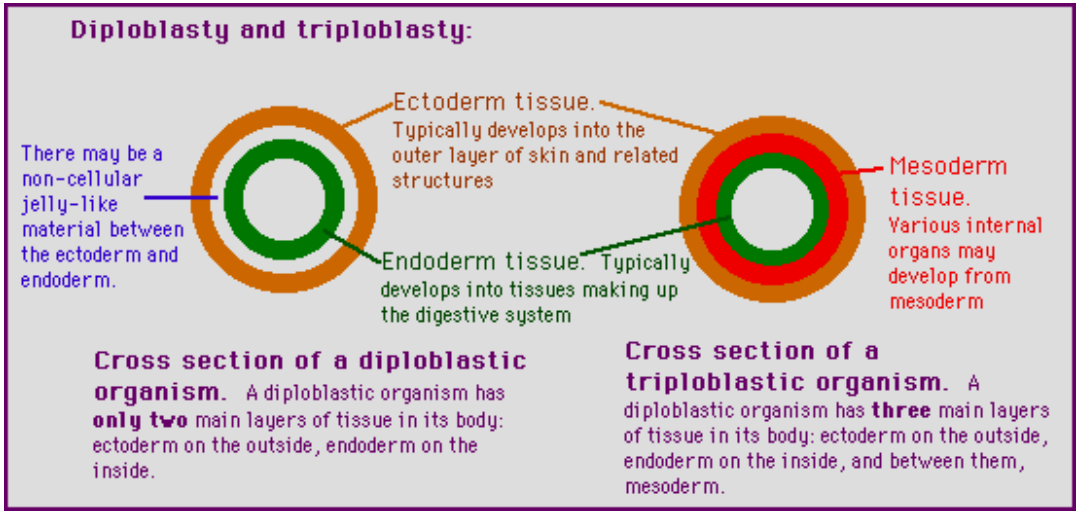
Overview of Bilateria

Multicellular animals, bilaterally symmetrical, triploblastic (mesoderm -- 3rd cell layer)

