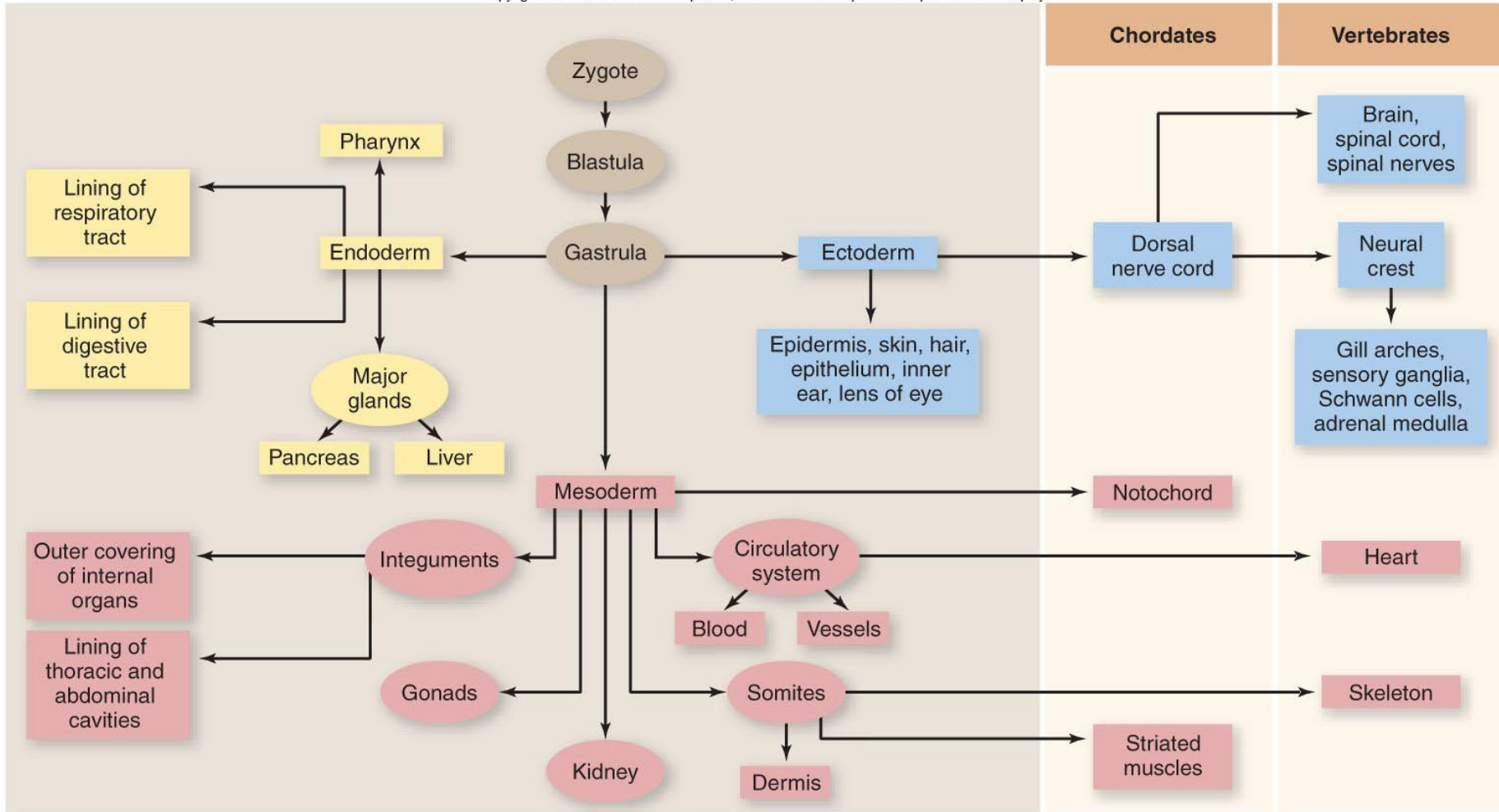


# Class Roadmap

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# I. Introduction to Zoology

## A. What is an Animal?

Animal life began in Precambrian seas with the evolution of multicellular forms that lived by eating other organisms. Early animals populated seas, fresh water, and eventually the land.

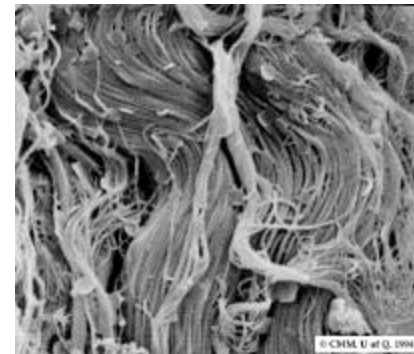
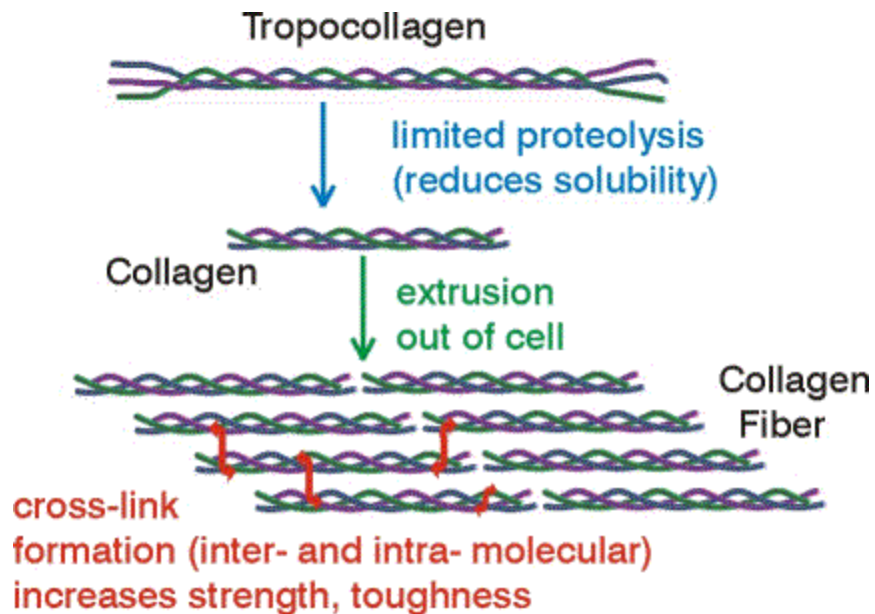
## B. Three things we focus on:

1. Structure
2. Nutrition
3. Life history define animals.

## C. Structure, nutrition, and life history define animals.

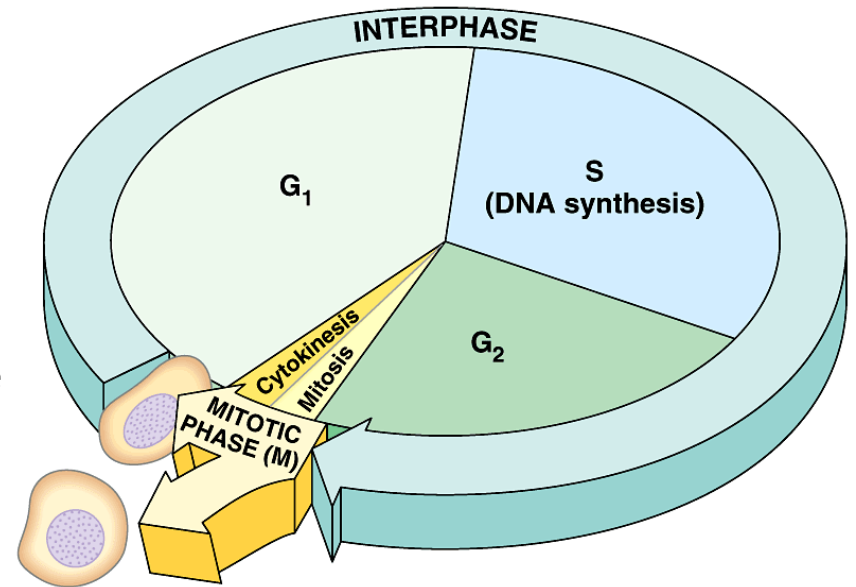
1. Animals are multicellular, heterotrophic, and eukaryotes. In contrast to autotrophic nutrition of plants and algae, animals must take into their bodies preformed organic chemicals. Animals can do this by **ingestion**-eating other organisms or organic material that is decomposing

2. Animals lack cell walls that provide strong support in the bodies of plants and fungi. The multicellular bodies of animals are held together by structural proteins, the most abundant being collagen.



3. Also unique among animals are two types of tissues responsible for impulse conduction and movement: nervous tissue and muscle tissue.

