

Invertebrate Evolution

Organisms: Basic To Complex



Porifera: Sponge



Cnidaria: Jelly Fish



Platyhelminthes: Flatworm



Nematoda: Roundworm



Annelida: Segmented Worms

Organisms: Even More Complex



Mollusca: Mollusks



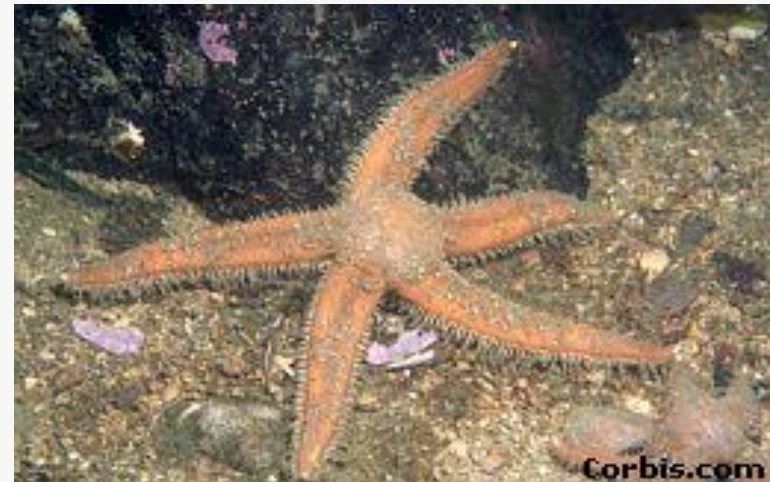
Arthropoda: Crustaceans



Arthropoda: Spiders



Arthropoda: Insects



Echinodermata: Sea Star

Evolutionary Trends

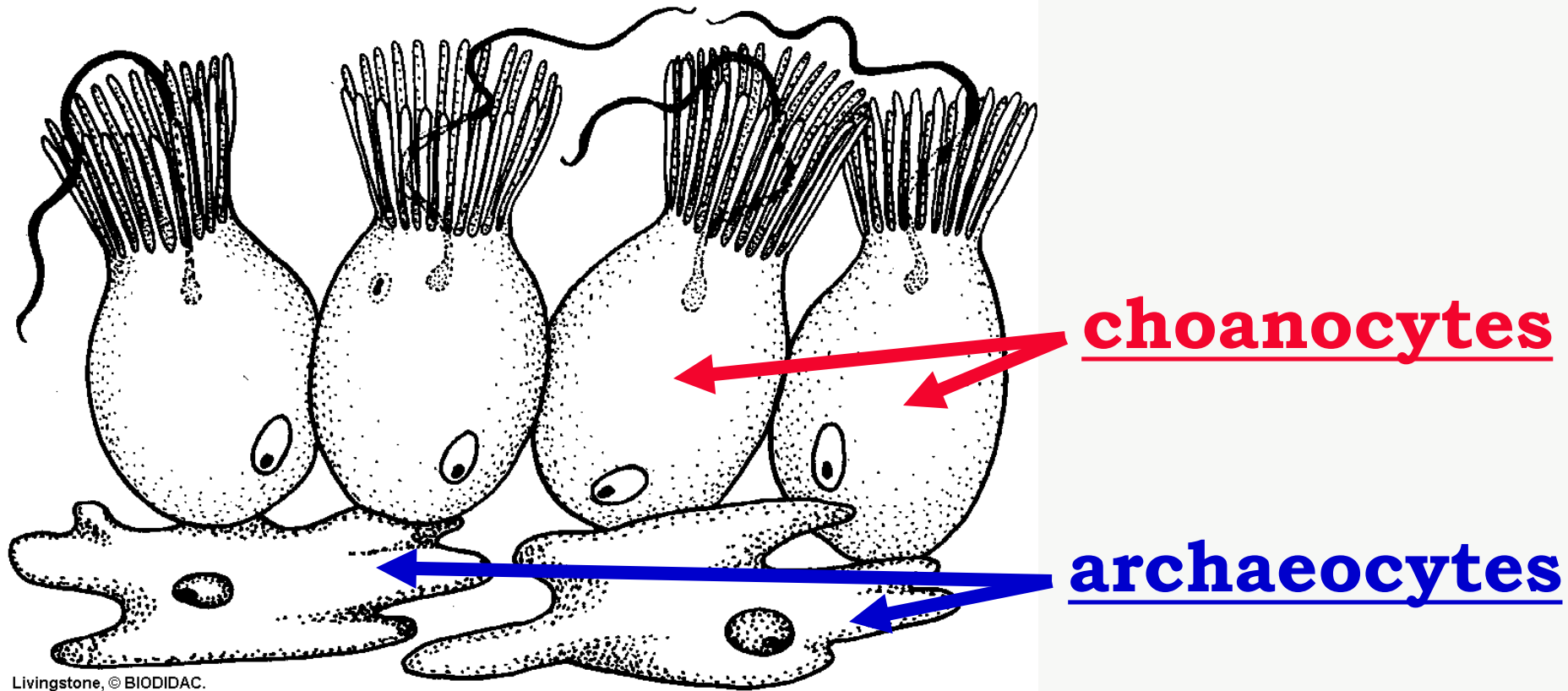
(Simple to Complex)

Specialized Cells

Tissues

Organs

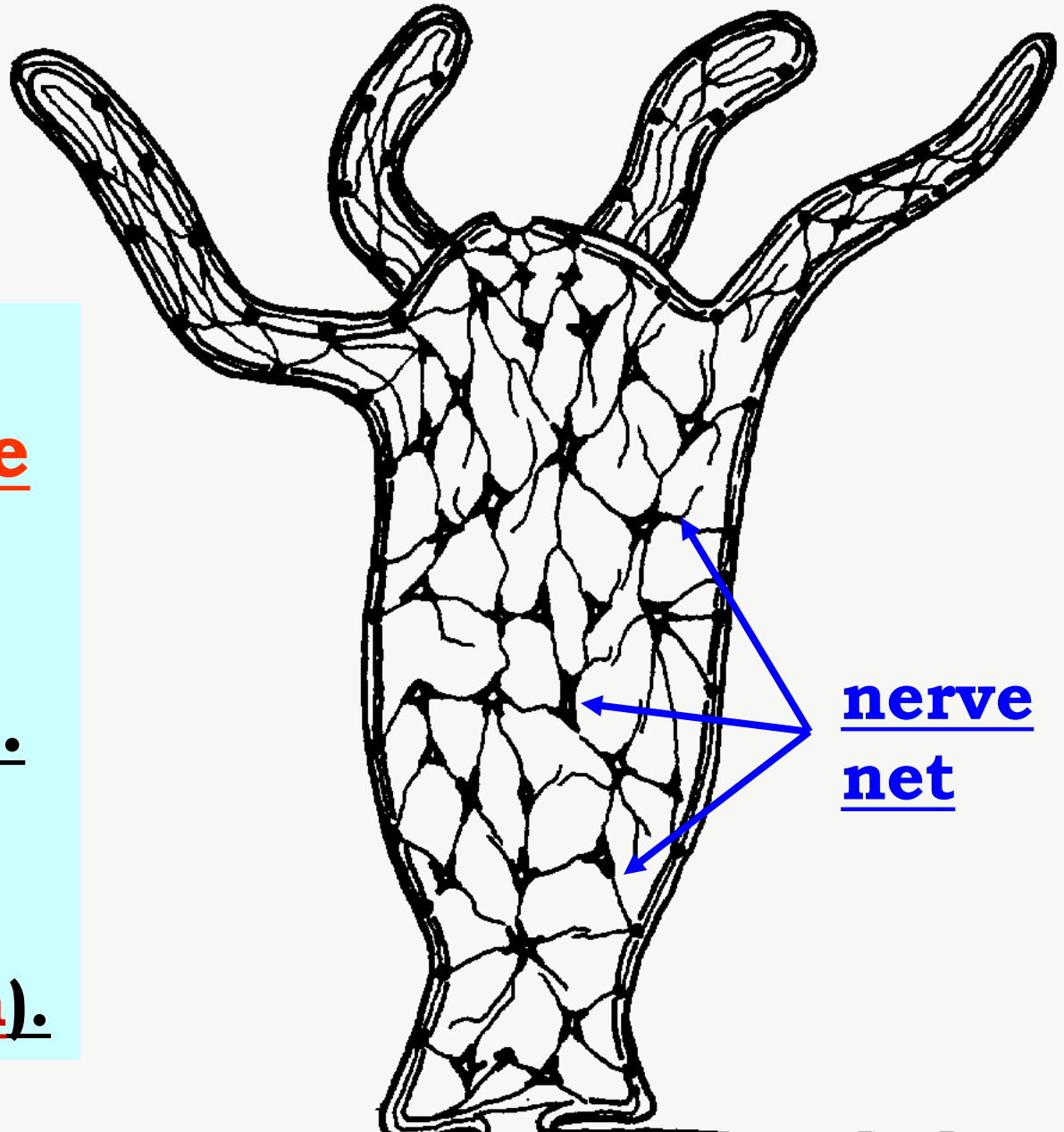
Organ Systems



Choanocytes capture food; archaeocytes digest the food and take nutrients to other cells.

