

Let us as teachers accept no single element or variety of culture as the one essential; let us remember that the best fruits of real culture are an open mind, broad sympathies and respect for all the diverse achievements of the human intellect at whatever stage of development they may be to-day—the stage of fresh discovery, or bold exploration, or complete conquest. The moral elements of the new education are so strong that the new forms of culture are likely to prove themselves quite as productive of morality, high-mindedness and idealism as the old.

CHAS. W. ELIOT.

SCIENTIFIC BOOKS.

West Indian Madreporarian Polyps. By J. E.

DUERDEN. *Memoirs of the National Academy of Sciences*, Vol. VIII. 1902.

It may seem strange that notwithstanding the thorough study that has been devoted to the skeleton of the corals our knowledge of their soft parts has been exceedingly limited until recent years. It must be remembered, however, that interest in the anatomy of the nearly related Actiniaria was not really awakened until the publication of Richard Hertwig's report on the Challenger collection in 1882, and the technical difficulties in the way of extended anatomical study of the coral may well be advanced as an excuse for its neglect.

In the same year that Hertwig's report appeared, however, von Koch laid the foundation for a proper appreciation of the significance of the soft parts of the corals by demonstrating the ectodermal nature of the corallum, and since that date valuable contributions to the anatomy of the Madreporarian polyps have been made by von Koch himself and by Bourne, Fowler and von Heider. The total number of forms studied has, however, remained comparatively small, and although enough information was gained to demonstrate a close similarity of the Madrepores to the Hexactiniæ, yet there was a lack of suffi-

cient data upon which general conclusions could be based. A systematic study of a large number of forms was needed, and this need has recently been supplied by Dr. J. E. Duerden in his paper on the West Indian corals, a paper destined to stand as a landmark in our knowledge of Madreporarian morphology equal in importance to that established by von Koch.

Duerden has made a thorough study of the morphology of no less than twenty-six species of corals belonging to nineteen different genera, and, when the difficulties in the way of such work are properly appreciated, nothing but admiration can be expressed for the patience, perseverance and thoroughness evidenced in every page of his work. It is monographic in its nature, considering in detail the structure, histology and development of the coral polyps as a group, and concluding with full descriptions of the special morphology of the various forms studied.

Dr. Duerden gives good reason for believing that all corals are fundamentally hexamerous, the corallum septa making their appearance symmetrically in embryos already provided with the six pairs of primary mesenteries. In some species the hexamerism becomes much obscured in later stages, while in others it is more or less distinctly preserved; and it has been possible to correlate these differences with the mode of non-sexual reproduction followed by the species. Two principal methods of non-sexual reproduction are recognizable, namely, gemmation and fission. In the former method the mesenteries of the new individual are formed *de novo* and repeat the embryological development, and consequently the hexamerism of those of the parent, while in the latter method half the mesenteries of the parent pass directly to each descendant whose growth processes are limited to an attempt to reproduce the lacking parts, a second fission frequently supervening before the attempt is carried to completion. In the polyps produced by gemmation the mesenteries present the usual hexamerous arrangement, two pairs of directives and at least four additional pairs arranged symmetrically to the

directives being present. But in fissiparous forms, since there is no tendency to reproduce directives in the regenerative growth which succeeds the division, all of the polyps of a colony, with the exception of two, will lack directives and will show little regularity in the arrangement of the mesenterial pairs.

What might be regarded as a third mode of non-sexual reproduction has been observed in the perforate corals *Madrepora* and *Porites* and has been aptly termed by Duerden *fissiparous gemmation*, since the mesenteries of any one polyp are partly derived directly from the parent and are partly new formations, the process in this respect resembling ordinary fission, while it also resembles gemmation in that the original hexamerous arrangement of the mesenteries and the typical number of directives are retained as a result of growth processes which precede the fission.

The careful study of the madrepores, however, has not yielded such important taxonomic results as might have been expected; their soft parts do not present as much variety as do those of the actinians. But by extending his observations over so great a number of forms Duerden has been able to establish as fundamental certain facts in the morphology of the corals which throw some light upon their position among the Anthozoa. The fact that the corallum appears only after the development of the first cycle of mesenteries seems to warrant the conclusion that the corals are derived from non-coralligenous hexamerous forms. In other words, it indicates that the Hexactiniæ, Zoantheæ and Madreporaria are all traceable to a common hexamerous ancestor, and that after the differentiation of the Zoantheæ the Madrepores and Hexactinians continued together for a time and have for a fundamental distinction only the development or non-development of a corallum. The Madreporaria are merely Hexactiniæ which secrete a corallum. This is by no means a novel view of the relationship of these two groups, but it is one that is emphasized by Dr. Duerden's careful and interesting observations.

But the question whether the derivation of

the Madreporaria from the Hexactiniæ is mono- or polyphyletic still lacks a decisive answer. The uniformity of structure shown by the madreporarian polyp seems to argue for a monophyletic origin, although it by no means excludes the other possibility. It is exceedingly interesting to note that of all the actinians, those which approach nearest to the corals in structure are, as Duerden himself has elsewhere pointed out, such forms as *Actinotryx* and *Ricordea*, forms, that is to say, belonging to the stichodactyline group of actinians, having more than one tentacle arising from certain of the endocœlic spaces. And yet such an arrangement of the tentacles is not known to occur among the corals. It would seem either that the corals are derived from actinine forms with regularly cyclical tentacles, and that the similarities which the actinians mentioned above present to them are due to similar conditions of life, the actinians molding themselves over foreign bodies very much as a coral polyp is molded over its corallum, or that we may yet discover stichodactyline corals. So far as our present information goes we are justified in assuming only an actinine origin for the corals, but if, as suggested, the similarities of *Actinotryx* and *Ricordea* to the coral be due to similar life conditions, it would be easy to understand how the formation of a corallum would lead to very general uniformity of structure in forms of different ancestry, and would permit a supposition that the coralligenous forms might have arisen independently from several actinine groups.

A decision on these points must be left for future investigation, which, it is hoped, will be abundantly stimulated by Dr. Duerden's most painstaking and important work.

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SOCIETIES AND ACADEMIES.

NEW YORK ACADEMY OF SCIENCE.

SECTION OF ANTHROPOLOGY AND PSYCHOLOGY.

The regular meeting of the section was held on April 27 in conjunction with the New York branch of the American Psycho-