Study Material for SEM 2

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CC2-3 (UNIT 7)

PRESENT STATUS OF BALANOGLOSSUS

INTRODUCTION :

Balanoglossus in a marine, burrowing homic hordate inhabiting shallow coastal waters of intertidal zone, but a few occur in deeper water.

It shallows sand or mud to obtain diatoms, protozoans, other icroorganisms and organic letritus on which it feeds. Sexes are separate.

BALANOGLOSSUS SP

Balanoglossus is a marine work-like animal inhabiting shallow seas of the tropical and temperate region ((Greek word "Balano" moons on Acorn and "glossus" means torgue). *Balanoglossus* belong to phylum Hemichordate which contains the enteropreusts and pterobranchs. The systematic position of *calanoglossus* is interesting as it was placed in the phylum chordate.

ANATOMICAL PECUILARITIES

1. Body elongated, *vermiform* and early divided into 3 regions – the proboscins, collar and trunnt.

2. Anus terminal, *no tail* .

3. The trunk beams an anterior *bronchial* region which has numerous gill pores.

4. Pharyngeal gill-slit becomes partially sub-divided by tongue-bar therefore, primary pharyngeal bars and secondary pharyngeal bars are present.

5. Presence of well – developed open circulatory system.

6. Unique excretory structure the glomerulus present .

7. Gonads extracoelomic.

8. Complete gut with buccal diverticulum which is also known as stonochord.

9 Notchord absent.

10. Circular and longitudinal mucles are present in the body wall of proboscis.

11. Short dorsal nerve cord or reurocord present which is probably homologous with the chordate nerve cord (K.V. Kardeny, second addition 1975)

12. Coelom septate, tripertile and enterocoelores.

13. Sexes separate with external fertilizedion and *indirect development* .

14. Cleavage radial and holoblastic.

EXTERNAL MORPHOLOGY

The body is soft, elongated, worm like, cylindrical and bilaterally symmetrical. It measures 10 to 50 cm in length, according to species. Colour is bright or drab with reddish or orange tints.

(A) DIVISION OF BODY

The body is un segmented but divisible into 3 district regions or parts : proboscis, collar and trunk

PROBOSCIS :

The proboscis in the anterior most part of the body. It is short, club shaped or conical and circular in cross section, Posteriorly, the proboscis narrows into a slender neck or proboscis stalk which is attached to the collar.

Below the stalk , the base of proboscis bears a U-shaped diated epidermal depression, called the preoral ciliary organ, water entering the mouth.

COLLAR : The collar or mesosome is the middle short and cylindrical part. Its flap like or funnel like anterior margin , termed *collarettle*.

Ventrally , below the proboscis stalk, the collarette encloses the **mouth**.

TRUNK : The traunk or metasome in the posterior and largest part of the body. It in rather flat and appears annulated due to circular constrictions on the surface.

The trunk is further differentiated into tree region.

(B) **BODY WALL**

Epidermis : The outermost layer or epidermis consists of a single layer of mostly tall, slender, columnar and ciliated cells. Three kinds of gland cells (GOBLET, RETICULATE & GRANULAR) Secreting mucus are present.

Musculature :

The muscles are smooth, weak and mostly longitudinal. But circular muscles fibre found in different specific part of the body.

Peritoneum : The coelom is linet by the parietal coelomic epithelium or peritoneum which covers the inner surface of body wall musculature.

(C) **COELOM :** Balanoglossus has a spacious coelom linet by coelomic epithelium and enterocoelus in origin.

(D) **ENDOSKELETON :** Balanoglossus has no definite endoskeleton of bone or cartilage. However, the following four stiff structure are present.

(i) Buccal diverticulum
(ii) Proboscis skeleton
(iii) Branchial skeleton
(iv) Pygochord.

INTERNAL STRUCTURE
Digestive System

(i) **ALIMINTARY CANAL**

The alimentary canal in a complete and straight tube running b/w the mouth and anus.

Its wall is made up of ciliated epithelium covered externally by a basement membrane.

(i) Mouth is a wife and circular opening situated ventrally.
(ii) The short buccual cavity occupiesthe collar region.
(iii) Phrynx lines in the branchial region of the trunk.
(iv) Behind the last pair of gillslite the phayax continues into the short oesophagous.

Intestine occupies the hepatic and posthepatic regions of trunk. The hepatic region of the intestine in highly vascular.