Bilateral symmetry


Mithrax pleuracanthus

Triploblasts

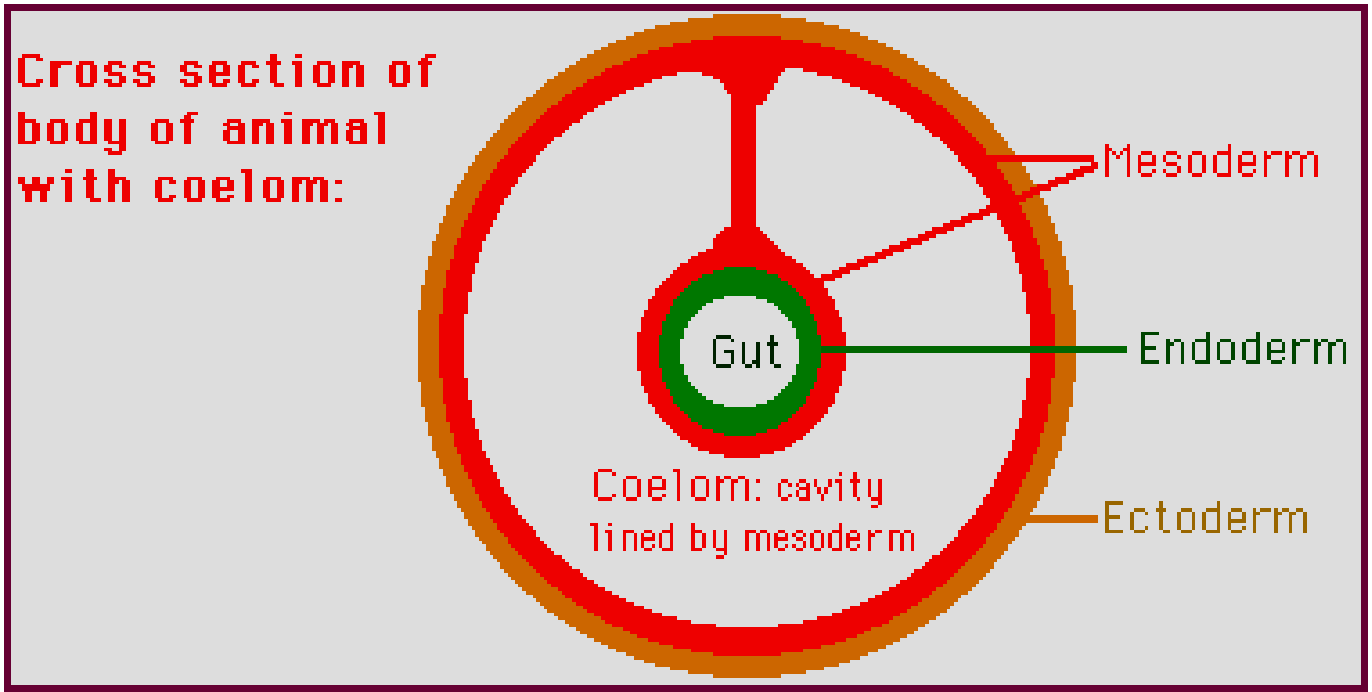


Coelom

Presence of coelom was considered (erroneously) to be a defining character for Bilateria.

Platychelminthes (flatworms) have no coelom, so they were considered to be the basal group of Bilateria. Another equally supported hypothesis states that flatworms have lost secondarily both coelom and anus.

What is a Coelom?



Protostomes vs Deuterostomes

Property	Protostomes	Deuterostomes
Blastopore	Becomes adult mouth	Newly formed
Anus	Newly formed	Formed from blastopore
Coelom	If present, formed by schizocoely	Formed by enterocoely
Cleavage of fertilized egg	Usually spiral	Always radial
Development	Determinate	Indeterminate
Larvae	When present, with downstream collecting ciliary bands	Larvae with upstream ciliary bands

Modified from Mayr's 2001 book "What evolution is"

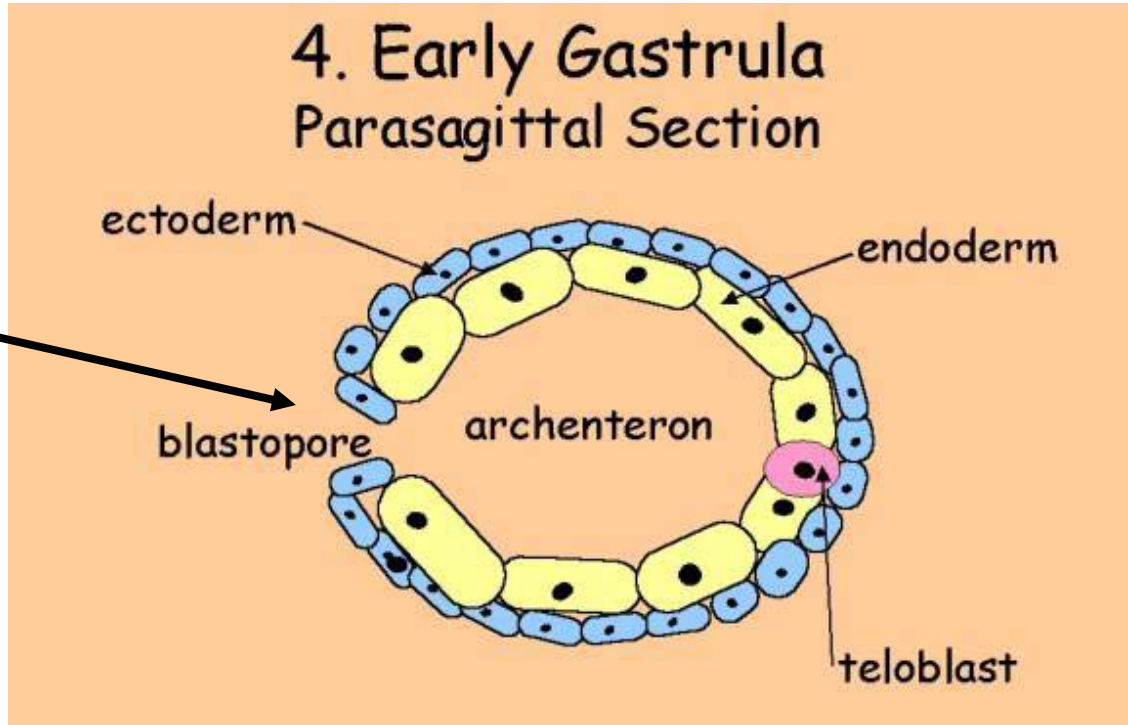
Origins of mouth and anus

The names **protostomes** and **deuterostome** derive from the differing fate of the initial opening of the primitive digestive tract (the archenteron) in an embryo.

