On the Substance Exhibited at the British Association, Brighton, by Mr. P. L. Sclater, and stated to be the Ossified Notochord of a Fish

NEARLY every one frequenting the Zoological Section at the British Association at Brighton must have seen and been puzzled by a substance exactly resembling in external appearance a slender willow twig when perfect, two feet or more in length, and pointed at both ends.

This substance was exhibited by Mr. Sclater, and pieces of it were freely distributed by him for examination.

I was, unfortunately, not present when he read his paper on the subject; but I gathered that he had said that the substance had been described to him by the person who sent it as occurring in the back of a fish, and that Mr. Sclater called it an ossified notochord. A drawing of the fish was exhibited.

I further heard that Mr. Gray, of the British Museum, regarded the substance as the axis of one of the Pennatulidæ, and that this opinion was held by several other naturalists also.

I first became acquainted with the substance at the Kew Herbarium, where a piece of it was shown me by Mr. Berkeley, it having been given to him by Prof. Thiselton Dyer; and I was told that Dr. Hooker had examined it with the microscope, and rejected it as certainly not vegetable.

It was almost impossible to conceive of the substance being the notochord of a fish. No fish's notochord is composed of longitudinal fibres, nor has a structure at all resembling that of the substance in question; and moreover a notochord in such a fish as a lamprey, in which it is persistent, is much thicker in proportion to its length than are these calcified rods. Further, the tendency is for a notochord to ossify peripherally, and form rings of bone, not a hardened central core.

On reaching Oxford from Brighton, I got Mr. Robertson to give me a specimen of *Funicularia quadrangularis*, one of the Pennatulidæ, which was preserved in spirits. I found it had a long slender flexible core, exactly similar in appearance to Mr. Sclater's substance, but quadrangular in section instead of circular. The core was about two feet and a half long, and pointed at both ends. Microscopical examination of longitudinal sections of the core, when treated with acetic acid, gave off carbonic acid in quantities, and showed a structure almost exactly resembling that observed under similar circumstances in Mr. Sclater's substance.

I then looked into the literature of the subject, which fully confirmed me in the opinion that the substance in question is the core of one of the Pennatulidæ. A few statements, culled from the two works I consulted, may be interesting to the readers of NATURE. The works were "Anatomisch-systematische Beschreibung der Alcyonarien," von A. Kölliker, Erste Abtheilung: Die Pennatuliden. Erste Hälfte (Frankfort: C. Winter, 1870). "Icones Histologicæ, oder Atlas der Vergleichenden Gewebelehre," herausgegeben von A. Kölliker. Zweite Abtheilung, Erster Heft. Die Binde-substanz der Cœlenteraten, p. 158 (Leipzig: W. Engelman, 1866).

The Alcyonariæ, a sub-order of polyps, are divided into three groups:—(1) Alcyonidæ; (2) Gorgonidæ; (3) Pennatulidæ.

The Pennatulidæ consist of hard and soft parts. The hard parts appear in most varieties in the form of an inner calcified axis, which in size and position is like that of the Gorgonidæ. It is to be considered as calcified connective tissue, is entirely and completely enclosed within the substance of the polyp colony, and is pointed at both ends.

The Pennatulidæ are thus divided:—

I. Pennatulidæ with polypbearers bilaterally symmetrical.
  A. Polypbearers feather-shaped in Pennatuleæ.
  B. Polypbearers leaf-shaped in Renillaceæ.
II. Pennatulidæ, with polyps arranged radially.

The Pennatuleæ break up into (1) Penniformes; Pennatuleæ with a well-marked feather-shape; (2) Virgularieæ; Pennatuleæ with a long, narrow polypbearer, and small leaves or polyps resting immediately on the axis. To this latter group belongs the genus *Funicularia*, and probably also the genus to which Mr. Sclater's specimen belongs.

With regard to the fine structure of the hard axis of Pennatulidæ, I have gathered the following from Kölliker's "Icones," p. 158.

