



VIVEKANANDA COLLEGE
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NAAC ACCREDITED A GRADE

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- NAME OF THE DEPARTMENT:- ZOOLOGY
(U.G.&P.G.)

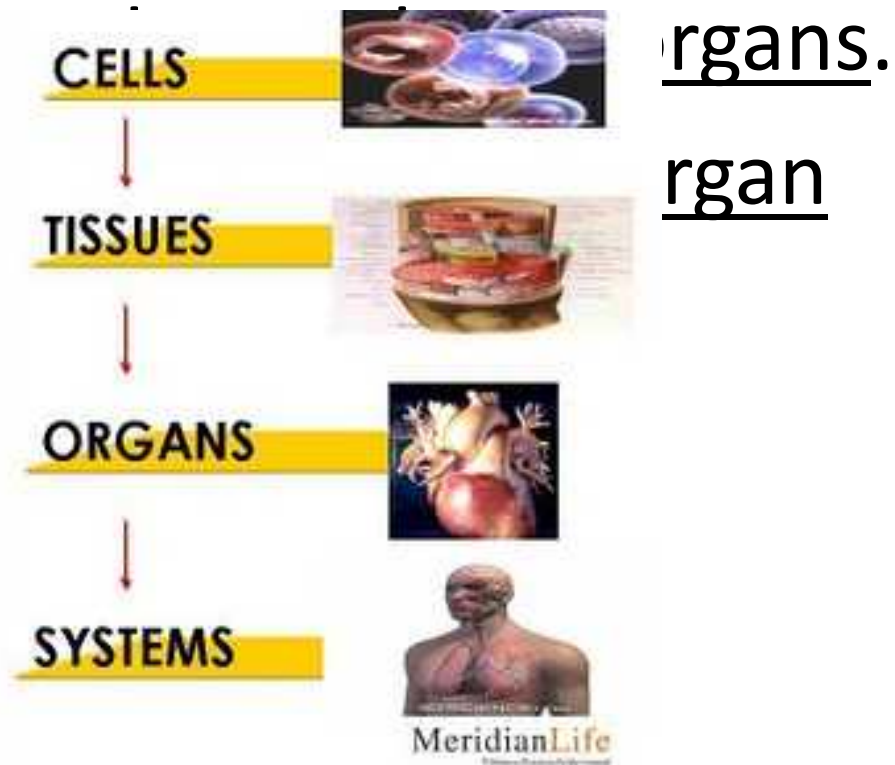
ANIMAL BODY PLANS
DR TRIJIT NANDA

What is an Animal?

- An animal is a living organism that is multicellular, eukaryotic, heterotrophic, and lacks cell walls.
- **Multicellular** means an animal is made up of many cells or (more than one cell).
- **Eukaryotic** is a term to describe a cell that has a membrane-bound nucleus, and membrane-bound organelles.
- **Heterotrophic** means an organism that consumes autotrophs, or other heterotrophs. In other words, it can not make it's own food.
- Animals have cell membranes but **no cell walls**.

Animal Body Designs

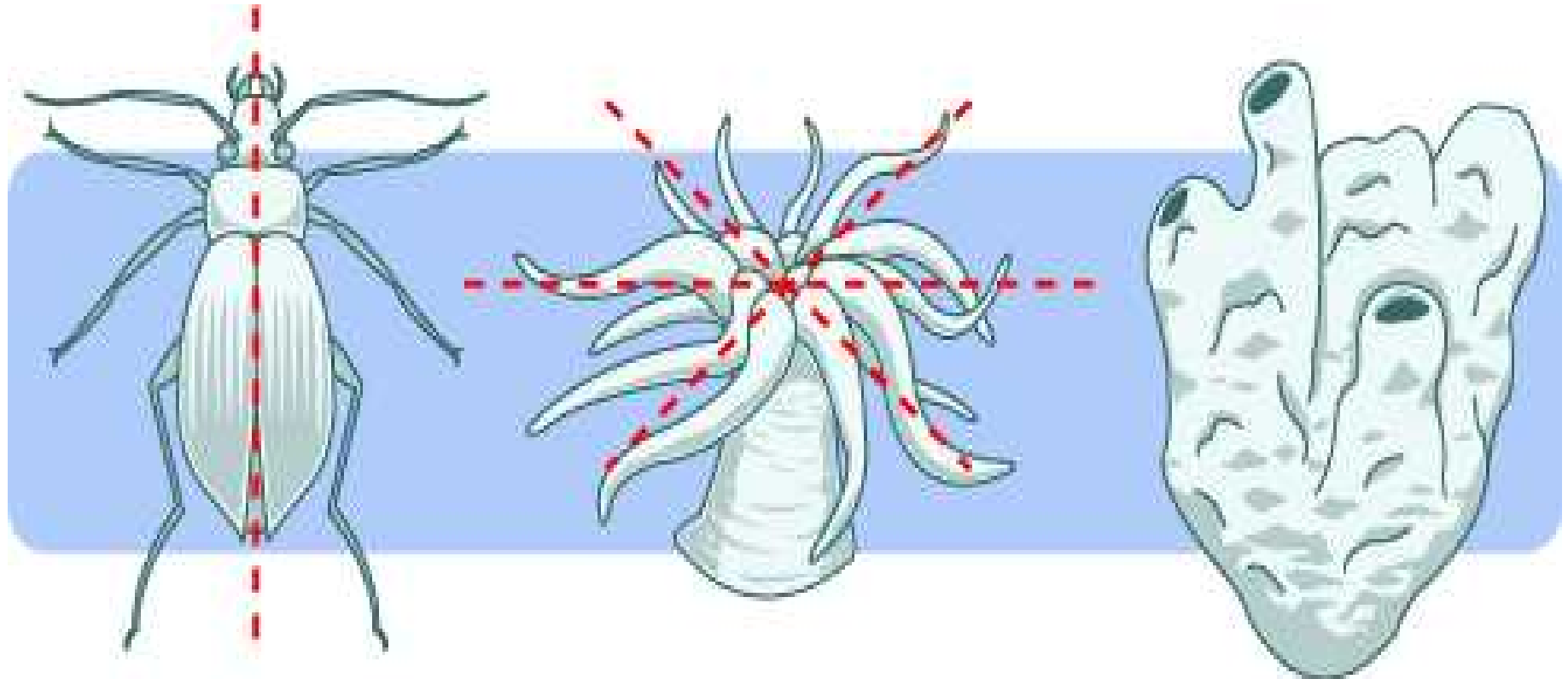
- Animals are made up of a complex system of cells.
- Cells grouped together make up tissues.
- Tissues & organs.
- Organs & systems.