In protostomes, this initial opening develops into the mouth, and an opening that develops later becomes the anus.

In deuterostomes, it develops into the anus, and an opening that develops later becomes the mouth.

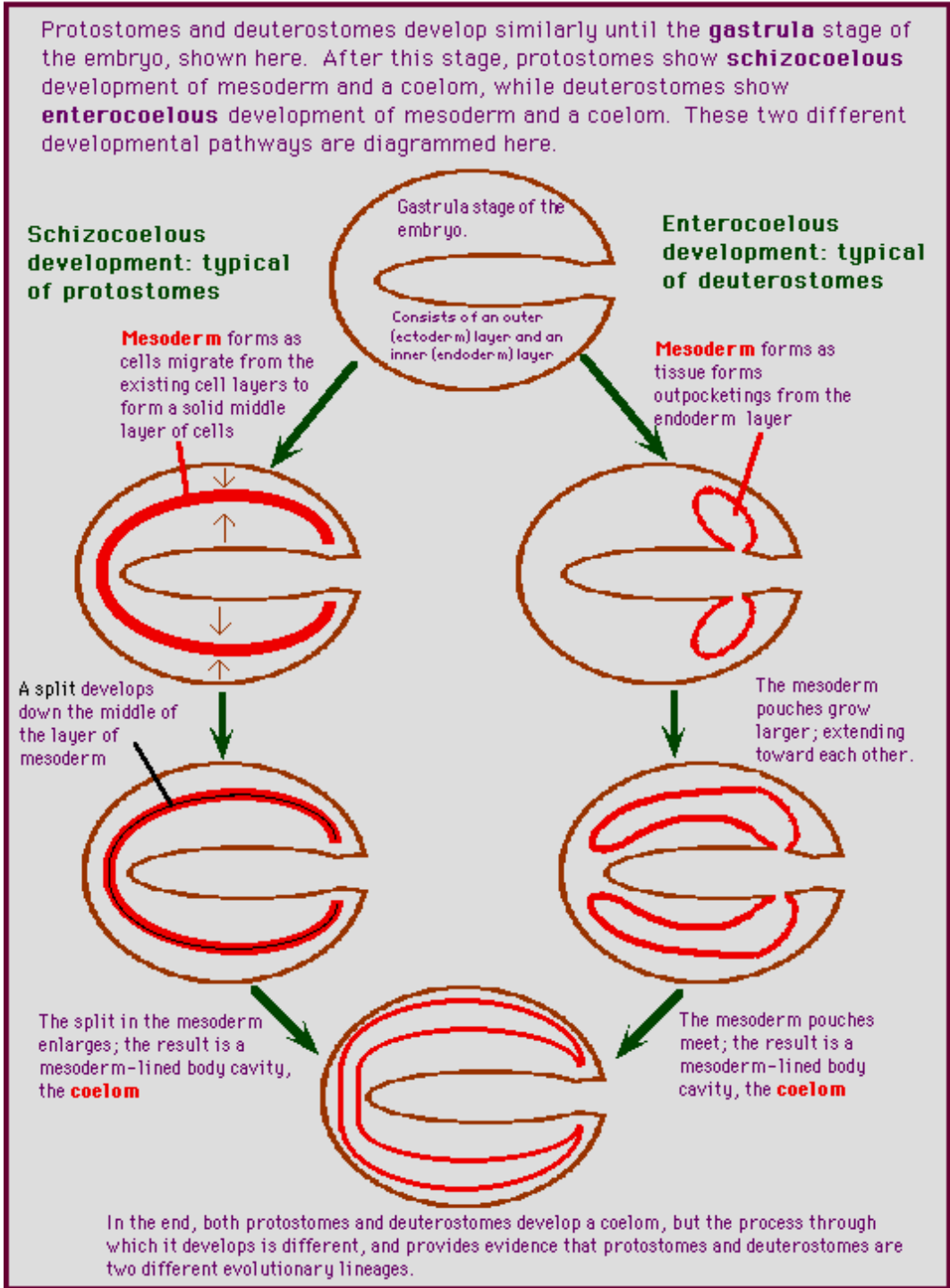
The blastopore is the opening to the archenteron (primitive digestive tract)



