

June 14, 1883.

THE TREASURER in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

Dr. James Crichton Browne, Surgeon-Major George Edward Dobson, Dr. James Matthews Duncan, Mr. Charles Edward Groves, Professor Arnold William Reinold, and Mr. John James Walker were admitted into the Society.

The following Papers were read:—

- I. "Researches on the Foraminifera. Supplemental Memoir. On an Abyssal Type of the Genus *Orbitolites*; a Study in the Theory of Descent." By W. B. CARPENTER, C.B., M.D., F.R.S. Received May 31, 1883.

(Abstract.)

This paper is supplemental to the series of Memoirs formerly presented by the author on the structure of certain of the higher forms of the group of Foraminifera; in which he laid down the new principles of classification afterwards worked out by him, in conjunction with Messrs. W. K. Parker and T. Rupert Jones, in his "Introduction to the Study of the Foraminifera;" and especially to the first of those memoirs ("Phil. Trans.," 1856), which consisted of a Monograph of the genus *Orbitolites*, and of some general doctrines deduced from the study of it as to the Range of Variation in Species, a question which was much occupying the attention of philosophical naturalists. The subsequent publication of Mr. Darwin's "Origin of Species" having led him unhesitatingly to adopt the principle of "Descent with Modification" or "Genetic Continuity," he had applied it to the construction of a pedigree of the *Orbitoline* type; between the smallest and simplest, and the largest and most complex of which, he had shown in his first memoir that such "continuity" could be clearly traced out.

Starting with the very simplest type of Foraminiferal organisation—a minute globular or pyriform monothalamous shell, with a single orifice, enclosing a particle of sarcodæ—he showed (1) that the extension of such a particle into a spirally-coiled sarcodic cord, invested by a porcellaneous shell, becomes a *Cornuspira*; (2) that a constriction of this cord at the points at which additions are made to the length of

the shell, with a partial interruption of the tube at these points, gives us *Spiroloculina*, the ancestral form of the whole *Milioline* series; (3) that the flattening-out of this tube (as in the more advanced growth of *Cornuspira*), and the formation of a complete septum across its mouth, traversed by separate pores for the issue of sarcodic filaments, convert it into a *Peneroplis*, whose sarcodic body consists of a succession of segments, occupying the successive chambers of the shell, which are divided by septal partitions, but are connected by "stolon processes" that traverse them; (4) that the subdivision of these chambers by transverse partitions into "chamberlets," and of the segments of the body into "sub-segments," the shell still growing along a spiral axis, gives us *Orbiculina*; the chamberlets of each chamber retaining a communication with each other by a continuous gallery, which is occupied in the living state by a band of sarcode that connects together all the sub-segments formed by the division of any one segment; and (5) that the opening-out of the *Orbiculine* spire, and the progressive extension of the *alæ* of its successively-formed chambers round its umbilicus, at last brings these *alæ* together, so that they unite into a continuous ring; and by the addition of new rings to the periphery of the preceding, a circular disk is formed—the plan of growth thus changing from the spiral to the *cyclical*, which is the distinguishing character of *Orbitolites*.

The materials at that time possessed by the author only enabled him to trace back this pedigree with any certainty from the typical *Orbitolites*, which exhibits no trace whatever of spiral growth, to the spiral *Orbiculina*; but he expressed his belief that the "nuclear mass" in which every *Orbitolites* originates—consisting of a pyriform "primordial segment," surrounded by a single turn of the "circumambient segment," is essentially an abbreviated *Milioline*; and he was thus led to rank *Orbitolites* as the most specialized type of the family MILIOLIDA.

It was, therefore, with singular satisfaction that he found in a new form of *Orbitoline* disk, brought up from a depth of 1,500 fathoms in the "Porcupine" expedition of 1869, the complete realisation of his hypothetical pedigree: the formation of this disk commencing in a minute primordial chamber, which first extends itself into a closely coiled spiral tube like that of a *Cornuspira*, then shows an incipient septation in the later coils of this tube, which constitutes it a *Spiroloculina*; then flattens-out and becomes camerated as a *Peneroplis*; then undergoes the subdivision of its chambers which converts it into an *Orbiculina*; and, finally, by the fusion of the lateral extensions of the chambers into complete annuli, assumes the *cyclical* plan of growth characteristic of *Orbitolites*. To this beautiful species, whose disk attains a diameter of $\frac{6}{10}$ of an inch, whilst its thickness does not exceed $\frac{1}{300}$ of an inch, the name *Orbitolites tenuissima* may be appropriately given.