(v) Posterior, intestine opens to the exterior by a terminal circular aperture, the anus, at the tip of the trunk.

FEEDING MECHANISM

Balanoglossus is a 'ciliary feeder'. It s food comprises of microscopic organism and organic particles present in the water and the bottom sand in which it makes its burrows. The lateral cilia lining the gill-slits set up a current of water which enters through the mouth, takes its course though the buccal cavity , pharynx, gill-slits and branchial sacs, and leaves through the gill pores. Some food particles directly enter the month with this current while some come in contact with the proboscis and get entangled in the mucous that covers it.

RESPIRATORY SYSTEM

The respiratory apparatus of Balanoglossus comparises : (i) the bronchial portion of pharynx bearing fills its and (ii) the branchial sacs that open out through gill pores.

MICHANISM :

The lateral cilia lining the gill slits set up a food-cum-respiratory current of water. It enters the pharynx through mouth, then passes through gill slits into the baanchal sacs and finally leaves through the gill pores. The tongue bars are richly vascular and participate in gaseous exchange.

BLOOD VASCULAR SYSTEM

The blood vascular system of Balansglossus in of the open tpe

It consists of -

(i) A central sinus
A heart
(ii) Colorless blood
(iii) Arteries and sinus
(iv) Veius or collecting vessels

Blood in a colourless fluid containing few white corpuscles. A respiratory pigment absent.

EXCRETORY SYSTEM

The excretory organ in glomerulus or proboscis gland lying in front of the central sinus and projecting into the proboscis coelom.

NERVOUS SYSTEM

The nervous system is of primitive type. Throughout the body a plexus or layer of nerve cells and nerve fibres lies just below the epidermis.

Ventral nerve cord present, which in extends upto color – trunk septum where it is connected with the dorsal cord by curcular strand, called circum entric nerve ring.

REPRODUCTIVE SYSTEM

Asexual reproduction : -

Asexual reproduction is rare in enteropneusts. During summer the young worms cut off small pieces from tail end , each regenerating into a complete sexual adult in winter.

Regeneration : Balannoglossus shows great power of regeneration Iroboscis, collar and isolated pieces from trunk can regenerate the lost parts of the body completely.

Sexual reproduction : Sixes are separate : Males and females cannot be indentified externally.

AFFINITIES and Systematic position of Balanoglossus

The group Enteropneusts, to which Balanoglossur belongs, was established by Gegenusour in 1870.

Since then due to their peculiar anatomical organization and embryology, the Hemichortala have been considered to the chordate as well as most non-charatephyla by different worker from time to time

AFFINITIES WITH CHORDATA

Such scientist proposed loser affinities b/w Hemichortala and chordate.

Their resemblance was based out presence of the three fundamental chordate characgeristics in Himachordata, that is (i) A notochord, (ii) a dorsal hollow herve cord and (iii) the pharyngeal gill slits.

AFFINITIES WITH Urochordata

(i) The structure and function of pharynx and branchial apparatus in hemichordate are similar to those of urochordates.

(ii) **REMARKS :** Relationship is superficial. The hemichordates are very remotely connected with the central stalk from which the urochondates are descendants.

AFFINITIES WITH Cephalochorda

Hemichordate show similarity with cephalochordate in the arrangement of coelemic sacs and in development.

Also branchial apparatus are similar in both group.

Due to these similarities Hemichoatala had been considered as a subphylum of the phylum chordate.

REMARK : Therefore Balanoglossus and cephalochandata are two separate groups.

OBJECTIONS

However, the hemichordates are no longer included under chordates because they do not ; possess chordate characters in a typical condition.

(i) A time notochord does not occur in hemichordates . Unlike that of the chordates , the so called 'notochord' in very short.
It in ventral to the main blood vessel and not covered by sheaths. Insteas of being solid and made of vacuolated cells, it us hallow and lived by epithelial cells. It does not originate from the roof of larval archentron but as a forward hollow projection of the forgot. Instead of being called notochord it is now termed the stoma chord.

Myman, prefers to name it as buccal diverticulum.

(ii) The nervous system is distinctly of the invertebrate type being intra epidermal in position and having ventral nerve cord and a circumenteric nerve ring which are absent in chordates.

In Balanoglossus, te dorsal tubular nerve cord is confined to the collar region only.

(iii) Gill-slits of Balanoglossus are numerous and dorsal in position, whereas they are 5 – 7 and lateral in higher chordates.