Enterocoelous versus schizocoelous development of the coelom

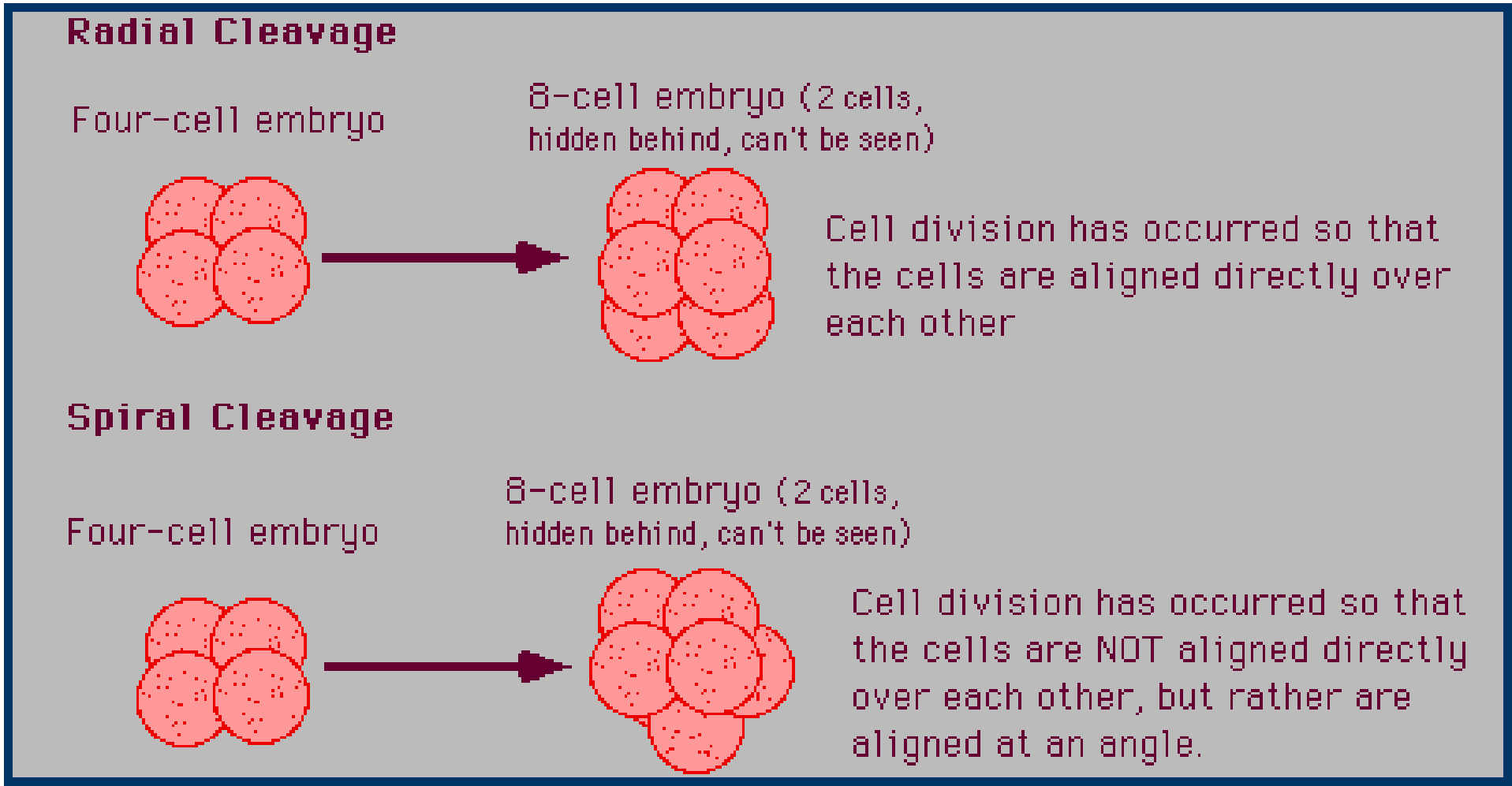
Enterocoelous development of the coelom occurs in deuterostomes. The mesoderm, and coelom, initially develop as pouches off of the primitive digestive tract (the archenteron).