Animal Body Symmetry

- Symmetry in animals refers to the way in which a plane or planes of axis can divide the body.
- Animals with **radial symmetry** can be divided into similar halves by many planes. (examples include jellyfish, sea urchins, sea anemones etc.)
- Animals with **bilateral symmetry** can be divided into equal left and right halves along the mid-sagittal plane. Animals with bilateral symmetry also exhibit **cephalization** (they have a head with a brain).

Animal Body Symmetry



a beetle has
bilateral symmetry

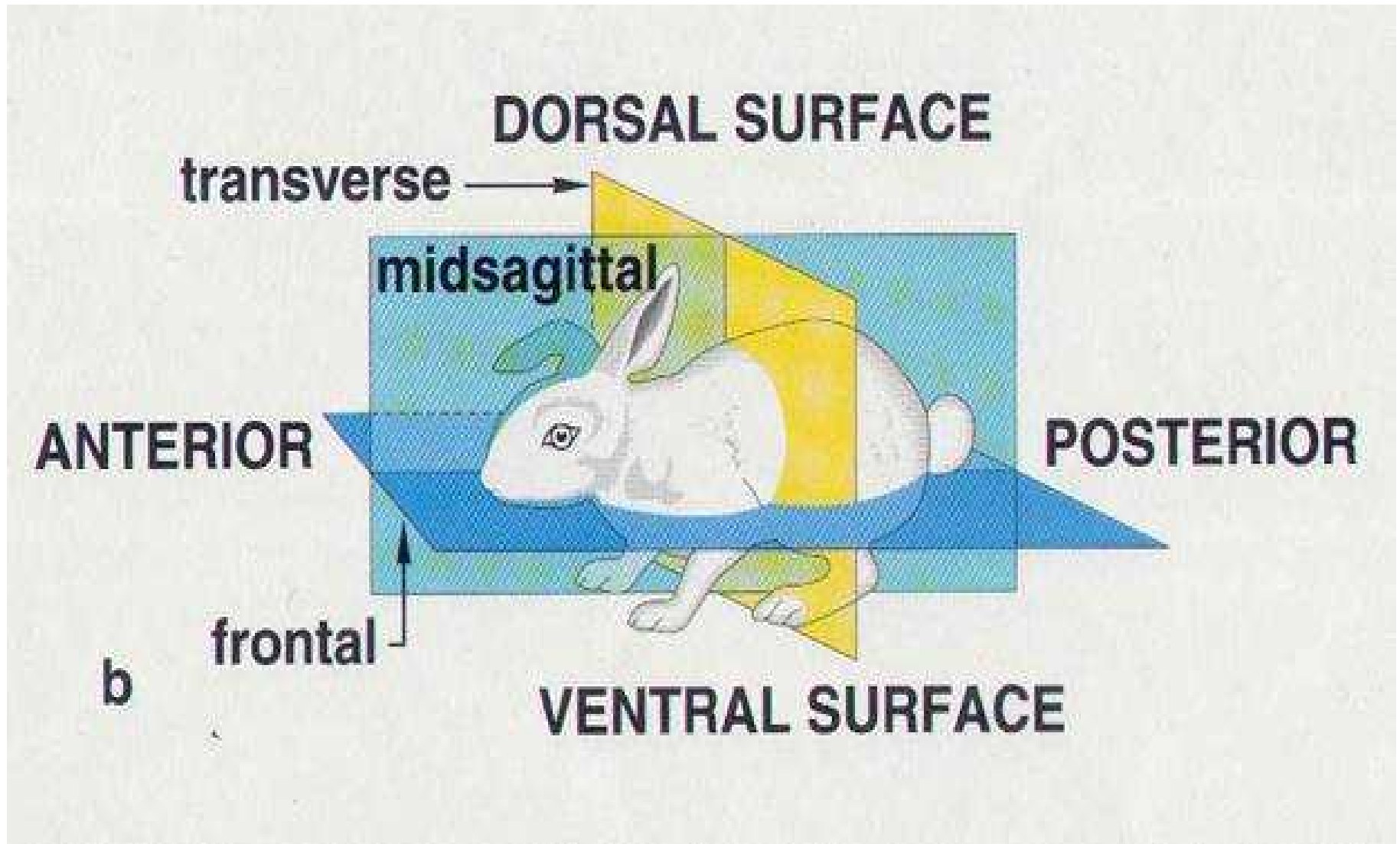
a coral polyp has
radial symmetry

a sponge has
no symmetry

Anatomical Orientation

- When studying the anatomy of animals, it is necessary to use terminology to describe directions, planes, and other points of reference.
- **Anterior/Posterior**: A direction on an animals body referring to towards the head and/or tail.