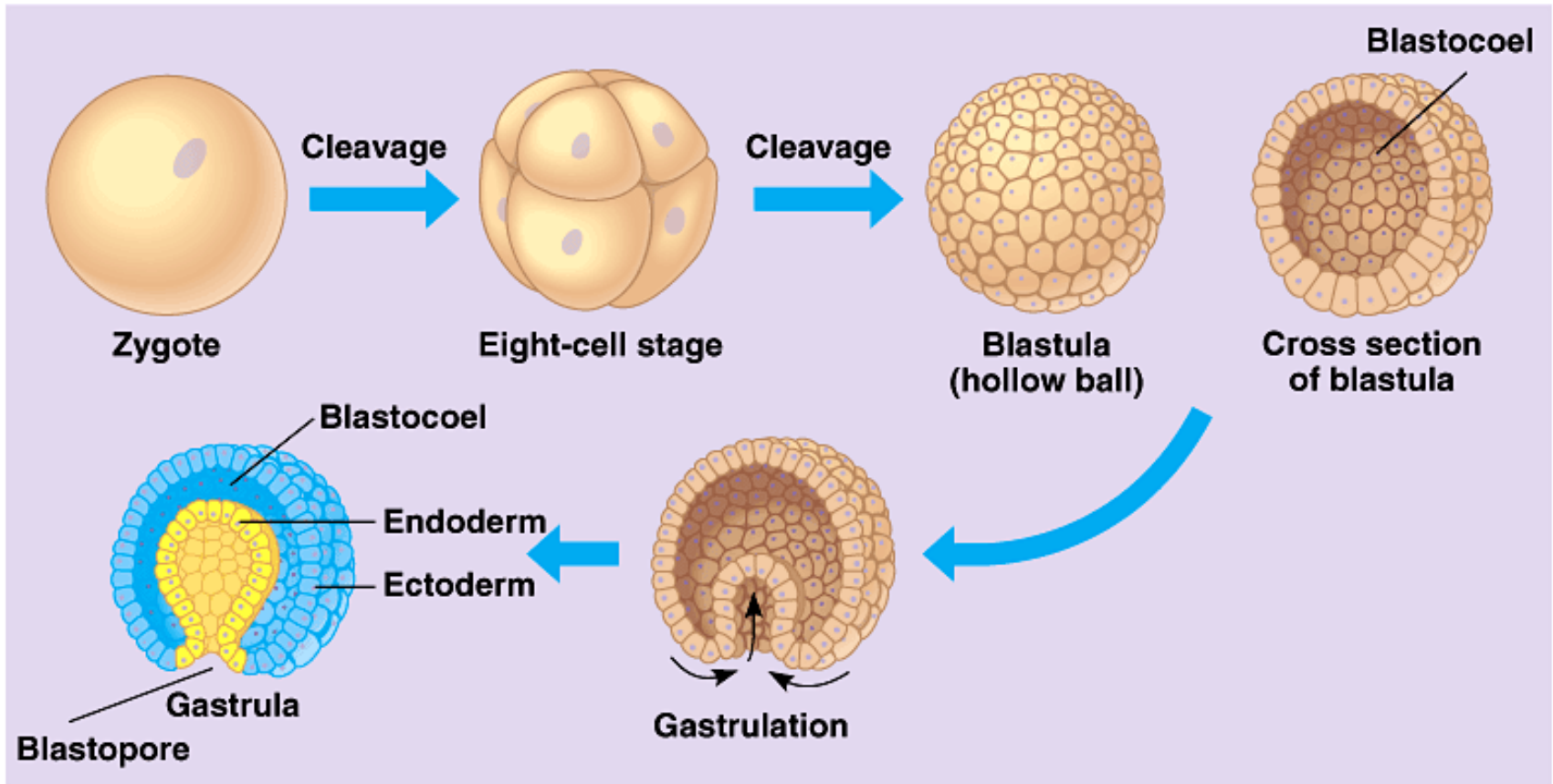
4. Most animals reproduce sexually, with the diploid stage usually dominating the cycle. \*\*\*See diagram on next slide



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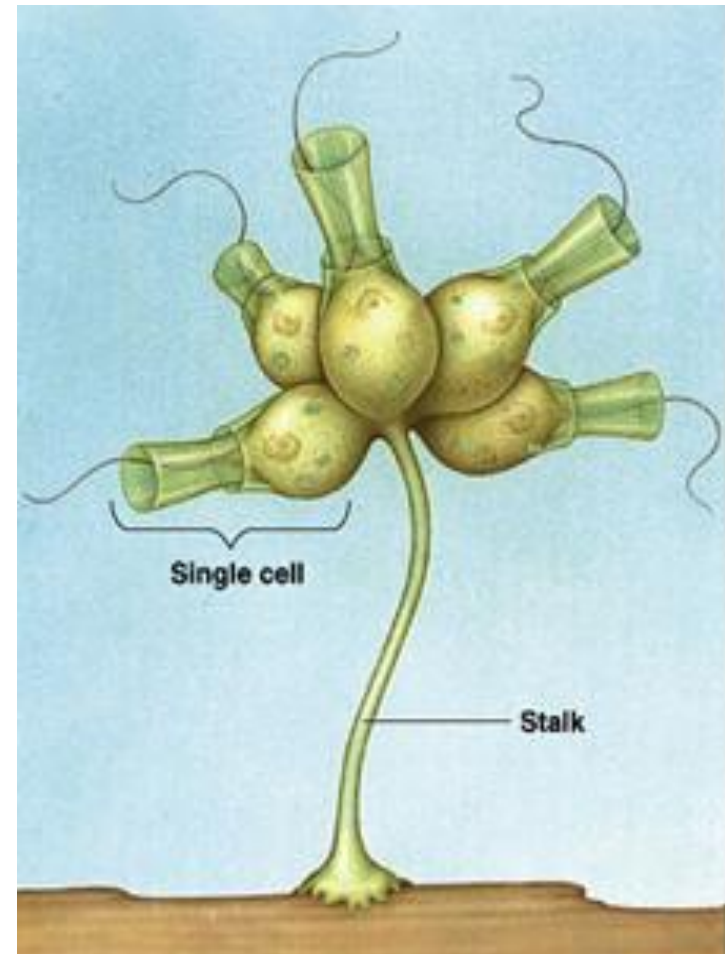
# Cleavage → Blastula → Gastrulation → Gastrula