Schizocoelous development of the coelom occurs in protostomes. The mesoderm, and coelom, initially develop from a solid block of mesoderm tissue that develops a split down the middle.



Spiral cleavage - **Protostomes.** A developing embryo has spiral cleavage if as it undergoes cell division (cleavage) and changes from a four-cell embryo to an eight-cell embryo, the cells divide at slight angles to one another, so that the none of the four cells in one plane of the eight-cell stage is directly over a cell in the other plane.

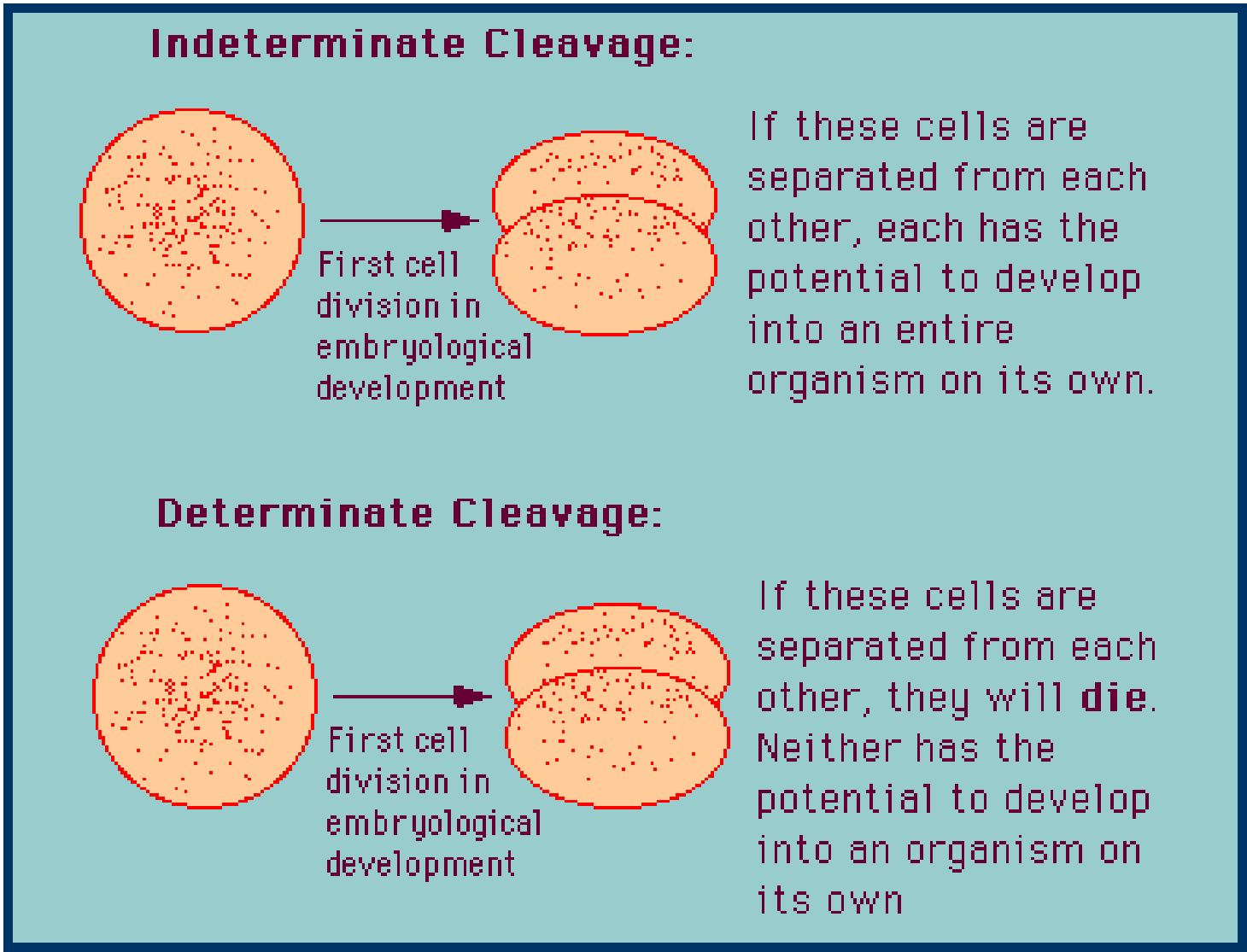
Radial cleavage -**Deuterostomes.** A developing embryo has radial cleavage if as it undergoes cell division (cleavage) and changes from a four-cell embryo to an eight-cell embryo, the cells divide such that each cell in the top four cell plane is directly over one other cell in the bottom plane.



