

Affinities of Echinodermata and Hemichordata

Hemichordata was till recently treated as the sub phylum of the phylum Chordate but is now regarded to be the independent phylum of invertebrates very close to the phylum Echinodermata. The peculiar characteristics of the animals belonging to Hemichordata are as follows, Enterocoelus coelom. Pharyngeal gill slits, buccal diverticulum (earlier considered as notochord). Vermiform body divisible into three regions – proboscis, collar, trunk. The phylum hemichordate includes a small group of soft, primitive and marine chordates called as acron worms or tongue worms. Most familiar genus of this phylum is *Balanoglossus* which belongs to the class Enteropneusta. Other closely related genera are *Saccoglossus*, *Glossobalanus* etc. The class Enteropneusta was established by Gegenbaur in 1870. Hemichordata have been considered closer to chordate as well as non-chordate phyla by different workers from time to time.

Systemic position of hemichordate

- Peculiar anatomical organisation of hemichordata makes their phylogenetic position uncertain and controversial.
- Earlier workers placed hemichordates as a sub phylum under the phylum Chordata.
- But the only chordate feature shown by them is the presence of pharyngeal gill slits.
- Therefore, some recent workers like Van der Host, Marcus etc. have chosen to remove them as the sub phylum of phylum Chordata and treat them as an independent invertebrate phylum.
- Since the hemichordate group consists of only 80 species, it is included in the category of minor phylum. The name Hemichordata suggests that they are half chordates.

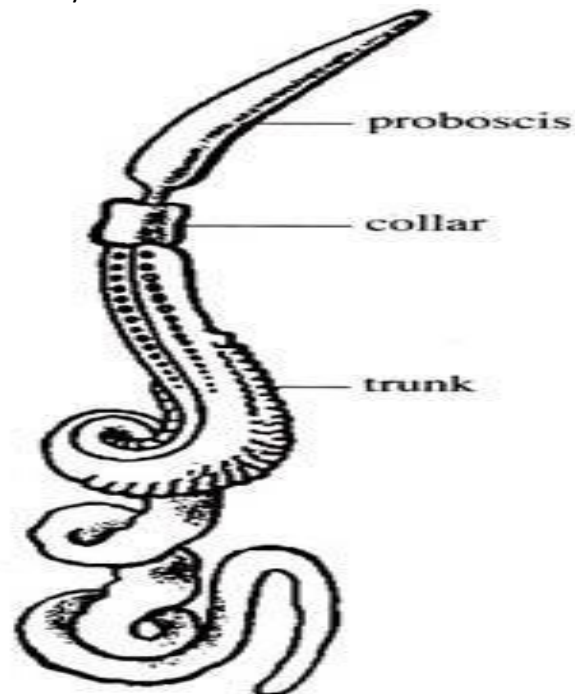
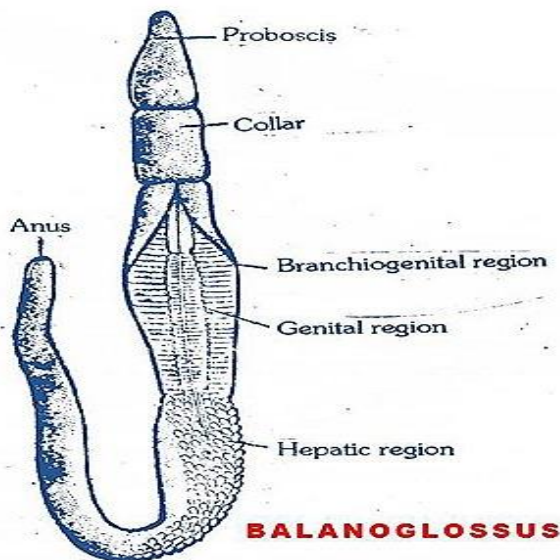


Fig. 1.139 : *Saccoglossus*.

