with a punch, so as to clasp the outer faces.

Four other specimens, very similar to that figured by Professor Putnam, were discovered by Mr. Middleton in a mound in Jackson county, Ill. The mound in which these were found is one of a group situated in the Mississippi bottom, a short distance from Grand Tower: it is about ninety feet in diameter, and six feet high. In excavating it, human bones were found at all depths, from six inches to six feet below the surface. Below this no human bones were observed; but at the depth of nine feet, that is, three feet below the original surface of the ground, some animal bones were discovered.

The copper specimens were found at the depth of three feet, lying by the side of a skeleton. The four are of the same form and size, being about one inch and a half in diameter: the axis is short, bringing the disks rather closer together than usual, the attachments being as described by Professor Putnam. All the specimens mentioned, except the first, are much corroded and very brittle. The first is also somewhat corroded, but not to the same extent as the others, and is probably the best formed and most perfect specimen of the kind so far discovered. CYRUS THOMAS.

[These so-called 'spool-shaped ornaments' have been shown by Mr. Putnam to be enormous ear-studs, his examinations of the altar-mounds in Anderson township, O., having brought to light over thirty made of copper, together with figurines in which similar objects were *inserted in the ears*. See *Science*, i. 348, 349.]

Unio forms a byssus.

If your correspondent at Holston River, Va., will consult my 'Observations on the genus Unio,' he will find most of his queries answered. The subject is treated in vols. i., iii., vi., x., xi. The byssus is not attached to the shell, but to the foot of the included soft parts. ISAAC LEA.

Philadelphia, March 24, 1884.

Illusive memory.

James Sully, in his 'Illusions,' suggests that a good way of testing for recollections of ancestral experience would be to find out whether children of seafaring men, who have been brought up far from the coast, have the feeling, when they first see the sea, of having seen it before.

Paul Radestock seems to consider that the question is settled by the fact, that while he was writing his

book, 'Schlaf und Traum,' and keeping a record of his dreams, whenever he had a dim idea that he had seen an object or had a thought before, he generally found that his dreams had contained something like it. But he overlooks the consideration that the dream, as well as the feeling, might have been a case of inherited recollection. C. L. F.

Baltimore, March 24.

The reproduction of Clathrulina elegans.

An article with this title (*Science*, iii. 303), by Dr. Stokes, contains two errors, to which his attention is courteously directed, and which are evidently founded upon an incorrect abstract of Miss Foulke's paper. Dr. Stokes says Miss Foulke's statements are "apparently confined chiefly to a process by quadruple subdivision of the body into uniflagellate organisms as observed by herself, with allusions to three additional processes as observed by others." Of the four processes described by the writer, three were first described by her, the fourth being that described by Cienkowski. Again: in the last paragraph is an error resulting from the position of the quotation-marks, which would seem to classify one of the writer's observations with those of Dr. Stokes. Colonies are also formed by the Actinophrys form of young, and the dissemination of the species is carried on as well by the uniflagellate as by the bi-flagellate organisms. These observations should teach us how varied may be the forms assumed by one animal.

SARA GWENDOLEN FOULKE.

WHAT IS A LIBERAL EDUCATION?

I DO not intend, in the present paper, to enter upon the disputed question between the advocates of classical culture on the one hand, and those of scientific training on the other; because it seems to me that the line on which the two parties divide is not that which really divides the thought of the day. If we look closely into the case, we shall see that the objects of a higher education may be divided into three classes, instead of the two familiar ones of liberal and professional. In fact, what we commonly call a liberal education should, I think, have two separate objects. With the idea of a professional education we are all familiar: it is that which enables the possessor to pursue with advantage some wealth-producing specialty. Although, in accordance with well-known economic principles, it is designed to make the individual useful to his fellow-men, the ultimate object in view is the gaining of a livelihood by the individual himself. On the other hand, the object had in view in what is commonly known as culture, is not the mere gaining of a livelihood, but the acquisition of those ideas, and the training of those powers, which conduce to the happiness of the individual. From this point of view, culture may be considered an end unto itself.

The third object which we have to consider is only beginning to receive recognition in the eyes of the public. It is the general usefulness of the individual, not merely to himself and to those with whom he stands in business relations, but to society at large. Modern thought and investigation lead to the conclusion, that man himself, the institutions under which he lives, and the conditions which surround him, are subject to slow, progressive changes; and that it depends very largely on the policy of each generation of mankind whether these changes shall be in the way of improvement or retrogression. During the next fifty years all of us will have passed from the stage of active life, and the course of events will be very largely directed by men who are still unborn. The happiness of those men is, from the widest philanthropic point of view, just as important as the happiness of those who now inhabit the earth; and, in the light of modern science, we now see that that happiness depends very largely upon our own actions. We thus have opened out to us an interest and a field of solicitude in which we need the best thought of the time. The question is, what form of education and training will best fit the now rising generation for the duty of improving the condition of the generation to follow it?

Let it be understood that we are now speaking, not of the education of the masses, but of that higher education which is necessarily confined to a small minority. So far as I am aware, that fraction of the male population which receives a college education is not far from one per cent. To that comparatively small body we must look for the power which is to direct the society of the future, and by their acts to promote the well or ill being of the coming generation. Our duty to that generation is to so use and train this select body as to be of most benefit to the men of the future. What is the training required? I reply by saying that I know nothing better for this end than a wide and liberal training in the scientific spirit and the scientific method. The technicalities of science are not the first object; and, so far as they are introduced, it is only as media through which we may imbue the mind with certain general and abstract ideas. If called upon to define the scientific spirit, I should say that it was the love of truth for its own sake. This definition carries with it the idea of a love of exactitude, — the more exact we are, the nearer we are to the truth. It carries with it a certain independence of authority; because, although an adherence to authoritative propositions taught us by our ancestors, and which we regard as true, may, in a certain sense, be