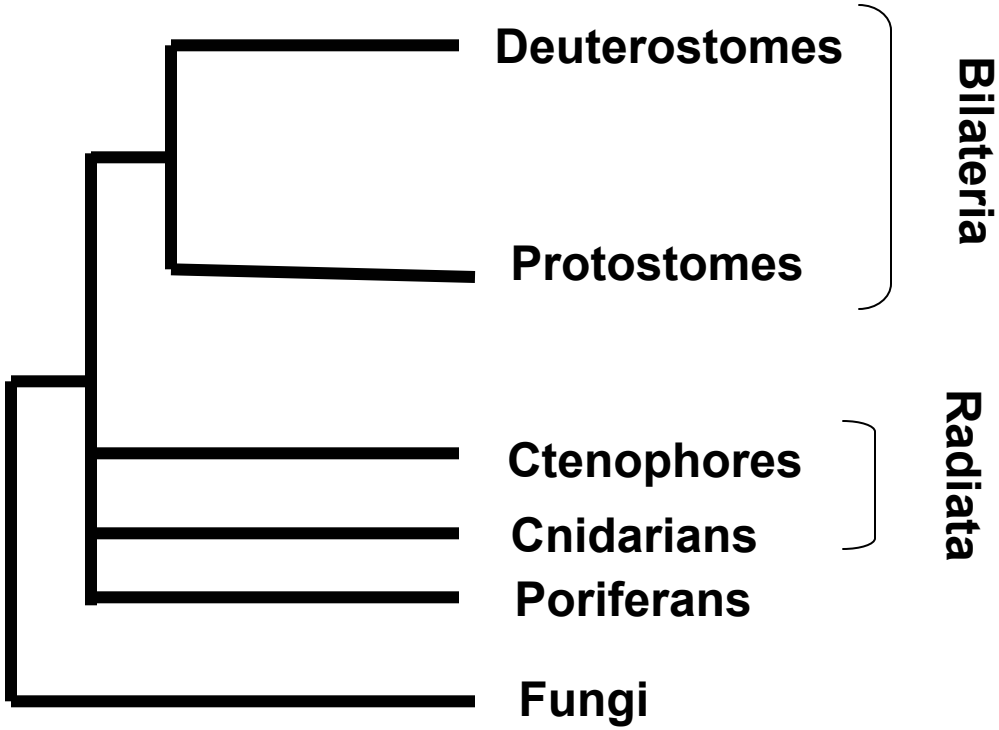
Determinate versus Indeterminate Cleavage