Nervous Tissue

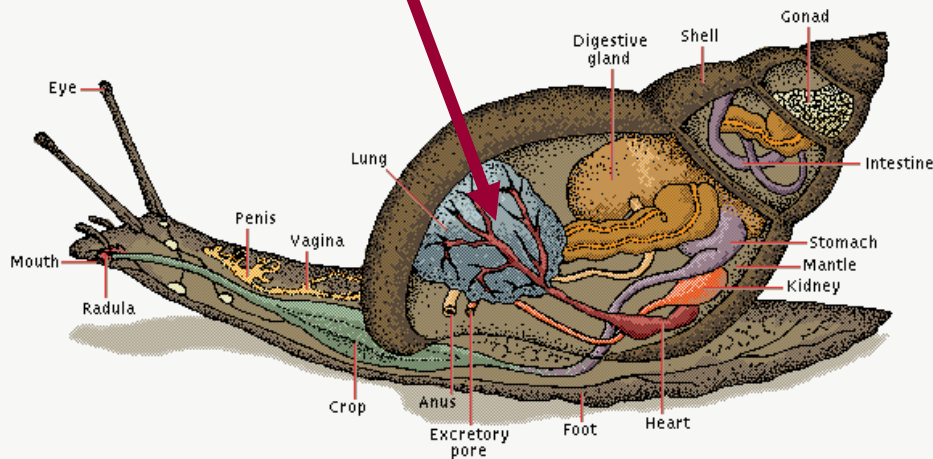
Cnidarians
have a **nerve**
net running
throughout
their bodies.
There is **no**
control
center (**brain**).



nerve
net

Land species usually have lungs;
water species usually have gills.

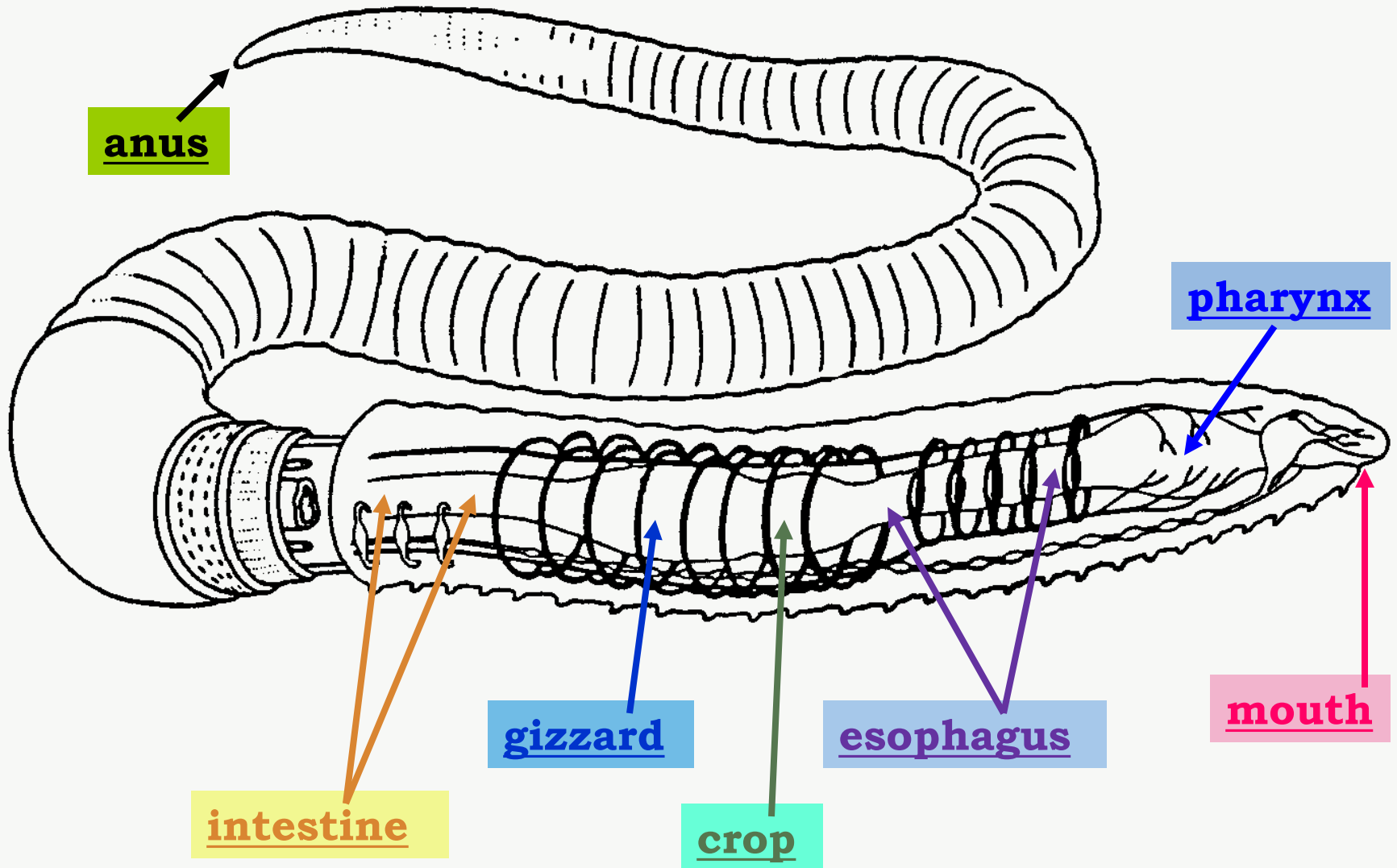
lungs



external gills



Digestive System



Types of Symmetry

Asymmetrical

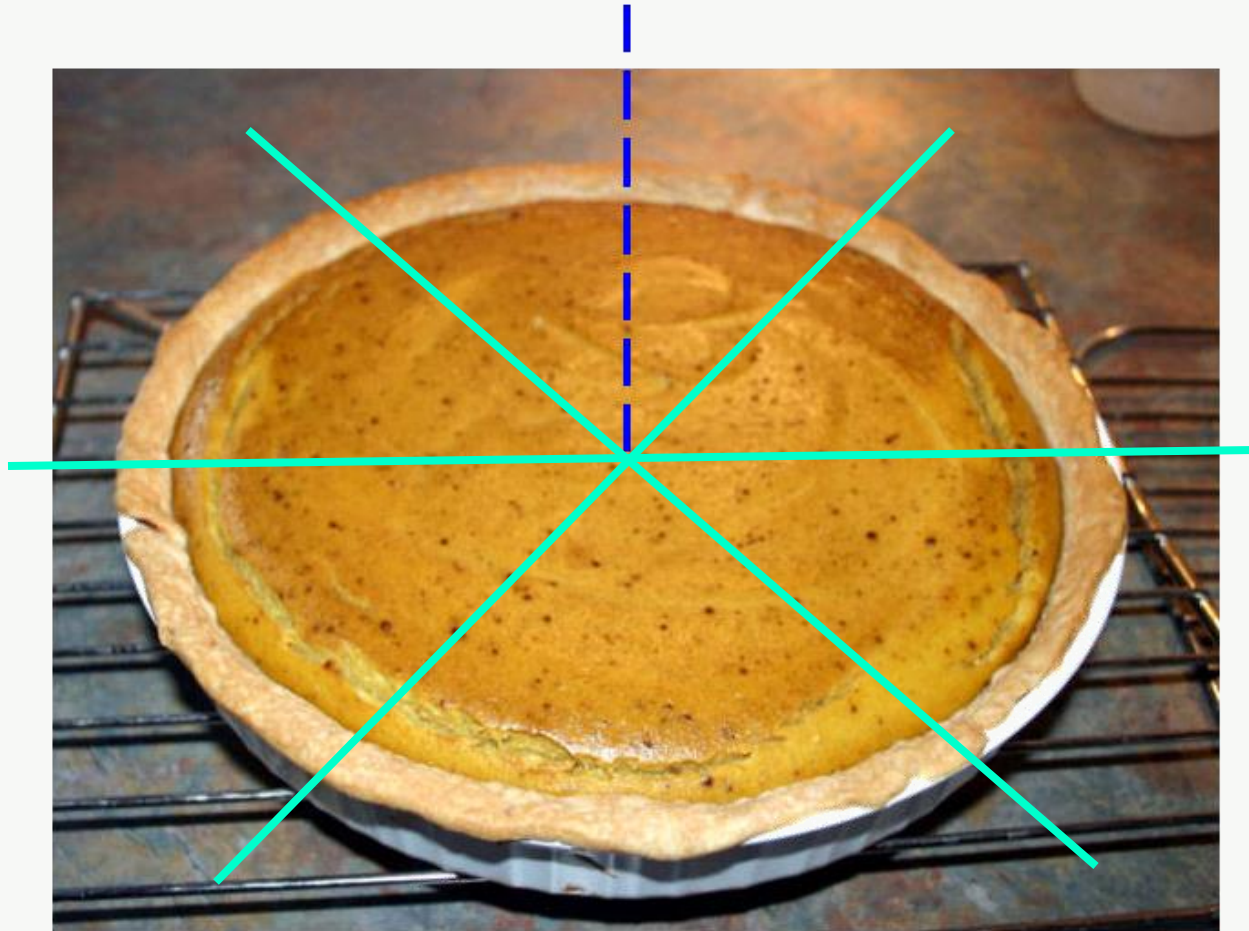
(no symmetry)