- **Dorsal/Ventral**: A direction on an animals body referring to towards the spine or belly.
- **Medial/Lateral**: A direction referring to towards or away from the midline or mid-sagittal plane of the body.
- **Distal/Proximal**: A direction referring to farther away from or closer to another point of reference.

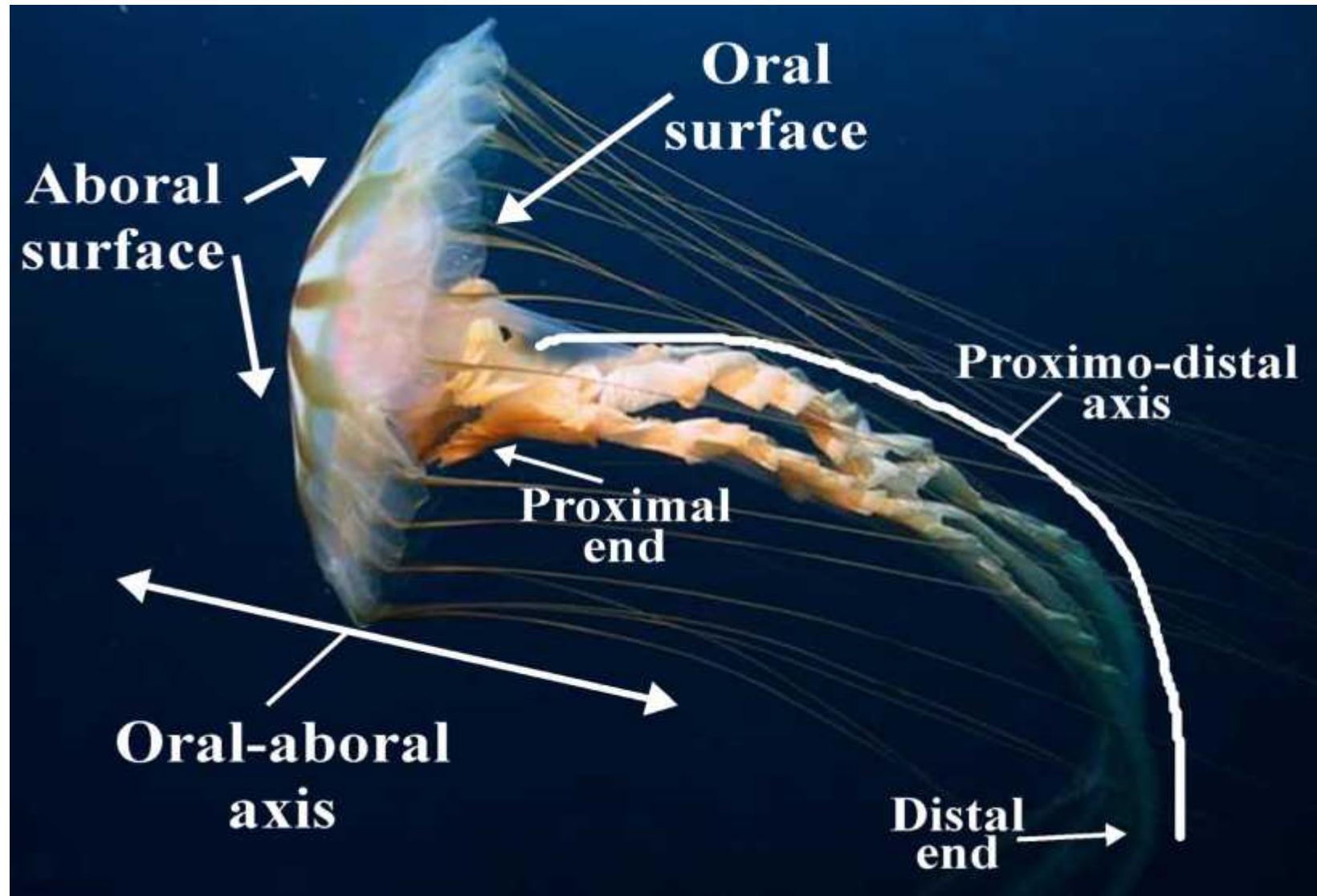
Anatomical Orientation



Anatomical Orientation

- **Sagittal plane**: An imaginary line or axis that goes through the body separating left and right halves.
- **Frontal plane**: An imaginary line or axis that goes through the body separating dorsal and ventral halves or sections.
- **Transverse plane**: An imaginary line or axis that goes through the body separating anterior and posterior halves or sections.
- **Oral/Aboral**: For animals with radial

