Metazoan Phylogeny

Lower Metazoa
A. We left off last time with the lower metazoans.
1. The goal was to show some of the fundamental characteristics common to all metazoan.
2. We are now going to look further.

Bilateria
1. Bilaterally symmetrical animals appear to have arisen next.
2. This is a large group that comprises the rest of the Animal Kingdom
   a. If radial symmetry appears, it has evolved secondarily.
**Bilateria**

1. Also includes two major groups separated by particular developmental characteristics:
   a. Deuterostomia
   b. Protostomia

2. We’ll get to these details shortly

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**Bilaterian Synapomorphies**

Are mainly associated with body form and nervous system organization.

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**Important Synapomorphies Common to Bilateria**

a. 52(3) - Ventrally located nervous system.
   b. 69(2) - Primary symmetry bilateral with cephalization.

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**Ventrally Located Nervous System**

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**Primary Symmetry Bilateral with Cephalization**
**Deuterostomia**

1. Common characteristics are mainly developmental.
   a. Several members in B&B’s classification are not in this group based on molecular characters.
   b. We will investigate this next lecture.

**Deuterostomia**

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

1. Important synapomorphies:
86(0) – anterior body cavity unmodified as a proboscis, trunk, collar (as in hemichordates).

Phoropsis californica

Deuterostomes:
Lophophorates (?)
Chaetognatha
Echinodermata
Hemichordata
Chordata

“Lophophorates”

1. All possess a unique feeding structure – a lophophore
2. Recently classified among the Protostomia based on:
   a. Ambiguous developmental characters
   b. Molecular phylogenies suggesting closer relationship to Molluscs

“Lophophorates”

1. B&B dispute this, and the debate is ongoing.
   a. We will not consider this group in detail this semester.
2. Phyla include:
   a. Phoronida
   b. Brachiopoda
   c. Ectoprocta (Bryozoa)

Phylum Phoronida

Phylum Brachiopoda
**Phylum Ectoprocta (Bryozoa)**

**Deuterostomes:**
- Lophophorates (??)
- Chaetognatha
- Echinodermata
- Hemichordata
- Chordata

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

**Phylum Echinodermata**

**Hemichordates and Chordates**
1. Highly specialized groups with clear relationships to each other
Hemichordates and Chordates

2. Important Synapomorphies:
   a. 22 – epithelia that binds to iodine
   b. 46 – pharangeal gill slits
   c. 52(4) – nervous system concentrated dorsally

Hemichordates and Chordates

Class Enteropneusta
Class Pterobranchia
Subphylum Urochordata
Subphylum Cephalochordata
Subphylum Vertebrata

Phylum Hemichordata

1. marine filter feeders
2. synapomorphies
   a. 15 – preoral gut diverticulum that supports anterior body - stomochord
   b. 51 – glomerulus as excretory organ.
3. Classes
   a. Enteropneusta
   b. Pterobranchia
Phylum Chordata
1. ancestrally marine, sessile filter feeders with motile larvae
2. synapomorphies:
   a. 39(1) – tripartite body cavity (again)
   b. 47 – notochord
   c. 48 – endostyle (becomes thyroid gland in vertebrates)
   d. 63 – muscular, locomotory tail (in larvae in urochordates)

Phylum Chordata
1. Representative Subphyla:
   a. Urochordata – sea squirts and other ascidians
   b. Cephalochordata - lancelets
   c. Vertebrata – vertebrates

Hemicordates and Chordates
Class Enteropneusta
Class Pterobranchia
Subphylum Urochordata
Subphylum Cephalochordata
Subphylum Vertebrata

Subphylum Urochordata

Subphylum Cephalochordata

Phylum Chordata
1. Synapomorphies separating Urochordates from Cephalochordates and Vertebrates:
   a. 21 – myotomes – blocks of muscles arranges in segments.
   b. 37 – longitudinal musculature derived from segmental enterocoelic pouching.
   c. 94(6) – dorsal hollow nerve chord.

Phylum Chordata
1. Representative Subphyla:
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Subphylum Vertebrata