no 2 halves will be the same

Radial Symmetry

**more
complex
than
spherical
but not
the most
complex**

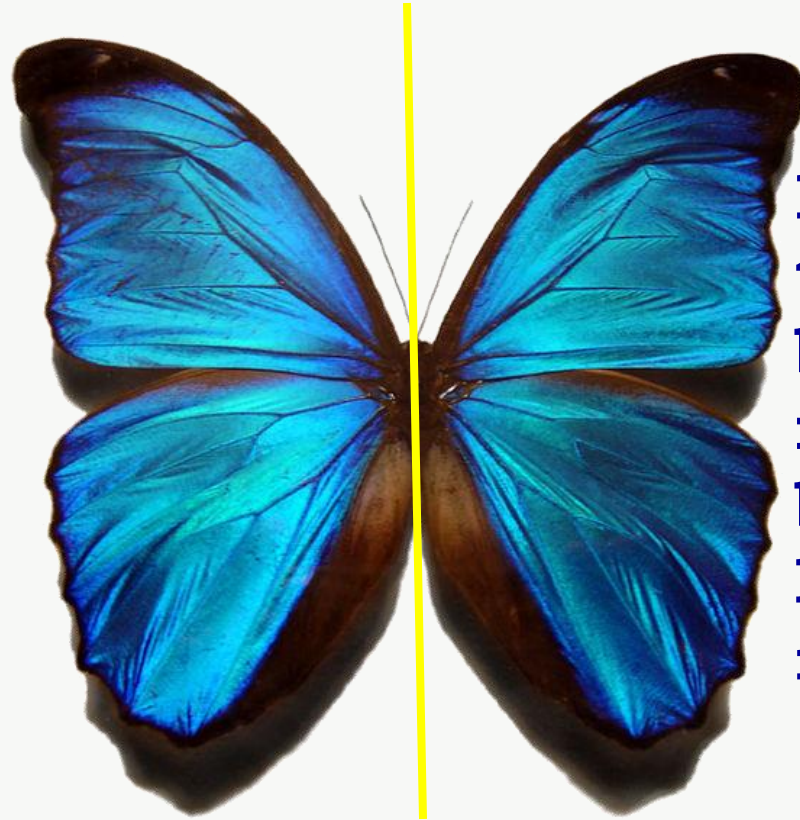


**has a
top and
bottom
but no
front,
back,
right,
or left**

cutting down a longitudinal axis gets equal halves

Bilateral Symmetry

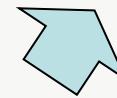
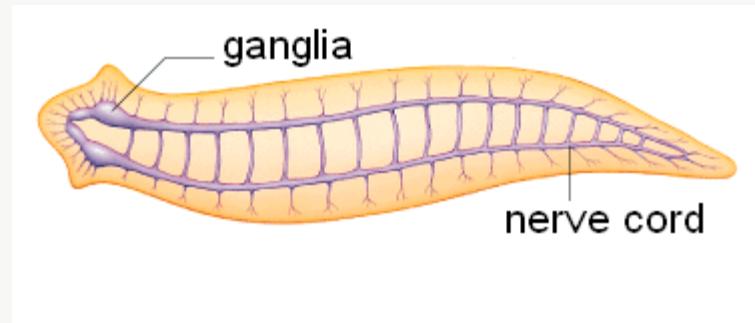
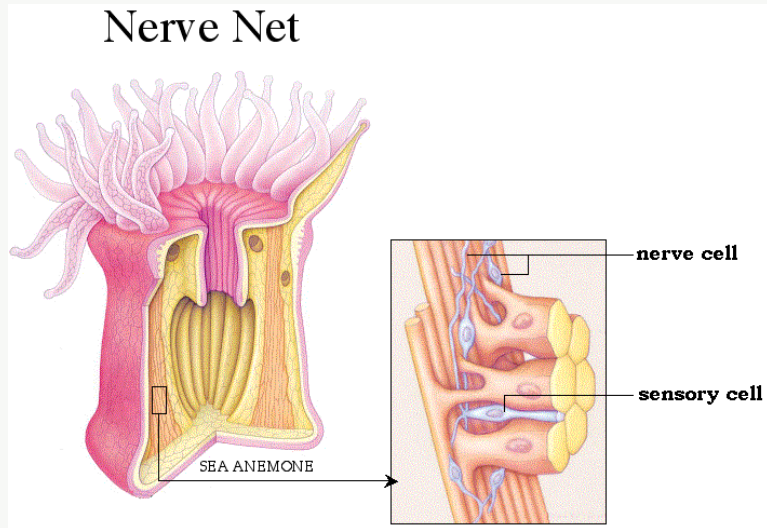
the
most
complex