## Cell Cycle: G1, S, G2, and Mitosis

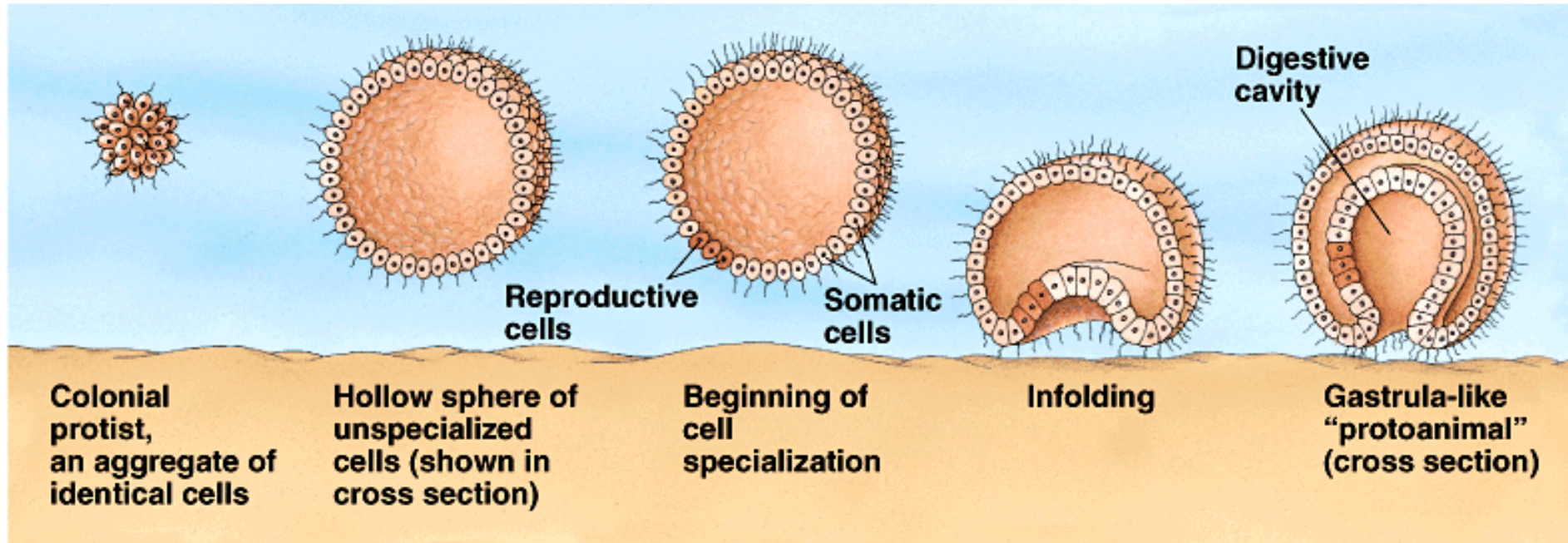


## D. Did the animal kingdom evolve from a flagellated protist?

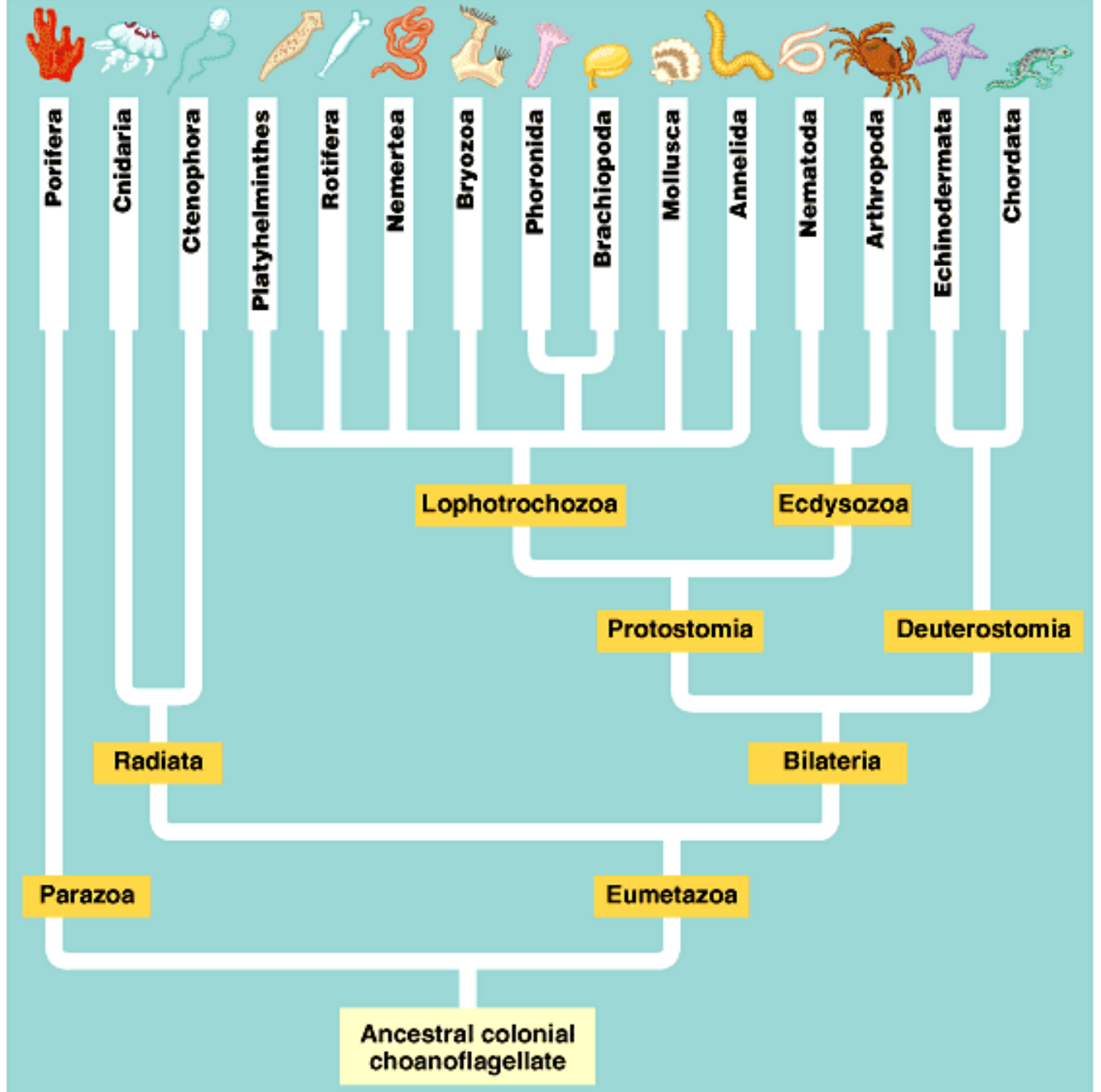
- Most scientist agree that the animal kingdom is monophyletic; animal lineages can be traced back to a common ancestor.
- Likely a flagellated protist over 700 million years ago.
- Related to a choanoflagellate, which arose about a billion years ago.



# Going From A single cell to Multicellular Organism







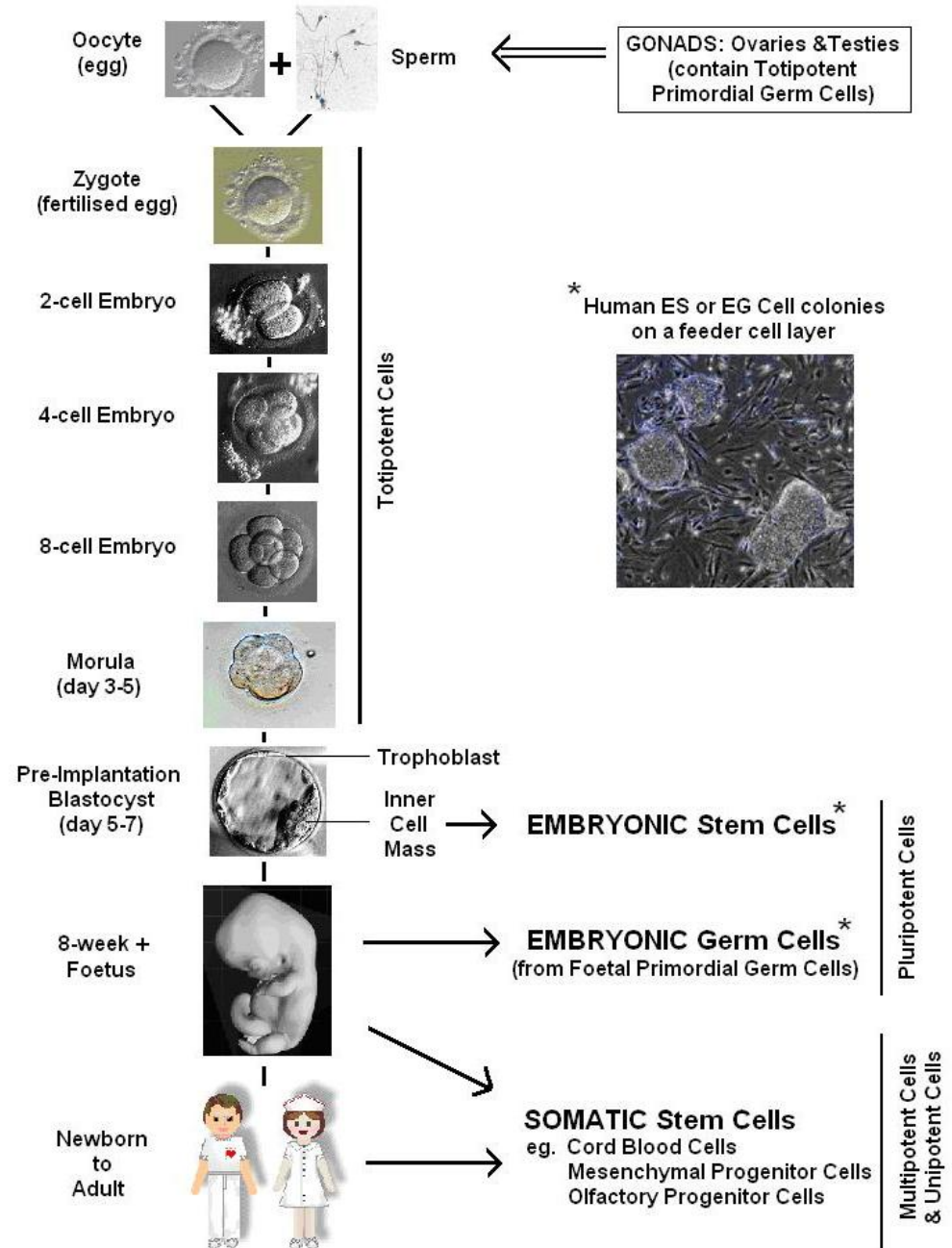
This is an example of Phylogenetic Tree

As an A & P class will work from left to right throughout the 1<sup>st</sup> marking period

•Do you see any patterns?

# Introduction

## How did we get here?



## II. Chapter 8

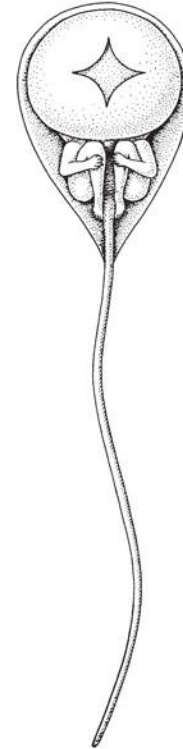
### A. Early Concepts: Preformation versus Epigenesis

#### a. Mystery of development in the 17<sup>th</sup> and 18<sup>th</sup> centuries

1. Naturalist-philosophers claimed that young animals were preformed in eggs and that development was simply a matter of unfolding what was already there.

