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Click on "Play from Beginning"

Kingdom Animalia I
Invertebrates

Learning CTR Online

Chapter 26:

Kingdom Animalia I

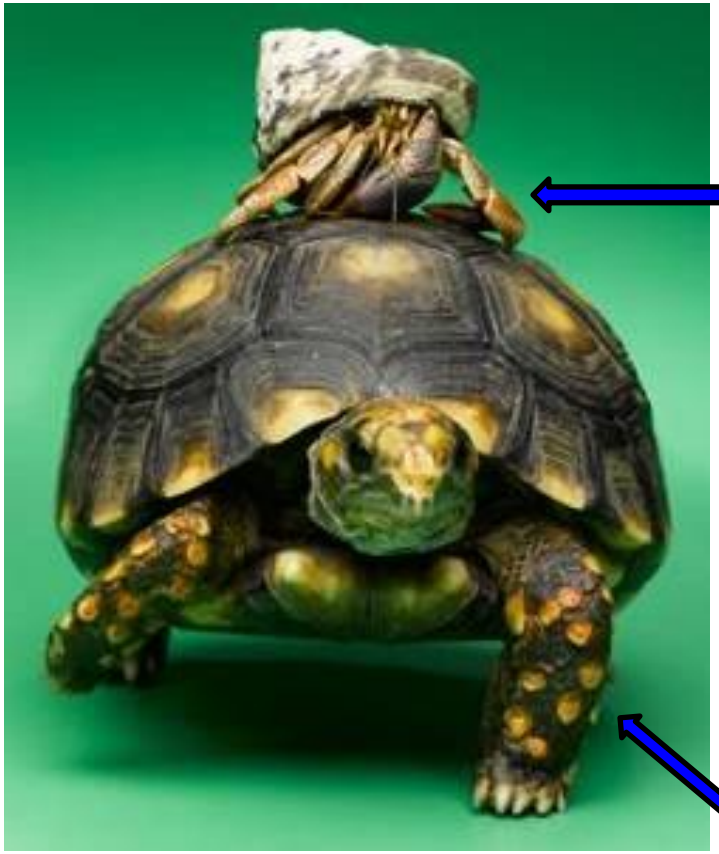
Lesson Objectives

By the end of this lesson, you should be able to:

- Identify the two branches of the animal kingdom (invertebrates and vertebrates).
- Explain five common characteristics of organisms in the animal kingdom.
- Describe the process of embryonic maturation (blastula, gastrula, true tissues).
- Distinguish the five Animal Body Plans and how this relates to animal phyla.
- Understand and explain the general features of invertebrate animals (non-chordates), including porifera and cnidarians. … Phylum, Examples of organisms, Location, Symmetry, Body plan (tissue layers), Coelom relationship (acoelomate, pseudocoelomate, coelomate), Protostome or deuterostome, Reproduction, Special features

- **Science Practice:** **Animal Phyla Project**

Animals are Divided into Invertebrates



- do NOT have a spinal column ("backbone").

Ex. Insects

  - Most animals are invertebrates.

Vertebrates

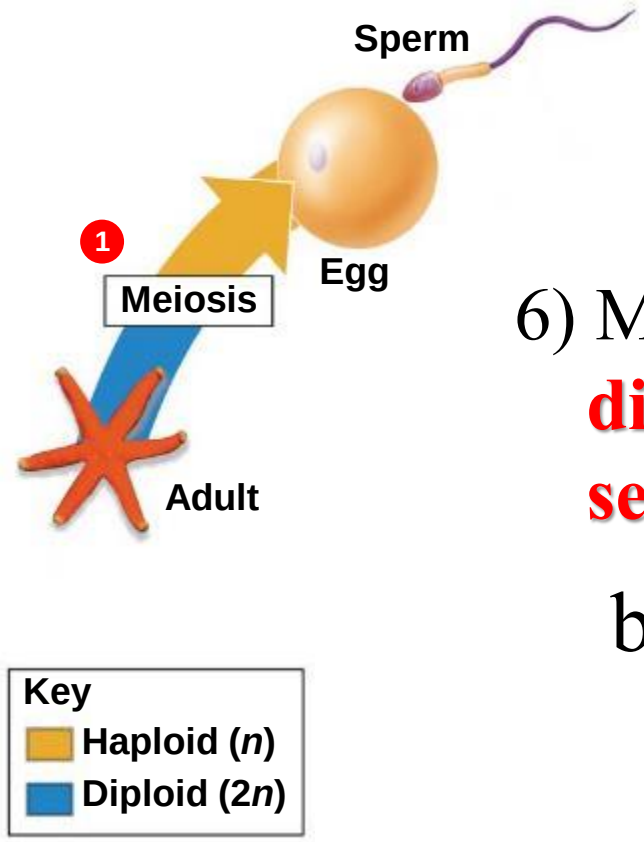
- have a spinal column ("backbone").

Ex. Mammals, Birds, Reptiles

Characteristics of Animals

1) Multicellular
2) Eukaryotes
3) No Cell Walls
4) Ingestive Heterotrophs (take in food and internally digest it).
5) Go through a Blastula stage of development.

ZOOLOGY
= Study of Animals

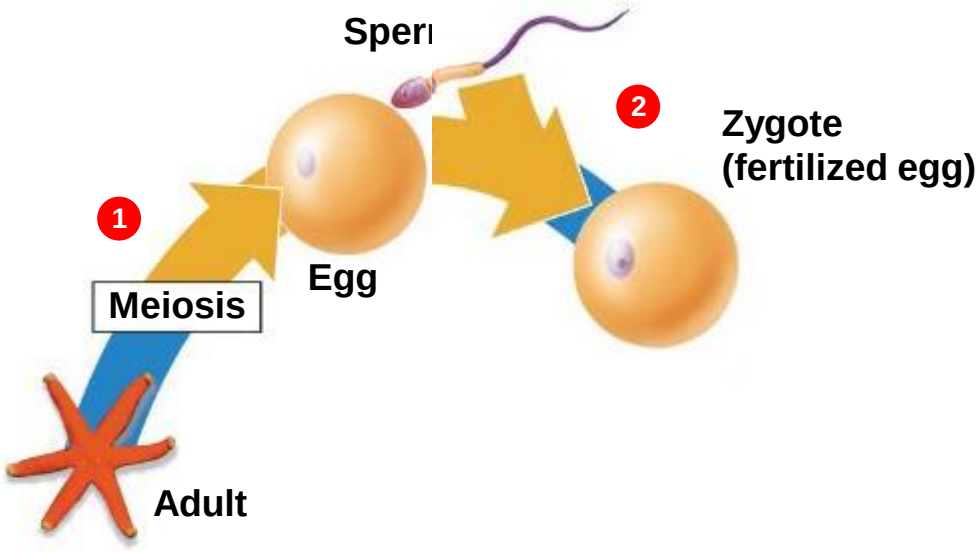


6) Most adult animals are **diploid** and reproduce **sexually …**

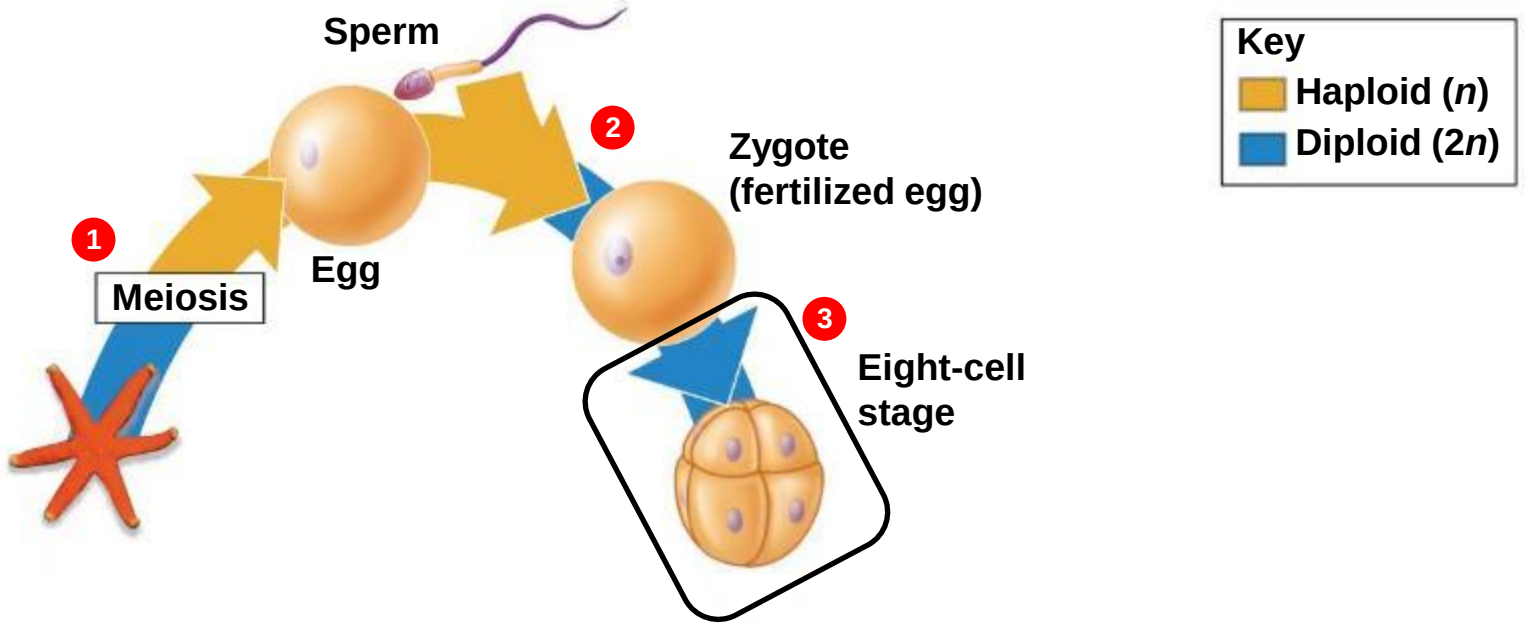
by **eggs** and **sperm**

1) are produced by meiosis

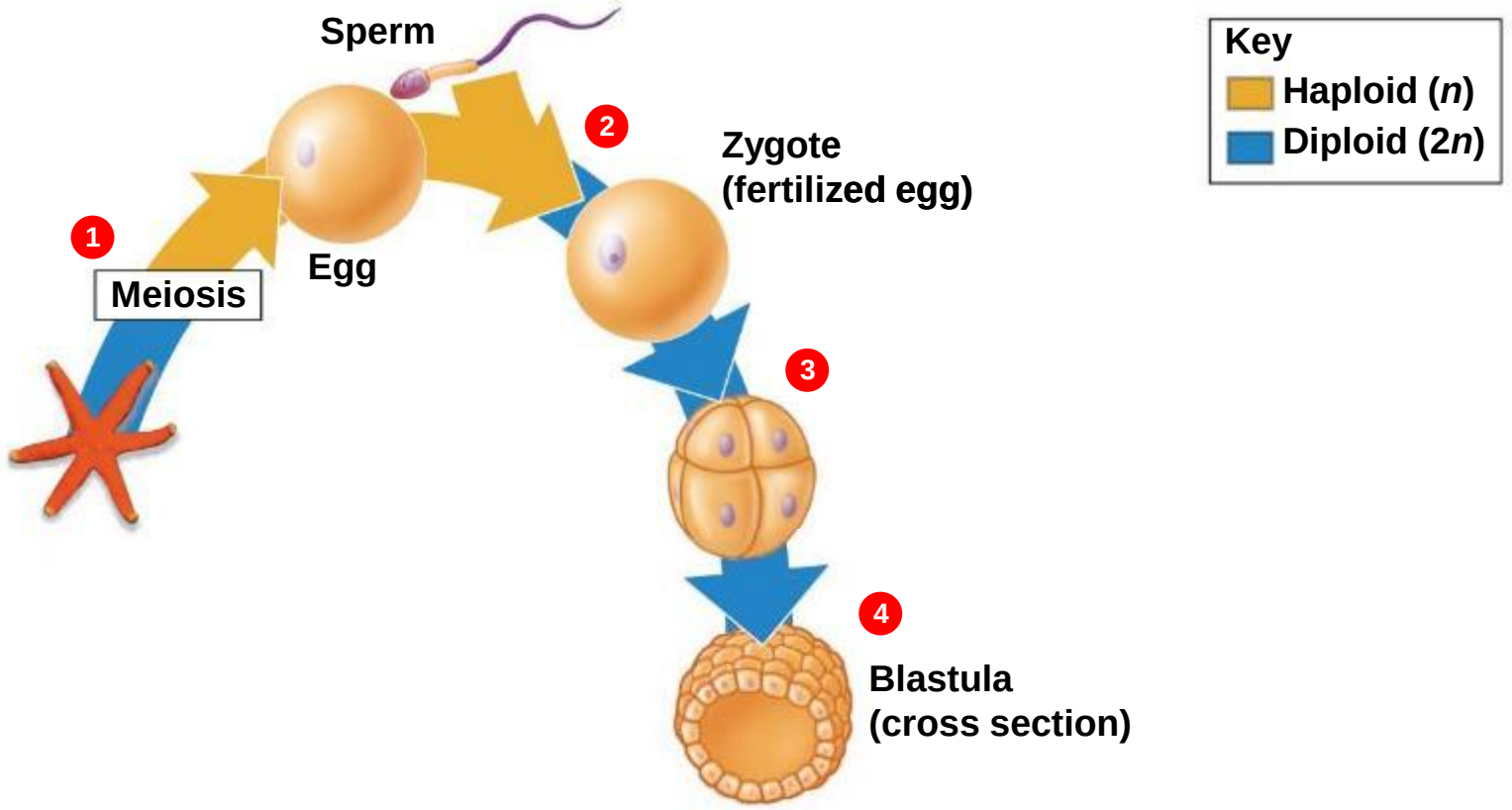
2) are the only haploid cells



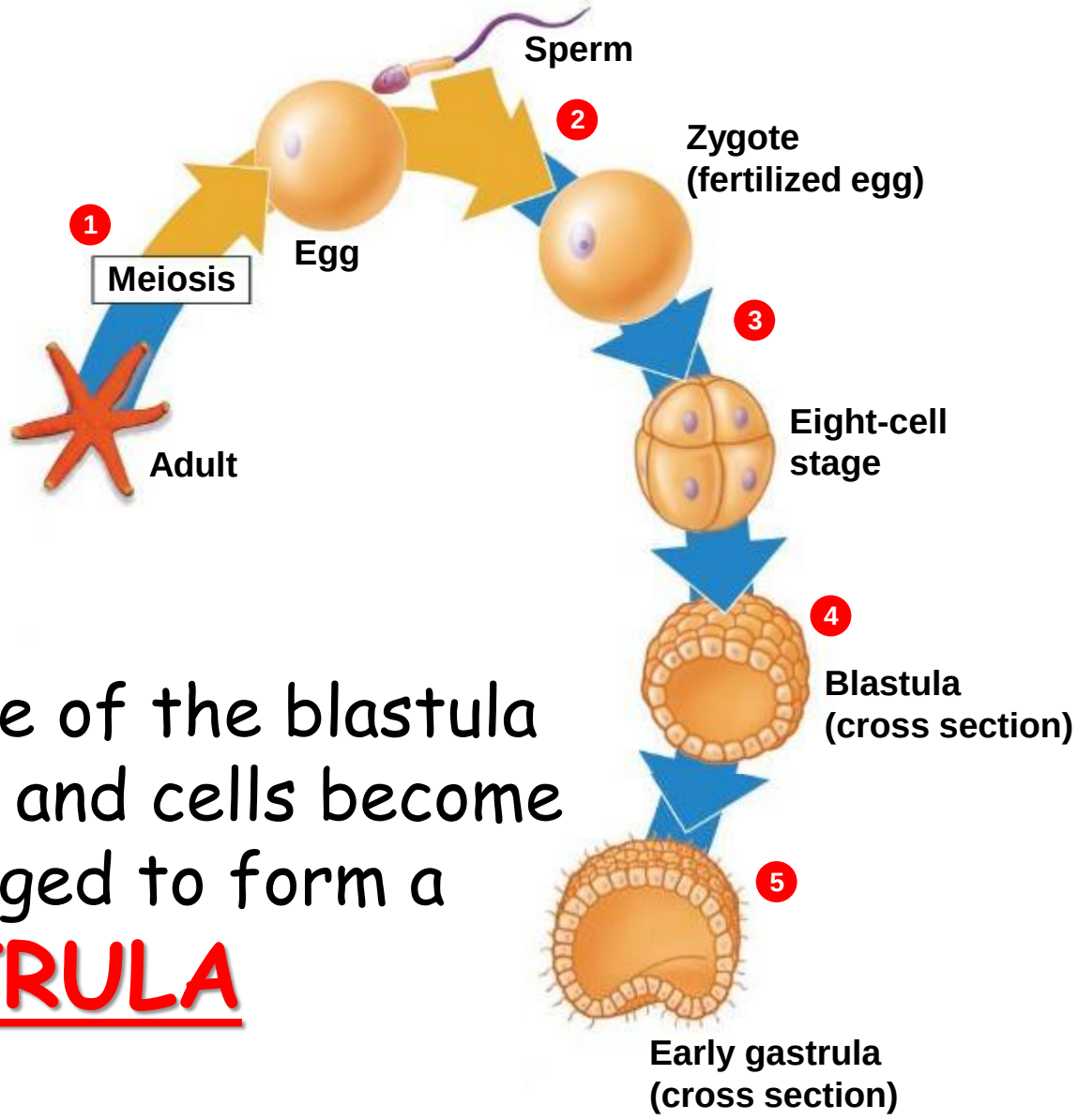
Gametes fuse during fertilization to form a **zygote**.