has a
top,
bottom,
front,
back,
left, and
right

there is only 1 way you can get 2 equal halves

Cephalization



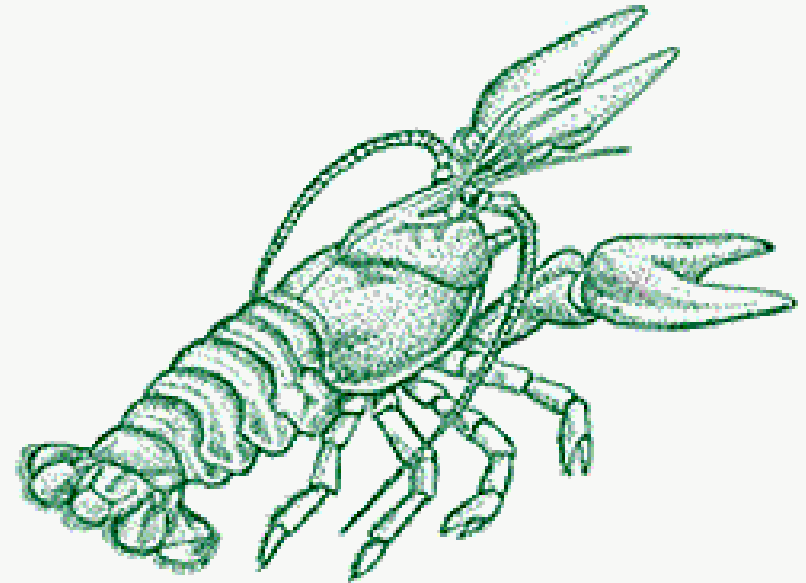
**possibly the
smartest
invertebrate**

Segmentation



**larger size with
minimal DNA
(repeating pattern)**

**specialized
functions**



Summary of Body Plans



sponges



cnidarians



flatworms



roundworms



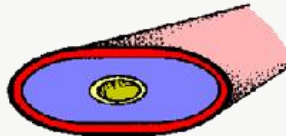
segmented
worms



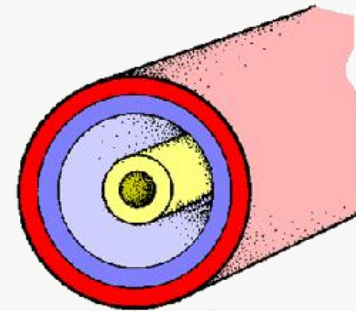
Acoelomate
Body Plan 0



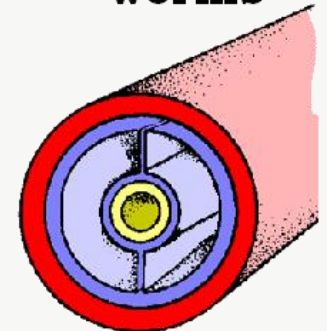
Acoelomate
Body Plan 1



Acoelomate
Body Plan 2



Pseudocoelomate
Body Plan 3



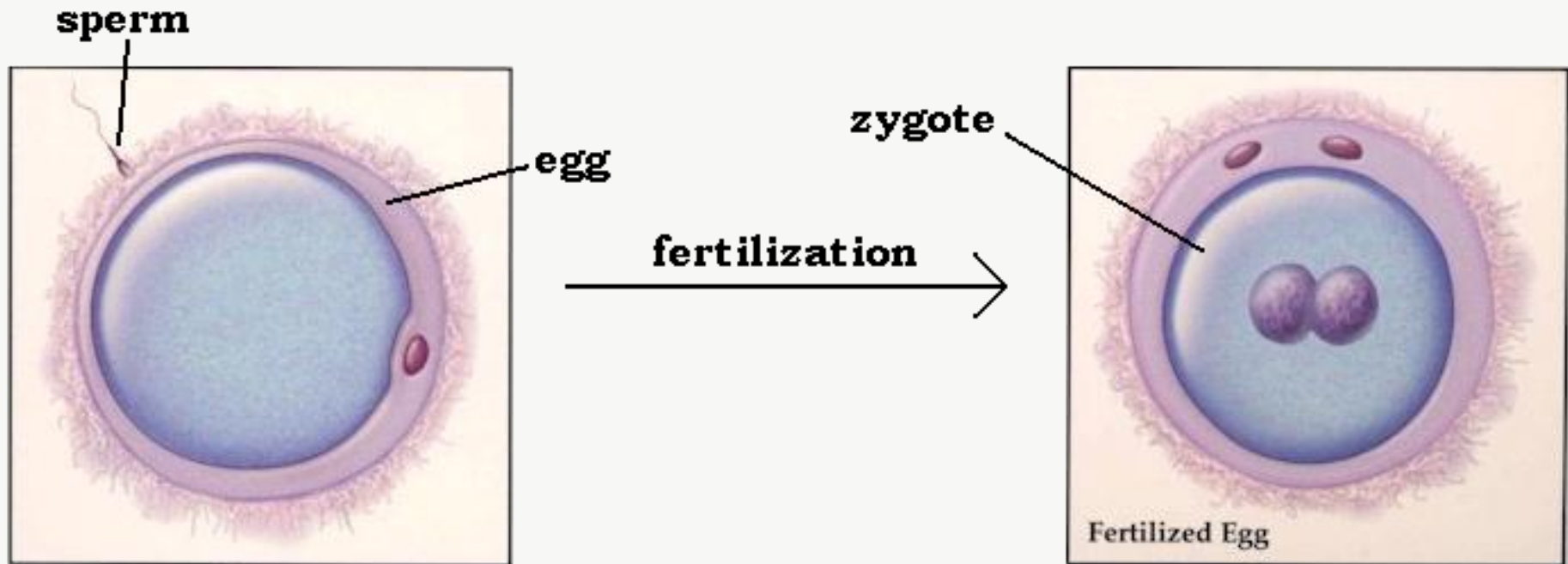
Coelomate
Body Plan 4

■ = ectoderm
 ■ = mesoderm
 ■ = endoderm
 ■ = digestive tract
 ■ = a body cavity

Early Developmental Stages of Animals

Fertilization

- the combining of a sperm with an egg

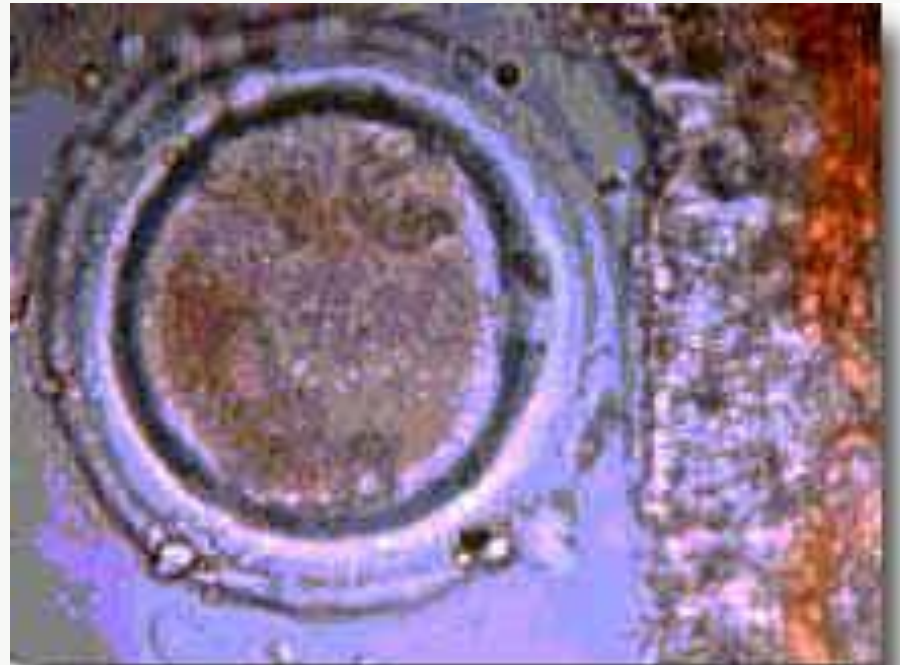


the result is called a zygote

Pictures of Zygotes



frog



human

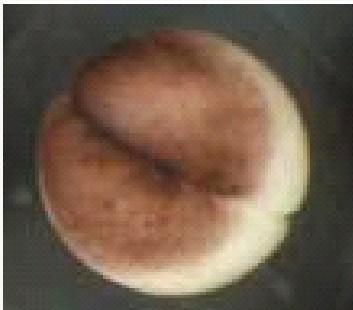
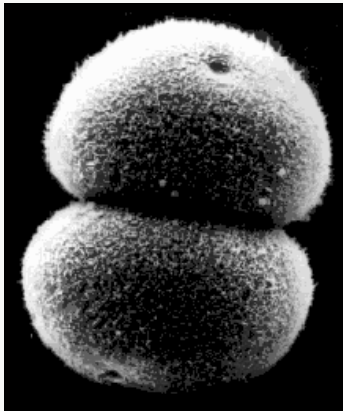
Early Cell Divisions

- the zygote cleaves to become 2, 4, & 8 cells

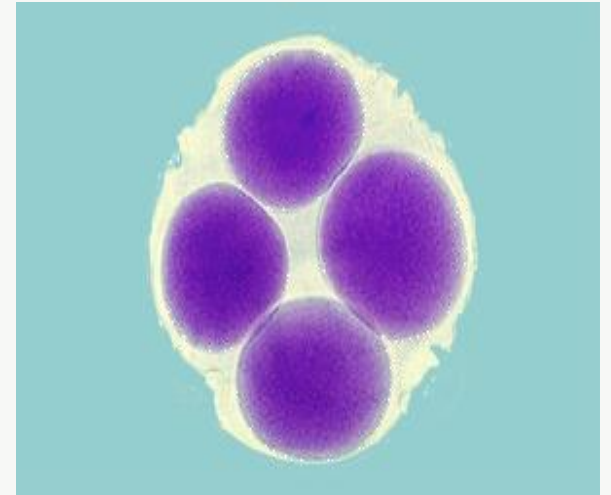
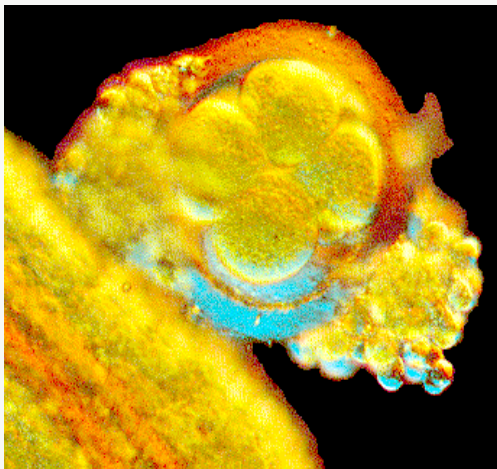
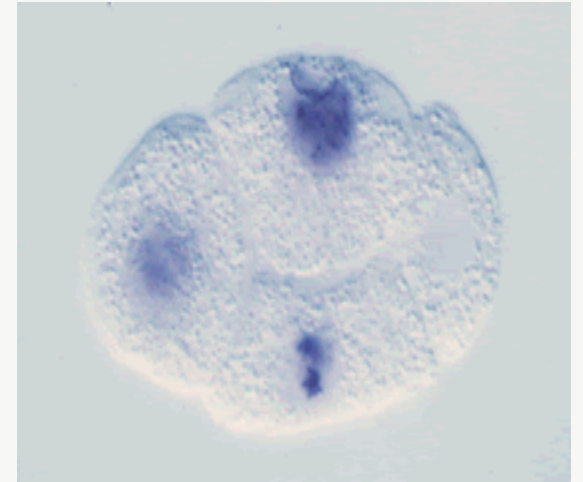
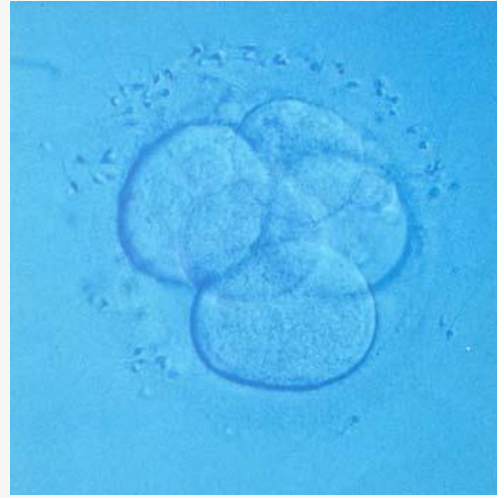