2. A 17<sup>th</sup> Century Dutch histologist thought he saw a preformed human infant in sperm in a microscope he made.

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### 3. 1759 Embryologist Kasper Wolff

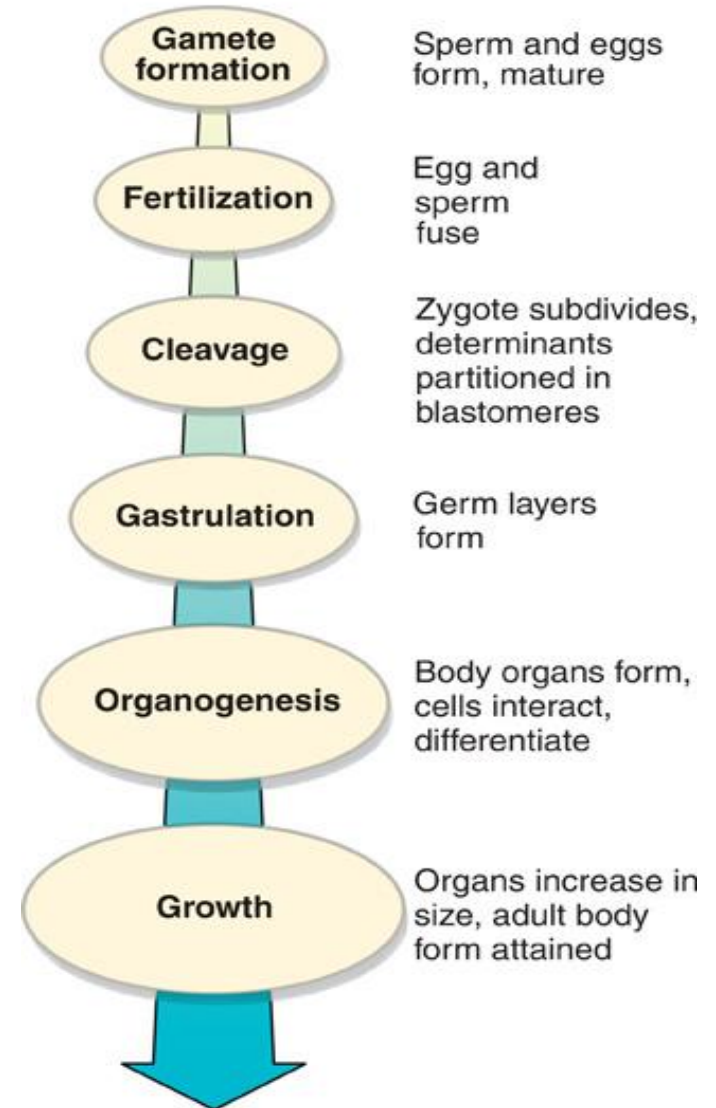
- Studied the development of a chick
- No preformed individual, only undifferentiated granular material that became arranged into layers.
- This process was called epigenesis-a fertilized egg contains the building materials for development.
- Unknown forces control these actions???



# B. Hierarchy of Development Decisions

- Course of Differentiation: cytoplasmic location and induction
- Cell types that make up the body do not just “unfold”, but arise from conditions created in preceding stages.

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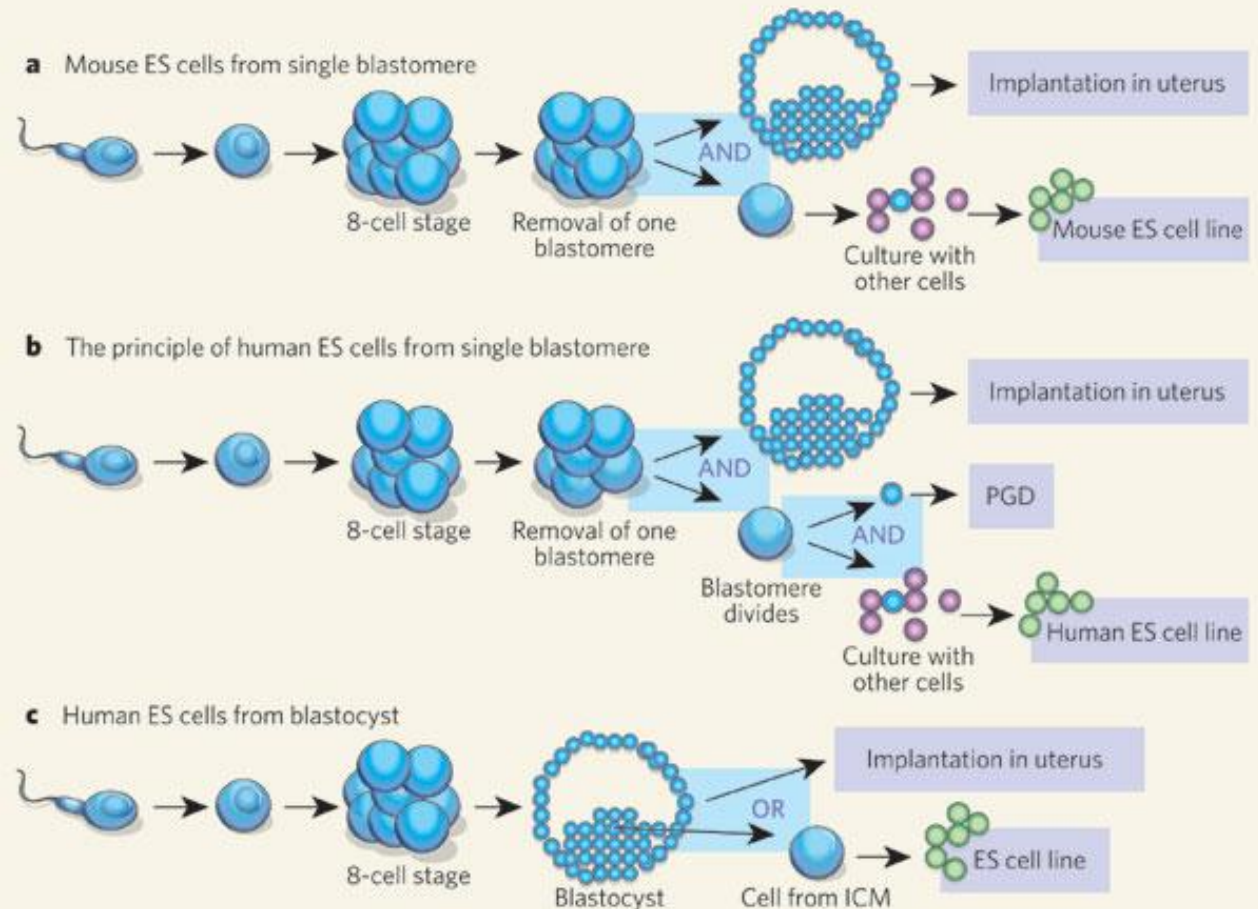


## C. Fertilization $(1n)$ egg + $(1n)$ sperm= $(2n)$ zygote

- The initial event in development in sexual reproduction is fertilization, the union of male and female gametes to form a zygote.
- Recombinant of parental and maternal genes
- Parthenogenesis-development without fertilization (Example some fish and salamanders)

## D. Cleavage and Early Development

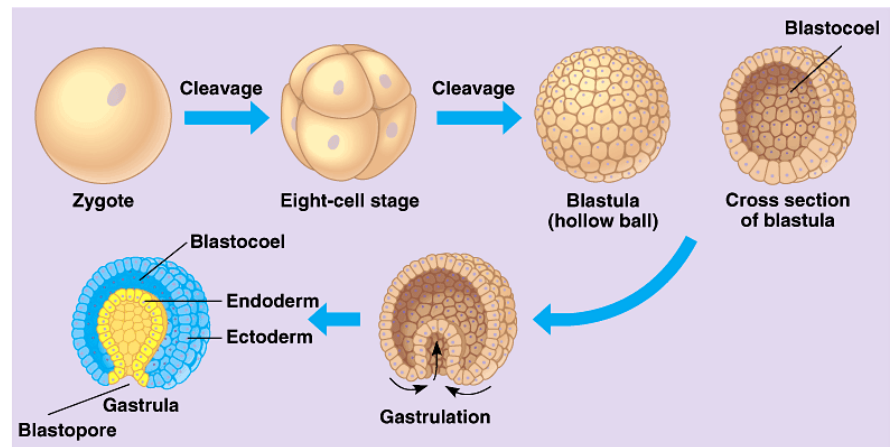
- During cleavage the embryo divides repeatedly to convert the large cytoplasmic mass into a large cluster of small maneuverable cells called Blastomeres.





