

Major divisions of Animalia

Parazoa vs. Eumetazoa
Radiata (Diploblasts) vs. Bilateria
 Within the Bilateria
 Protostomes and Deuterostomes

Major divisions of Animalia

Parazoa vs. Eumetazoa
 Tissue Organization

- Parazoa minimal tissue organization
 - Grind a sponge, it can reaggregate
 - No true epidermis
- Eumetazoa
 - tissues and organs present; nervous system with neurons
 - Epidermis regulates material passage to various compartments

Parazoa

Phylum Porifera

- Sponges— more later
- Probably more than one phylum, really

Phylum Placozoa

- Phylogenetic position is controversial-conflicting results from ribosomal and mtdna studies
 - often been seen as the "living ancestor" of animals
 - Is it a sister to all animals, bilaterians, or does it fit in the cnidarians?
- 1 species *Trichoplax adhaerens*
 - easily collected in tropical lagoons, but range not known
- Another was once reported but never seen again
 - 1st found in an aquarium
- Most simply organized multicellular animal known
 - only a few thousand cells & only 4 somatic cell types
- no symmetry, although has upper/lower (not true dorsoventrality)
 - a few fibric cells in between
- looks like pinkish, moving deposits in aquaria
- smallest amount of DNA ever measured for any animal.

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Parazoa

Phylum Placozoa

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 - often been seen as the "living ancestor" of animals (basal)
 - Is it a sister to all animals, bilaterians, or does it fit in the cnidarians?

sister to the Eumetazoa

Srivastava et al Nature 2008. 104 nuclear genes found genes in *Trichoplax* associated with advanced cell types and processes

sister to the bilaterians

b Phylogeny based on molecular data

Ball et al. 2004 Nature Reviews Genetics

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sister to all animals

Parazoa

Phylum Placozoa

- Schierwater et al. PLOS 2009
- "Total Evidence" analysis
 - sum of morphological evidence, the secondary structure of mitochondrial ribosomal genes, and sequence data from mitochondrial and nuclear genes
 - Bilateria* and *Diploblasts* are sister groups
 - Placozoa* is basal to all diploblasts

sister to the Eumetazoa

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Placula hypothesis

Attempt to explain evolution of metazoans from protists

Flagellated protozoans unite to form a plate-like metazoan organism.

The one-layered protist form (a) evolves to the two-layered "placula" (b,c). Cells of the upper layer form the ectoderm, while cells of the lower layer (orange) adopt a feeding function and later invaginate to form the endoderm (d-g)

Placula transformation cross section

"oral" view

Diplox expression (6) ("oral" view)

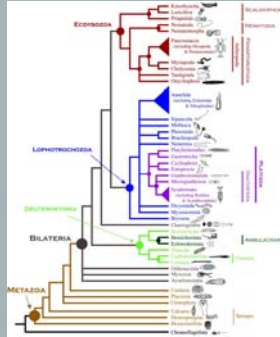
Cnidarian

Trichoplax

Eumetazoa

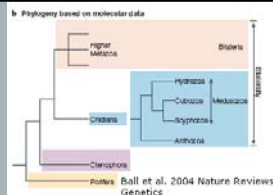
Innovations:

- 1) true epithelia
 - permit establishment of regulated compartments
 - control passage of materials
 - chemical environment can be controlled
- 2) bodies with definite axes
 - e.g. anterior-posterior or oral-aboral
- 3) tissues and cells with greater differentiation
 - muscle and nervous tissues present
- 4) gut
- 5) often with large, complex, motile bodies



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Radiata



Radial symmetry as a character is likely on it's way out – other molecular/developmental characters would replace

Cnidaria: hydras, jellies, sea anemones, and coral animals

Ctenophora: Comb jellies

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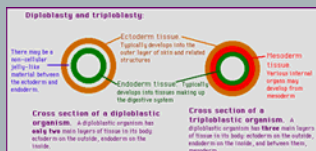
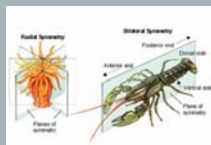
Diploblasty versus Triploblasty

Eumetazoa

- number of tissue layers forming during gastrulation
- Diploblast:
 - epidermis derived from ectoderm
 - gastrodermis derived from endoderm
- triploblastic: three embryonic tissues (germ layers:)
 - ectoderm: outer layer - skin and nervous tissue
 - endoderm: inner layer - lines digestive tract
 - mesoderm: middle layer - muscles, bones, circulatory system, organs

Parazoa and Eumetazoa: Radiata are diploblasts (maybe??)

- It's looking like ctenophores and cnidarians might have mesoderm



Mouth formation in a deuterostome
(Echinoderm, sea urchin)

Blastopore Gut Mouth Anus

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Sources: Gilbert and Raunio 1997, fig 16.11; Wolpert 1998 fig 6.19

Larval forms of protostomes and deuterostomes

Apical tuft
Stomodaeum
Mesoderm

Trochophore larva of Mollusc (marine snail)

Pluteus larva of Echinoderm (sea urchin)