early cell divisions are called cleavage

Pictures of 2 Cell Stage



Pictures of 4 Cell Stage



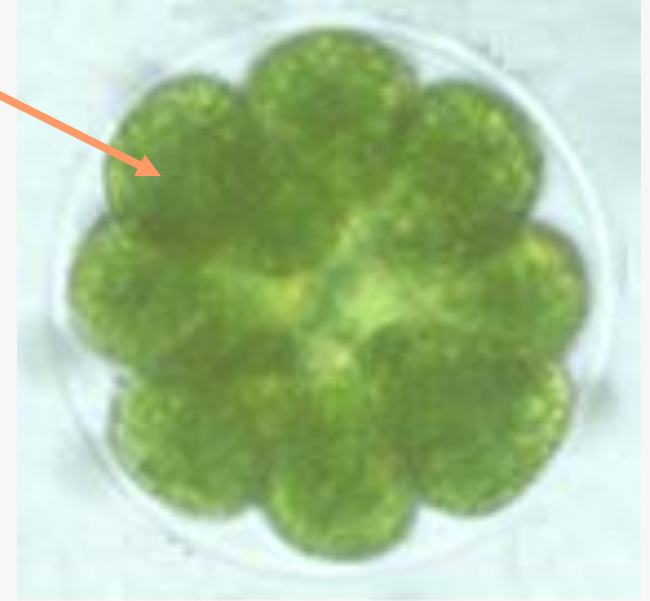
8 cells become 16 cells



8 cells

morula

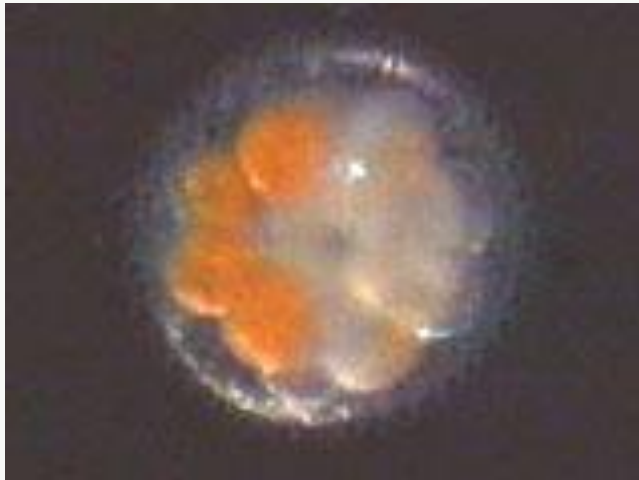
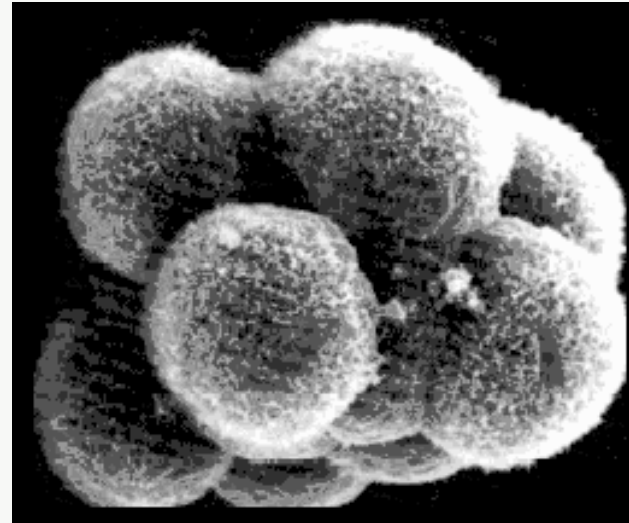
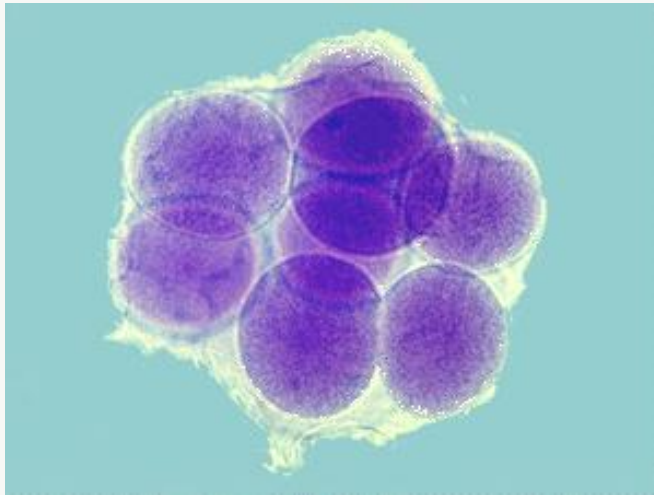
cleavage →



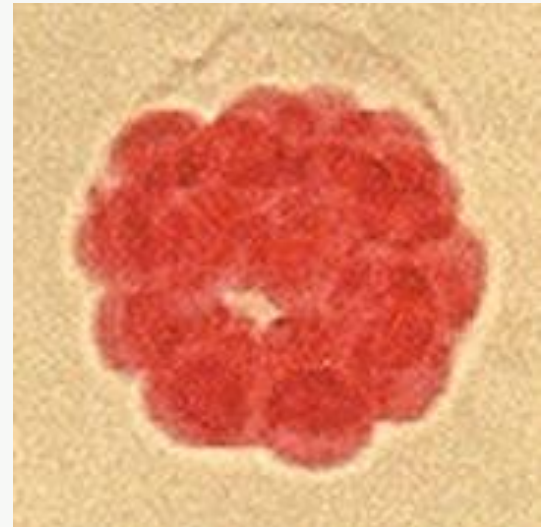
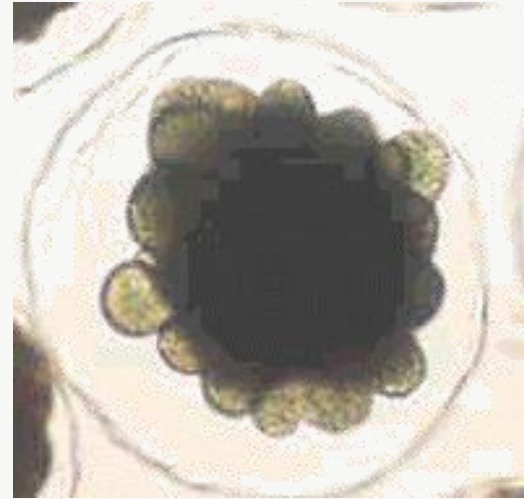
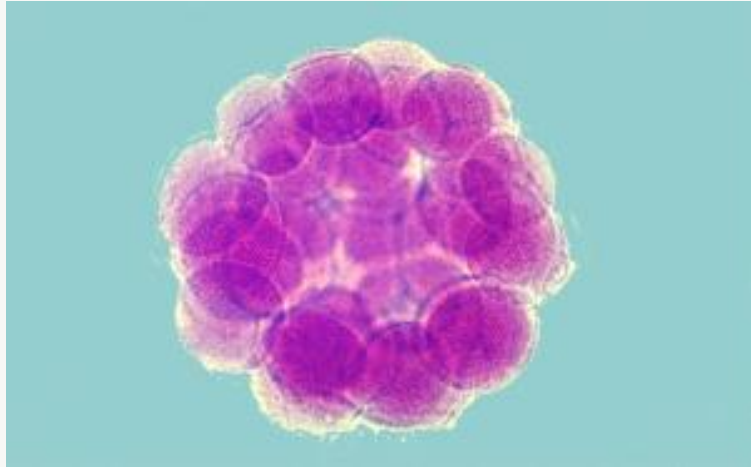
16 cells

