

BIO 221

Invertebrate Zoology I

Spring 2010

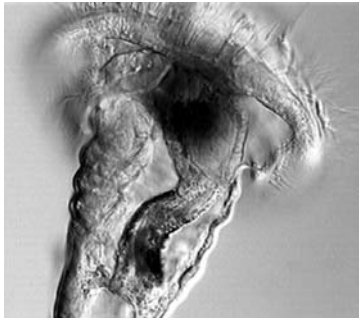
Stephen M. Shuster
Northern Arizona University

<http://www4.nau.edu/isopod>

Lecture 14

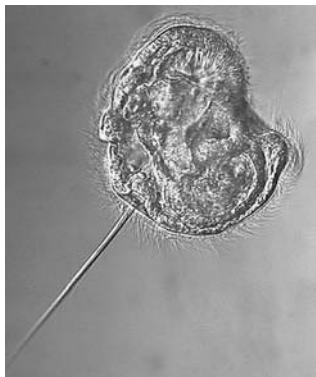
Invertebrate Classification

Note: we now have some additional characteristics that can be used to classify **Protostomes** and **Deuterostomes**.



Protostomes

- a. Usually spiral, determinate cleavage.
- b. Name from "first mouth"; blastopore becomes mouth.
- c. Coelom formation by schizocoely.
- d. Represent a major evolutionary lineage.
- 1. Some exceptions are now known; e.g. Lophophorates.

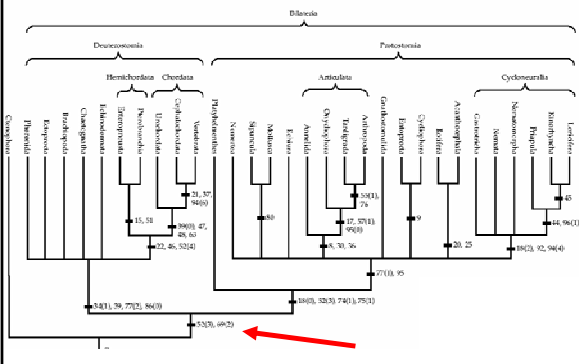


Deuterostomes

- Usually with radial, indeterminate cleavage
- Name from "second mouth" blastopore becomes anus, mouth forms later.
- coelom formation by enterocoely
- also represent a major evolutionary lineage
 - again with some exceptions.



Rotation at the Proto-Deutero Node



Deuterostomia

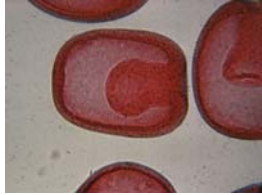
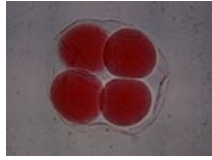
1. Synapomorphies

- 34(1) – mesoderm derived from archenteron by enterocoelic pouching
- 39 – tri partite coelom (anterior, middle and posterior compartments)
- 77(2) – internal body cavity lined by peritoneum (mesodermally derived).
- 86(0) – anterior body cavity unmodified as a proboscis.

Deuterostomia

1. Synapomorphies:

- a. 34(1) – mesoderm derived from archenteron by enterocoelic pouching



Deuterostomia

1. Synapomorphies:

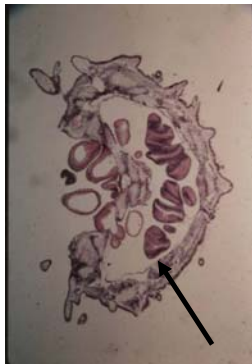
- b. 39 – tri partite coelom (anterior, middle and posterior compartments)



Deuterostomia

1. Synapomorphies:

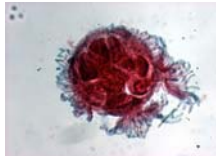
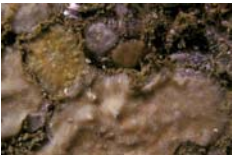
- c. 77(2) – internal body cavity lined by peritoneum (mesodermally derived).