The axes of Pennatulidæ consist of calcified horny substance, arranged in concentric lamellæ about a central core. The lamellæ are pierced by peculiar soft radial fibres, which, however, are well defined in certain species only. The organic basal substance shows an extremely well marked fibrillar structure. The axes are less firmly calcified than those of the Gorgonidæ, and are thus for the most part able to be cut with a knife and bent.

According to the analyses of Fremy (Ann. de Chimie, 1855, t. xliii. p. 98), the axis of *Pteroeides spinosum* contains from 31 to 40 per cent. mineral matter, and that of *Pennatula rubra* from 45 to 48 per cent.

A drawing is given by Kölliker of a transverse section of the axis of a Virgularia (*Lygus mirabilis*) prepared by grinding, which shows a white central core, surrounded by a broad brownish cortex, which is marked with concentric and radial lines.

If the axis of a *Lygus* be treated with acetic acid, a development of carbonic acid takes place. It becomes soft, and allows the following structure to be made out:—

The bulk of the axis consists of a fibrous tissue which resembles ordinary fibrillar connective tissue in the most deceptive manner, and consists of very fine fibrillæ, which run parallel to one another in a wavy fashion, and which can be isolated from one another. On the surface of the axis is a yellowish cuticle.

Drawings are given of longitudinal sections of the axis of *Lygus mirabilis*. It shows the peculiar broad transparent radial fibres crossing the finer longitudinal ones. In another figure of a similar preparation from *Funicularia quadrangularis*, these radial fibres are less marked, but the cavities containing them appear as oval apertures in the section.

Reference is made to Quekett, Lectures on Histology, II., and Histological Catalogue, I., where the structure of the axes of *Pteroeides*, *Lygus*, and *Funicularia* is described, but the radial fibres mistaken for canals.

I think any one who has examined Mr. Sclater's substance, and very many have had such an opportunity owing to his kindness in distributing pieces, will find that both in external characteristics and internal microscopical structure, it conforms very closely to the description given here from Kölliker of the axis of the Pennatulid. I have sent the Editor of NATURE some pieces of the axis of *Funicularia quadrangularis* in case any one cares to compare the two substances, and has not the material at hand. In the mean time I cannot but conclude that Mr. Sclater has been misinformed, and that we are very unlikely ever to see that very marvellous fish in the flesh.

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Ocean Currents

HAVING just returned from a sojourn of nearly two months amongst the White Mountains, I am now for the first made aware of the publication, both of my last note on Ocean Currents, and also of Mr. Croll's reply. I have not been disposed to enter into an extended discussion of this subject, knowing that it cannot be properly treated without the use of mathematics, in short essays suited to NATURE, and doubting whether the discussion could be made either acceptable to its Editor or edifying to its readers. In my last note, therefore, I endeavoured to be as brief as possible, and considered only the more simple form of the conditions of the problem, as expressed by differential equations, showing the relations between the forces, resistances, and the differentials of the motions, and showed that the deflecting force eastward exerted upon a pound of water or any body in moving toward the pole with a velocity of one mile per day, and which must be sensibly the measure of the resistance of friction, is of the same order near the parallel of 45° as the action of gravity on the same body upon a gradient of 6 ft. from the equator to the pole; and from tidal considerations it was inferred that the resistances to the slow motions of ocean currents may be very much less than the action of gravity upon any body upon a gradient of 6 ft. in the distance of a quadrant.

If, instead of considering the differential equations of any problem, and endeavouring to satisfy them directly, we adopt the less simple method, and consider the integrals of these equations, and endeavour to satisfy them directly, the method, though less simple, is entirely legitimate, and we should obtain the same results. This is substantially the method adopted by Mr. Croll; and from considering the problem in this way, he comes to the conclusion that the deflecting force eastward, which is the measure of the resistance, is at least 1,500 times greater than the action of gravity on a gradient of 6 ft. from the equator to the parallel of 60°; and as the velocity of the pound of water eastward, and that toward the pole, are probably about of the same order, and consequently the resistances, he justly infers that the resistance to the motion toward the pole must be overcome by