the 16 & 32 cell stage is called a **morula**

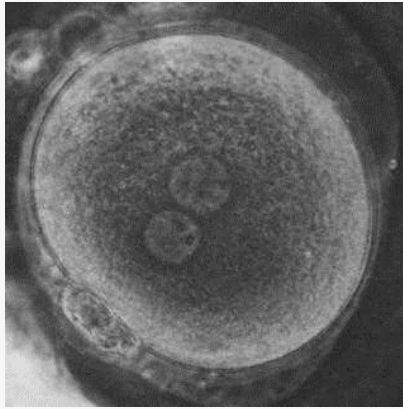
Pictures of 16 celled Morula



Pictures of 32 Celled Morula

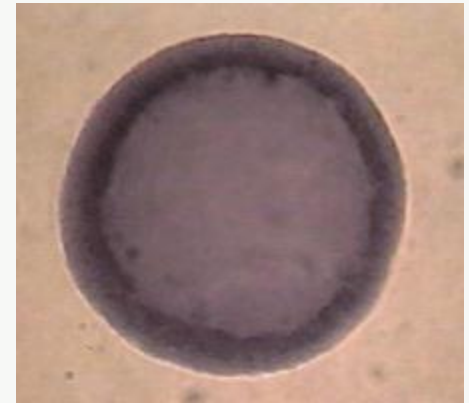


Blastulation



zygote

blastulation

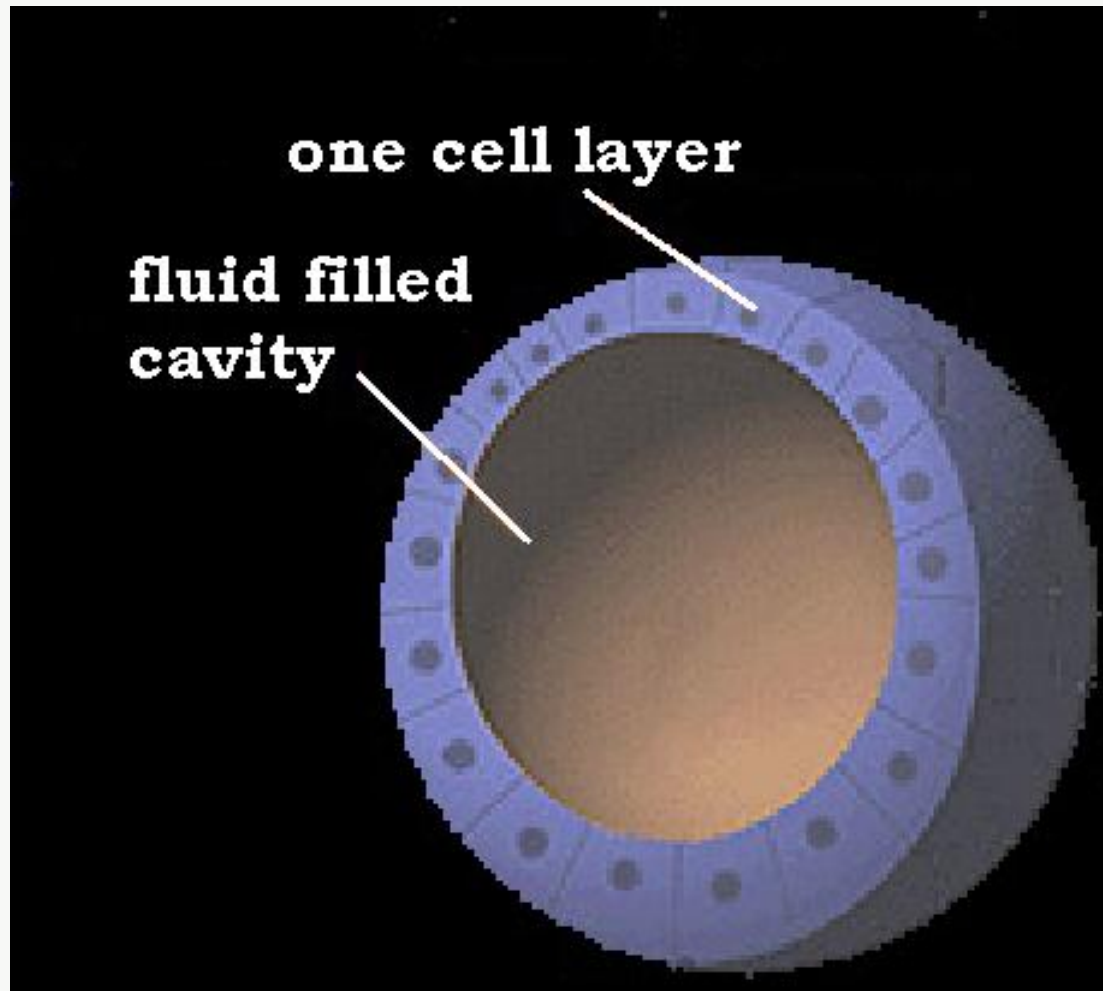


blastula

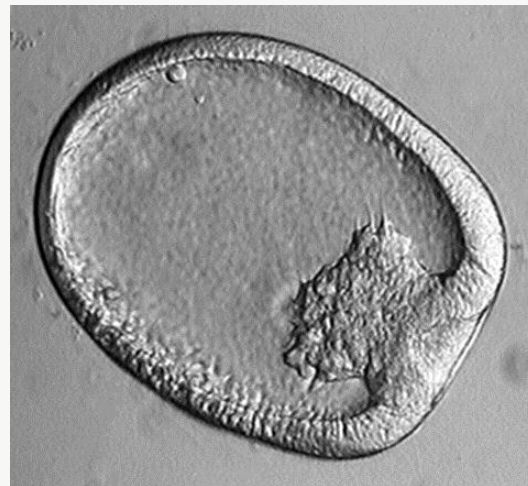
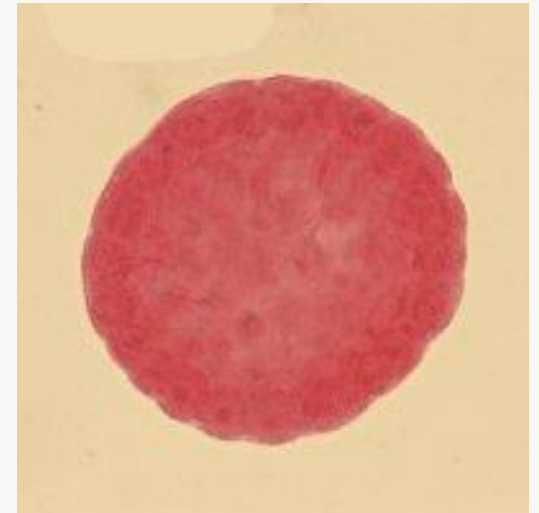
After several more divisions, the stage is called a **blastula.**

The entire process of changing from a zygote to a blastula is called **blastulation.**