The **zygote** divides into cells.

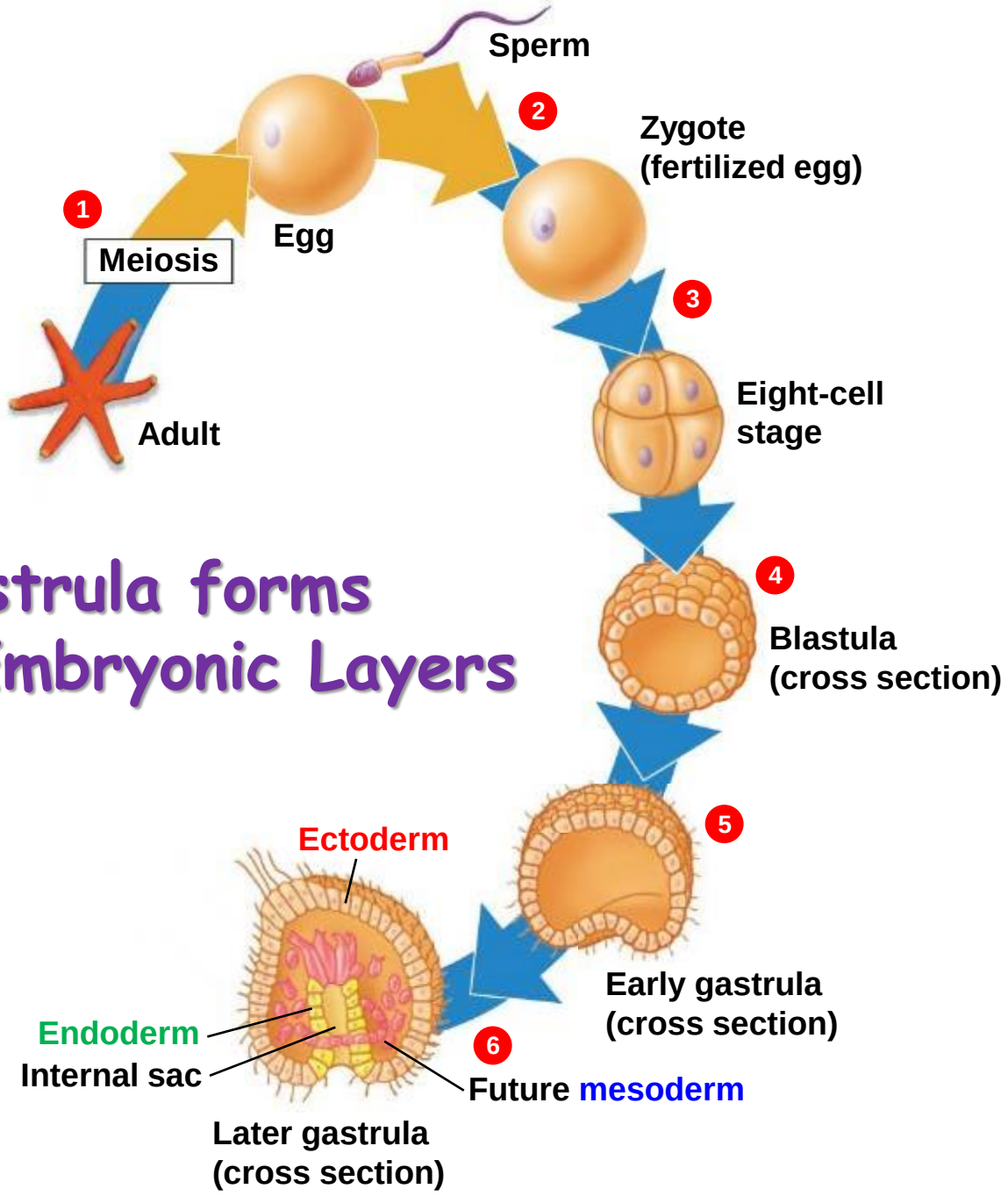


The zygote divides by mitosis to form a hollow ball of cells called a **BLASTULA**.



One side of the blastula folds in and cells become rearranged to form a **GASTRULA**

The gastrula forms three Embryonic Layers



Gastrula Development

Endoderm

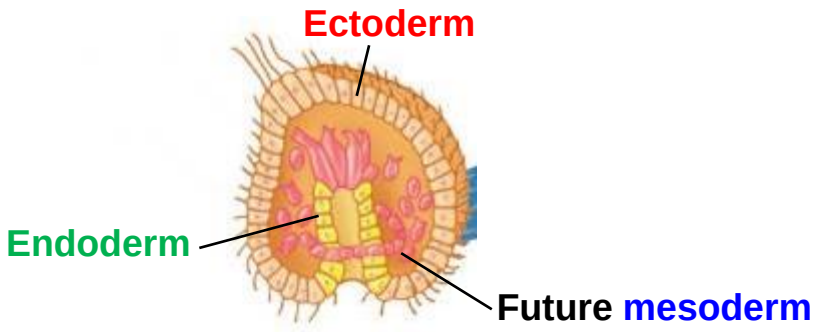
forms a lining of the future digestive tract.

Ectoderm

forms an outer layer that will give rise to the skin and nervous system.

Mesoderm

forms a middle layer that will give rise to muscles and most internal organs.



Maturation

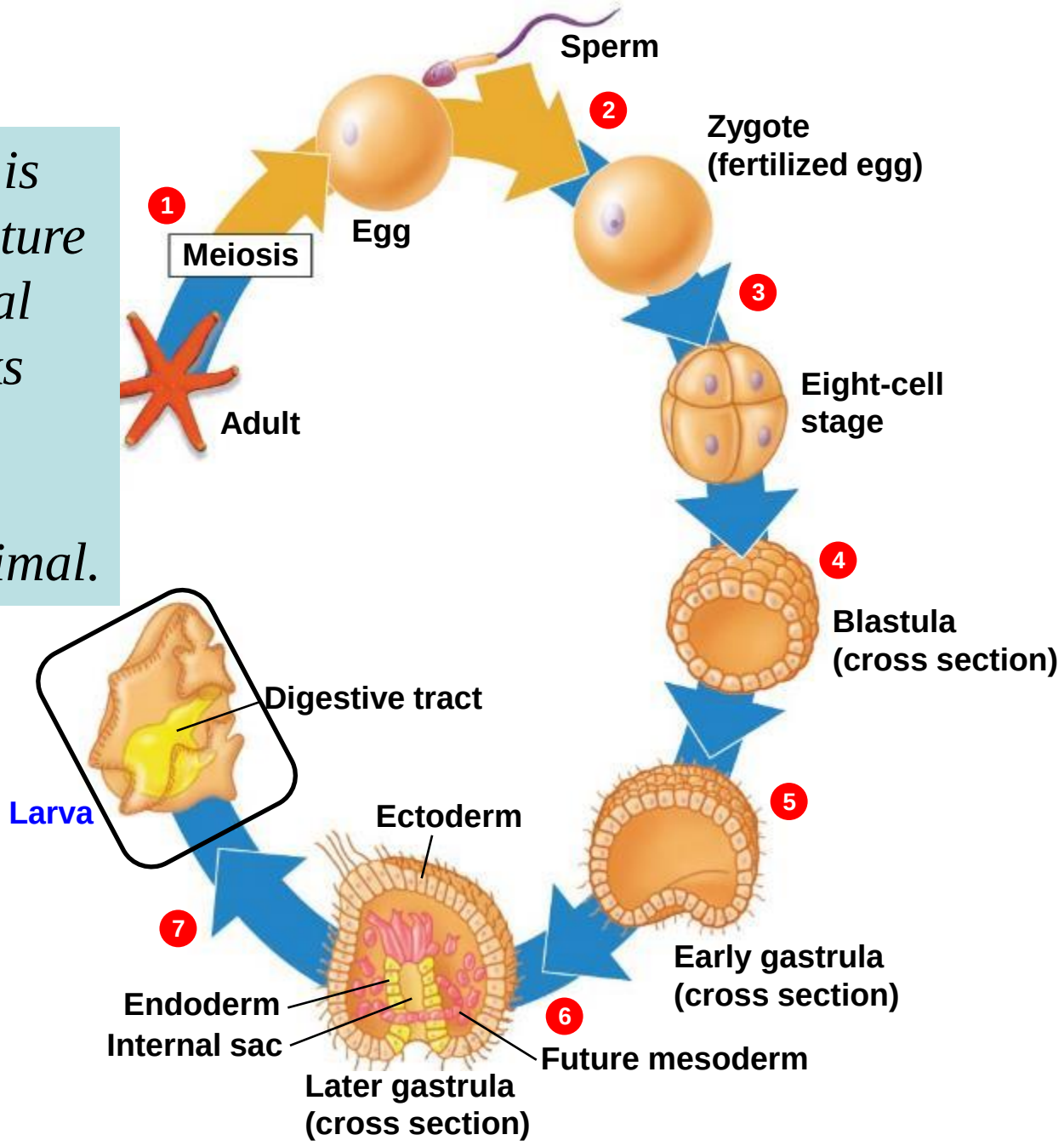
After the gastrula stage, many vertebrate animals **develop directly into adults.**

Invertebrate and some vertebrate animals **do NOT develop directly into adults.**

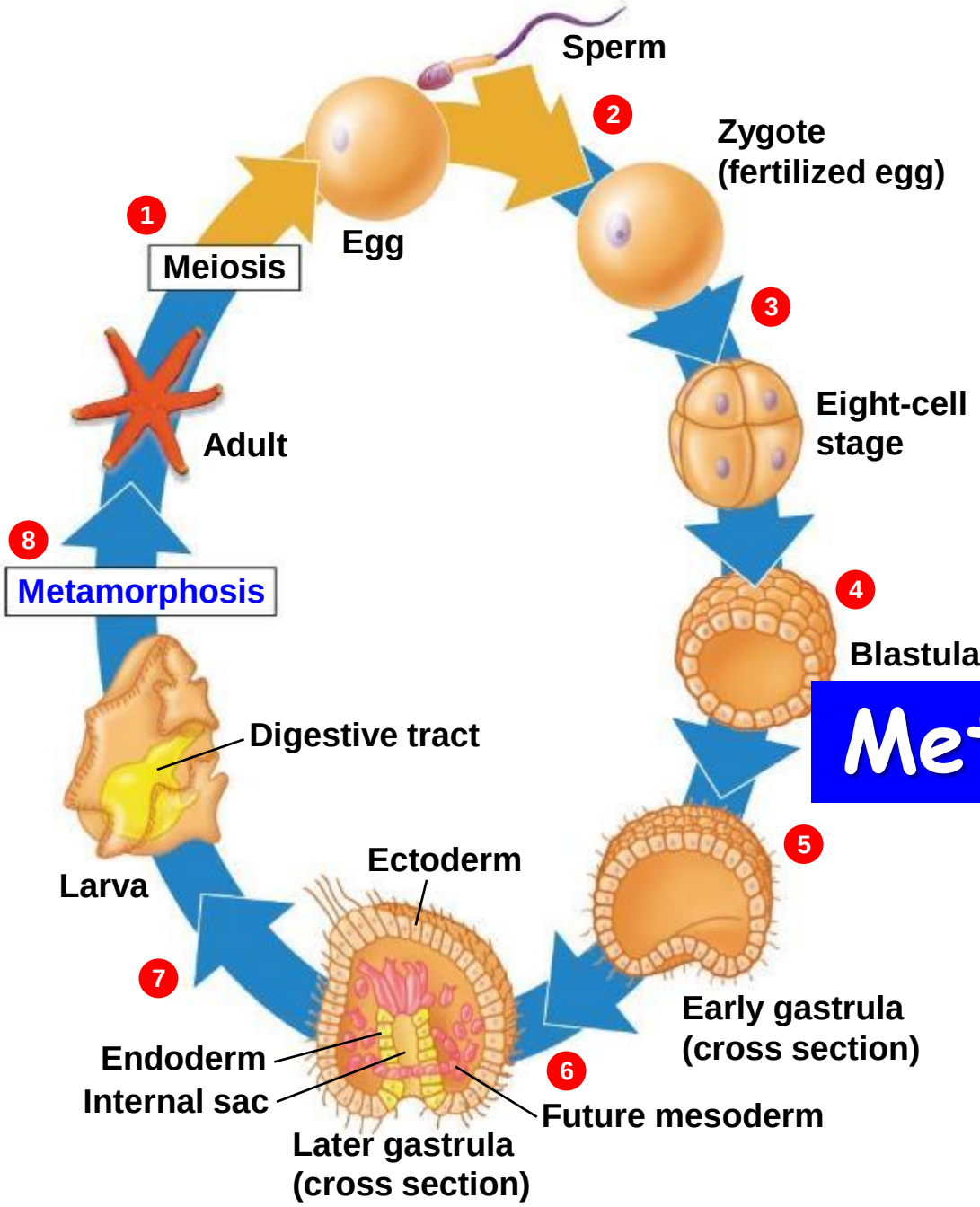
Phyla of Invertebrates:

Porifera, Coelenterata (Cnidaria), Platyhelminthes (flat worms), Nematoda (round worms), Annelida (segmented worms), Echinodermata, Mollusca, and Arthropoda.

*A **Larva** is an immature individual that looks different from the adult animal.*



Some animals, such as the sea star, **develop into one or more larval stages.**



A larva undergoes a major change in body form.

Metamorphosis

It becomes a mature adult that can reproduce.

QUICK CHECK

What are the two branches of the animal kingdom?

List five characteristics of animals.

List the embryonic tissues and what they produce.

QUICK CHECK

What are the two branches of the animal kingdom? Invertebrates & vertebrates

List five characteristics of animals.

1) **Multicellular**
2) **Eukaryotes**
3) **No Cell Walls**
4) **Ingestive Heterotrophs (take in food and internally digest it).**
5) **Go through a Blastula stage of development.**

List the embryonic tissues and what they produce.

Endoderm forms a lining of the future digestive tract.

Ectoderm forms an **outer layer** that will give rise to the skin and nervous system.

Mesoderm forms a **middle layer** that will give rise to muscles and most internal organs.

Creation of the Animal Kingdom

"And God said, Let the waters bring forth abundantly the moving creature that hath life, and fowl that may fly above the earth in the open firmament of heaven.

21 And God created great whales, and every living creature that moveth, which the waters brought forth abundantly, after their kind, and every winged fowl after his kind: and God saw that it was good.

22 And God blessed them, saying, Be fruitful, and multiply, and fill the waters in the seas, and let fowl multiply in the earth.

23 And the evening and the morning were a **fifth day.**

24 And God said, Let the earth bring forth the living creature after his kind, cattle, and creeping thing, and beast of the earth after his kind: and it was so.

25 And God made the beast of the earth after his kind, and cattle after their kind, and every thing that creepeth upon the earth after his kind: and God saw that it was good.