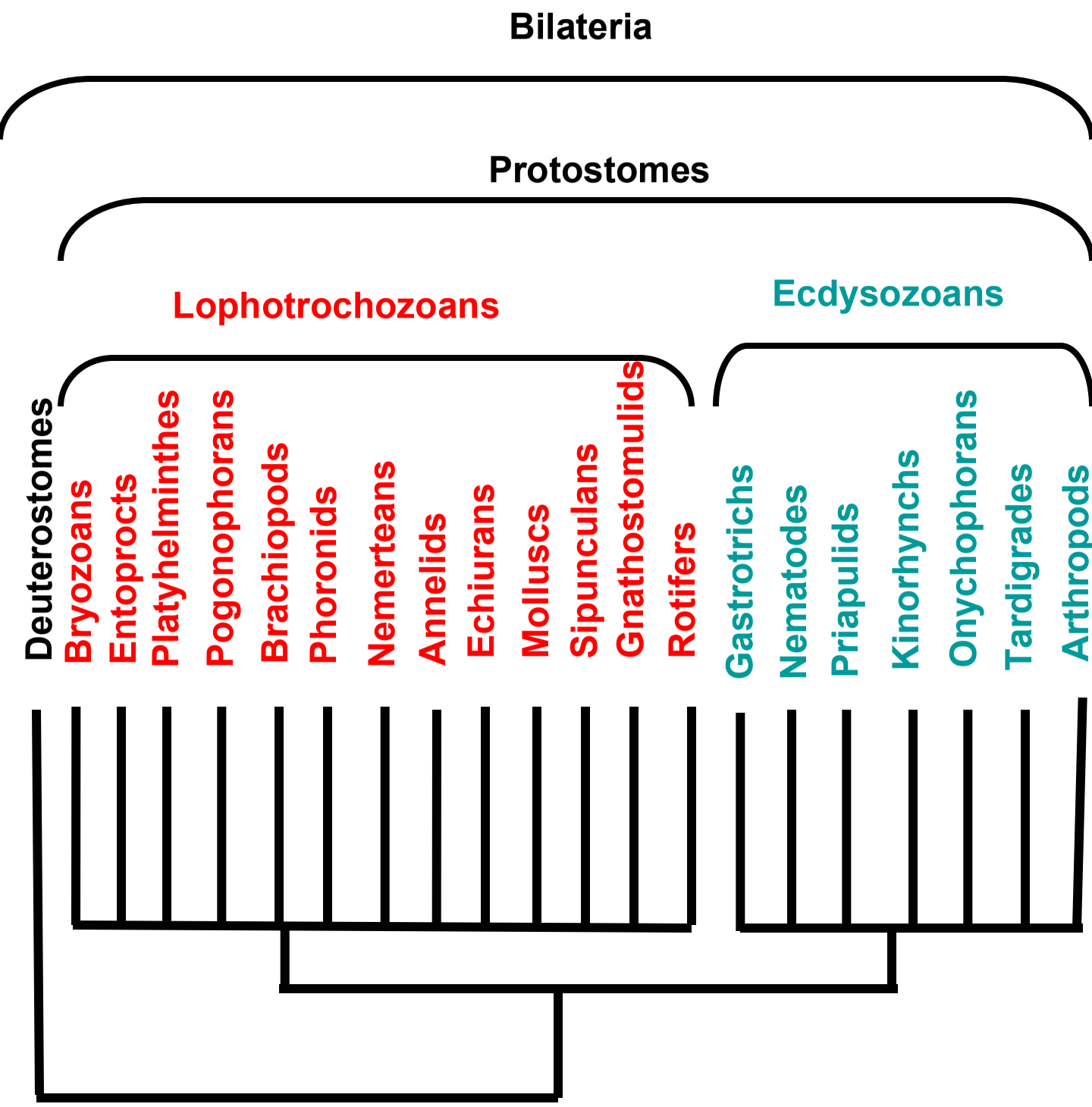
Determinate cleavage - **Protostomes**. After the initial cell division the fate of the resulting daughter cells is determined -- they can develop into specific tissues, not the whole organism.

Indeterminate cleavage - **Deuterostomes**. After the initial cell division the fate of the resulting daughter cells is not determined -- each has the potential to develop into an entire organism. (e.g. identical twins).