Anatomical Orientation

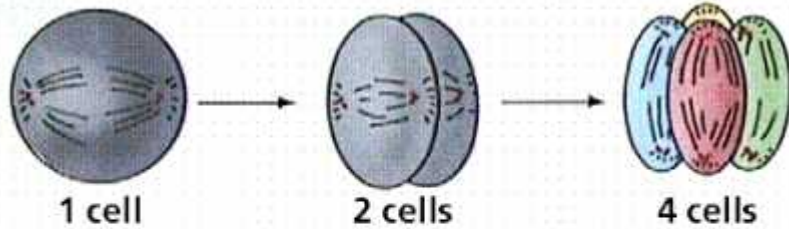


Early Embryonic Development

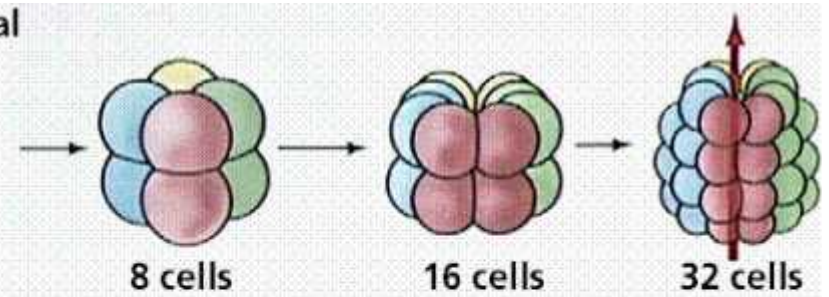
- After fertilization of an egg occurs, the egg becomes a **zygote**. Then, a zygote begins dividing its cells in a process called cleavage.
- Some animals (like echinoderms and chordates) exhibit **radial cleavage**, in which the cleavage planes are symmetrical.
- Other animals (like mollusks and annelids) exhibit **spiral cleavage**, in which the cells divide in a spiral or asymmetrical pattern.

Radial vs. Spiral Cleavage

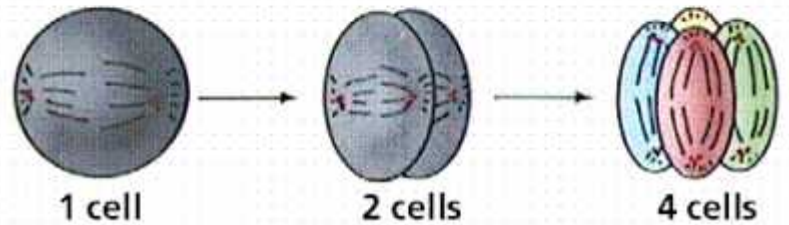
Radial cleavage (Deuterostomes)



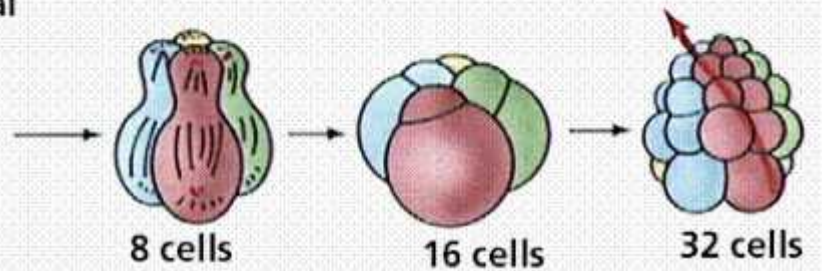
Radial



Spiral cleavage (Protostomes)