Affinities of the phylum Hemichordata

Affinities with Chordata

- Zoologists proposed closer affinities between the phylum Chordata and Hemichordata. Their resemblance was based on the presence of three fundamental characteristics of Chordates in hemichordates,
- Notochord
- Dorsal hollow nerve chord
- Pharyngeal gill slits
- Moreover the structure and functions of pharyngeal and branchial apparatus of Hemichordates is similar to that of Cephalochordates and Urochordates.
- Also the origin of coelom is enterocoelic type in the form of five pouches from the archenteron as in Brachiostoma.
- Due to all the above stated similarities Hemichordata was considered as sub-phylum of the phylum Chordata till recently.

Affinities with Echinodermata

The following are the resemblances of the adult hemichordates and echinoderms:

- Echinoderms and hemichordates are similar in having enterocoelus coelom which is divided into three different parts filled with sea water to serve hydraulic mechanism.
- Heart vesicle and glomerulus of hemichordates are considered homologous to dorsal sac and axial gland of echinoderms.
- Both have common habits, ecological niches and remarkable power of regeneration.

The following are the resemblances of the larval hemichordates and echinoderms.

- Larvae of both groups are small, pelagic, transparent and oval
- Similarity in the development of the coelom
- Blastopore becomes anus and digestive tract is complete with mouth, anus and same parts.
- The adult hemichordate and adult echinoderm are so different that one cannot suspect any relationship between them the only anatomical similarity between them is their nervous system which in both cases consists of nerve net lying near the surface embedded in the epidermis
- But 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 the auricularia larva and specially with bipinnaria of Asteroidea

Resemblances:

The resemblance extends into the following details:

1. The ciliated band is identical and follows the same course in the tornaria and the auricularia and bipinnaria, though the telotroch and eye spots of the tornaria are absent in echinoderm larvae.
2. The alimentary canal has the same shape and the same divisions into foregut, stomach and intestine in hemichordate and echinoderm larvae.
3. In both groups the blastopore becomes larval anus.
4. The cleavage and gastrulation follow the same pattern in both.
5. The greatest and the most convincing resemblance lies in the method of formation and arrangement of coelomic cavities. In both the coelom is of enterocoelous origin and it divides into three antero-

posterior parts, which in hemichordates are called proboscis coelom (protoel), collar coelom (mesocoel), and trunk coelom (metacoel).

6. While in echinoderms the three parts of the coelom are axocoel, hydrocoel, and somatocoel. Moreover, the proboscis coelom and collar coelom of hemichordates open to the exterior by pores through short hydroporic canals, as does the hydrocoel in echinoderms.

7. The heart vesicle of hemichordates is related to the proboscis coelom and is homologous with the madreporic vesicle of echinoderm larvae and both these structures are closely connected to the glomerulus of hemichordates and the axial gland of echinoderms which have a combine vascular and excretory function.

8. Proteins and phosphagens present in adult hemichordates and echinoderms are very similar.

Differences:

There are following differences between two groups:

1. Eye spot present in tornaria is absent in bipinnaria.
2. The apical plate and telotroch present in tornaria are absent in bipinnaria.
3. The protoel is paired in echinoderms, while unpaired in tornaria larva.
 - The many embryonic resemblances between hemichordates and echinoderms are merely due to convergent evolution due to similar mode of habits and habitat.
 - The many embryonic resemblances between hemichordates and echinoderms cannot possibly be accidental or due to convergent evolution.
 - The only infallible conclusion is that the two groups are closely related and that they arose from a common ancestor.
 - Echinoderms have deviated greatly from the ancestral type, while hemichordates are closer to it. The common ancestor gave rise to echinoderms as a blind side branch, while the main line of evolution produced the hemichordates and chordates.

Conclusions

- The close affinities of Hemichordata, Echinodermata and Chordata, etc., have led to the conclusion that they have common ancestor from which they have arisen independently.
- Probably the common ancestor was dipleurula larva. Recently Barrington (1965) expressed that Echinodermata deviated greatly from the ancestral stock and formed a blind branch.
- Hemichordata also did not stand on the direct line of ancestry but formed a divergent offshoot from the main line of chordate evolution.
- Thus, it may be suggested that *Balanoglossus* and other chordates are running on the same field but not on the same track.
- Since the hemichordates arose from the ancestral line after the divergence of the ancient Echinodermata but before the rise of true chordates, they are often called prechordates.