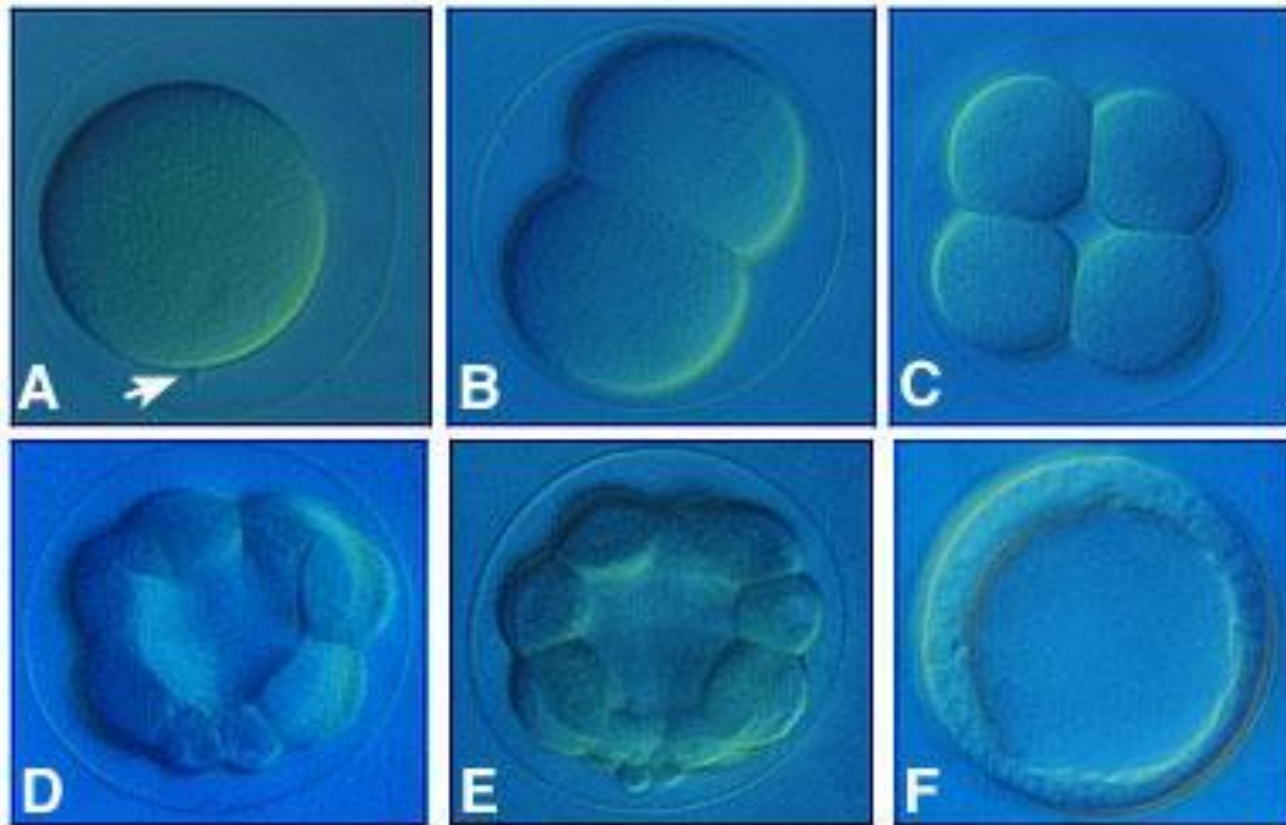
The Blastula



Pictures of Blastula



Review of Blastulation



A. 1 cell

B. 2 cells

C. 4 cells

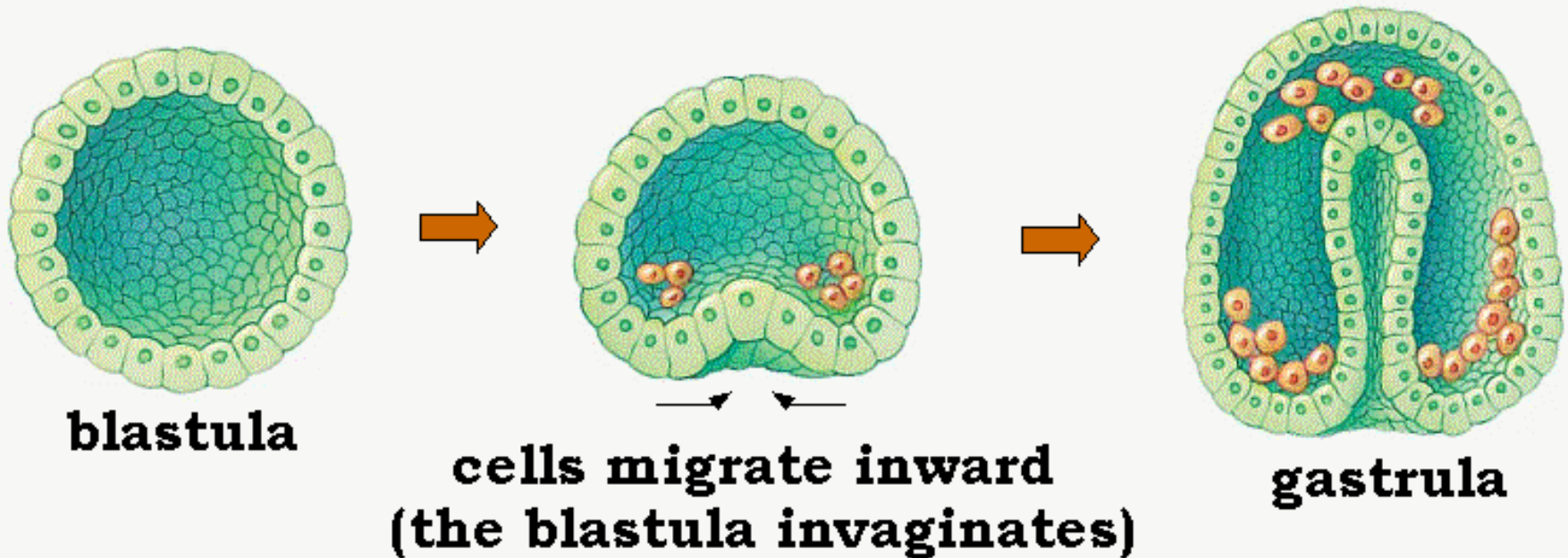
D. 8 cells

E. morula

F. blastula

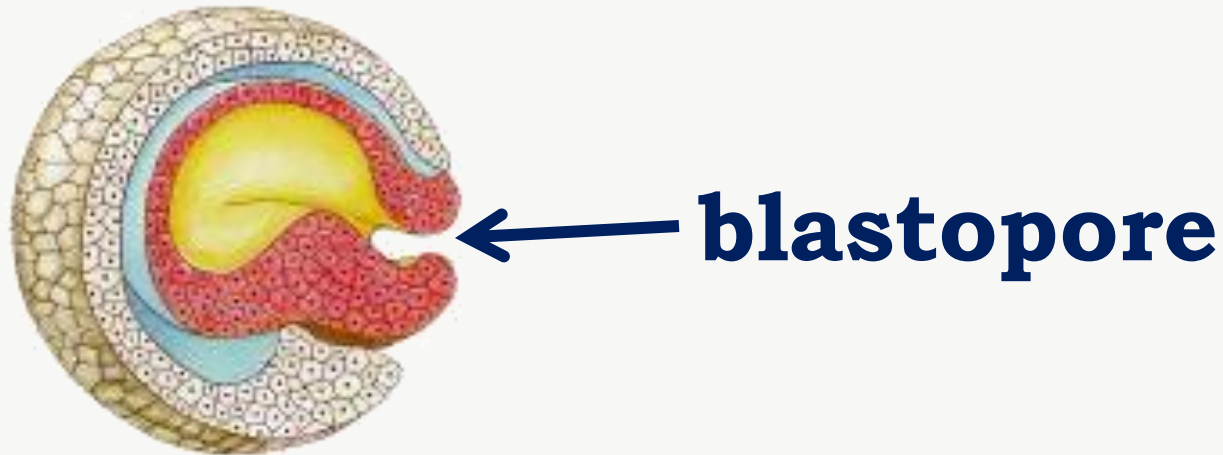
Gastrulation

- a blastula becoming a gastrula



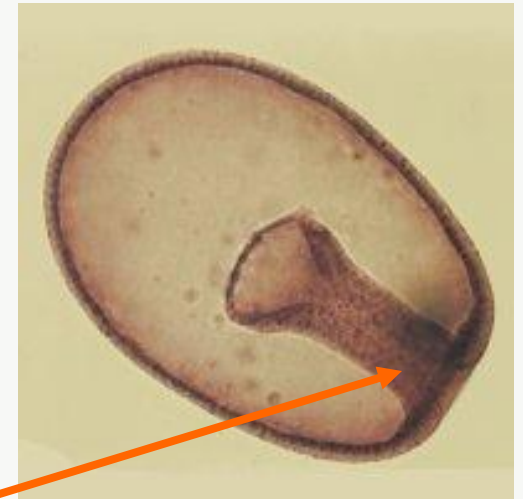
invagination – the folding inward of an object

Gastrulation

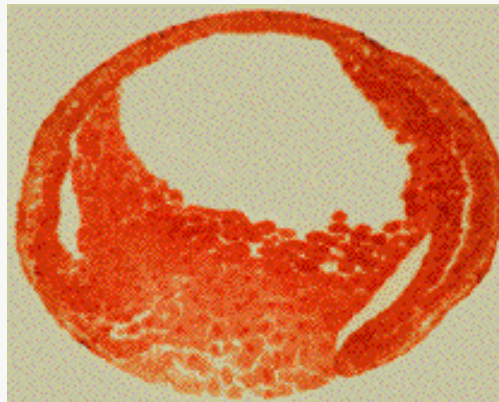


Gastrulation starts with the folding inward of cells at a spot called the **blastopore**.