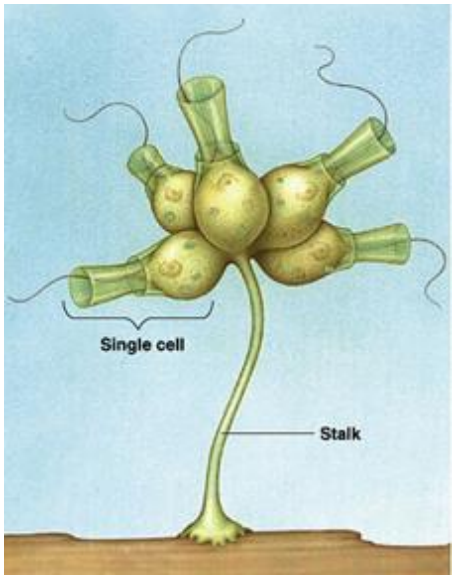
31 And God saw every thing that he had made, and, behold, it was very good. And the evening and the morning were the **sixth day."**

Genesis 1: 20-31

Animal Diversity
(according to Evolution)

Animals are believed to have descended from a common ancestor (an ancestral flagellated protist).

Most of today's phyla of animals are believed to have appeared for the first time in the geological column during a period called "Cambrian Explosion".



Animal's Body Plan

1) Presence of True Tissues

2) Symmetry

3) Embryonic Tissue Layers

4) First Opening formed by Gastrulation

5) Presence of a Body Cavity

1) True Tissues

What is a Tissue?

Presence or **Absence** of true tissues separates animals into two groups:

- **Sponges** (simplest animals): **NO** true tissues.

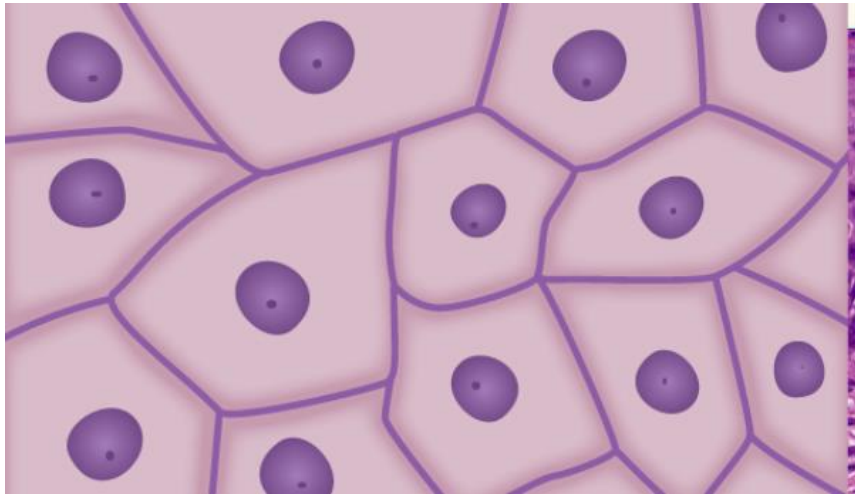
- **Animals with true tissues.**

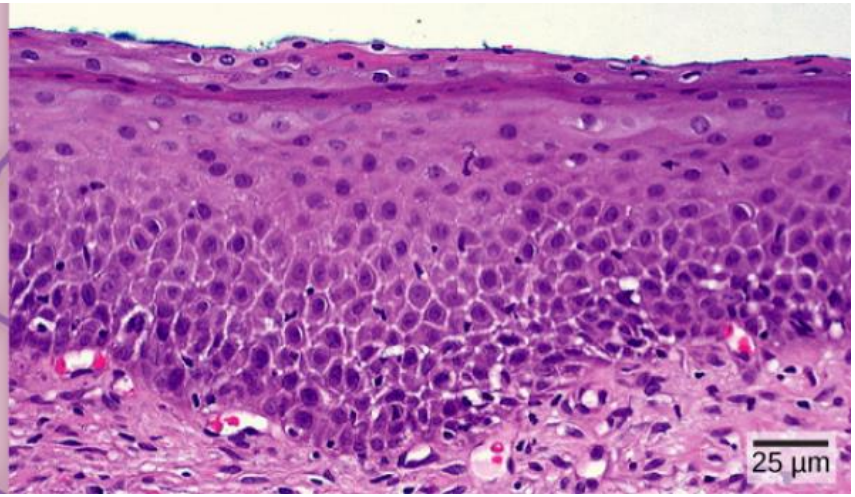
1) True Tissues

What is a Tissue?

Tissues are an integrated group of cells that share a common structure and a common function.

For example, epithelial, connective, nervous or muscle tissue).





2) Body Symmetry

- Symmetry is the arrangement of body parts around a central point or axis.
- Asymmetry occurs when the body can't be divided into into equal parts (sponges).

This ant has **bilateral symmetry.** The two halves of its body mirror each other. On each side you see one eye, one antenna, and three legs.

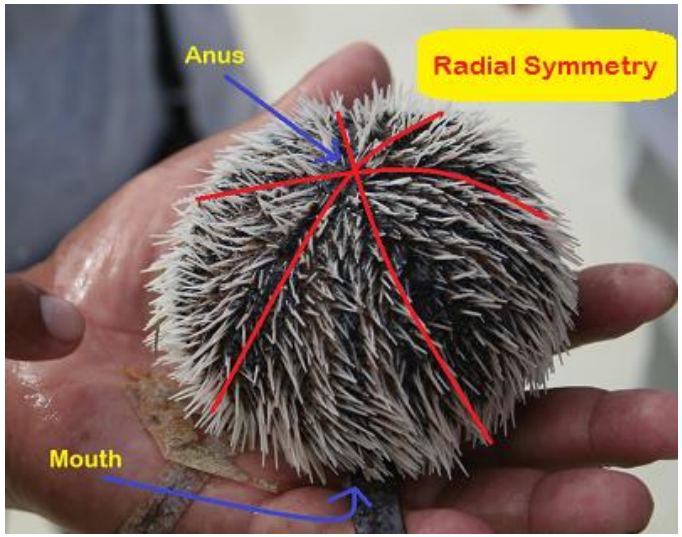
This sea anemone has **radial symmetry.** Animals with radial symmetry have a body organized around the center, like spokes on a wheel.

This sponge is **asymmetrical.** You cannot draw a straight line so that its body is divided into two equal halves.

2) Body Symmetry

Radial Symmetry occurs when body parts are arranged around a central point like spokes on a wheel (jellyfish, sea stars, sea urchins).

Most animals with radial symmetry are sessile (attached) or sedentary (move very little).



2) Body Symmetry

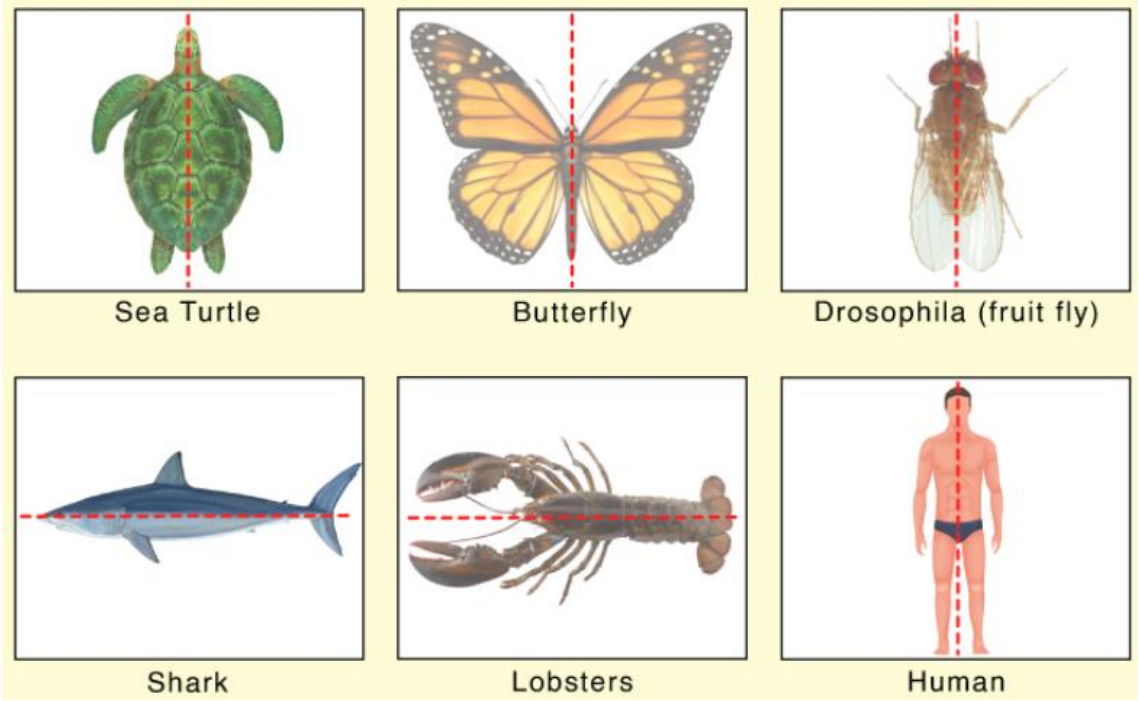
Bilateral Symmetry occurs when animals can be divided into **equal halves** along a single plane.

Organisms will have **right and left sides** that are mirror images of each other.

2) Body Symmetry

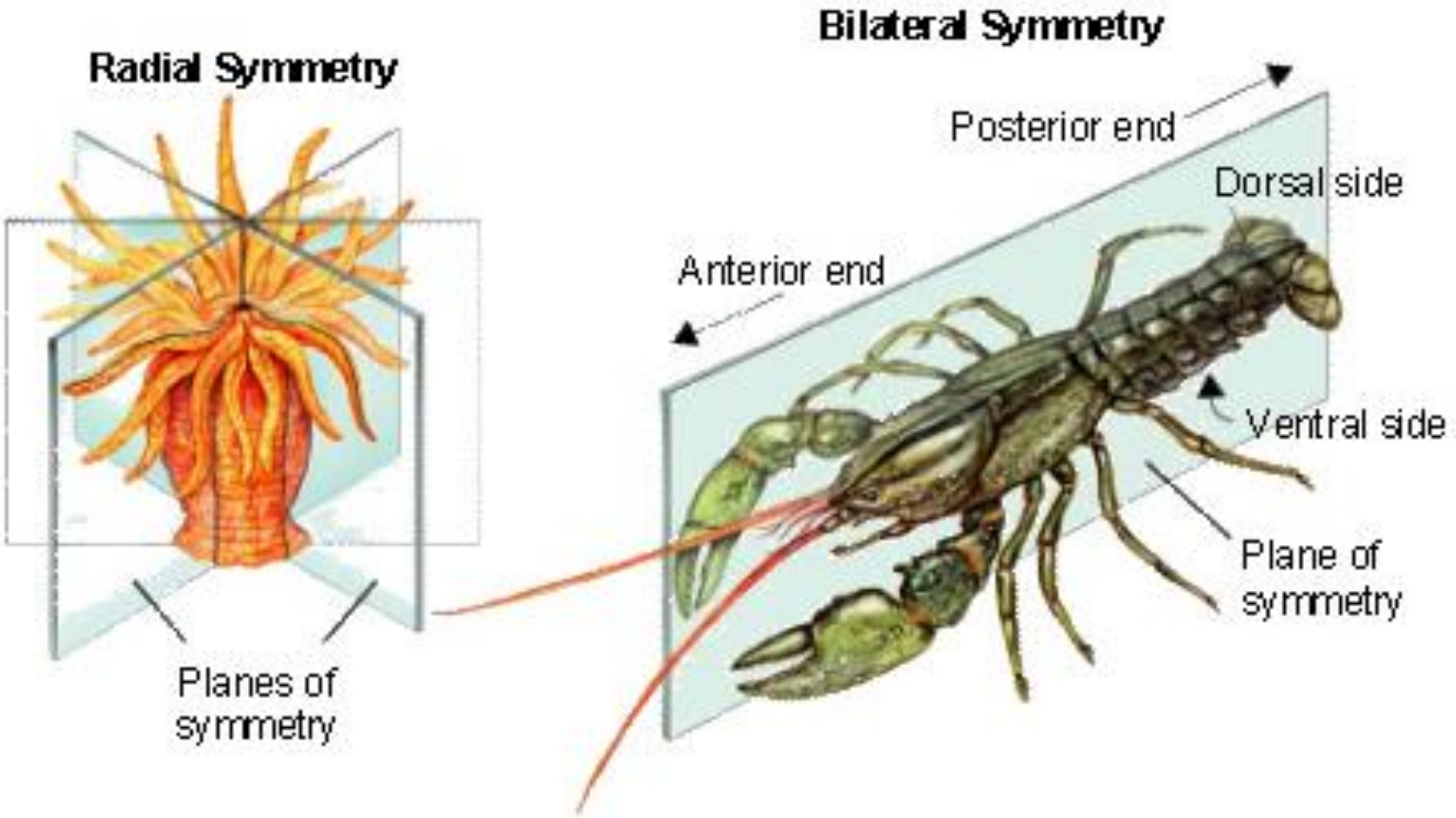
Animals with Bilateral Symmetry are usually motile.

- Have an anterior and posterior ends.



Show **Cephalization** (tendency to concentrate sensory organs and a brain at the head or anterior end).

2) Body Symmetry



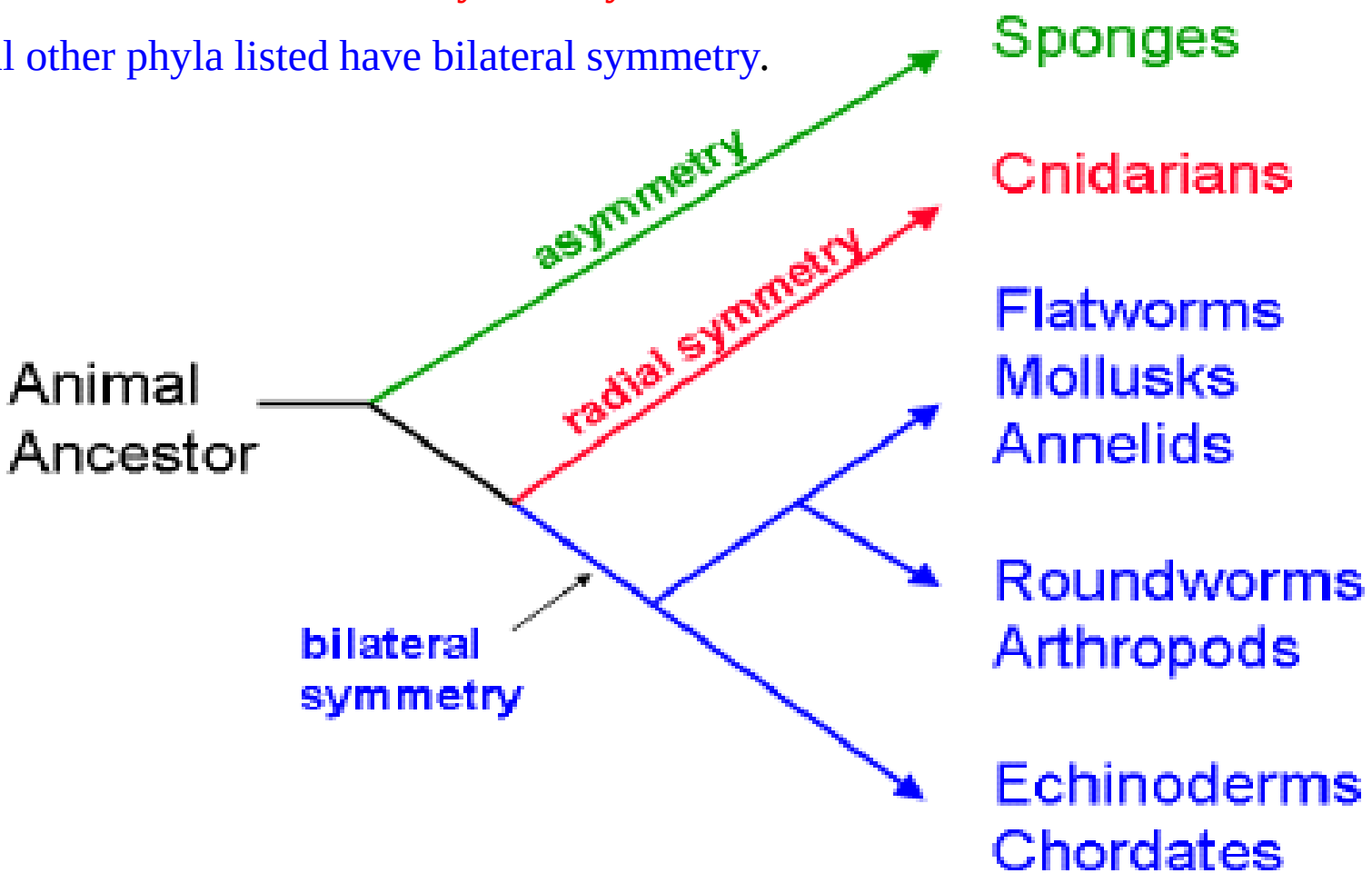
2) Body Symmetry

Evolution of Symmetry *(simple to complex)*

Sponges lack symmetry.