Phylum Brachiopoda

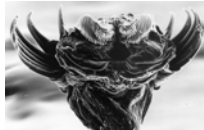
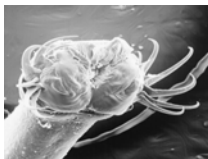
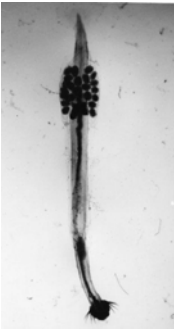


Phylum Ectoprocta (Bryozoa)



Phylum Chaetognatha

1. Also known as “arrow worms” – small, highly voracious predators
2. Will not be considered in great detail.



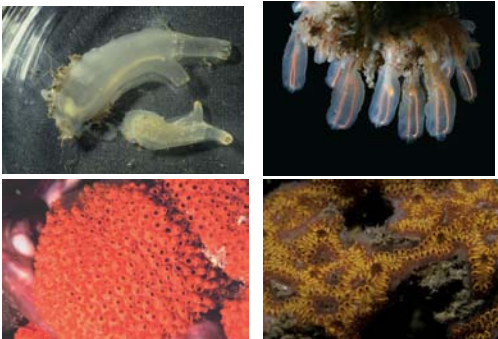
Phylum Echinodermata



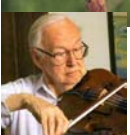
Phylum Hemichordata



Subylum Urochordata



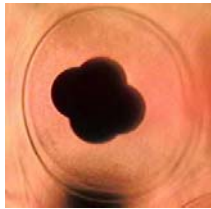


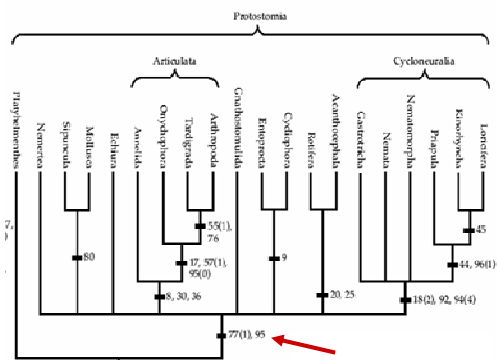
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- a. 18(0) – Cleavage pattern spiral.
- b. 52(3) – Ventral or ventrolateral synaptic nervous system.
- c. 74(1) – Entomesoderm derived from a single mesentoblast (4d) cell.
- d. 75(1) – Subepidermal muscle in sheets, derived (at least in part) from 4d cell.

a. 18(0) – Cleavage pattern spiral.





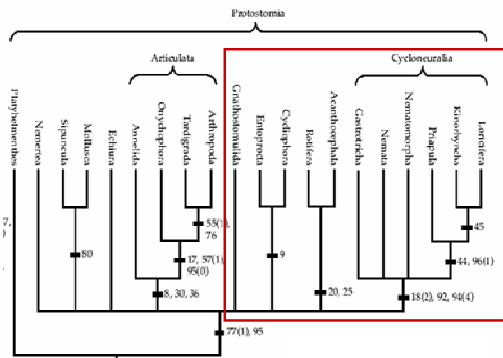
Coelomate Protostomia

1. Synapomorphies

- 77(1) – Schizocoelous coelom with body cavity lined with mesodermally derived epithelium (peritoneum).
- 95 – With trochophore larvae.