Metazoan Phylogeny

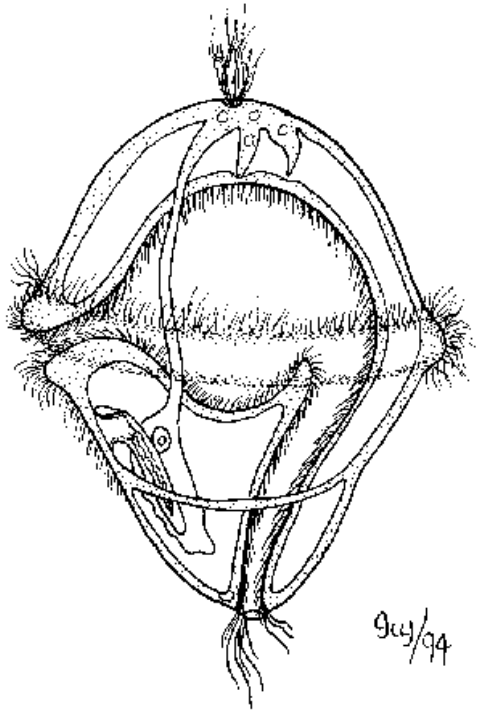



Bilateria
Protostomes
Lophotrochozoans
Ecdysozoans
Deuterostomes
Bryozoans
Entoprocts
Platyhelminthes
Pogonophorans
Brachiopods
Phoronids
Nemerteans
Annelids
Echiurans
Molluscs
Sipunculans
Gnathostomulids
Rotifers
Gastrotrichs
Nematodes
Priapulids
Kinorhynchs
Onychophorans
Tardigrades
Arthropods

Where is the name coming from?

The name **Lophotrochozoa** comes from the names of the two major animal groups included: the **Lophophorata** and the **Trochozoa**. Lophophorata (e.g. brachiopods, Bryozoans, Phoronids, Entoprocta) and Trochozoa (e.g. Nemerteans, Annelida, Echiurans, Pogonophorans, molluscs).

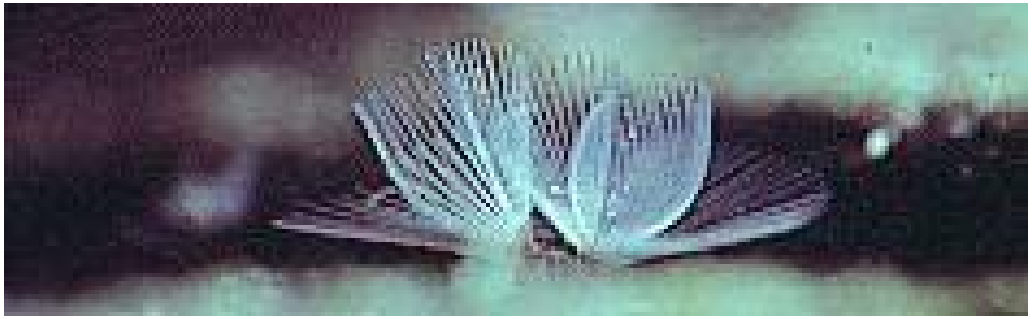
Many annelids and molluscs share patterns of development in early embryonic stages. When these larvae hatch, each is a microscopic swimmer known as a **trochophore larva**, shown at right. The larva has two bands of cilia around the middle that are used for swimming and for gathering food, and at the "top" is a cluster of longer flagellae. So the larvae of these groups is nearly identical, even though they mature into very different adult forms.



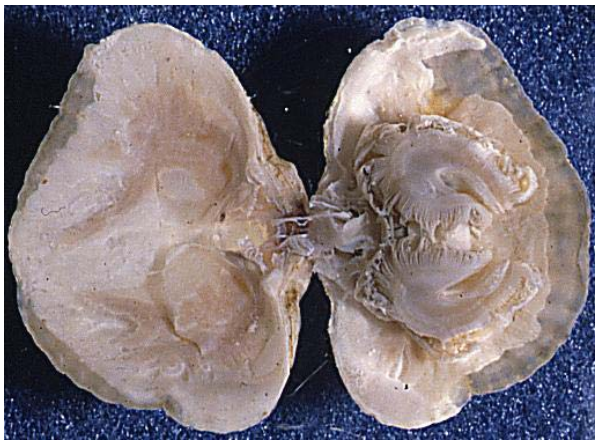
Arthropoda (insects and crustaceans) were thought to be close relatives of the Annelida, based on the fact that both groups are segmented, but no arthropod has a trochophore larva and no molecular studies support a close relationship.

Where is the name Lophophorates coming from?

The feature shared by this group is the lophophore, an unusual feeding appendage bearing hollow tentacles.



The lophophore can most easily be described as a ring of tentacles, but it is often horseshoe-shaped or coiled. Phoronids have their lophophores in plain view, as shown above, but brachiopods like the one below must be opened wide in order to get a good view of their lophophore.



Lophophorata are placed in the Lophotrochozoa as the most popular hypothesis, but there are studies that suggest they may belong with the deuterostomes, or may even be **paraphyletic**.

Deuterostome Phylogeny