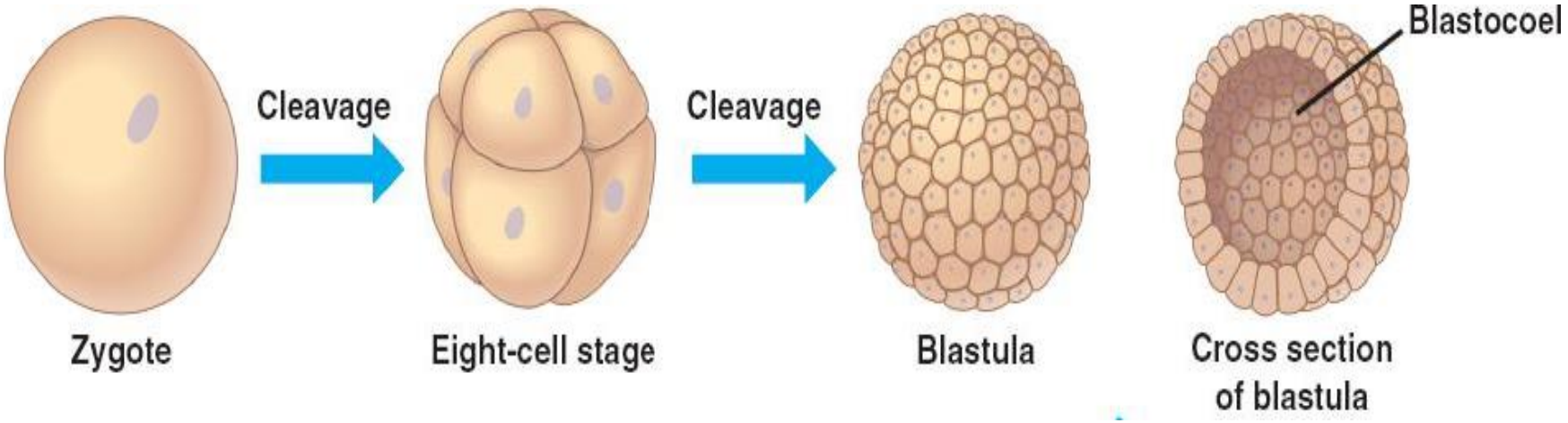
Cnidarians exhibit radial symmetry.

All other phyla listed have bilateral symmetry.



3) Embryonic Development

2 or 3 Tissue Layers



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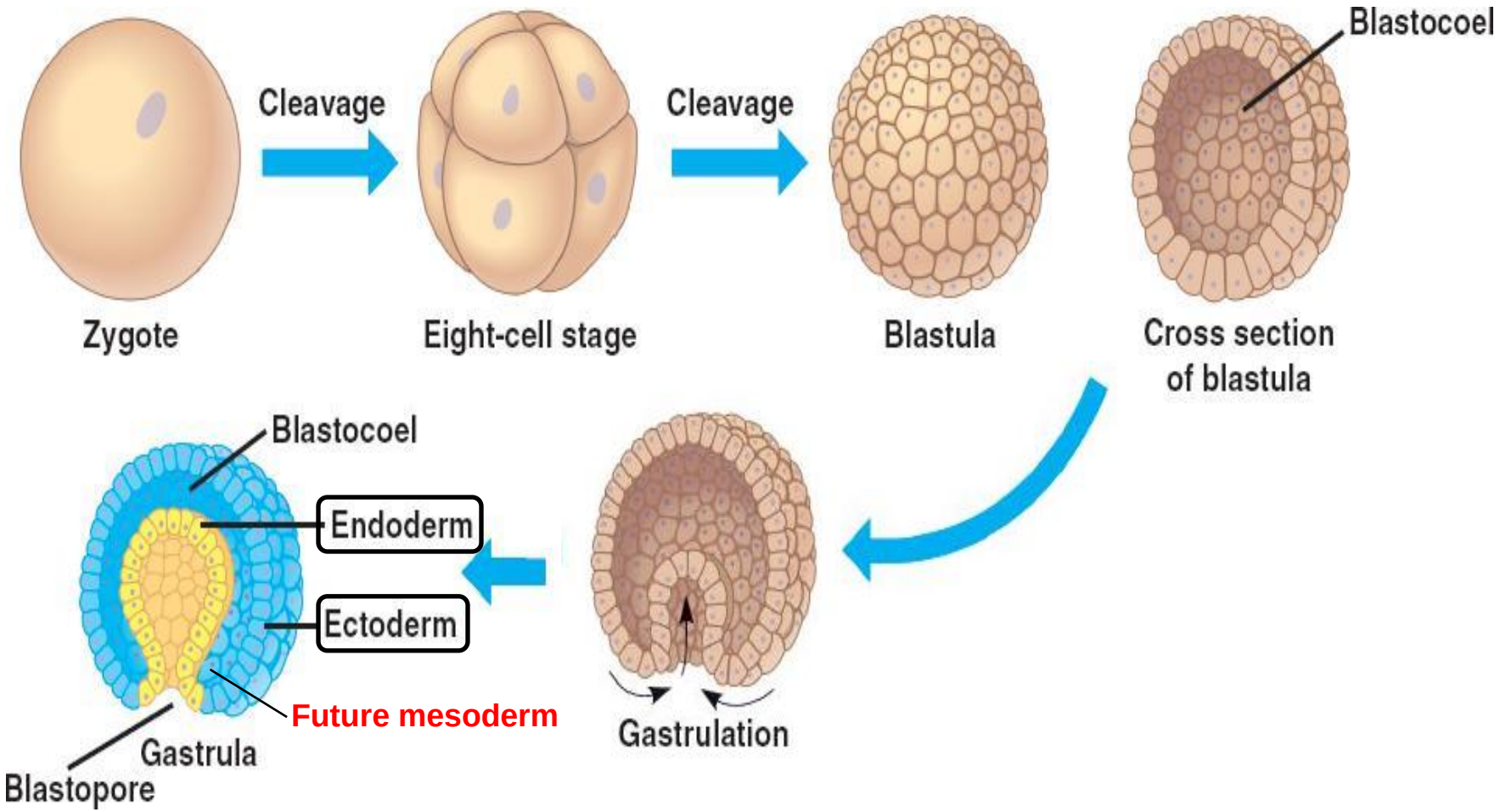


3) Embryonic Development

2 or 3 Tissue Layers

In animals with TRUE tissues, the Blastula folds in on itself to generate the Gastrula.

Gastrulas of Cnidarians (jellyfishes and their relatives) have two tissue layers:

- Ectoderm: Outside
- Endoderm: Inside

All other animals with true tissues have a third tissue layer:

- Mesoderm: between ectoderm & endoderm

Gastrula Development

Endoderm

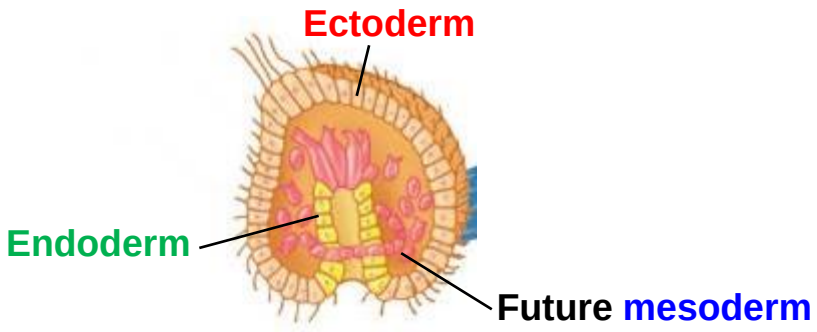
forms a lining of the future digestive tract.

Ectoderm

forms an outer layer that will give rise to the skin and nervous system.

Mesoderm

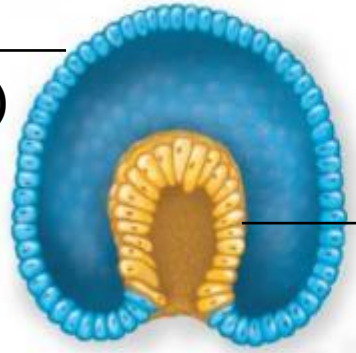
forms a middle layer that will give rise to muscles and most internal organs.



3) Embryonic development: tissue layers

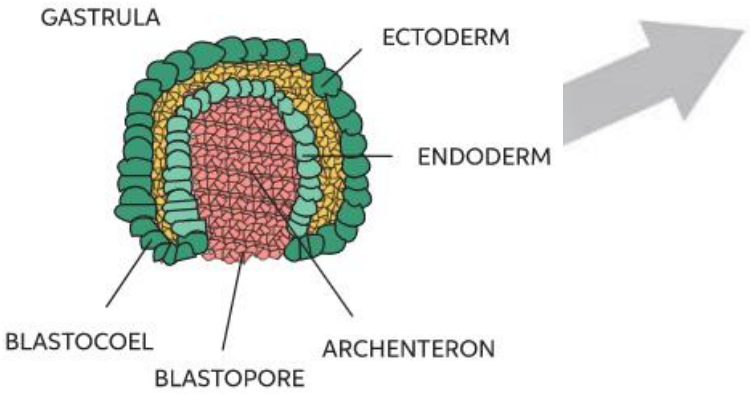
Two layers (some animals)

Ectoderm
(outer layer)



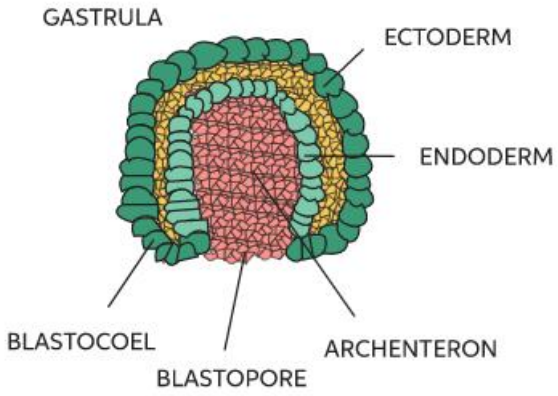
Endoderm
(inner layer)

Gastrulation

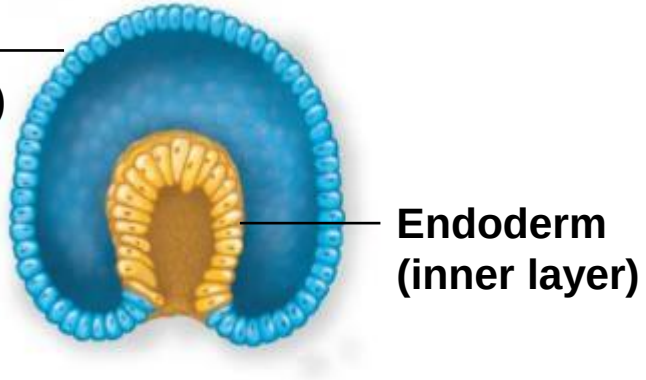


3) Embryonic development: tissue layers

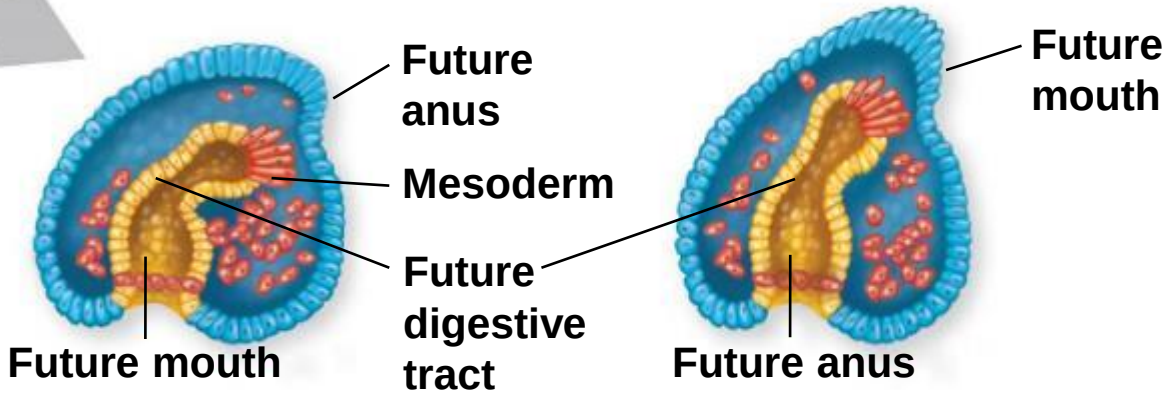
Gastrulation



Two layers (some animals)



Three layers (most animals)



Protostome
(“first mouth” in Greek)

Deuterostome
(“second mouth” in Greek)

4) Embryonic Development: First Opening formed by Gastrulation

Animals with 3 tissue layers are divided into 2 groups:

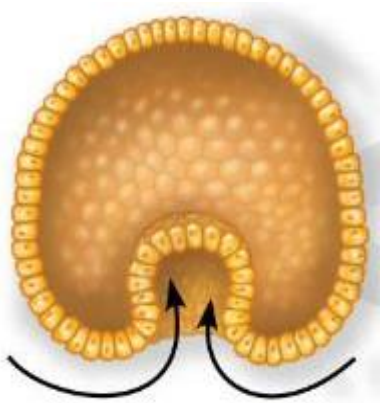
Protostomes if the first indentation (opening) during Gastrulation becomes the Mouth.

Ex. Arthropods, Worms

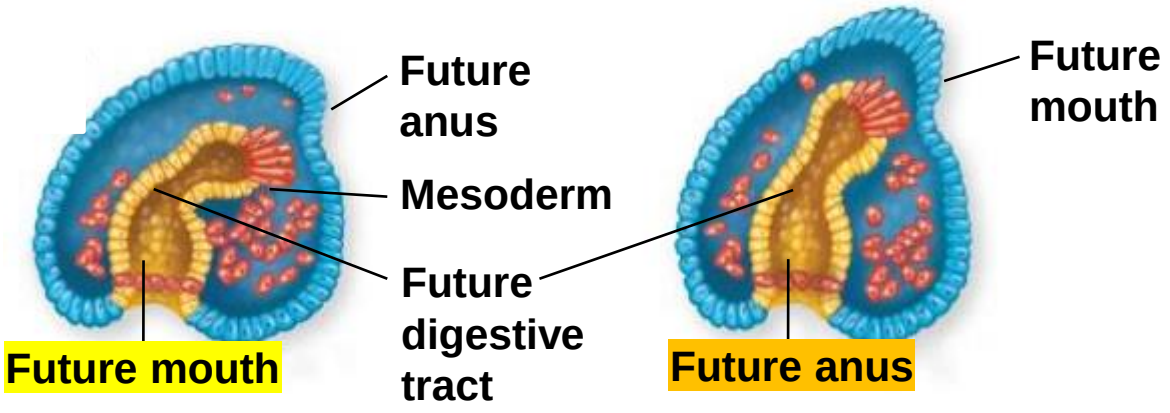
Deuterostomes if the 1st indentation (opening) during Gastrulation becomes the Anus & the mouth forms from a 2nd opening.