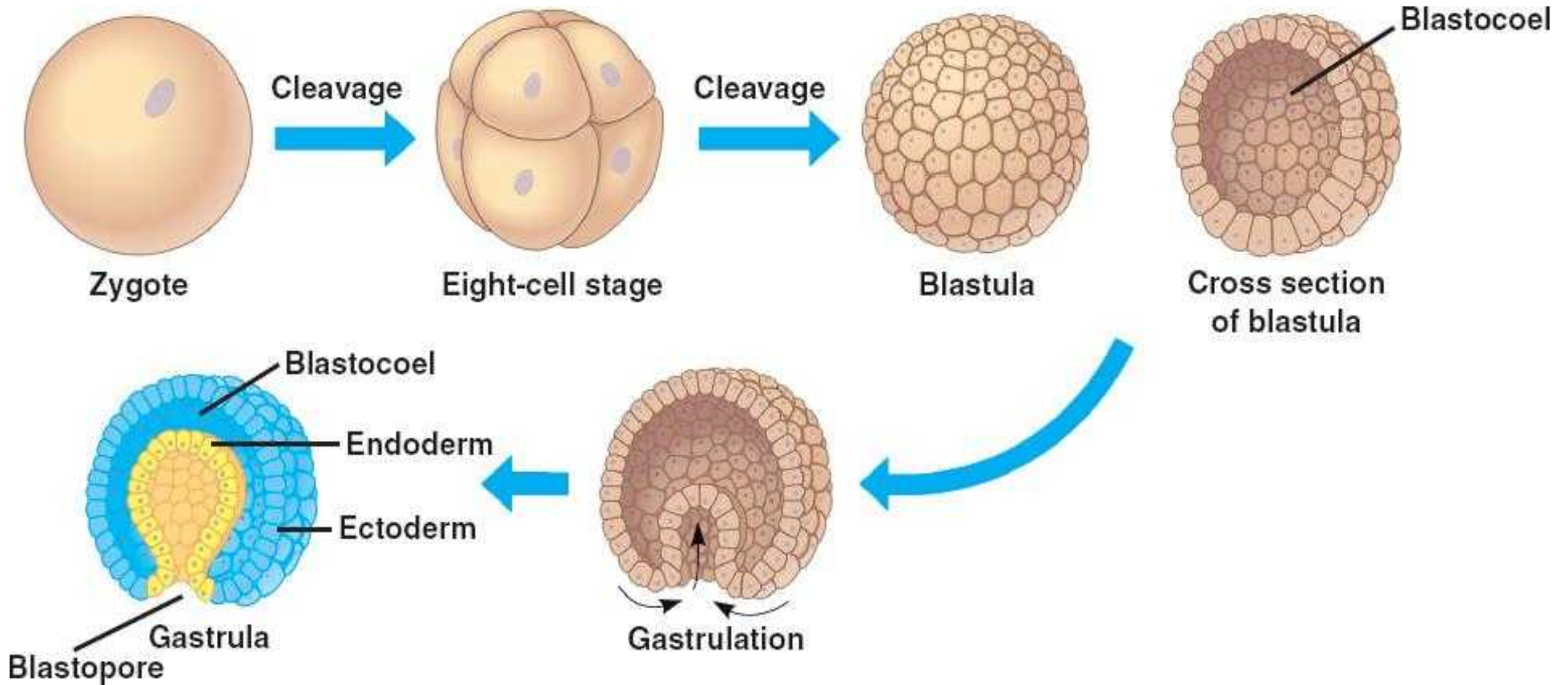
Spiral



Body Plan Development

- Cleavage continues to occur in the zygote until the dividing cells begin to form a fluid-filled ball of cells which is called a **blastula**.
- Inside the blastula is a fluid-filled cavity will be formed called a **blastocoel**.
- In most animals, the blastula develops further into a two-layered organism called a **gastrula**.
- The gastrula is made up of two tissue layers called the **endoderm** and **ectoderm**. Later on these two tissue layers will form the outer and

Early Embryonic Development in Animals



Body Cavities

- The **gastrocoel** (cavity inside the gastrula) develops into a digestive cavity in most adult animals.
- Some animals such as the sea anemone never advance beyond the gastrula stage.
- In a sea anemone, the opening or blastopore becomes the opening in its gut, which is called the gastrovascular cavity.
- In most animals, a third germ (tissue) layer develops after the gastrula stage called the