The henichordaztes further differ from the chardates in lacking segmentation, ceplalization , paired appendages, post anal tail haemoglobin etc.

AFFINITIES WITH POGONOPHORA

(i) Entopocoelus formation of coelous
(ii) Body and coelousdivided into 3 region.
(iii) Mesosome and metasome soperated by septum.
(iv) Gonuds found in trunk.
(v) Nervous system intra epidermal.

AFFINITIES WITH ANNELITA

(i) Body vermin form and coelomate
(ii) Burrowing habit, tubicolous life and ingesting mud which is passed out as castings through anns.
(iii) Collar of Balanoglossus similar to clitellum of earthworm
(iv) Proboceis and prostomium similar ant preoral.
(v) Dorsal position of heart.
(vi) Torraria larva of Balanaglossus shows several structural resemblances with the trachphore larva of Annelida
(vii) Tornaria larva of Balanoglossus shows several structural resemblances with the trachophore larva of Anneliva.

OBJECTION

(i) Annelid do not have pharyngeal gill slits, stomached or buckle diverticulum and dorsal tubular nerve cord found in Balanoglossus.

(ii) Balanoglossus does not have double and solid ventral nerve cords and nephridia found in annelid

Thus compared to their great fundamental differences, the similarities of the two groups are only superficial and quite insight feint indicating probably a convergent evolution due to similar habits and habitat.

AFFINITTES WITH ECHINODERMATA

ADULT :

(i) Enterocoelic origin of coelom and its division into 3 successive parts filled with sea water to serve a hydraulic mechanism.

(ii) Heart vesicles and gloumerculus of enterquousta are considered homologous to the dorsal sac and axial gland of echinoderms. Both the structures are related and combine vascular and excretory function.

(iii) Nervours system is poorly developed and forms epidermal verve plexn.

BIOCHEMICAL :

Creatine phosphate acts as a phosphate doner in both Needhan 1932.

EMBRYOLOGICAL (larval) between tornaria larva and bipinnaria larve.

i) Both have similar twisted similar bands

ii) Enterocoelic origin of coelom in both.

iii) Position of mouth and anus similar.

REMARK : Fell (1948) concluded that the resemblance between the two groups due to convergent evolution and so their cannot is true affinity between two groups.

GENERAL CONCLUSION :

Hemichordate share characters with both echinoderms and chordates. With chordates they share gill-slits which help them in feeling and breathing. In addition, a short dorsal, somewhat hollow nerve cord in the collar zone may be homologous to the nerve cord of chordates. (Hickman etal in Integrated principles of Zoology 12th addition 2004).Phylogeneticaly hemichordate placed between Echinoderm and Chordate.