Ex. Echinoderms, Chordates

Gastrulation



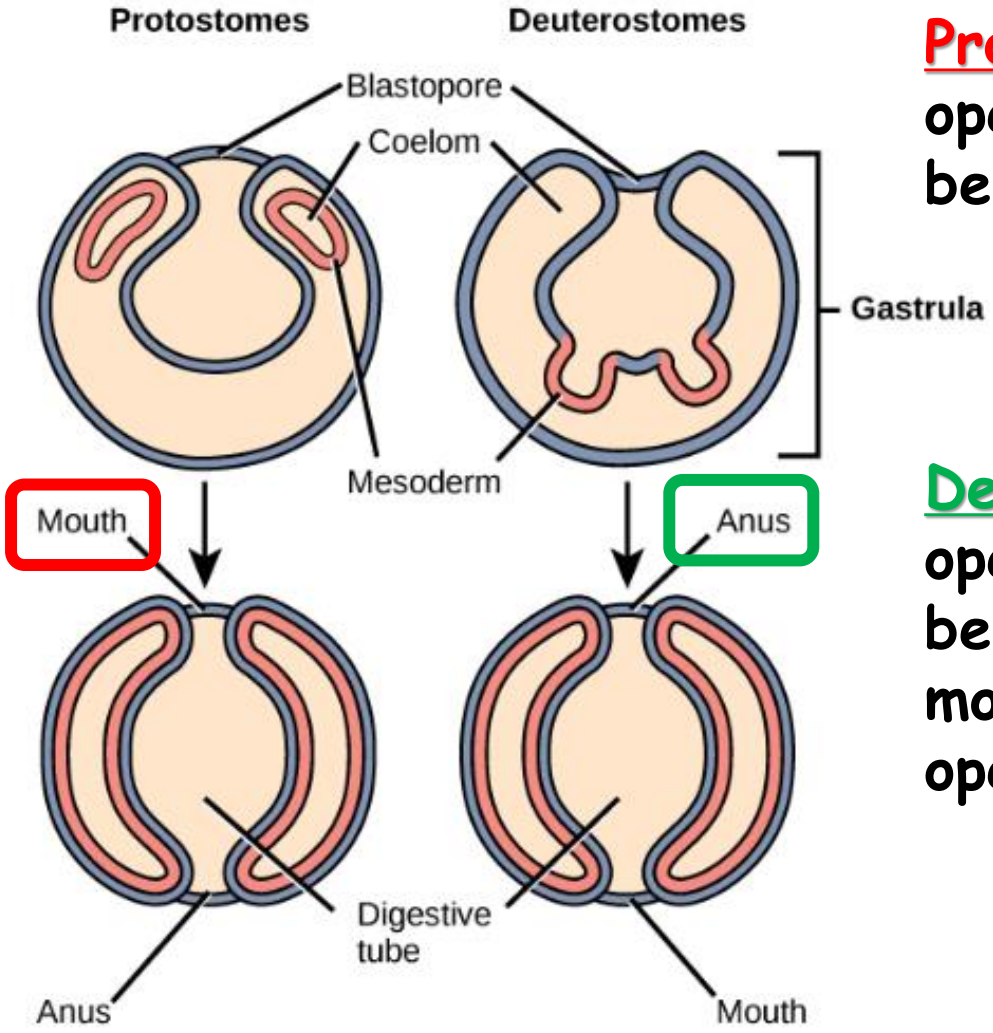
First opening in embryo



Protostome
("first mouth" in Greek)

Deuterostome
("second mouth" in Greek)

4) Embryonic Development: First Opening formed by Gastrulation



Protostomes if the first opening during Gastrulation becomes the **Mouth**.

Ex. Arthropods, Worms

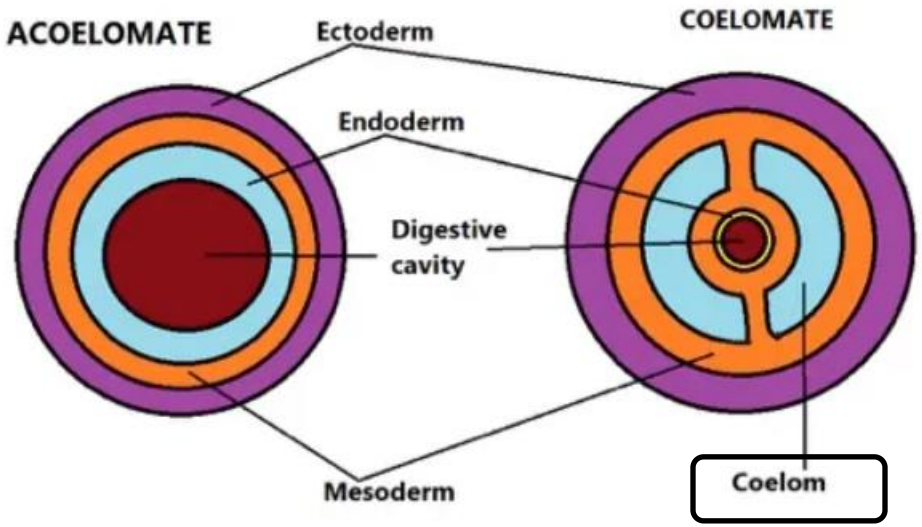
Deuterostomes if the 1st opening during Gastrulation becomes the **Anus** & the mouth forms from a 2nd opening.

Ex. Echinoderms, Chordates

5) Coelom: Body Cavity

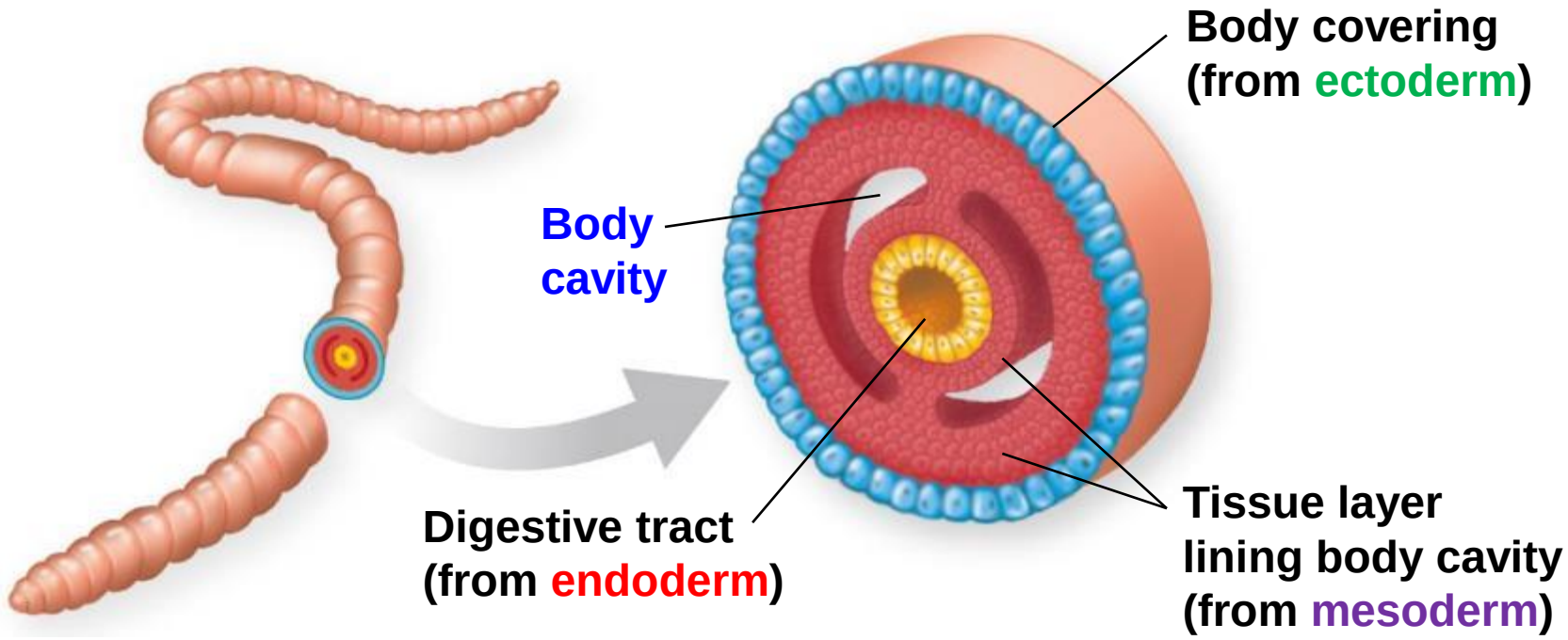
Most animals with 3 tissue layers have a Body Cavity or Coelom:

- Fluid-filled space between the outer body wall (ectoderm) and the digestive tube (endoderm) in which the internal organs are suspended.
- This body cavity helps protect the suspended organs from injury.



5) Coelom: Body Cavity

Embryonic development: body cavity
(helps protect organs from injury)



5) Coelom: Body Cavity

Acoelomates (No Coelom)

Animals that have no internal, fluid-filled body cavity separating its body wall from its digestive tract. E.g. Porifera (sponges), Platyhelminthes (flatworms).

Pseudocoelomate

Organisms with body cavity lined with patches of mesoderm, but not derived from the mesoderm, as in a true coelom, or body cavity. E.g. Nematodes (round worms).

Coelomates

Organisms with a body cavity, ("True Coelom") that is derived from and lined with mesoderm. The coelom is the space (body cavity) between the digestive organs and the outer body wall.

What are two major ways to explain diversity?

QUICK CHECK

List the five animal body plans.

Distinguish asymmetry, radial and bilateral symmetry.

What are two major ways to explain diversity?

QUICK CHECK

Creation (Genesis 1-2) & macroevolution (gradual, random)

List the five animal body plans.

1) **Presence of True Tissues**
2) **Symmetry**
3) **Embryonic Tissue Layers**
4) **First Opening formed by Gastrulation**
5) **Presence of a Body Cavity**

Distinguish asymmetry, radial and bilateral symmetry.

Asymmetry no definite shape.

radial body parts are arranged around a central point

bilateral divided into equal halves along a single plane.

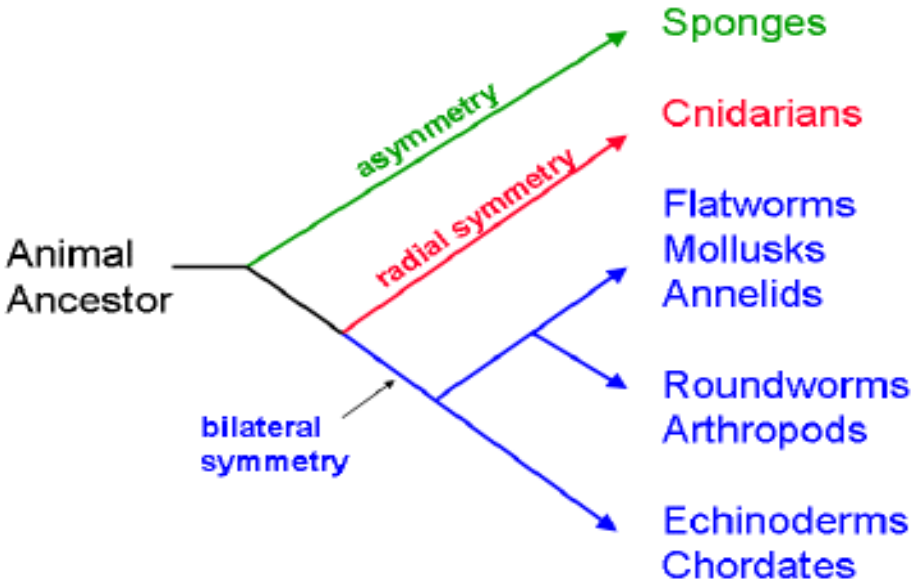
TRY IT

Give examples of phyla with each type of body symmetry.

Name and define the branches of animals with 3 embryonic tissue layers.

Name and define the 3 body cavity types in animals.

Give examples of phyla with each type of body symmetry.



TRY IT

Name and define the branches of animals with 3 embryonic tissue layers.

Protostomes the first opening during Gastrulation → Mouth.

Deuterostomes the first opening during Gastrulation → Anus.

Name and define the 3 body cavity types in animals.

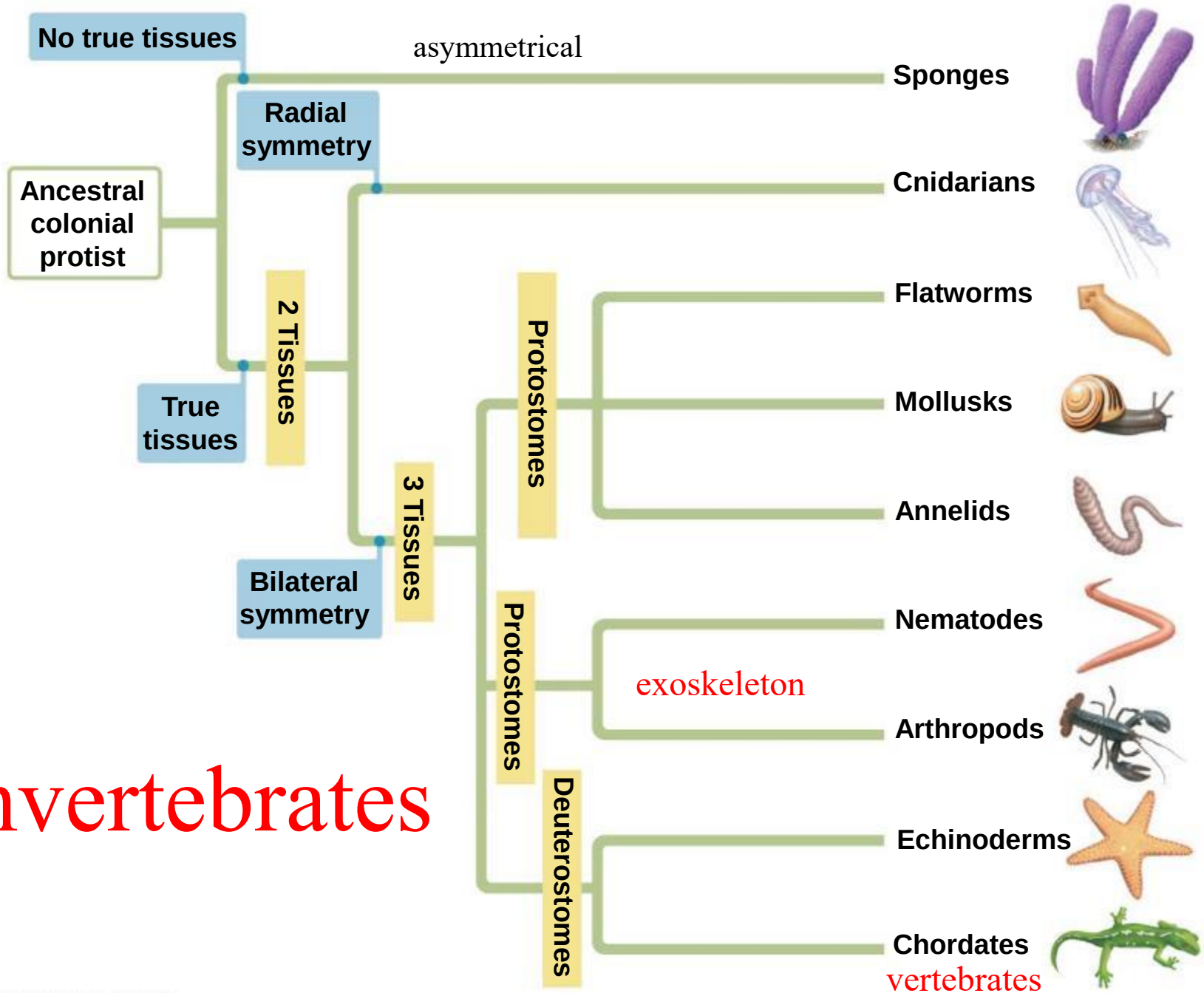
Acoelomate → no body cavity (flatworms)

Pseudocoelomate → patches of mesoderm (round worms)

Coelomates → derived from and lined with mesoderm.

Invertebrates

- "Simplest" animals.
- Contain the greatest number of different species.
- Do NOT have a backbone.
- Includes sponges, cnidarians, flatworms, roundworms, mollusks, annelids, arthropods, and echinoderms.