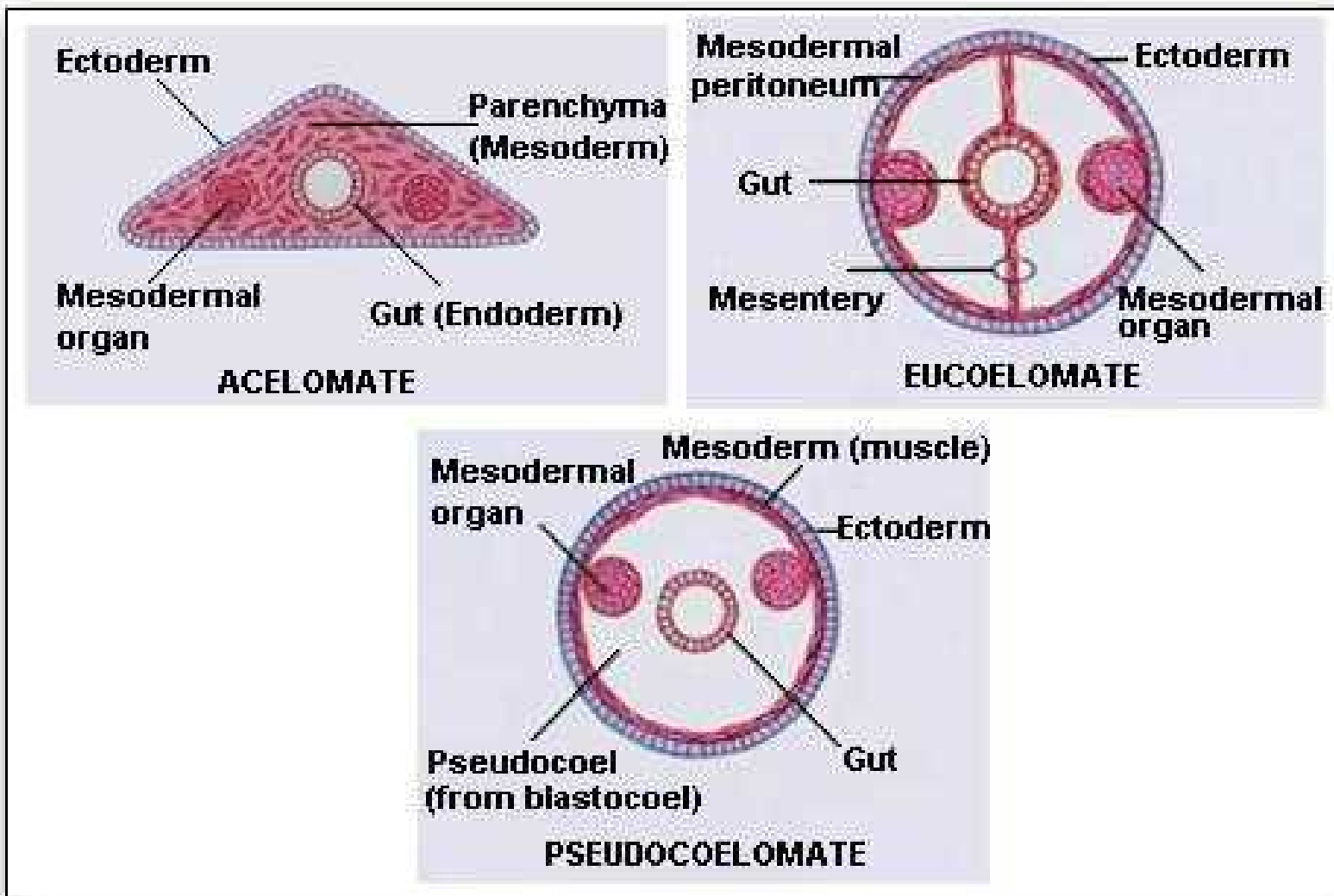
Body Cavities

- In some animals, the mesoderm lies along the outer edge of the ectoderm, but not along the endoderm. These types of organisms are referred to as **pseudocoelomate**, meaning “false coelom”.
- In other animals, mesoderm completely fills the internal body cavity. This type of body cavity is without a coelom. These organisms are referred to as **acoelomate**, meaning “no body cavity”.

Body Cavities

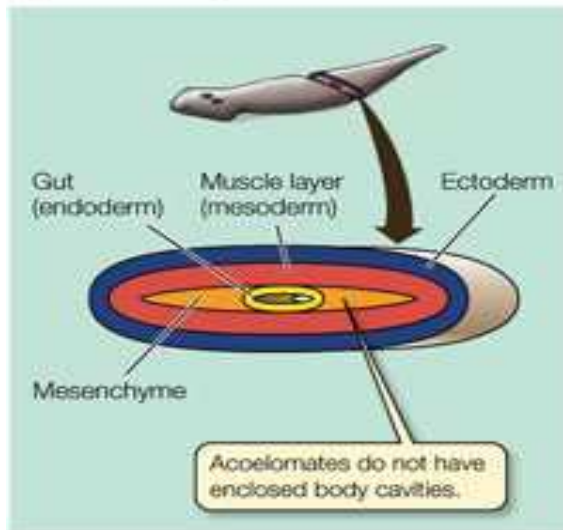
- And lastly the type of body cavity of most animals are eucoelomate or "true coelomate". Usually the cavity is simply referred to as a **coelomate** body cavity. In this body plan, the mesoderm completely lines the endoderm and the ectoderm.
- A true coelom or body cavity allows much more flexibility and space for internal organs.
- Larger and more complex organisms have a coelomate body cavity.