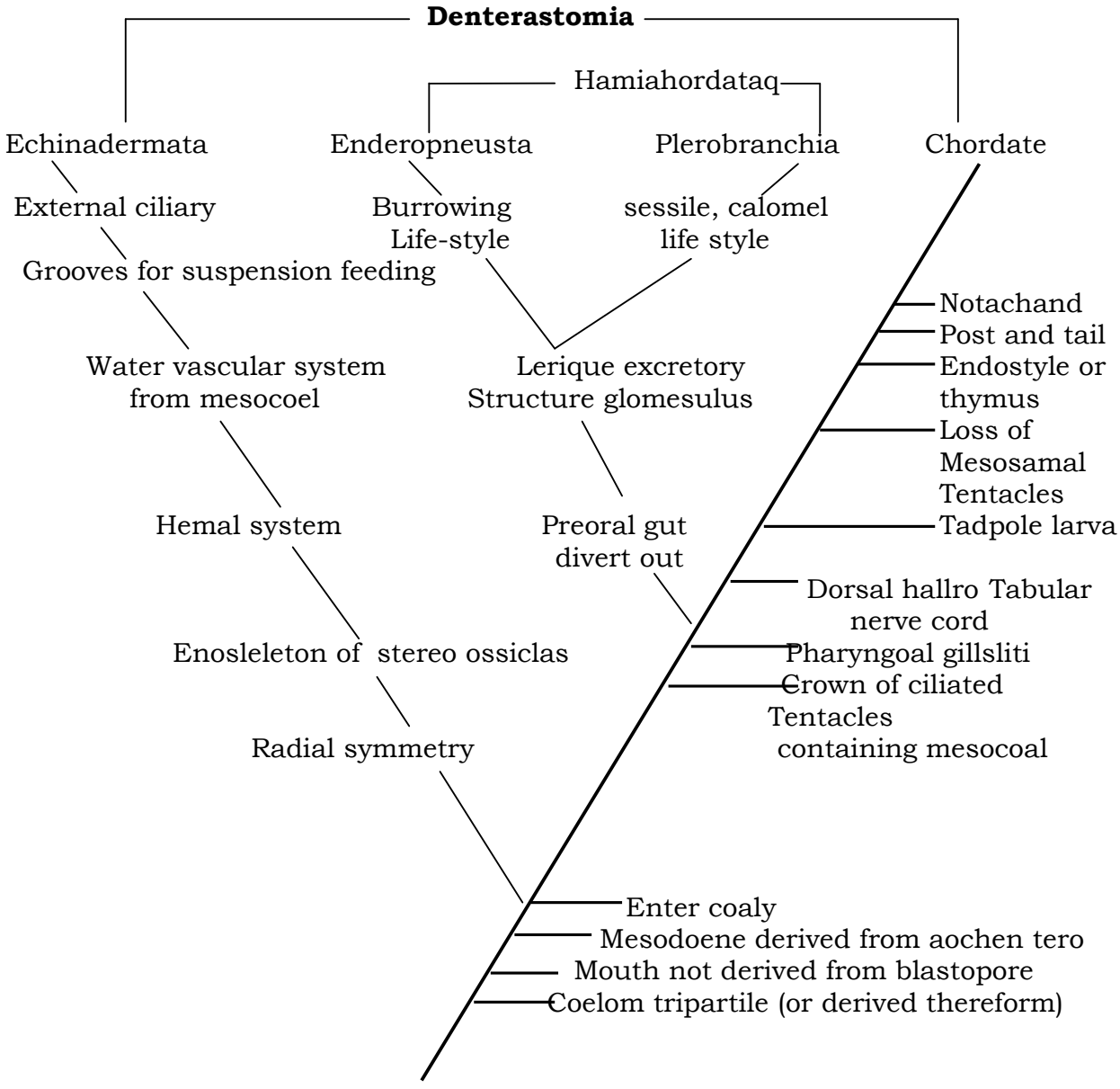
ECHINODERMATA ⟹ **HEMICHORDATE** ⟹ CHORDATE

MOUTH CAVITY :

i) The buccal diverlum in the hemichordate mouth cavity is now considered a synpomorphy of hemic chordate themselves

ii) The larval similarity suggest that echinoderm form the sister group of hemichordates and chorales.

iii) Sequence analysis of the game encoting the small submit rRNA support a denterostome clade, ablest smaller than traditional Denteratomic.


Denterastomia
Hamiahordataq
Echinadermata
Enderopneusta
Plerobranchia
Chordate
External ciliary
Burrowing
Life-style
sessile, calomel
life style
Grooves for suspension feeding
Water vascular system
from mesocoel
Lerique excretory
Structure glomesulus
Notachand
Post and tail
Endostyle or
thymus
Loss of
Mesosamal
Tentacles
Tadpole larva
Hemal system
Preoral gut
divert out
Dorsal hallro Tabular
nerve cord
Enosleleton of stereo ossiclas
Pharyngoal gillsliti
Crown of ciliated
Tentacles
containing mesocoal
Radial symmetry
Enter coaly
Mesodoene derived from aochen tero
Mouth not derived from blastopore
Coelom tripartile (or derived thereform)

Brusca & Brawce (2003) Inverlebrales

TORNARIA LARVA :

i) Oval and bilaterally *symmetrical* body.

ii) Size of tornaria larva varies from 1 – 3 mm.

iii) Mouth present on ventral side near the *equatorial plan of the body.*

iv) The portion of the body anterior to the mouth is *prolonged into a pre-oral lobe.*

v) Anterior end of the pre-oral lobe *bears a distinct* apical plate having *nerve fibers*, a tuff of cilia and a pair of pigmented eye-spot.

vi) There are 3 distinct ciliated bond's on the body – preoral, postural and *circum oral.*

vii) There is a separate ciliated ring present around the anus the circum and ciliated bound or *telotroch*.

viii) The anus is located medially on the posterior end of the body.

ix) The digestive tract is divided into oesophagus and intestine.

x) Tornarvia larva possess only one pair of gill-slits.

REMARK : Finally the tornaria larva sinks to the bottom and metamorphoses into an adult.

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