Invertebrates

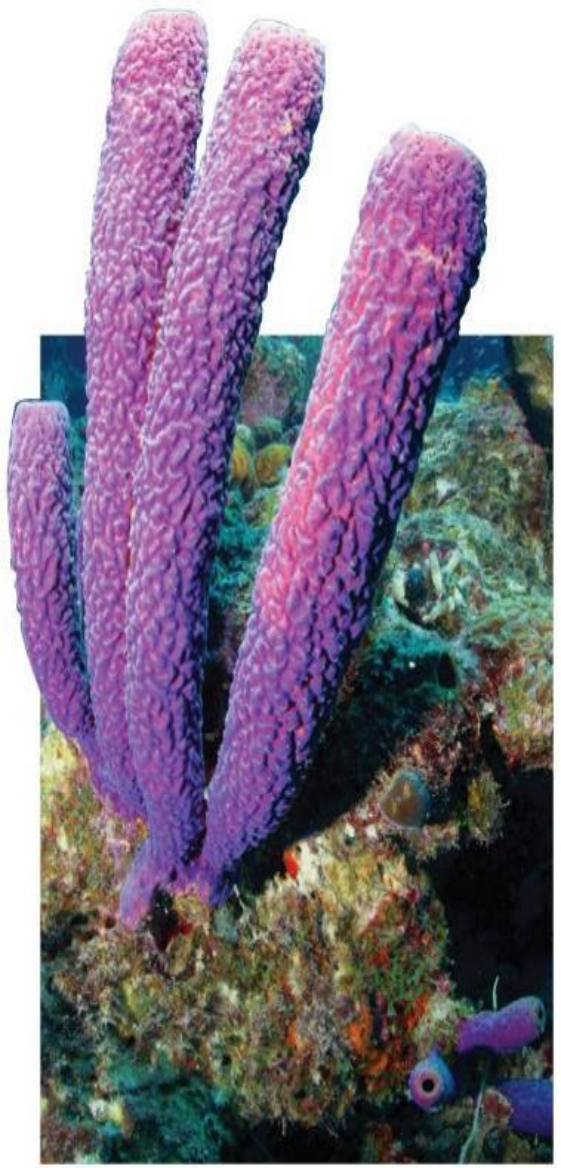
Phylum Porifera: Sponges

The phylum includes about 5,000 species of sponges, grouped into 3 classes depending mainly upon the types of skeleton found in them.

The Porifera may be defined as an **asymmetrical** or somewhat radially symmetrical, multicellular organism with a cellular grade of an organization **without true tissues** and organs.

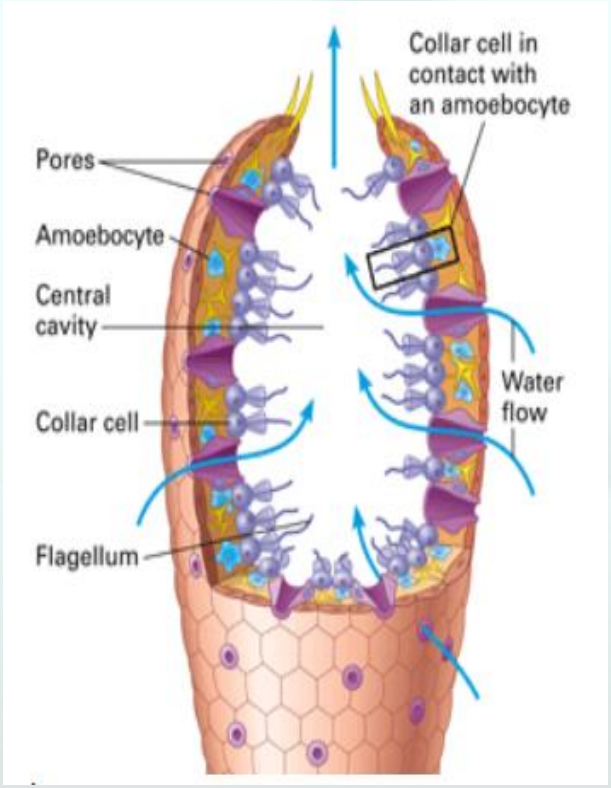
Phylum Porifera: Sponges

- **Simplest** of all animals
  - **Lack true tissues** and organs
- **Aquatic**, mostly marine
- **Lack** body **symmetry (asymmetrical)**
- Hollow, **Porous** bodies
- **Sessile:** generally remain anchored to their substrate.



Phylum Porifera: Sponges

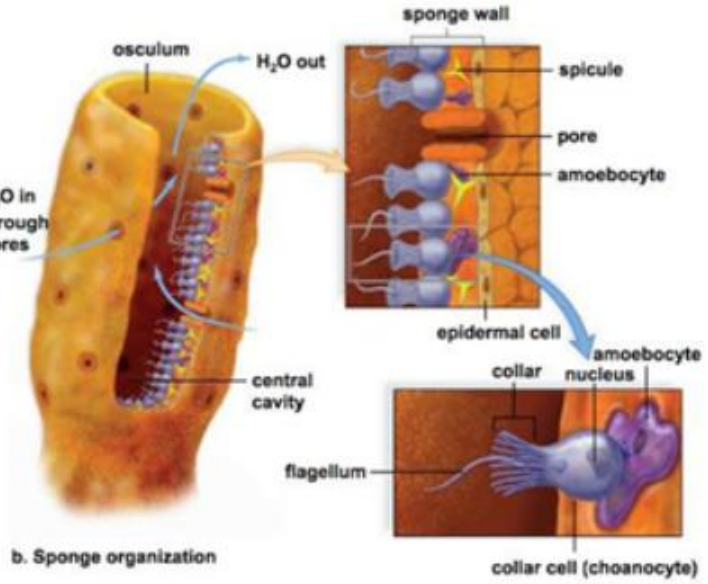
- Body wall has outer layer of flattened cells and inner layer of flagellated "collar cells".
- Between these two layers is a jelly-like matrix that has many types of cells embedded in it (amoebocytes).
- These cells digest food, store and transport nutrients, etc.



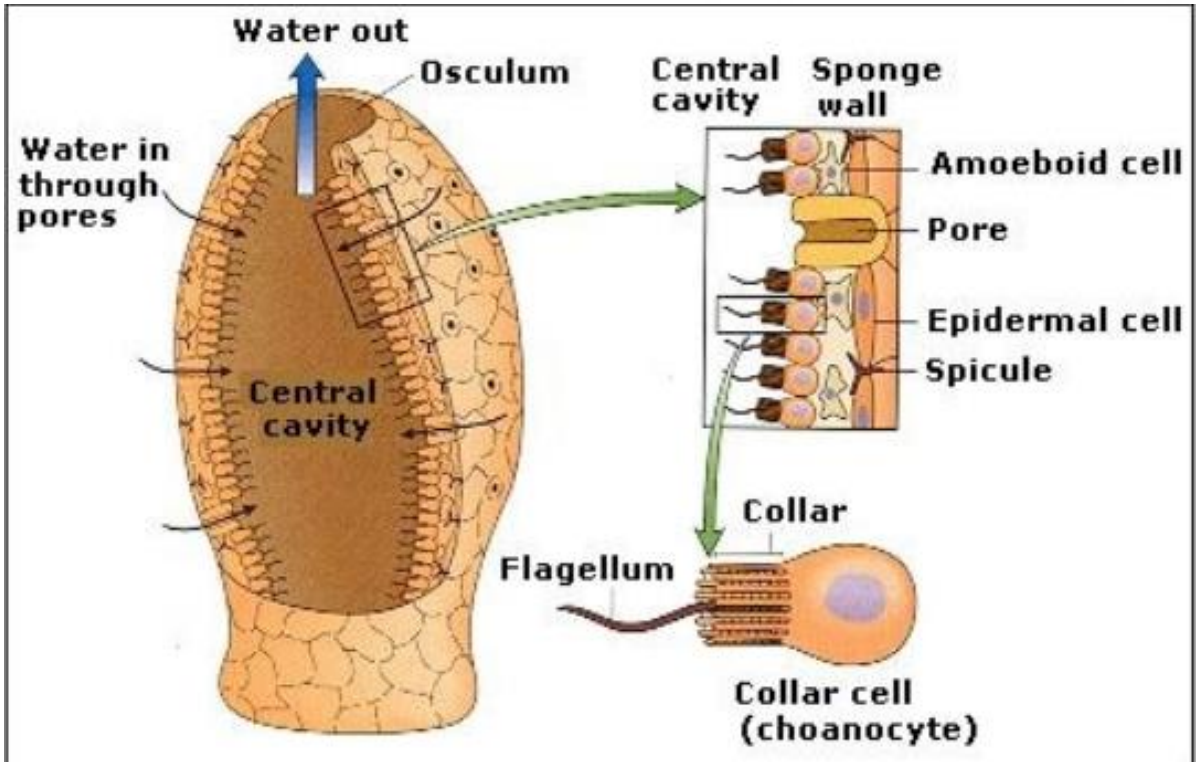
Porifera do not have a circulatory system.

Porifera have no coelom (acoelomate).

a. Yellow tube sponge, *Aplysina fistularis*



b. Sponge organization

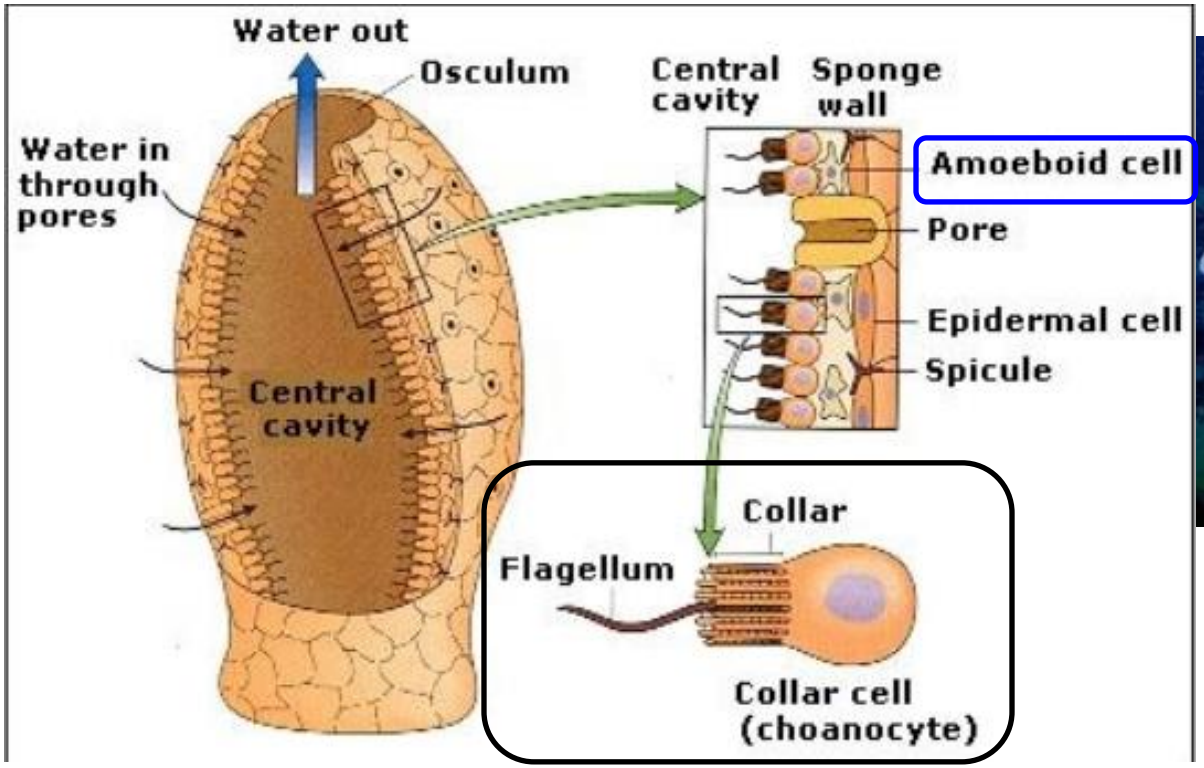


Porifera have no real body layers but they do have 2 cell layers:

- an outer layer that makes up the epidermis
- an inner layer that makes the inner cavities.

Porifera have specialized cells called choanocytes (collar cells). Choanocytes have a flagella, which is surrounded by collar composed of cytoplasm. Flagella produce water current to capture food.

Amoebocytes are cells that perform similar tasks of a circulatory system and store nutrients.



Phylum Porifera: Sponges

Filter Feeders

Movement of flagella on collar cells produces a current of water into the sponge's central cavity.

- Food particles are trapped and distributed to other cells.
- Water and wastes exit through a large hole at the top.

Phylum Porifera: Sponges

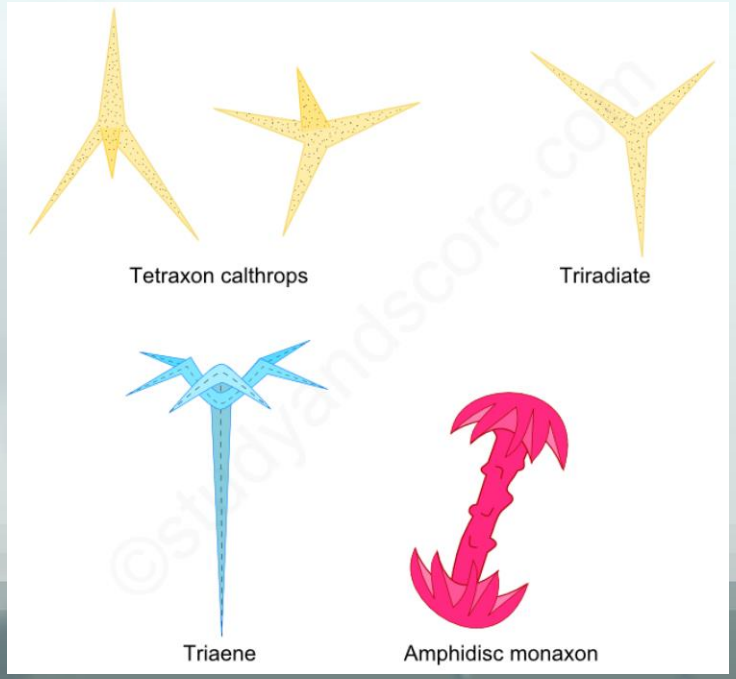
Porifera have both Asexual and Sexual reproduction.

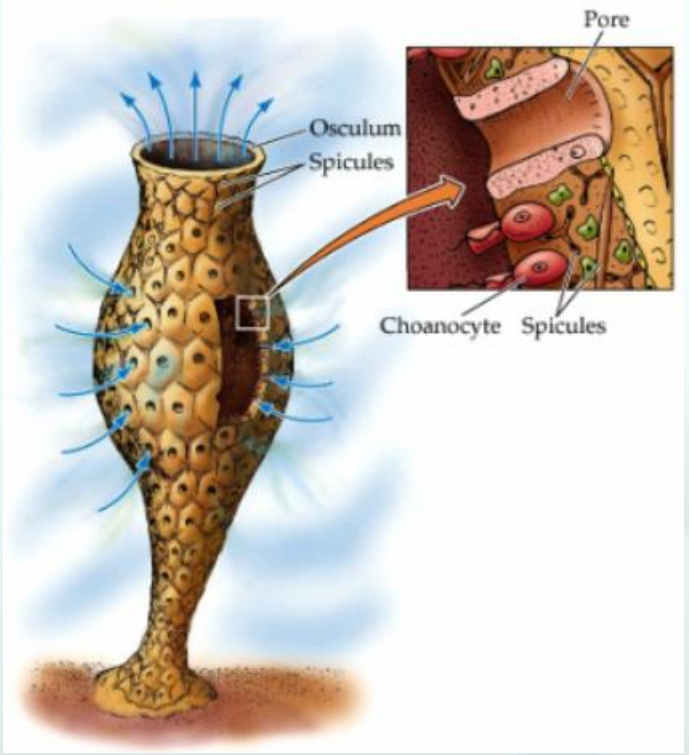
- **Hermaphrodites**
  - **Possess & release BOTH eggs and sperm into the water (SEXUAL reproduction).**
- **Sponges can reproduce asexually by BUDDING …** the unique ability of regeneration, a form of asexual reproduction. E.g. injury

Phylum Porifera: Sponges

"Skeleton"

- **Spicules** are microscopic crystalline structures that give rigidity and form.