## E. Cleavage and Early Development

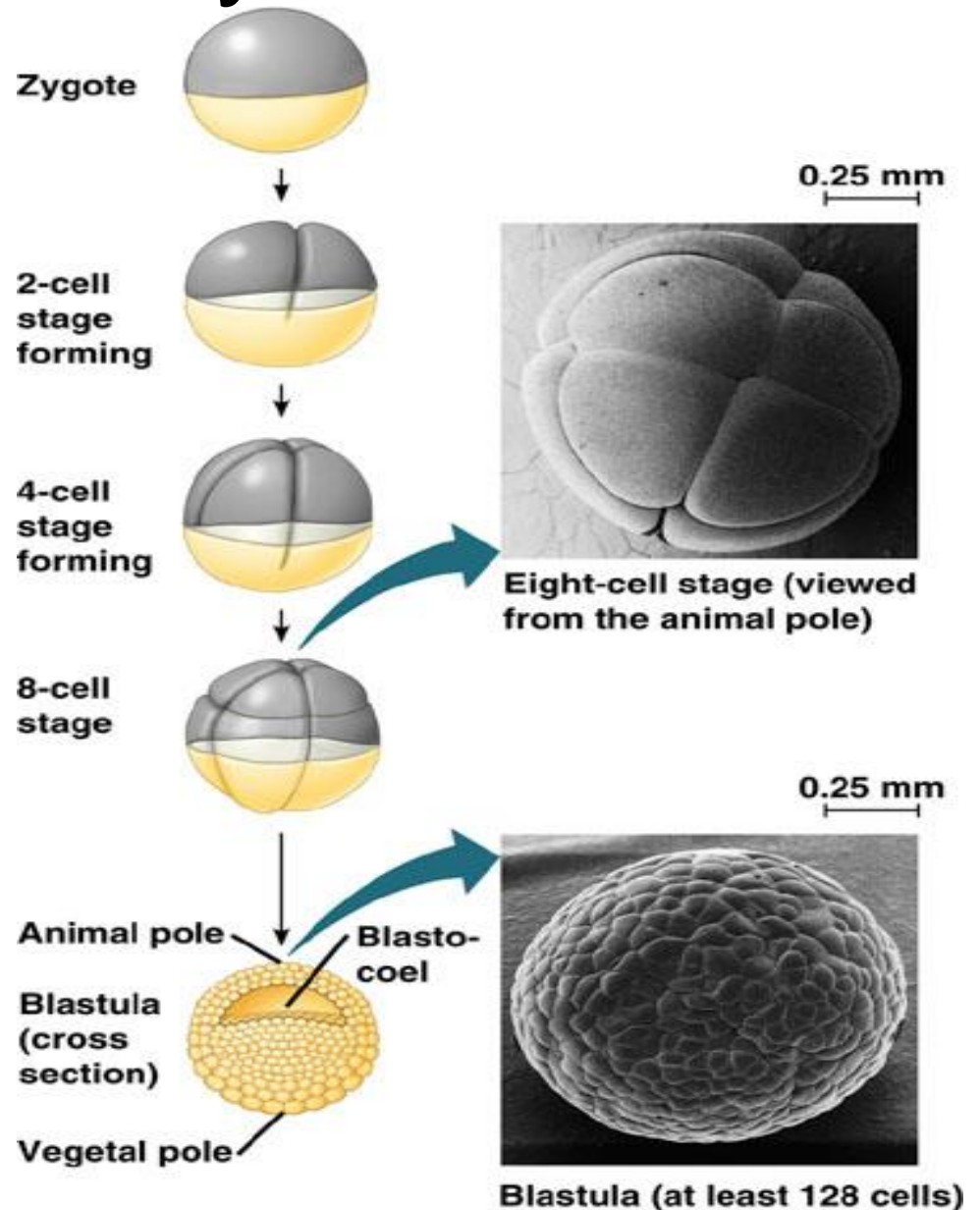
- No growth during this period, only subdivisions of mass, which continues until somatic cell size is attained. Think of it a origami!!!!
- So, what are somatic cells?
- At the end of cleavage 100s to 1000s of cells



# Cleavage and Early Development

Look at the Diagram to see an example of a VEGETAL POLE AND ANIMAL POLE

- What is the role of the yolk?
- Do the cells at the poles divide at the same rate?



## F. What can we learn from Development?

- Developmental Biology is a growing field!!
- How can a zygote, a single layer cell, produce a multitude of body parts in an organism and how gene expressions proceeds.
- Search for commonalities among organisms.

## II. An overview of Development Following Cleavage

### A. Blastulation

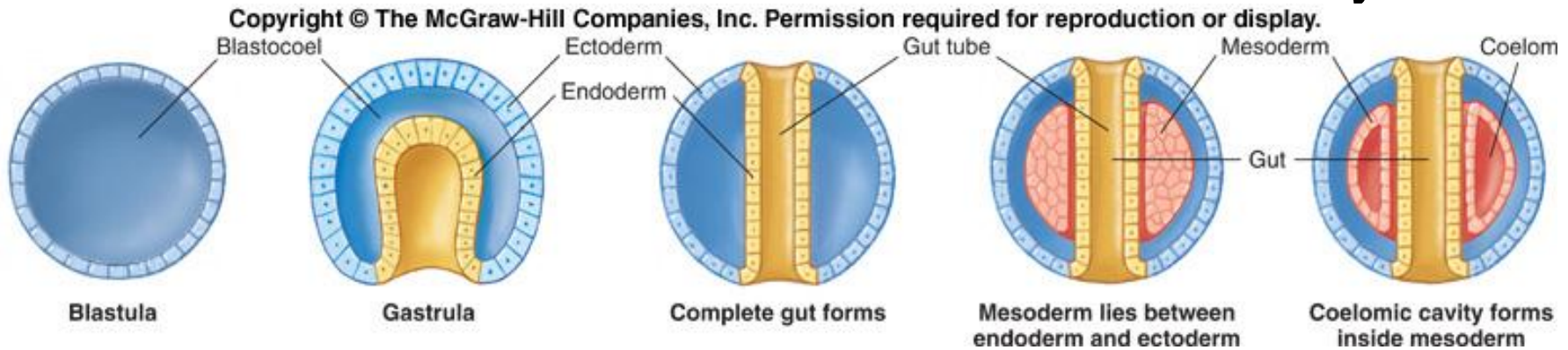
- Cleavage subdivides the mass of zygote until a cluster of cells called a **blastula** is formed (looks like a hollow mass of cells).
- In most animals, the cells are arranged around a central fluid-filled cavity called a **blastocoel**.
- Formation of a blastula stage, with its one layer of germ cells, occurs in **all** multicellular animals.

## B. Gastrulation and Formation of Two Germ Layers

a. Gastrulation converts the spherical blastula into a more complex configuration and forms a second germ layer.

- One side of the blastula bends inward in a process called invagination, forming a new internal cavity. Picture pushing in a beach ball-the inward region forms a pouch.
- The internal pouch is the gut cavity called an archenteron or gastrocoel.
- The opening to the gut, where the inward bending began, is the blastopore.

# Gastrulation and Formation of Two Germ Layers



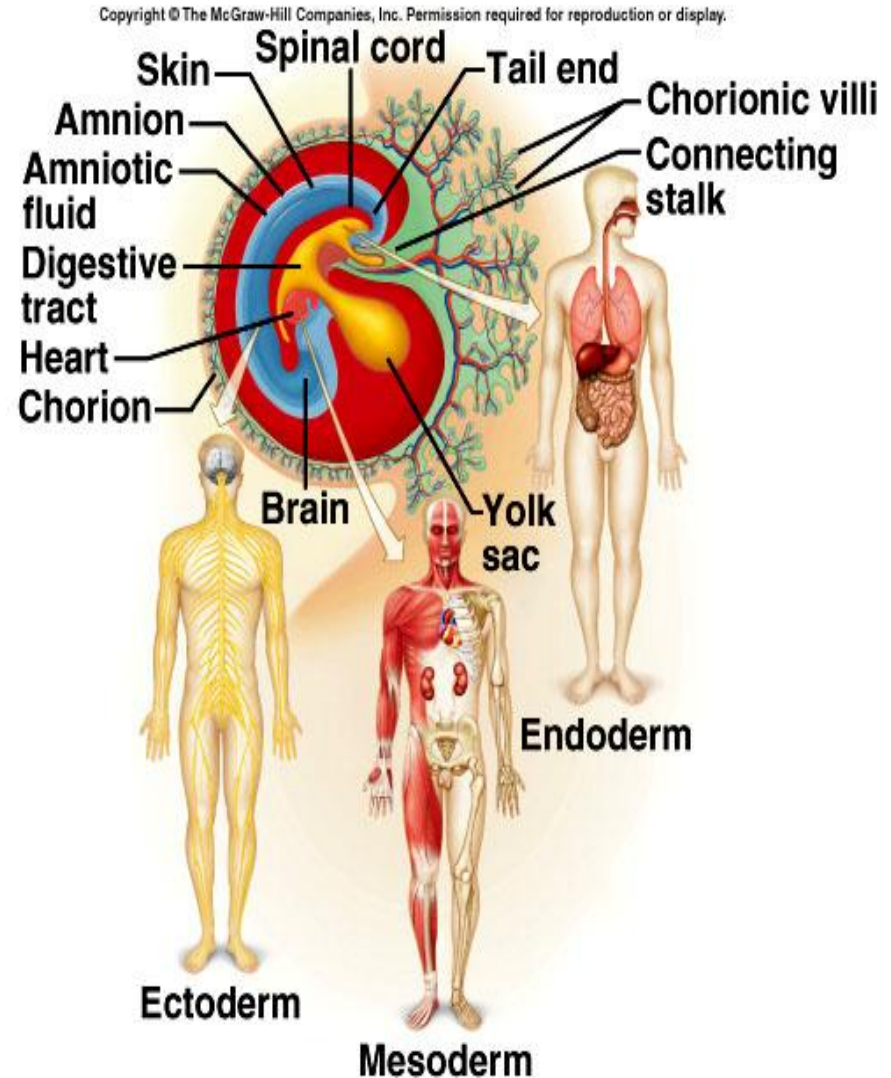
C. The gastrula stage has two layers:

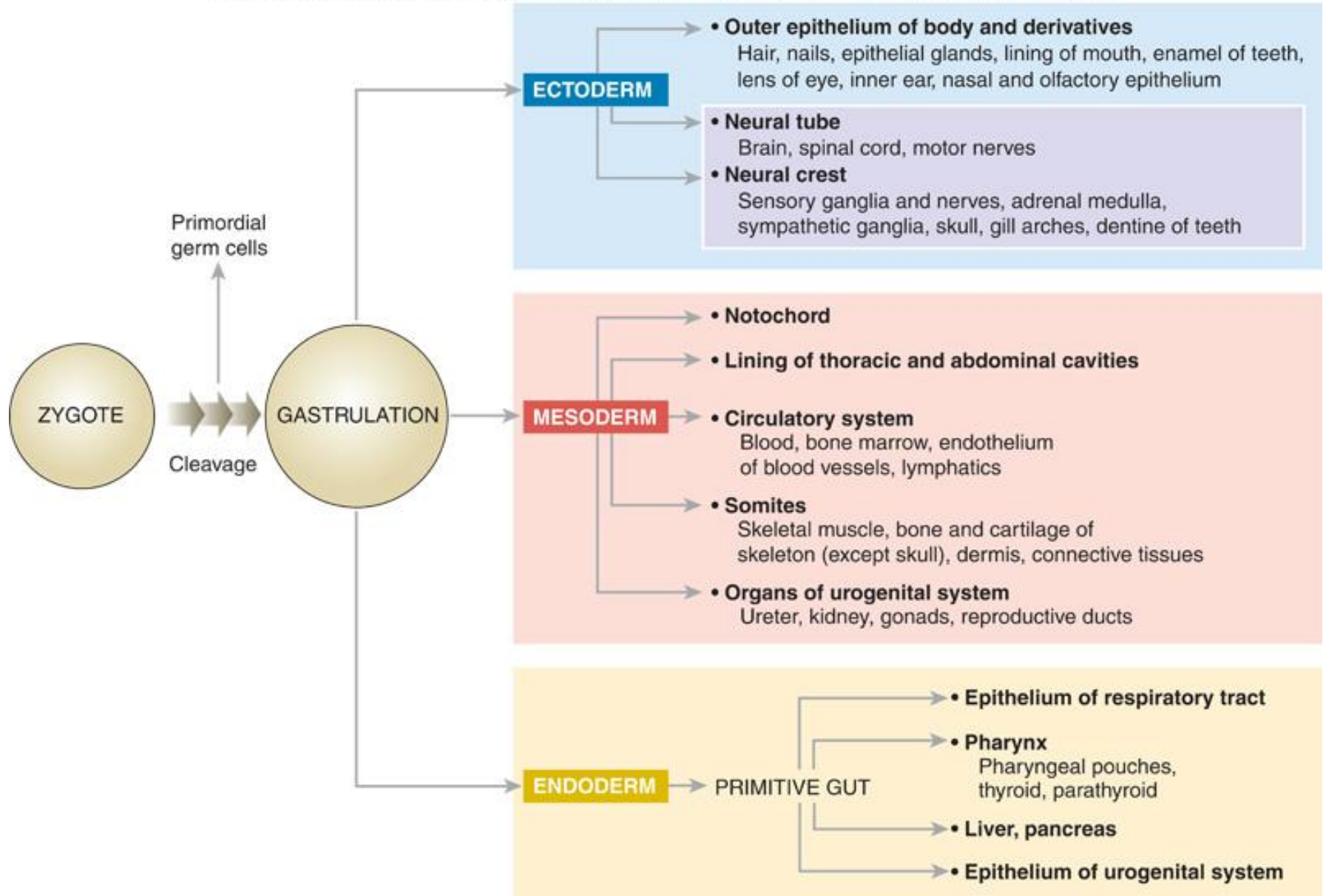
- An outer layer of cells surrounding the blastocoel, called ectoderm
  - An inner layer of cells is called endoderm
- The gut opens only at the blastopore it is called a blind or incomplete gut. Animals with a blind gut must consume food completely digested, or the remains of the food egested through the mouth. Ex sea anemones and flatworms.
  - Most animals have a complete gut with a second opening, the anus.

## c. Formation of the Mesoderm, a Third layer

i. Multicellular animals (not sponges) proceed blastula to gastrula

- Two germ layers called DIPLOBLASTIC
- Three germ layers called TRIPLOBLASTIC
  - The third layer is called mesoderm