Body Cavities

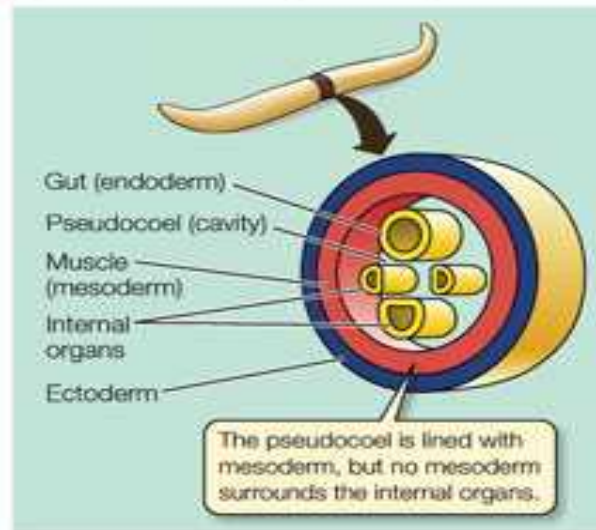


Body Cavities

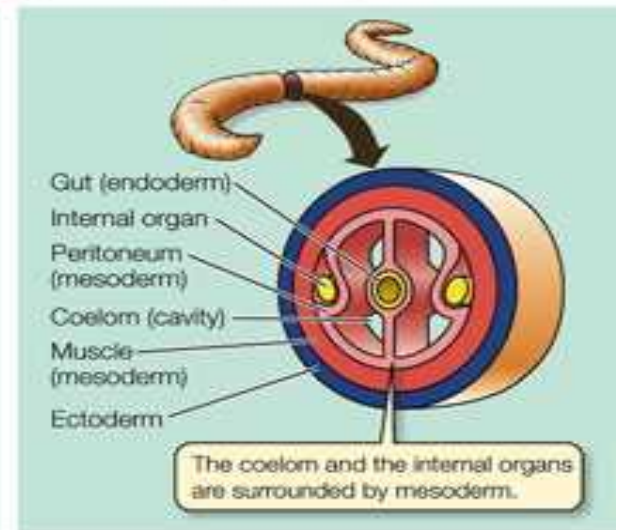
(A) Acoelomate (flatworm)



(B) Pseudocoelomate (roundworm)



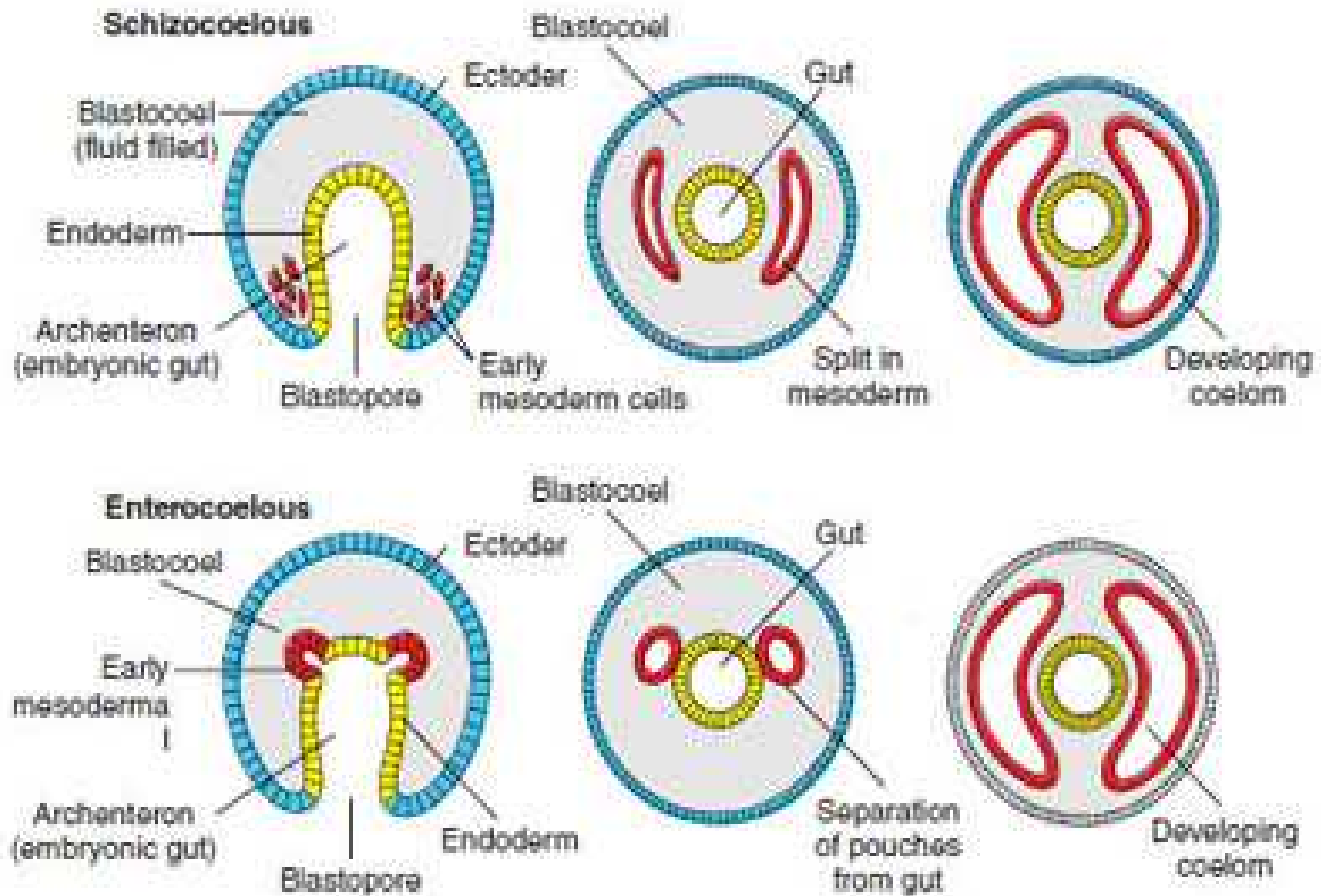
(C) Coelomate (earthworm)



Development of animals and their body cavities

- In coelomate animals if the coelom forms from mesoderm splitting off in the blastopore region, this pattern of development is referred to as **schizocoelous** development.
- In coelomate animals if the coelom forms from sections of mesoderm that pinch off from a region located at the terminal end of the endoderm, this pattern of development is referred to as **enterocoelous** development.