Some spicules have toxic chemicals that help deter predators or catch prey.

Which branch of animals has the most species?

TRY IT

Sponges are phylum ___ and most are ___ (body symmetry). They are ___ (live in water) and ___ (attached to a substrate). They have no ___ tissues.

They are ___ (body cavity type). For circulation, digestion, and storage they have ___ cells and ___ and are called ___ feeders.

Sponges reproduce ___ with sperm and egg and are called ___ because they use both gametes. They reproduce ___ by ___ and can regenerate body parts.

Sponges' skeletal system for form and rigidity come from ___ , which can also capture ___ and deter ___ .

Which branch of animals has the most species?

invertebrates

TRY IT

Sponges are phylum porifera and most are asymmetrical (body symmetry). They are aquatic (live in water) and sessile (attached to a substrate). They have no true tissues.

They are acoelomate (body cavity type). For circulation, digestion, and storage they have collar cells and amoebocytes and are called filter feeders.

Sponges reproduce sexually with sperm and egg and are called hermaphrodites because they use both gametes. They reproduce asexually by budding and can regenerate body parts.

Sponges' skeletal system for form & rigidity come from spicules, which can capture prey and deter predators.

Phylum Cnidaria

Hydra, jellyfish, coral, & sea anemones

Phylum Cnidaria

Includes hydras, jellyfish, coral, sea anemones

Aquatic (mostly marine)

Radial symmetry

Body Plans: 2 Tissue Layers

- Ectoderm → protective & sensory
- Endoderm → nutritive, glandular, digestion
- Mesoglea → nerve network

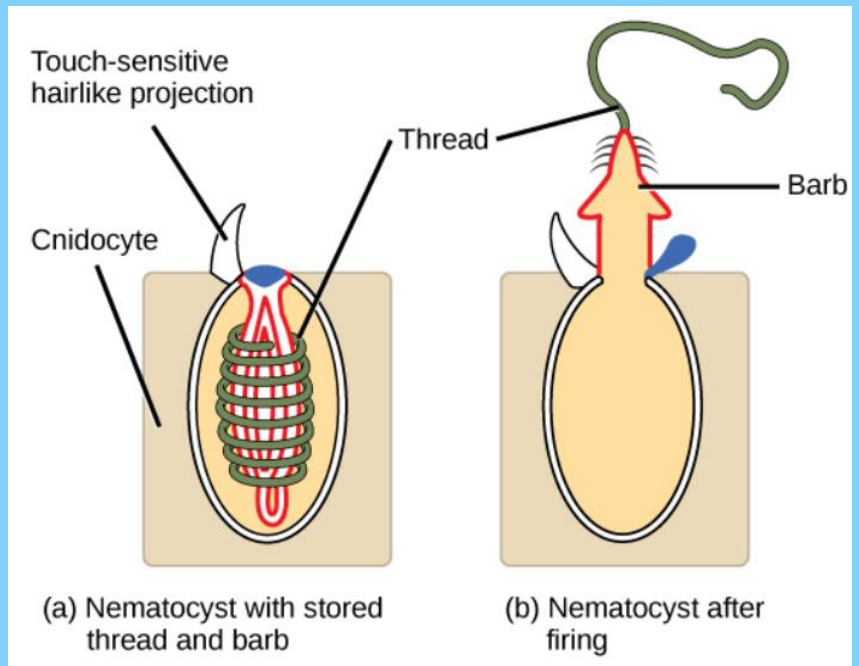
Gastrovascular cavity → 2-way digestion

- Acoelomate
- Mouth surrounded by tentacles.
- Nematocysts: (stinging cells)

Phylum Cnidaria

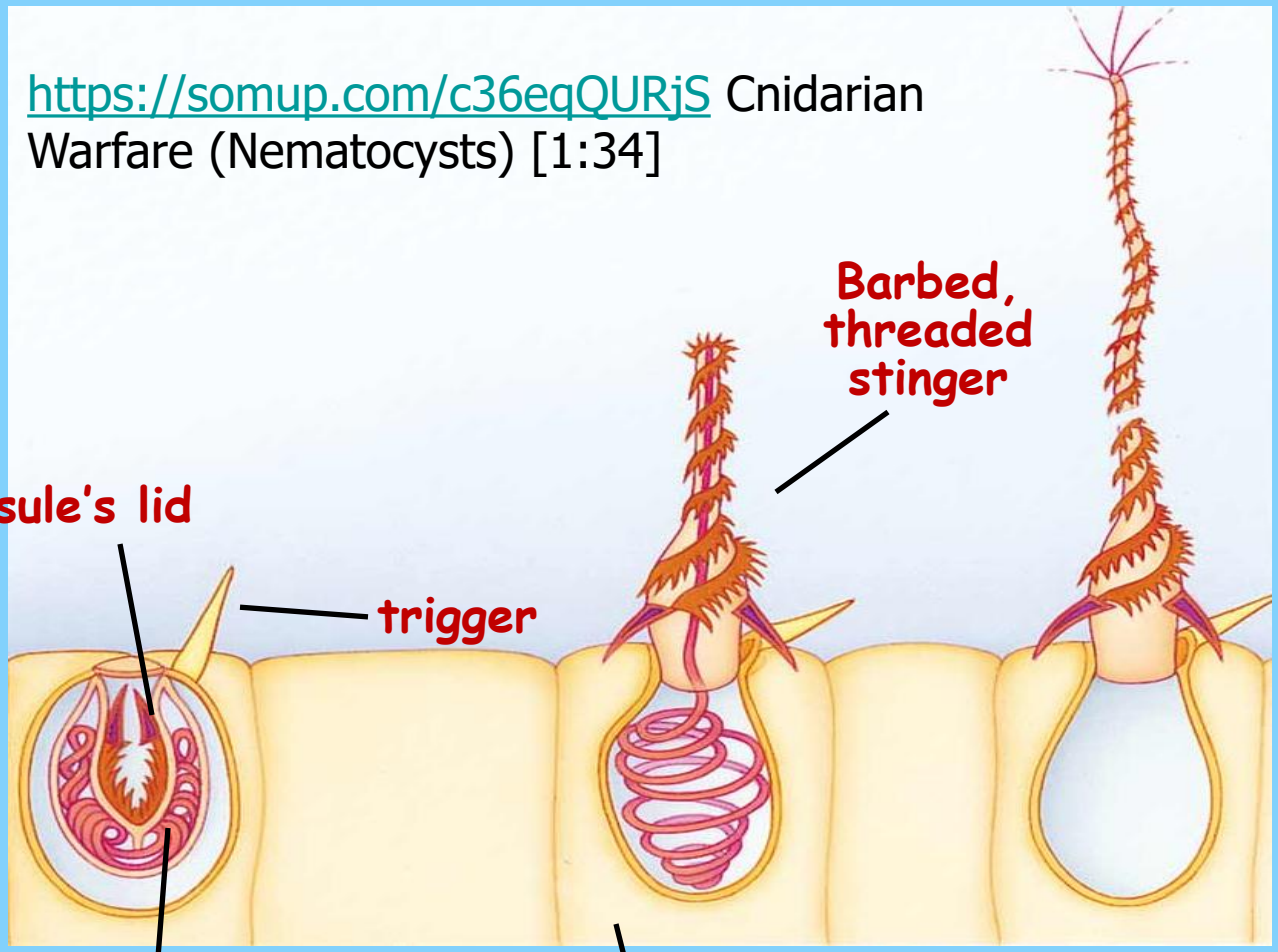
Feeding Habits

- Food is grabbed by tentacles and paralyzed with nematocysts to sting predators and prey.
- CNIDOCYTES (stinging cells) found in the Tentacles. Each has a Nematocyst that has a coiled, harpoon-like stinger that shoots out when triggered.



Nematocyst

https://somup.com/c36eqQURjS Cnidarian Warfare (Nematocysts) [1:34]

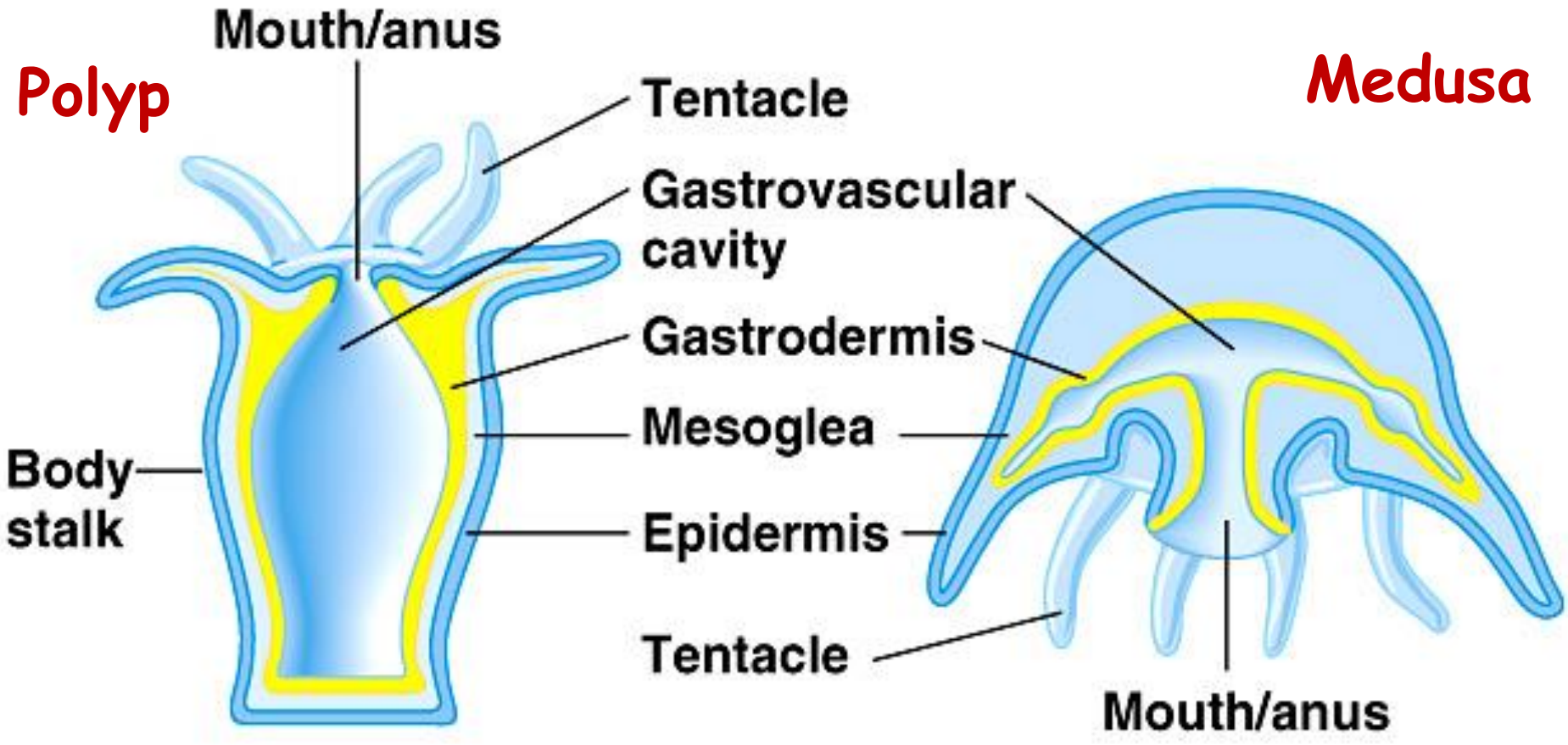


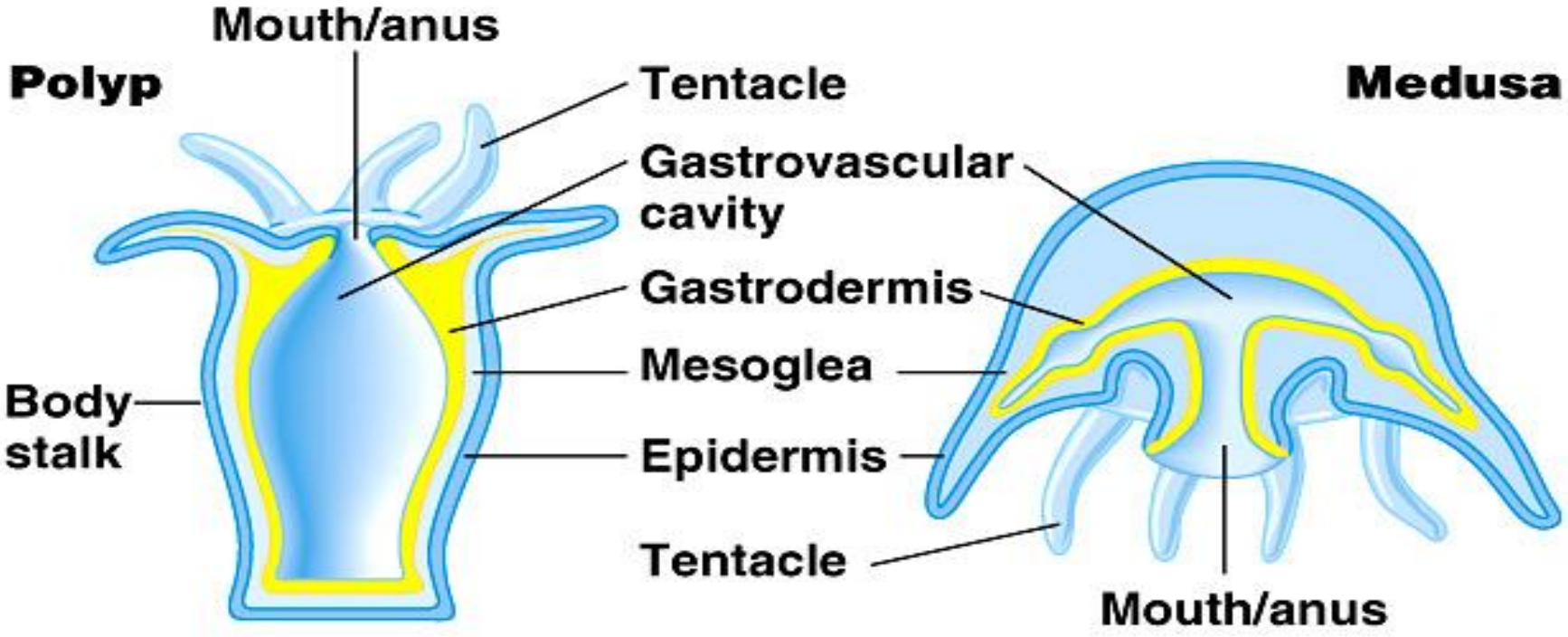
Phylum Cnidaria

Life Forms

POLYP: mouth directed **upward**; hydra, Coral

MEDUSA: mouth directed **downward**; Jellyfish





(a) Sea anemone: a polyp

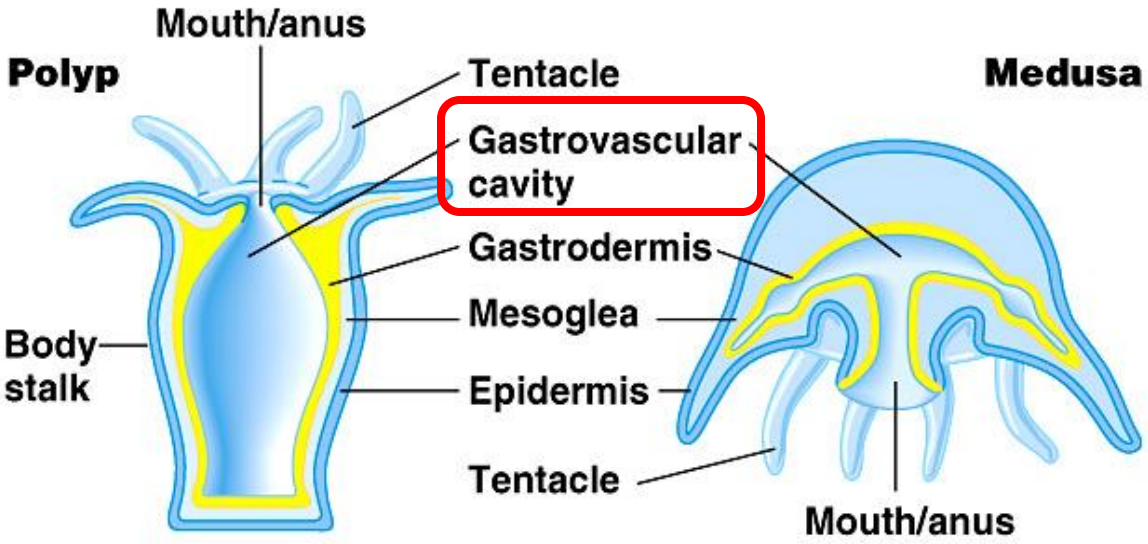
(b) Jelly: a medusa

Cnidarians have an incomplete digestive system with only one opening; the **gastrovascular cavity** serves as both a mouth and an anus.

