



Study of Origin of Metazoa and various theories associated with the Origin

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Introduction : On a rough estimate, life began on Earth about 3.7 billion years ago. First cell to appear was a prokaryote cell without a definite nucleus. Later, the eukaryote cell developed having a well-organized nucleus. The earlier unicellular or nonmulticellular organisms were neither plant (Protophyta) nor animal (Protozoa) in nature. Ernst Haeckel (1866) called them protista which may be defined as organisms, usually of small size, consisting of a nuclear apparatus (no definite nucleus, one nucleus or many nuclei) in a cytoplasmic body which is not divided into cells. With an increase in complexity of life, multicellularity developed in plants and animals. As mentioned earlier, the term Metaphyta is used for multicellular plants and Metazoa for multicellular animals.

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Premetazoan Ancestors

There is no direct proof about the ancestors of Metazoa. But all Zoologists agree that the metazoans have evolved from some unicellular or acellular organisms, such as Protozoa. This is strongly evident by the facts of embryonic development in which each metazoan passes from an acellular (zygote) to a cellular condition (morula, blastula, gastrula, etc.). A unicellular protistan individual performs all the functions of the living. From such a functionally complex single-celled protistan arose the multicellular animals. But, how single-celled protozoa, which is evolved possibly 2,000 million years ago, gave rise to the fundamental mysteries of evolution. It is difficult to solve it because the earliest metazoans, like most invertebrates, were soft-body and left no fossils.

Theories of Origin of Metazoa : Different views have been expressed by many prominent scientists from time to time to explain the evolution of Metazoa from different groups of Protozoa. All these views can be generalized into three principal view:



- (1) The ancestral metazoan originated from a colonial flagellate through increasing cellular specialization and interdependence (Colonial theory).
- (2) The ancestral metazoan arose from a multinucleate syncytial ciliate which became compartmented or cellularized by the appearance of cell boundaries (Syncytial theory).
- (3) The metazoans had a polyphyletic origin from different unicellular groups (Polyphyletic theory).

Colonial Theory

The Colonial or Flagellate theory is the classic and most frequently repeated theory of the origin of multicellular Colonial theory holds that multicellular animals came about through association of many one-celled flagellate individual forming a colony. With increase in the number of individual cells, they became more and more specialized in structure and functions. Soon, individuality in the cells was lost and the whole colony itself became a single multicellular individual or a metazoan. The Colonial theory has been greatly accepted, since it conforms best with the facts of embryonic development. The belief in the flagellate ancestry of Metazoa is also supported by several facts.

The flagellates are a highly plastic group, which is capable of great changes. In all probability, the entire plant kingdom, and all other protozoan classes have originated from them.

The flagellates show a great tendency of forming compact colonies, and these clearly resemble various stages in the embryonic development of Metazoa. The metazoan tailed sperm cell very closely resembles a modified flagellate. Therefore, the occurrence of flagellate or

Lankester's theory. According to Lankester, the ancestral metazoan was a morula like solid colony, such as synura or pandorina. Food taken by outer surface of the external flagellated cells (ectoderm) was passed into their inner ends, a process still seen in living sponges and coelenterates. Later, the inner ends of cells got separated forming an internal digestive layer or endoderm. Lankester named this hypothetical ancestor as planula. This was a solid organism. Later on, it developed mouth and digestive cavity. Lankester's theory found no acceptance because:

- (1) Endoderm formation by primary delamination is very rare in the Metazoa.



(2) Formation of internal digestive tube or endoderm will be of no use without a mouth for taking in food.

Butschli's theory:

The plate like form such as *Gonium* was favoured by Butschli as the ancestral metazoan type. He postulated that first this became two layered by cutting off a lower plate of cells and later curved into a sphere. But this idea gets no support from the embryonic development of metazoans.

Polyphyletic Theory

More recently, Greenberg (1959) and Preston (1967) held that probably all Metazoa have not originated from any single ancestor. They have suggested a polyphyletic origin for the metazoans. It is fairly certain that sponges developed by way of colonial flagellates (e.g. *Proterospongia*), whereas other multicellular groups originated from the cellularization of Syncytial protociliates or perhaps the mesozoans.

Summary:

In this lecture we have covered the origin of Metazoa as well as views expressed by many prominent scientists to explain the evolution of Metazoa from different groups of protozoa. Different theories proposed by various scientists such as Colonial theory, Syncytial theory and Polyphyletic theory were also discussed.

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