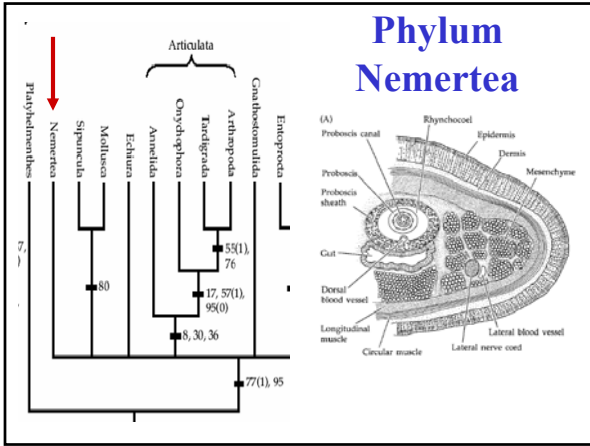


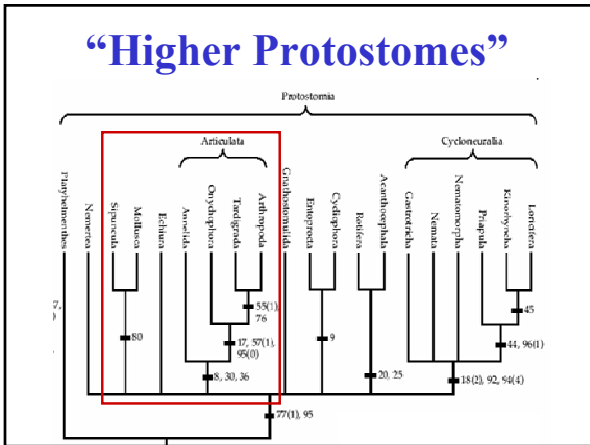
“Blastocoelomates”

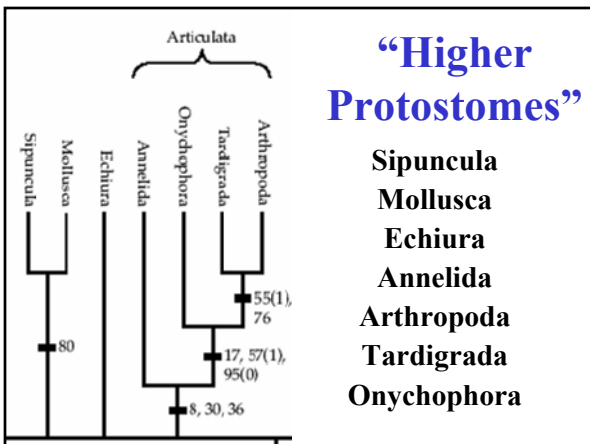


Blastocoelomates

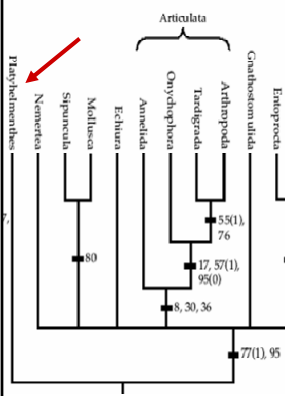
- Gnathostomulida
- Entoprocta
- Cycliophora
- Rotifera
- Acanthocephala
- Cycloneuralia
 - Gasterotricha
 - Nemata
 - Nematomorpha
 - Priapulida
 - Kinorhyncha
 - Loricifera



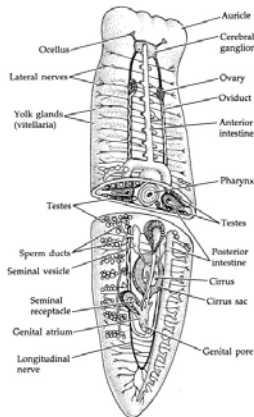




Phylum Platyhelminthes



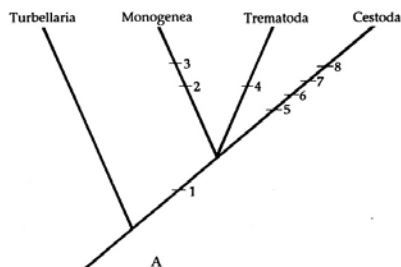
1. Parasitic or free-living, unsegmented worms (The subclass Eucestoda, in the class Cestoda, is strobilated)
2. Triploblastic, acoelomate, bilaterally symmetrical; flattened dorsoventrally
3. Spiral cleavage and 4d mesoderm
4. Complex, though incomplete, gut usually present; gut absent in some parasitic forms (Cestoda)
5. Cephalized, with a central nervous system comprising an anterior cerebral ganglion and (usually) longitudinal nerve cords connected by transverse commissures (ladder-like nervous system)
6. With protonephridia as excretory/osmoregulatory structures
7. Hermaphroditic, with complex reproductive system



Platyhelminthes: Classic Scheme

Characters:

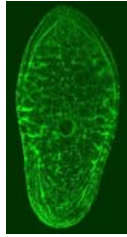
1. Tegumental cell extensions
2. Prohaptor
3. Opisthaptor



Class Turbellaria

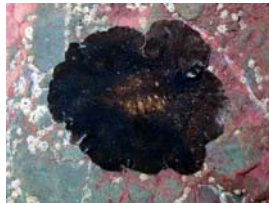
Free living forms:
4,500 spp

1. possess a gut of various proportions
2. Used to be classified by how yolk was apportioned around the egg.