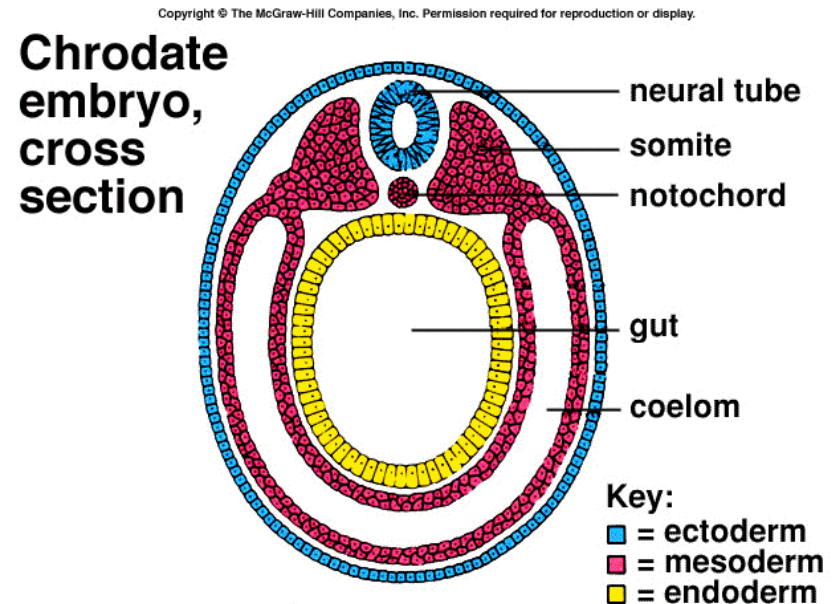






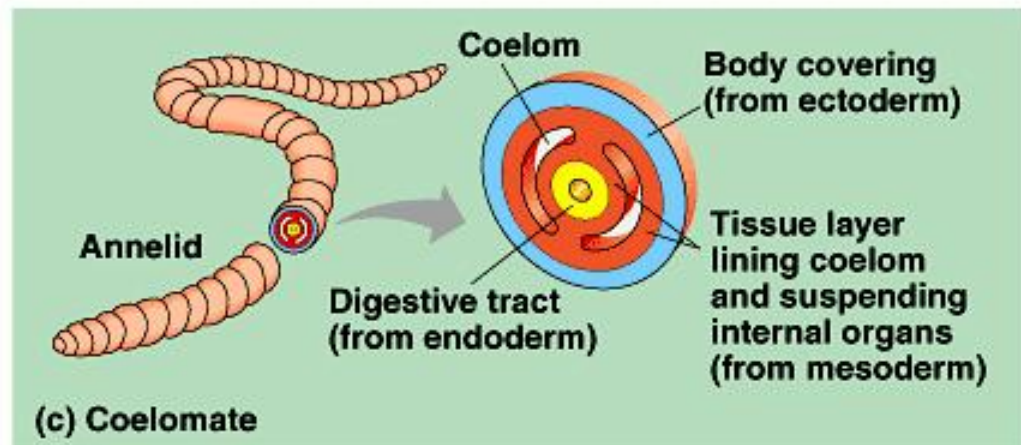
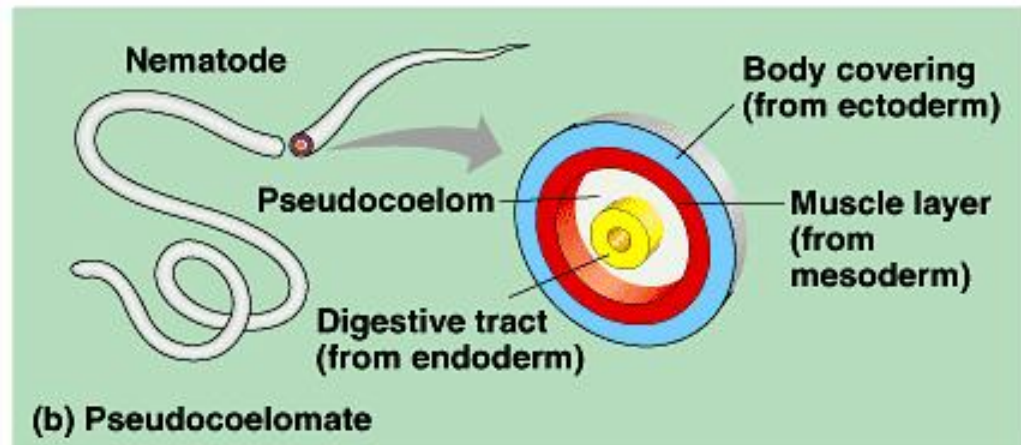
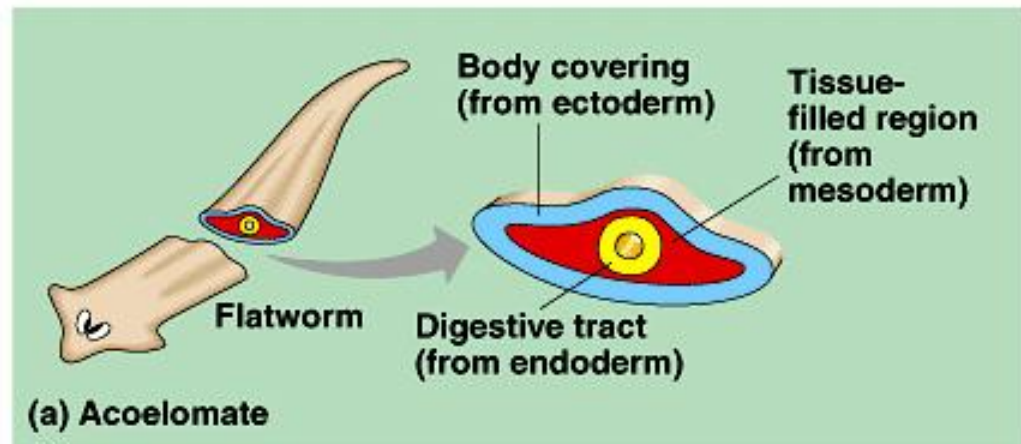
# C. Formation of the Coelom

- Coelomates are animals with a true coelom, a fluid filled body cavity completely lined by tissues derived from mesoderm.
- The inner and outer layers of tissue that surround the cavity connect dorsally and ventrally to form mesenteries that suspend the internal organs.



Animals can be divided into three body type:

1. Acoelomate
2. Pseudocoelomate
3. Coelomate


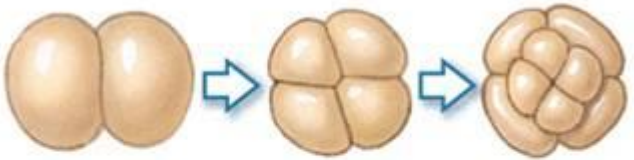
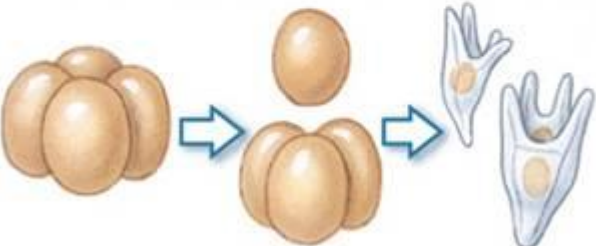
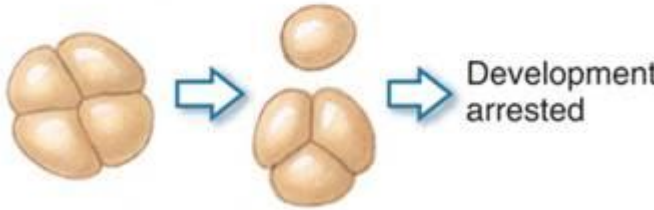
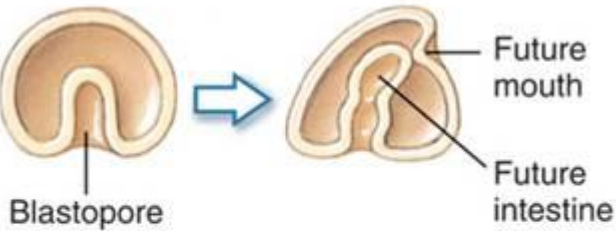
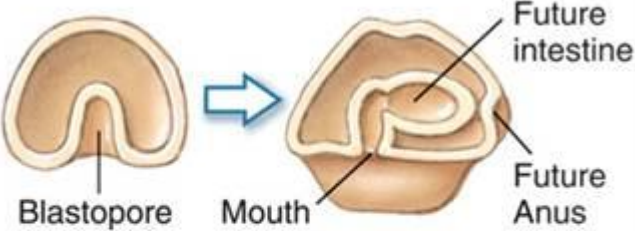
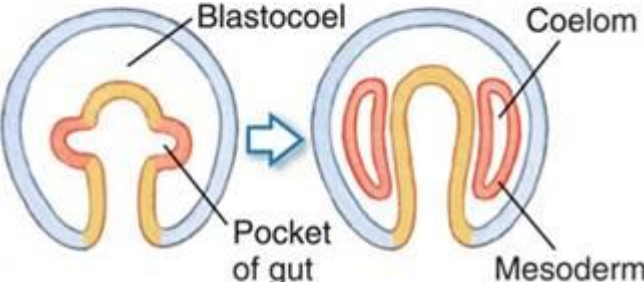
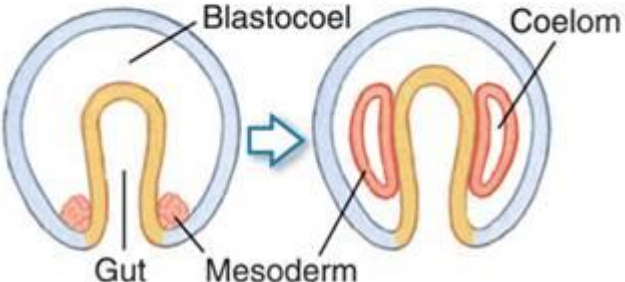


## D. Protostome vs Deuterostome in Coelomates

- Mollusks, annelids, arthropods and some other phyla are collectively called protostomes.
- Echinoderms and chordates are called deuterostomes.

4 Fundamental differences between the two groups:

\*\*\*\*\* See Class Handout or next slide

DEUTEROSTOME	LOPHOTROCHOZOAN PROTOSTOME
<p><b>1 Radial cleavage</b></p> 	<p><b>1 Spiral cleavage</b></p> 
<p><b>2 Regulative embryo</b></p>  <p>4-cell embryo      1 blastomere excised      2 normal larvae</p>	<p><b>2 Mosaic embryo</b></p>  <p>4-cell embryo      1 blastomere excised      Development arrested</p>
<p><b>3 Blastopore becomes anus, mouth forms secondarily</b></p>  <p>Blastopore      Future mouth      Future intestine</p>	<p><b>3 Blastopore becomes mouth, anus forms secondarily</b></p>  <p>Blastopore      Mouth      Future intestine      Future Anus</p>
<p><b>4 Coelom forms by outpocketing (enterocoelous)</b></p>  <p>Blastocoel      Coelom      Mesoderm      Pocket of gut</p>	<p><b>4 Coelom forms by splitting (schizocoelous)</b></p>  <p>Blastocoel      Coelom      Mesoderm      Gut</p>