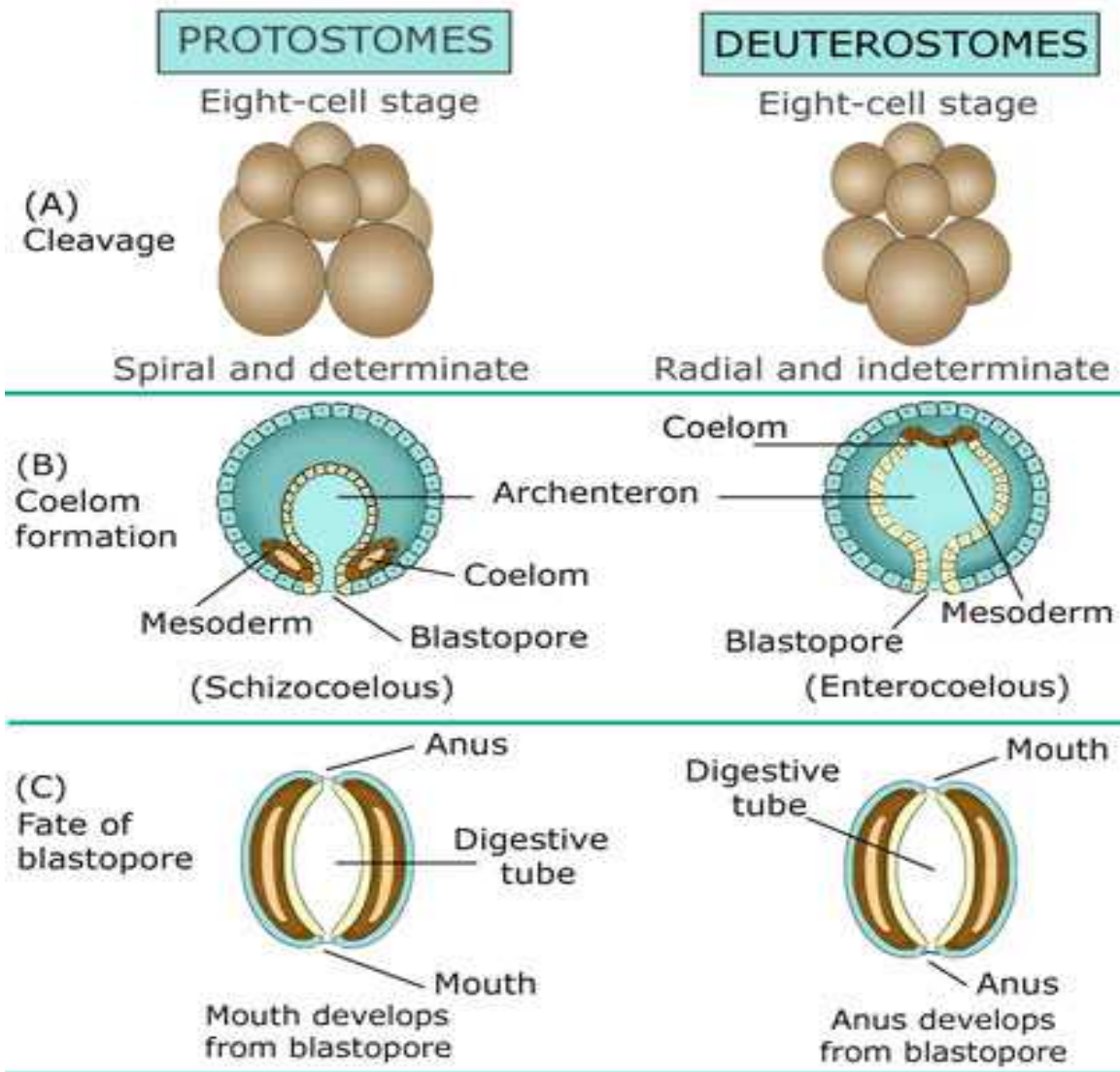
Animal Development



Animal Development

- Another main difference in the way animals develop is the fate or outcome of the **blastopore**, or the opening that forms the mouth or anus.
- In **protostomes**, which means “mouth first”, the blastopore develops into the mouth. This is how most invertebrates such as annelids, molluscs, and arthropods develop.
- In **deuterostomes**, which means “mouth second”, the blastopore develops into the

Protostomes vs. Deuterostomes



The Development of Tissues

- Eventually the germ layers (ectoderm, endoderm, and mesoderm) begin to specialize to form tissues. All of the body tissues of animals are comprised of four tissue types.

- Epithelial tissue
- Connective tissue
- Muscular tissue
- Nervous tissue

Four types of tissue



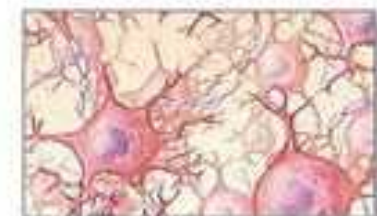
Connective tissue



Epithelial tissue



Muscle tissue



Nervous tissue

Body Tissues