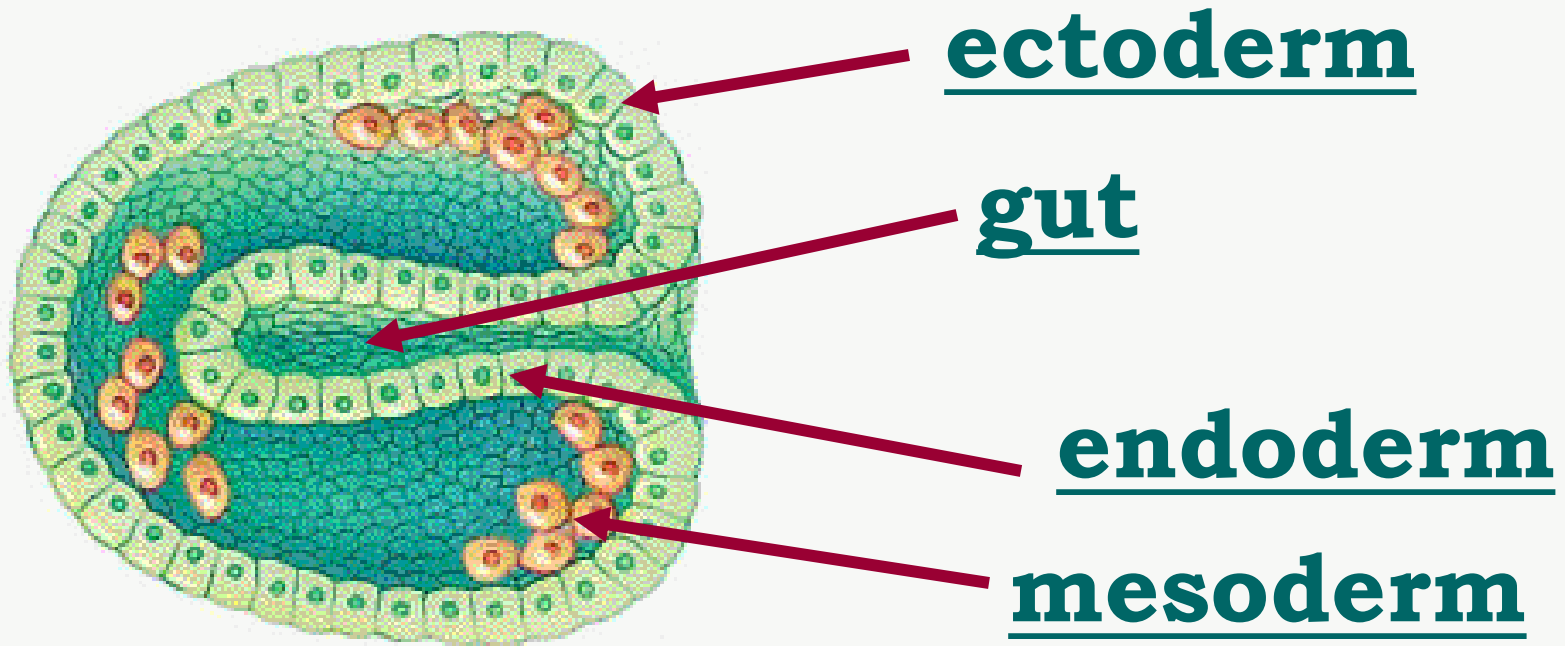
Pictures of a Gastrula



blastopore



Result of Gastrulation



Gastrulation creates a cavity “gut” that will become the digestive system. In addition, gastrulation results in 2 or 3 cell layers (called “germ” layers).

3 Germ Layers from Gastrulation

Ectoderm

- skin and nervous system

Endoderm

- digestive system

Mesoderm

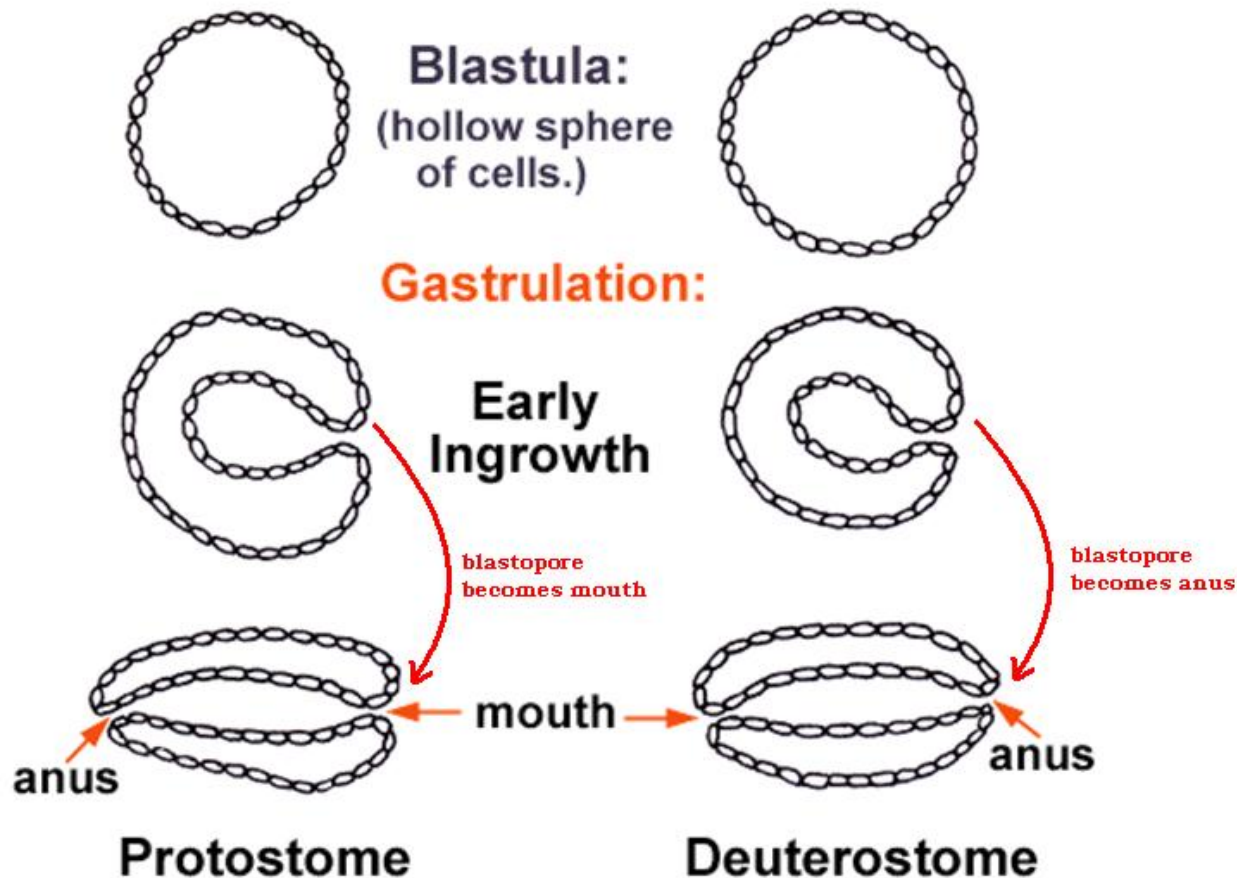
- muscles and other internal organs systems

Protostomes vs. Deuterostomes

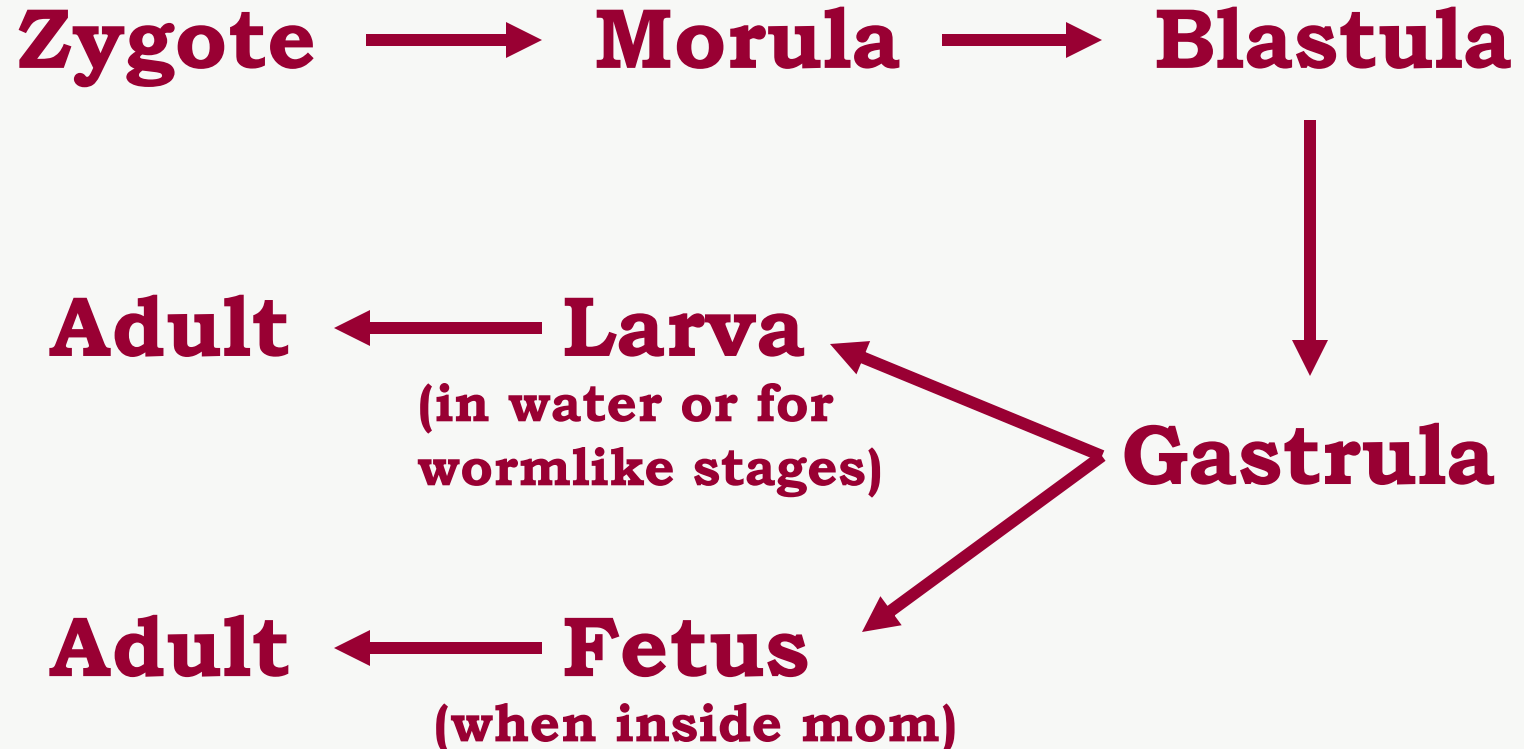
proto = first

stome = mouth

deutero = second



Summary of Development



- the term “embryo” is usually used for any stage of development