

COMPOSITE ANIMALS.

BY J. CARTER BEARD.

The circle of individuality, which beginning with that simplest of units of living matter, the free cell, ascends in a spiral, and returning upon itself finds expression in the higher unities of multicellular organisms, of which the original cells are integral parts, thus forming a second and more perfect set of individualities, makes or tends to make another complete circuit, in producing, by the aggregation of this second set, still a third series of individualities.

Carried through an increasingly intimate association in forms and functions of life, among the so-called compound animals, especially the ascidians, the third circle is still left incomplete, and the missing arc is perhaps more nearly supplied by the *Hydrogia* than by any other class of animals.

When it first issues from the egg, the hydroids are little flat wormlike creatures, too minute to be examined by the naked eye. Under a lens of sufficient magnifying power they appear fringed with fine hairs or cilia, by means of which they swim about. In a short time this planula, as it is called, attaches itself to some support, and the second stage of its life begins. It loses its cilia, and assumes the shape of a round-bottomed flask. It changes its form several times, and at last is elongated into a stalk, sends out roots, and at the summit blossoms into a flower-like circle of tentacles. The tentacles elongate, clusters of eggs like fruit appear (see figure of hydroids in the illustration, No. 2) and the life circle seems to be complete. From the roots other individuals arise, some of which, like the parent form, develop hydranths or blossoms, but others, instead of so doing, have only reproductive functions. In these last are developed small zooids, which in some cases become free, and in other cases, as for instance in the species figured in the illustration, *Clava leptostyla*, they never separate from their parent. The medusa-buds produce eggs and spermatozoa, which in turn give rise to other colonies similar to that described. Here is exhibited a division of function among the individuals forming the colony, which in fact in its entirety is a single animal, which is not to be found among the compound ascidians. The hydranths or individuals carrying tentacles are the nutritive portions of the colony. The tentacles capture, and the stalk digests food for the whole organism, while the gonangia devote themselves to reproducing offspring. Full of suggestion and interest as it is, only the hastiest glance can be given to this branch of the subject. The only remark which the present opportunity allows with regard to it is that, strange as it appears, it nevertheless seems to be shown in the genesis of hydroid communities that an animal can exist in separate parts, and that a con-

tinuity of substance is not an indispensable condition to unity of individuality. "From a single egg," says Prof. Clark, speaking of the matter from a different standpoint, "there is developed a number of zooids, from which there escape quantities of medusæ (jelly fish) which are frequently capable of feeding and of reproduction. Are each of these jelly fishes reproductive sacs and feeding portions, to be regarded as separate individuals or as parts of one individual? The latter is the true course; an individual embraces all the products of a single egg, and the name zooid is applied to the various more or less independent portions, whatever spaces may intervene between them, both of the medusa buds that float away, and of other parts that may arise by dividing or fission, but never by a new ovarian reproduction." The writer has interpolated and marked the interpolation in this paragraph, in order to carry out the plain inference given by the statement.

But after all, the division of function in the hydroids admits of little diversity of component zooids or subordinate individualities, while in the colonial jelly fish or siphonophora (see illustration) the specialization of offices and of the connected animals which perform them, as well as in the much more definite form and character of the aggregate, bring us very far on our journey toward realizing that a composite animal of the third degree, consisting of the union of complex individuals, may yet have an individuality of its own quite apart from those of the members which compose it. The composite animals belonging to this class consist of communities of individuals, each and all of which are modified and specialized in such a manner as will most effectually serve the communal body to which they are attached. This body, instead of consisting of a fixed and stationary colony of zooids, whose boundaries are shaped and determined by the spot it chances to occupy, has like the higher animals a constant form peculiar to its species, is free, and has the means and power of voluntary motion.

The *Physalia arethusa*, for instance, consists of a large elongated air sac or float, surmounted by an elegant indented crest, which is nothing else than a zooid enlarged and adapted for the purpose it serves, and a multitude of animals of different degrees of development according to their use, clustered upon its under part toward the broader end. These pendent animals have surrendered the power of separate existence, and so much of individuality as to become little more than the organs of the corporate body. A portion in which all functions have become atrophied except that of progressing through the water, by allowing it to enter their cavities and then forcing it out again, constitute the locomotive organs of the physalia. Other hollow structures open at the end are so many mouths with stomachs attached; they seize upon all such tiny marine organisms as certain other members of the community, modified into long processes armed with stinging and paralyzing organs; shock into insensibility. They devour and digest the food thus provided, and send the nutritive fluid that they elaborate to all parts of the colony. Scattered among these feeding stinging polyps are smaller zooids with egg-shaped bodies, each carrying a long thread. These threads are really nerves, and are very sensitive. Their use is to make the organism to which they belong aware of its surroundings. They are sense organs. Besides these there are two or three other sorts of individuals, which elaborate the particular sort of reproductive cells required for the perpetuation of the particular species to which the composite animal belongs. These are specialized medusa polyps, of which one sort larger than the other supplies the active sperm cells, while the smaller sort furnishes the inactive egg cells.

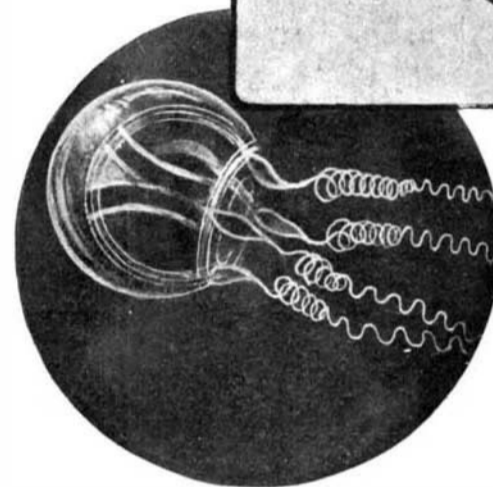
This is certainly a remarkable state of affairs, however we may consider it. If the various parts and the different organs of our bodies, the lungs, the stomach, the nerves, and all the viscera and members of our bodies, were individual entities that might be conceived of as originally separate organisms, each part still possessing in some sort traces of a separate consciousness of its own, it could scarcely be stranger. There are many of these composite animals, presenting every degree and variety of complexity, until we reach those in which the individuality of the constituent parts is entirely lost.