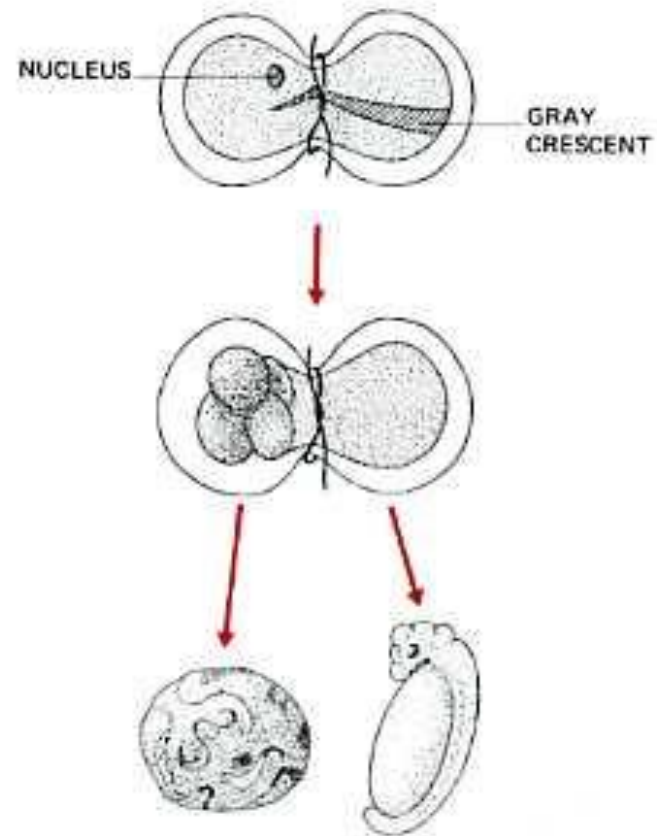
- Which process Radial or Spiral Cleavage will develop identical twins?

Example: Identical twins



# Mechanisms of Development

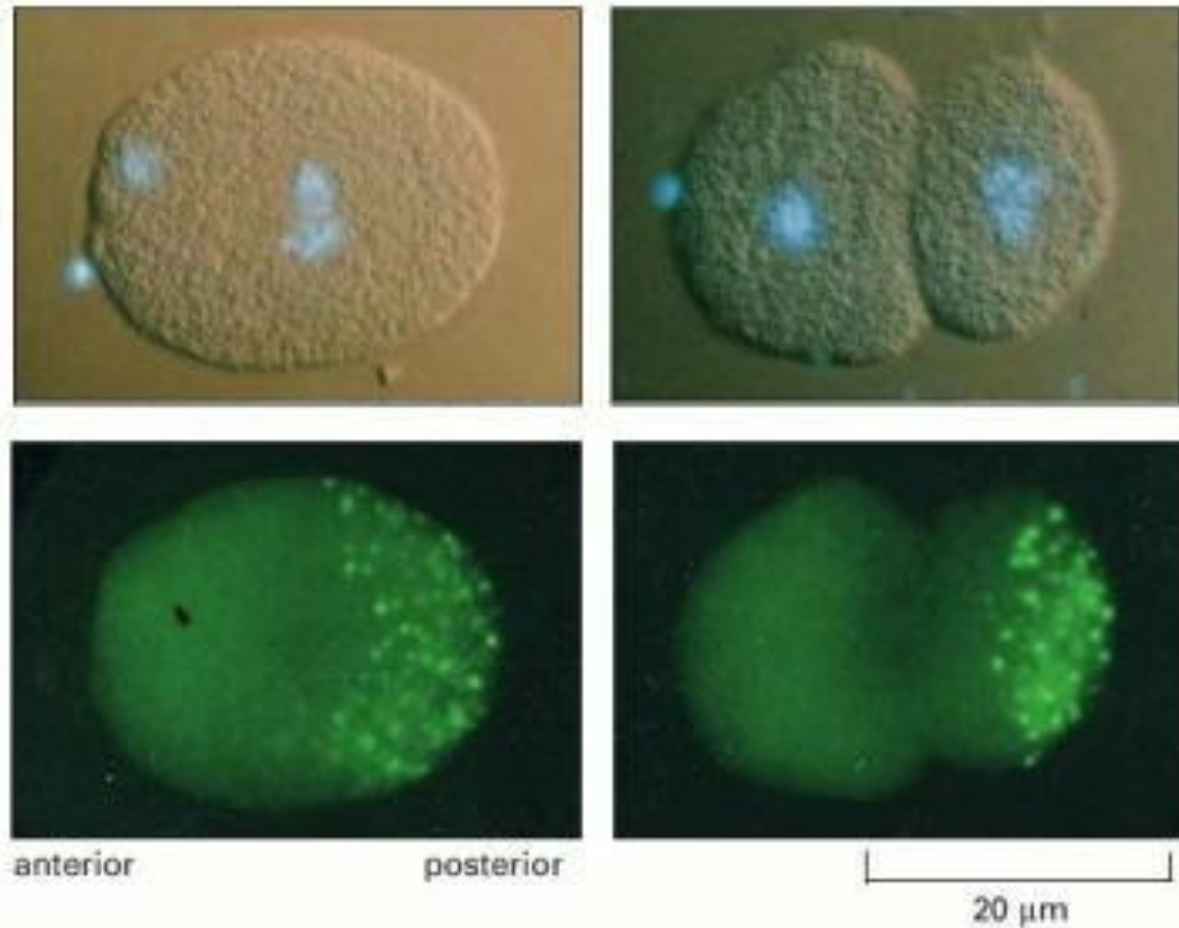
- First Nuclear Equivalence
- What does this diagram tell us?



UNORGANIZED DEVELOPMENT      NORMAL DEVELOPMENT

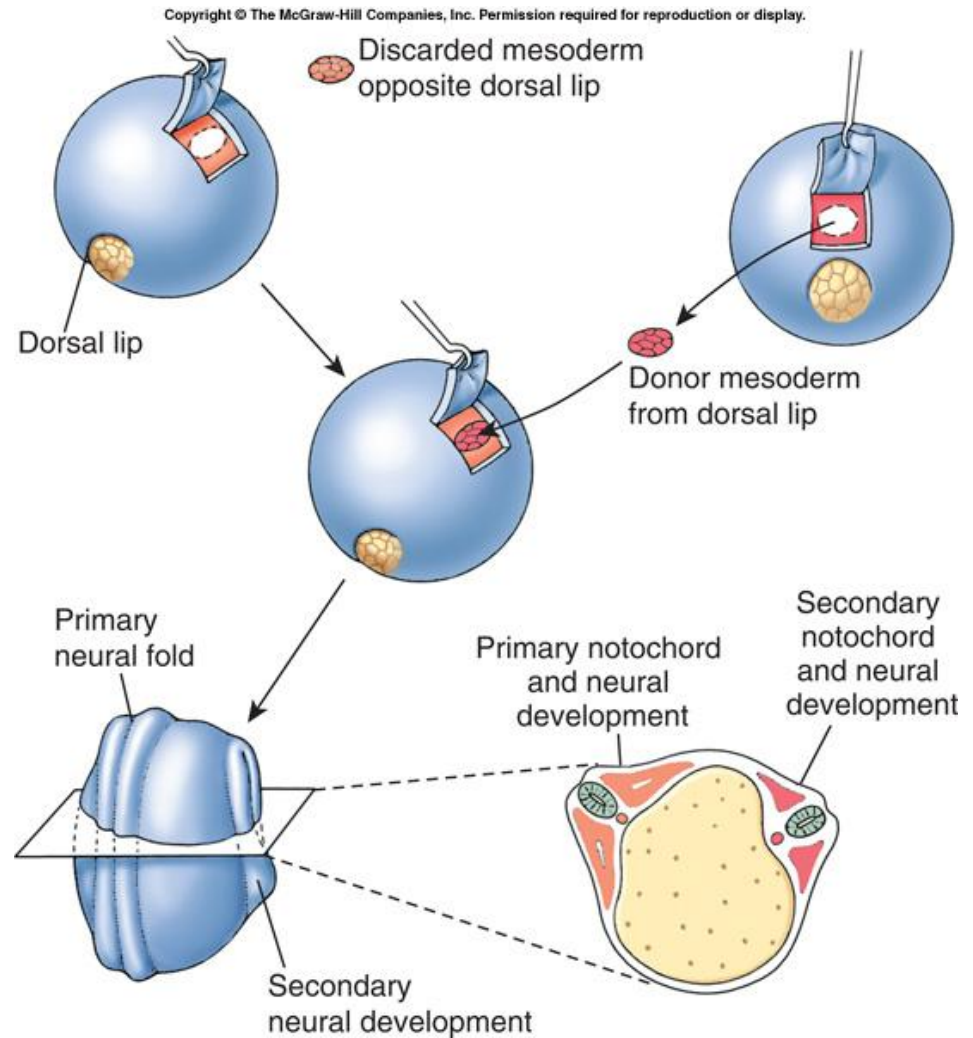
# Mechanisms of Development

- Second Cytoplasmic specification
- What does this diagram tell?



# Mechanisms of Development

- Third Embryonic induction
- What does this diagram tell?





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