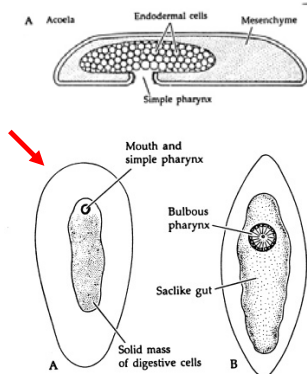
Class Turbellaria

- a. Archioophorans - yolk inside
- b. Neoophorans - yolk outside
- c. No longer the only designation, but still somewhat useful for identifying different orders.
- d. 12 Orders.



Order Acoela

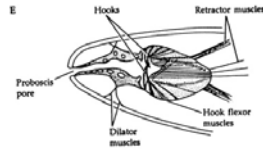
1. Simple pharynx, no gut.
2. Usually free-living in marine sands.
3. Similar to that described in Syncitial model, but internal syncytium forms later.



Order Catenulida

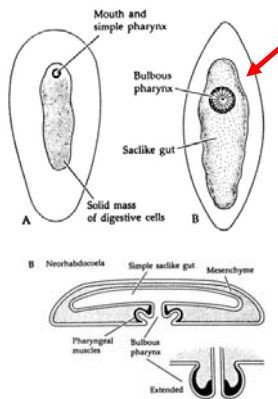
Order Macrostomida

1. Free living forms, often predaceous.
2. Good organisms for behavior.



Order Rhabdocoela

1. Rod shaped gut (hence the name)
2. Often endosymbiotic with Crustacea or other invertebrates.



Order Rhabdocoela

3. *Syndesmis*
 - a. note complex reproductive system

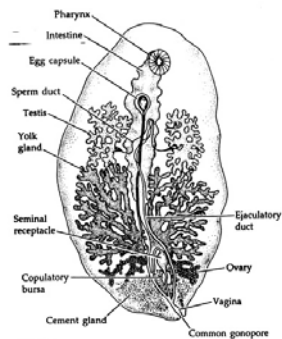
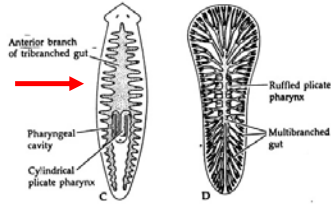


Figure 10
Syndesmis, a rhabdocoel from the gut of a sea urchin. (After Hyman 1951.)

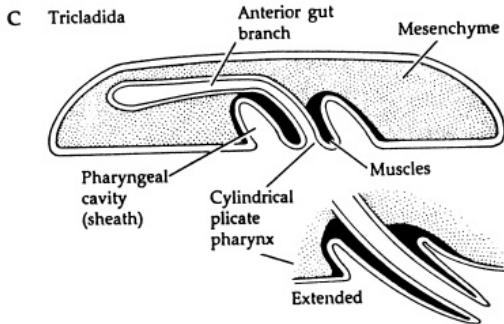
Order Tricladida

1. Three branched gut.
2. Free living forms, including planarians, marine, freshwater, terrestrial.



Order Tricladida

3. With protusible pharynx



Order Tricladida

4. Well-known for asexual reproduction, regeneration.
- a. Chimeras possible by selective cuts.
5. Sexual reproduction is often with few eggs and lots of parental care.

