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AFFINITIES OF BALANOGLOSSUS

INTRODUCTION

- ❖ The position of Hemichordata, in the scheme of classification of animals, has been controversial.
- ❖ In 1814, Sedgwick and Huxley suggested the affinities of Enteropneusta (Hemichordata) with the vertebrates and it was in 1885, Bateson considered this group as a subphylum of the phylum Chordata.
- ❖ Metschnikoff (1865) stated that Enteropneusta had certain affinities with Echinodermata.
- ❖ Spengel (1893) showed the relationship of Enteropneusta with Annelida.
- ❖ But on the basis of general organization, some recent workers, such as Van der Horst (1989), Dawydoff (1948), Marcus (1958) and Hyman (1959) have thought it proper to remove this group from phylum Chordata to give it the status of an independent Invertebrate phylum.
- ❖ The name “Hemichordata” is, however, retained for the group because it suggests that its members are related to chordates, i.e., they are “Half” or “Part” Chordates, a fact that is undisputed.
- ❖ Affinities of *Balanoglossus* (Enteropneusta, Hemichordata) with chordates and non-chordate phyla are as follows:-

AFFINITIES WITH CHORDATA

Batson (1887) included Hemichordata in phylum Chordata, since then a close relationship has been acknowledged between hemichordates and chordates.

RESEMBLANCES

- ❖ The phylogenetic relationship of hemichordates and chordates is based on the supposed presence of the three fundamental chordate characters in both groups, viz., a notochord, central nervous system and gill-clefts.
- ❖ The buccal diverticulum or stomochord of hemichordates has been regarded as the equivalent of notochord since the time of Bakon. Modern workers of hemichordates do not accept this idea and have raised many objections.

1. The buccal diverticulum is a hollow evagination of the anterior wall of buccal cavity, whereas the notochord is a long solid rod formed from the roof of the archenteron.
 2. The buccal diverticulum is generally made of ordinary epithelial cells, while the notochord of vertebrates consists of large vacuolated cells.
 3. Buccal diverticulum lies ventral to the dorsal blood vessel, whereas the vertebrate notochord is always dorsal to the main dorsal blood vessel.
 4. The buccal diverticulum is small and confined to the proboscis, while the notochord extends far backwards.
- ❖ There are certain resemblances between the nervous system of hemichordates and chordates, such as its position, formation of the dorsal nerve cord from the dorsal epidermis, and the hollow collar cord which often has a neuropore and is comparable with the neural cord of the vertebrates.
 - ❖ The chief link between the hemichordates and chordates lies in the pharynx and its gill-clefts. The details of branchial apparatus having tongue bars, M-shaped skeletal rods and synapticula are exactly like those of *Amphioxus*.

Such similarity can be only due to common ancestry, and phylogenetic relationship of hemichordates and chordates cannot be denied.

DIFFERENCES

The inclusion of hemichordates in phylum Chordata cannot be justified on the basis of a few similarities which are more than outweighed by important differences. The main differences are:-

- ❖ Chordates do not have the body and coelomic regions corresponding to those of hemichordates.
- ❖ The circulatory and nervous system of hemichordates are like those of invertebrates.
- ❖ There is no post-anal tail in hemichordates.
- ❖ Chordates are metamerically segmented animals, this segmentation is clearly shown by the muscular, nervous, circulatory and excretory systems, whereas there is a total absence of segmentation in hemichordate.

AFFINITIES WITH PHORONIDA

RESEMBLANCES

- ❖ Similar nature of epidermal nervous system.
- ❖ The paired diverticula of Phoronis, like the buccal diverticulum of *Balanoglossus*, forming so called notochord.
- ❖ Actinotorch larva of Phoronis has several enteropneust features of tomaria such as similar disposition of coelom, anus surrounded by a ciliary ring, presence of a proboscis pore and a sensory apical plate with cilia and eye spots.
- ❖ Both have great power of regeneration.

DIFFERENCES

- ❖ Pharyngeal gill slits and other chordate characters of *Balanoglossus* are absent in *Phoronis*.

Keeping differences in mind, zoologists like Champs (1940) rejected the idea of keeping these two in one group.

AFFINITIES WITH ANNELIDA

RESEMBLANCES

- ❖ The general body form and burrowing habit of tubicolous forms are alike and mud is ingested in burrowing. It passed out from the anus as castings.
- ❖ The vascular system of most hemichordates is like that of annelids with blood flowing anteriorly in the dorsal vessel and posteriorly in the ventral vessels.
- ❖ The Hemichordate *tornaria larva* appears like a modified *trochosphere larva* of Polychaete worms.

DIFFERENCES

- ❖ Gill-slits are absent in annelids.
- ❖ Paired nerve cords are present in annelids.
- ❖ The larva of Hemichordata and Annelida also differ in the following ways:-
 1. Nephridia are absent in *tornaria larva*.
 2. Pre-oral coelom is absent in *trochosphere larva*.
 3. In *trochosphere* blastopore becomes the mouth, while in *tornaria* it becomes the anus.

AFFINITIES WITH ECHINODERMATA

The only similarity between the two phyla is anatomical, i.e., their nervous system which in both cases consists of nerves lying near the surface embedded in the epidermis. There is a strong affinity between the two phyla on embryological evidence, the method of formation of the gastrula and the coelom is very similar in the two phyla and for years the *tornaria larva* was considered to be the larva of an echinoderm. The *tornaria larva* shows a very striking resemblance with *auricularia larva* and especially with *bipinnaria* of Asterozoa.

RESEMBLANCES

- ❖ The ciliated band is identical and follows the same course in the *tornaria* and the *auricularia* and *bipinnaria*.
- ❖ The alimentary canal has the same shape and the same divisions into foregut, stomach and intestine in the larva of both phyla.
- ❖ In both groups the blastopore becomes larval anus.
- ❖ The cleavage and gastrulation follow the same pattern in both.

- ❖ The method of formation and arrangement of coelomic cavities follow the same path.
- ❖ The heart vesicle of hemichordates is related to the proboscis coelom and is homologous with the madreporite vesicle of echinoderm larvae.

DIFFERENCES

- ❖ Eye spot is absent in bipinnaria.
- ❖ The apical plate and telotroch are absent in bipinnaria.
- ❖ The protocoel is paired in echinoderms, while unpaired in tornaria larva.

On the basis of above fact the only infallible conclusion is that the two groups are closely related and they arose from a common ancestor.

CONCLUSION

- ❖ The above affinities have led to the conclusion that echinoderms, hemichordates and chordates have arisen from a common ancestral stock, the **dipleura larva**. Further, the echinoderms deviated greatly from the ancestral stock and formed blind branch in the main line of evolution. The main line of evolution continued to give rise to hemichordates and chordates.
- ❖ It appears most reasonable to place them in the invertebrates as an independent phylum which has arisen from an ancestral stock that has given rise, on the one hand, to echinoderms and on the other hand, to hemichordates and chordates.