And thus a circle in life of which only the roughest sketch can be here suggested (it would require a volume to do it justice) as far as our space allows, is completed.

It is certainly a wonderful and a suggestive circle, one that might possibly have a value and a meaning not only in any given theory of genesis of species, but upon the foundation upon which all such theories must



Compound animal, *Clava leptostyla*, showing medusa buds growing upon the zooids.



Medusa of Campanularian hydroid.

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rest, the genesis of the individual.

A few years ago railway mileage was computed in hundreds, whereas now it is measured in tens of thousands. The general manager once knew all of his subordinate officials, because they were few and changes were not frequent. He once knew all of his master mechanics, station agents, conductors, engineers, dispatchers, and even telegraph operators. They knew him and were working for him because he was personally close to them in their work. All this has changed as the roads themselves became greater and as roads, great in themselves, combined into systems, as has never been done anywhere else in the world. With this change the officers have, by a powerful current, been carried far from the men in the ranks and far even from their subordinate officials. From personal friends, the men have become to them as mere numbers.

THE PERGAMON MARBLES IN THE PERGAMON MUSEUM OF BERLIN.

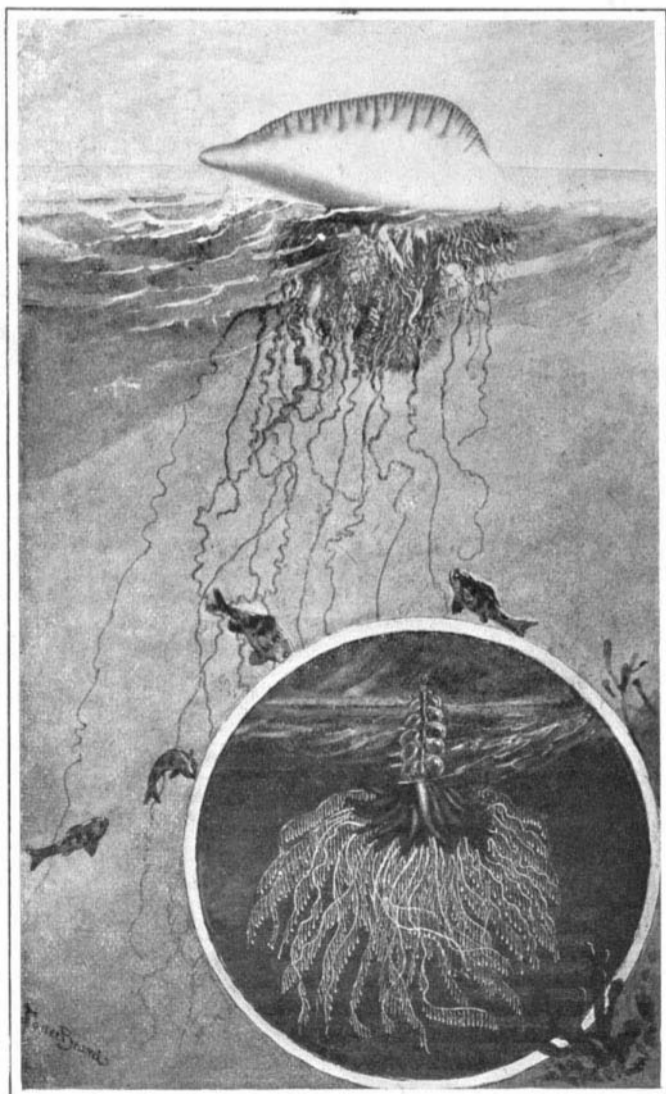
BY CHARLES A. BRASSLER.

When, in 1873, the German savant, Carl Humann, sent the first pieces from the Pergamon citadel to Berlin, no one would have thought that they might some day give impulse to the construction of the museum which is now standing on the Museum Island in Berlin.

The discovery and the excavation of the Pergamon antiquities has been, for men of art and science, an event of extraordinary importance. It is true that before the German discoveries were made, Pergamon, now Bergama, and its citadel had been visited several times by savants, especially of France, who after their visit reported that, in all probability, antiquities of undreamt-of importance might be hidden beneath the debris and rubbish of the acropolis. But the credit for having discovered these antiquities is due in the first place to Carl Humann, and then to Alexander Couze, at that time director of the collection of antique sculpture in the Royal Museum, who, when seeing the first pieces of the great frieze, recognized them as parts of the "Gigantomachie" mentioned by Ampelius in the words: *Ara marmorea magna, alta pedes quadraginta, cum maximis sculpturis—continet autem gigantomachiam.*

Excavations, conducted by Humann under the direction of the Royal Museum were made from 1878 to 1886. Later they were again and again prosecuted, and recently the German Institute of Archæology has continued and extended them over the entire site of the old capital. They have revealed a complete picture of the old royal citadel of the Attalides and of its aspect in the time of Roman kings and, above all, they have restored a unique work of art—the reconstructed great altar with its frieze. It was not before the Pergamon antiquities were discovered that the connection of Greek and Roman art was established. It is also for this reason that the Pergamon discoveries have been an event of extraordinary importance.

These relics are now preserved in the Pergamon



Physalia arethusa—American Portuguese man-of-war, or jelly fish.

Physophora hydrostatica—Mediterranean jelly fish.

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