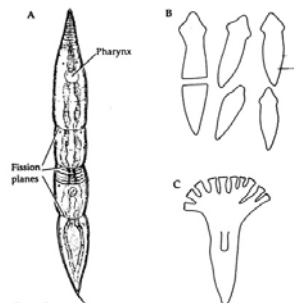
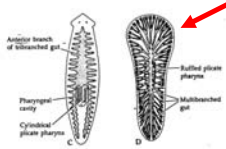
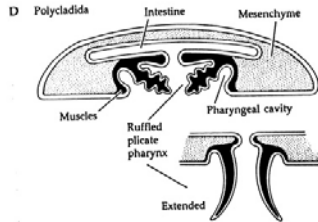


Figure 21
A, Asexual reproduction by transverse fission in the catenulid rhabdocoel *Alacorea*. B-C, Regeneration after injury in planarians. (A from Bayer and Ojeda 1966, after Ivanov 1955; B after various sources; C after Hyman 1951.)

Order Polycladida

1. Multiple branched gut, ruffled pharynx.
2. Nearly all marine.
3. Common in littoral zones.



Order Polycladida

4. Many also brood eggs, but some have planktonic larvae.
1. Muller's larvae.
 - a. Looks like a hunting cap.
 2. Gotte's larva.
 - b. Fewer ciliated lobes.

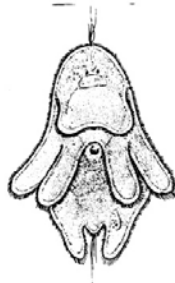
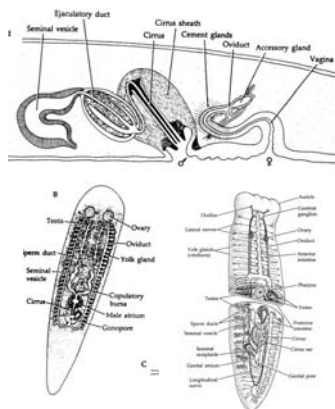


Figure 24
Face-on view of Müller's larva of a polyclad (*Planocera*). (From Bayer and Owe 1968, after Kato 1940.)

Order Polycladida

5. Polyclad development is well known.
6. Reproductive system, like that of all other turbellarians, is hermaphroditic.
7. But, sexual selection can occur (*Pseudoceros*).



Order Polycladida: Penis Fencing in *Pseudoceros*



Platyhelminth Systematics

Major revisions have occurred recently.

Two subphyla

1. Subphylum Catenulida

a. lack a frontal organ, with monociliated cells

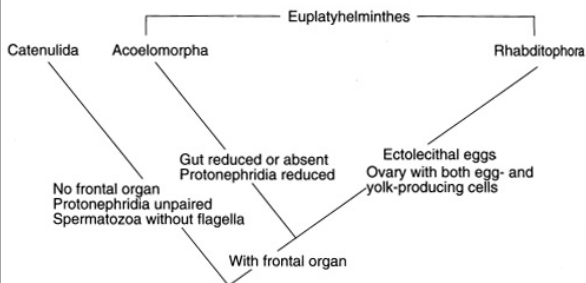
2. Subphylum

Euplatyhelminthes

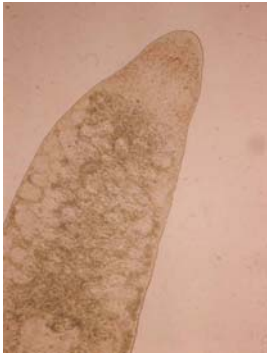
a. with a frontal organ, with lots of epidermal cilia.



Platyhelminth Systematics-New



Euplatyhelminthes



Superclass Acoelomorpha

- a. Simple pharynx, no gut.
- b. Usually free-living in marine sands.
- 3. Also parasitic/commensal on echinoderms.

Euplatyhelminthes

2. Superclass Rhabditophora - with rhabdites

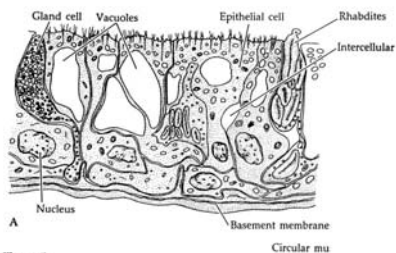


Figure 5

Turbellarian epidermis and body wall structure. A, Epidermis of the polyclad *Thysanozoon brochii*. B, Body wall and cellular epidermis of the triclad *Geoplana*. (A after C. Bedini and F. Papi, in Riser and Morse 1974; B after Bayer and Owre 1968.)