Cnidarians carry out EXTRACELLULAR DIGESTION, where enzymes break down the food particles and cells lining the gastrovascular cavity absorb the nutrients.

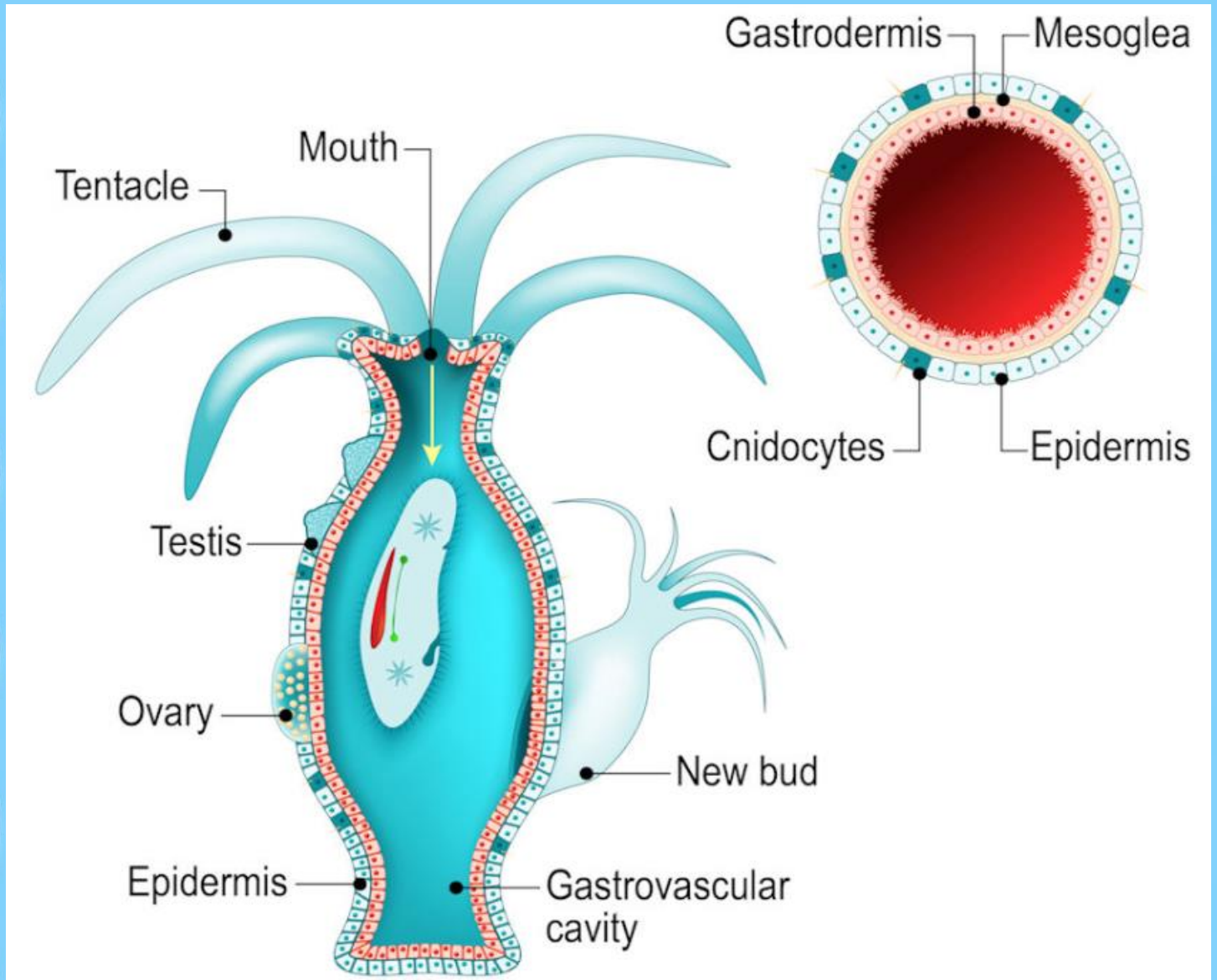
An advantage of extracellular digestion is the capacity to eat larger food particles.

https://somup.com/c36eqgURXL (4:49) Cnidarians General Features



Phylum Cnidaria

Anatomy (polyp)



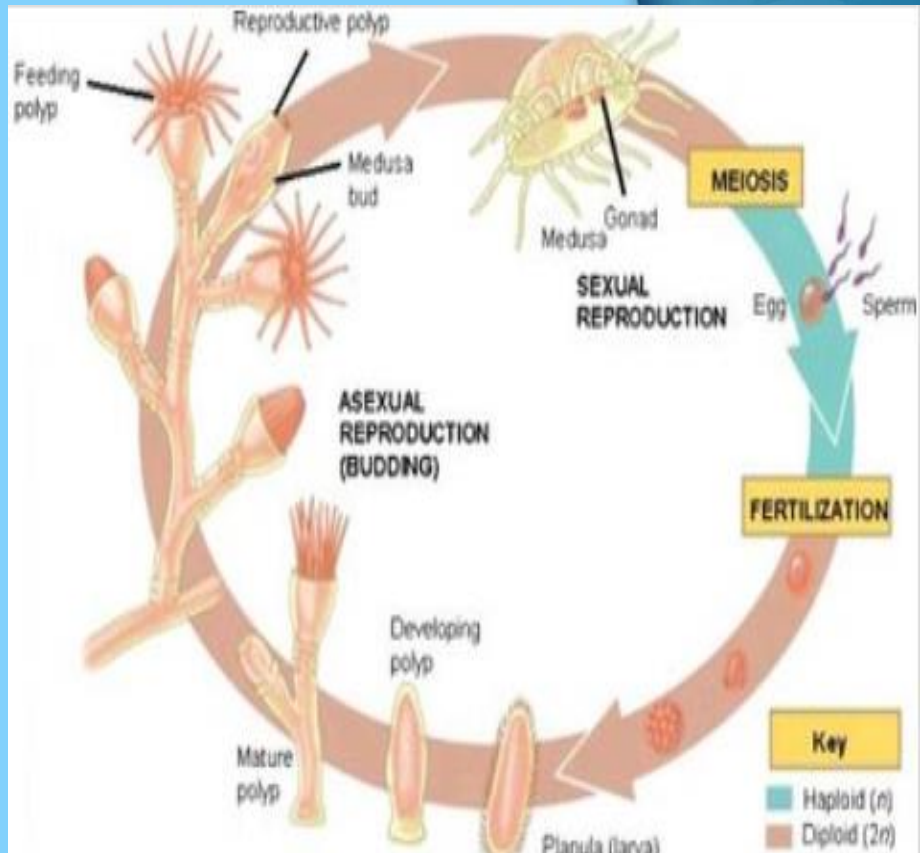
Phylum Cnidaria

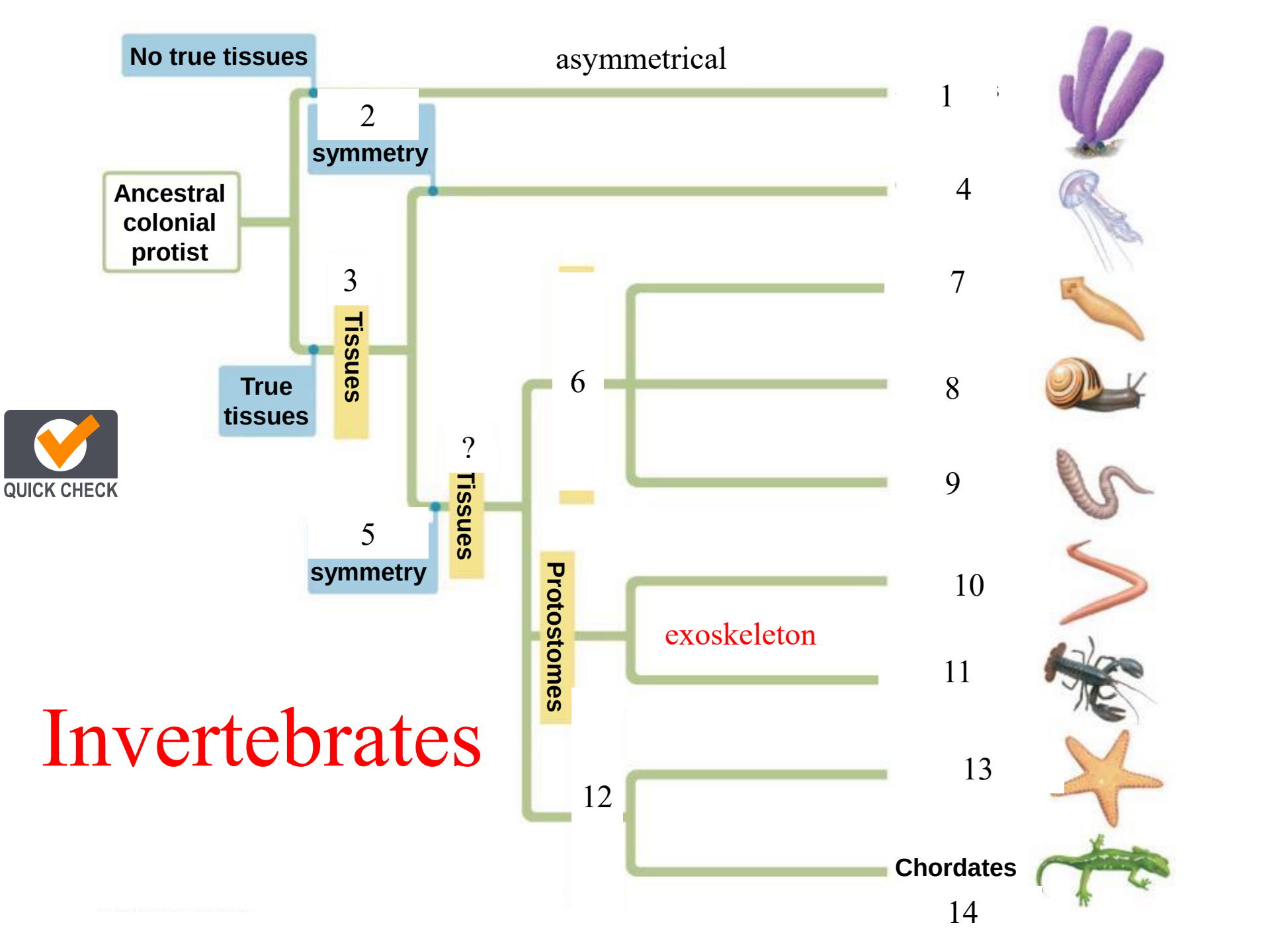
REPRODUCTION

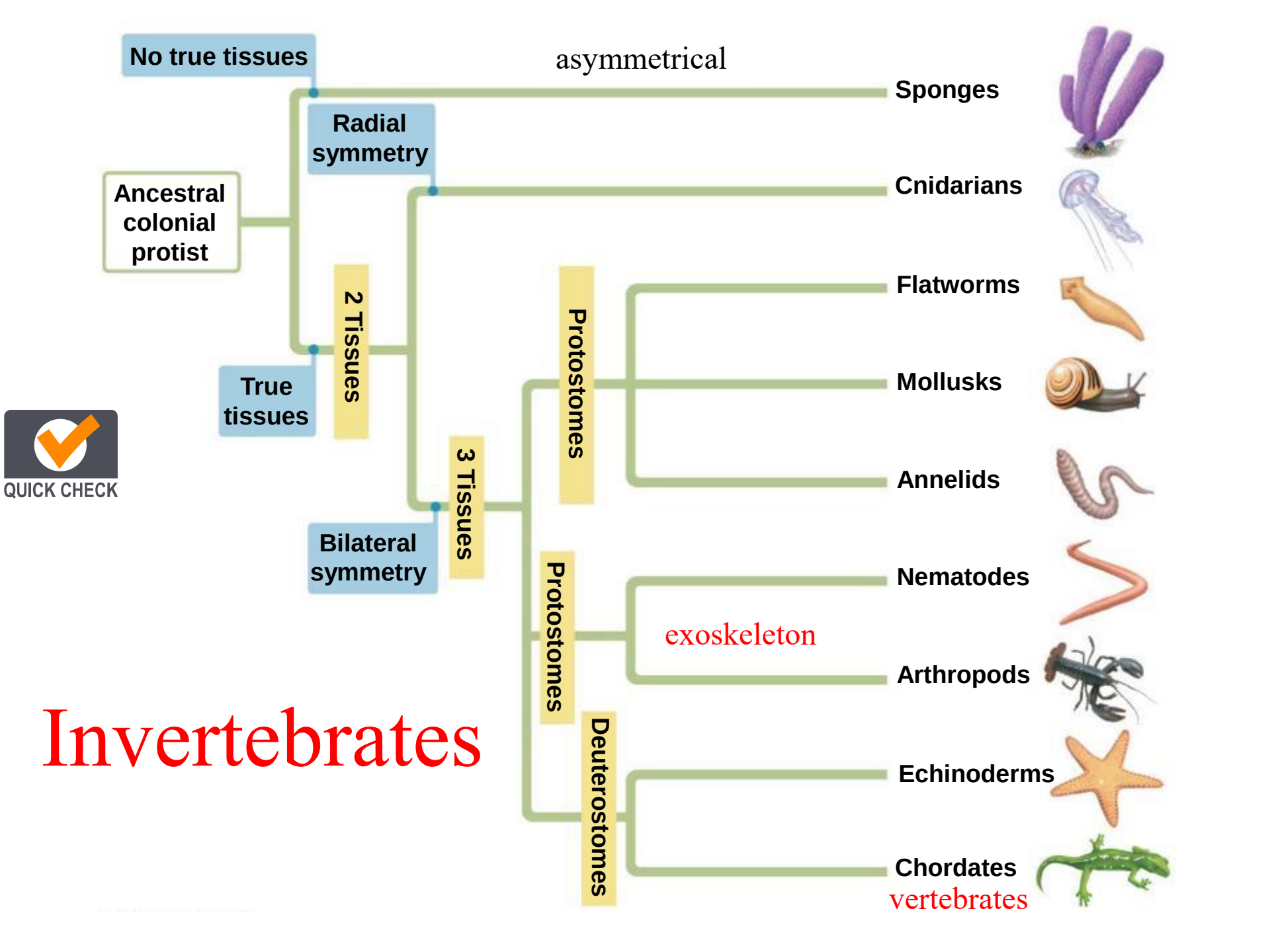
Cnidarians reproduce **both sexually and asexually**.

Some species can produce both eggs and sperm in the same organism. These organisms are called simultaneous hermaphrodites and release gametes into the ocean in egg-sperm bundles.

Some species are also either male or female and produce either eggs or sperm.




No true tissues
asymmetrical
2
symmetry
Ancestral colonial protist
3
Tissues
True tissues
?
Tissues
5
symmetry
6
Protostomes
exoskeleton
12
1
4
7
8
9
10
11
13
Chordates
14
QUICK CHECK
Invertebrates


No true tissues
asymmetrical
Sponges
Radial symmetry
Ancestral colonial protist
Cnidarians
2 Tissues
Flatworms
Protostomes
True tissues
Mollusks
3 Tissues
Annelids
Bilateral symmetry
Nematodes
Protostomes
exoskeleton
Arthropods
Deuterostomes
Echinoderms
Chordates
vertebrates
QUICK CHECK
Invertebrates

Animal Phyla Project

- Download the worksheet.
- Download the PowerPoint template.
- Secure “google drive” access.