The passage of each individual of this species through a series of forms which, in the classification of M. D'Orbigny, belong to *four different Orders*, sufficiently proves that, among Foraminifera, *plan of growth* is a character of secondary value; whilst the retention, in the perfected disk, of the entire series of those ancestral forms, through which the very simplest of Foraminiferal organisms has become evolved into one of the most complex, invests this abyssal type of *Orbitolites* with a peculiar interest and value.

Having been for some time engaged in the study of the large collection of *Orbitolites* (chiefly made on the Fiji reef) brought home by the "Challenger," with a view to the preparation (at the request of the late Sir C. Wyville Thomson) of a complete Report upon this generic type, the author has delayed the publication of this remarkable confirmation of his previously-expressed views, until he should have concluded his investigation of the large mass of new material which has thus come into his possession; having early seen reason to believe that his recent study would prove of some value in its general relation to the Theory of Descent. And he now offers the results of it as a contribution to that great inquiry, in the conviction that (as was admirably said thirty-five years ago by Sir James Paget) "the highest laws of our science are expressed in the simplest terms, in the lives of the lowest orders of creation."

The aggregate of the phenomena presented by the evolutionary history of this type (and equally, the author fully believes, by that of every other of the more complex types of Foraminifera) may be thus summed up:—

1. That there has been a progressive specialization in the structure of the shelly envelope, which, in the highest type of *Orbitolites* (the large *O. complanata* of the Calcaire Grossier and of the Fiji reefs) attains a very extraordinary complexity.

2. That this specialization has followed a very definite and well-marked line.

3. That this progressive complication in the structure of the disk is attained without any corresponding specialization in the structure of the animal, whose sarcodic body retains throughout (as far as the most careful examination can enable us to determine) its primitive homogeneity.

4. That all the ancestral forms through which the highest type has passed, are still living and flourishing under exactly the same conditions (so far as can be ascertained) as itself.

The full discussion which the doctrine of the "Origin of Species by Natural Selection" has now received, may be considered as having clearly established that what has been called the Law of Natural Selection is simply a generalised expression of the fact, that among the varetal forms continually arising *de novo*, those survive

which are best adapted to their environments. The causes of such variation, not being in any way accounted for by "natural selection," must be looked-for either in the influence of the "environment" on the organism, or on some tendency to vary inherent in the organism itself; and the question which now most occupies the minds of thoughtful Evolutionists, is whether the variations that have conduced to the establishment of the higher types are "aimless," or whether they have followed a definite "plan."

From a careful consideration of all the circumstances of this case, the author comes to the conclusion not only that such a "plan" can be clearly traced out in the present case, but that "natural selection" can have had scarcely any share in determining the progressive evolution and relative distribution of the several forms of the *Orbitoline* type.

II. "On the Development of the Great Omentum and Transverse Mesocolon." By C. B. LOCKWOOD. Communicated by W. S. SAVORY, F.R.S. Received May 18, 1883.

(Abstract.)

The paper begins by quoting the two usually accepted descriptions of the peritoneum as far as the relations of the omentum and transverse colon are concerned. The old account, that which makes the transverse colon to be between the two ascending layers of the great omentum, is first given. Afterwards the new account is repeated; this says that the colon is not between the layers of the great omentum, but only adherent to them. The development of the colon is next mentioned, and Haller's theory, that the colon and omentum become adherent, is discussed. Reasons are given to show that the old account of the peritoneum is the true one, and that, therefore, Haller's theory is unacceptable. After speaking of the development of the omentum and its relation to the transverse colon, the changes which the author believes to occur are described. Instead of adhesion taking place between the omentum and colon, it is shown that the peritoneal fossa, which at early periods exists between them, gradually disappears, owing to an unfolding or drawing out of the peritoneum at that point. It is further shown that when this has taken place the transverse colon comes to be between the two ascending layers of the great omentum.

A brief description of the anatomical preparations which accompany the paper is also given.