Biology 40S

Unit #4 Organizing Biodiversity

Domain Eukarya (3)

"Organizing Kingdom Animalia"

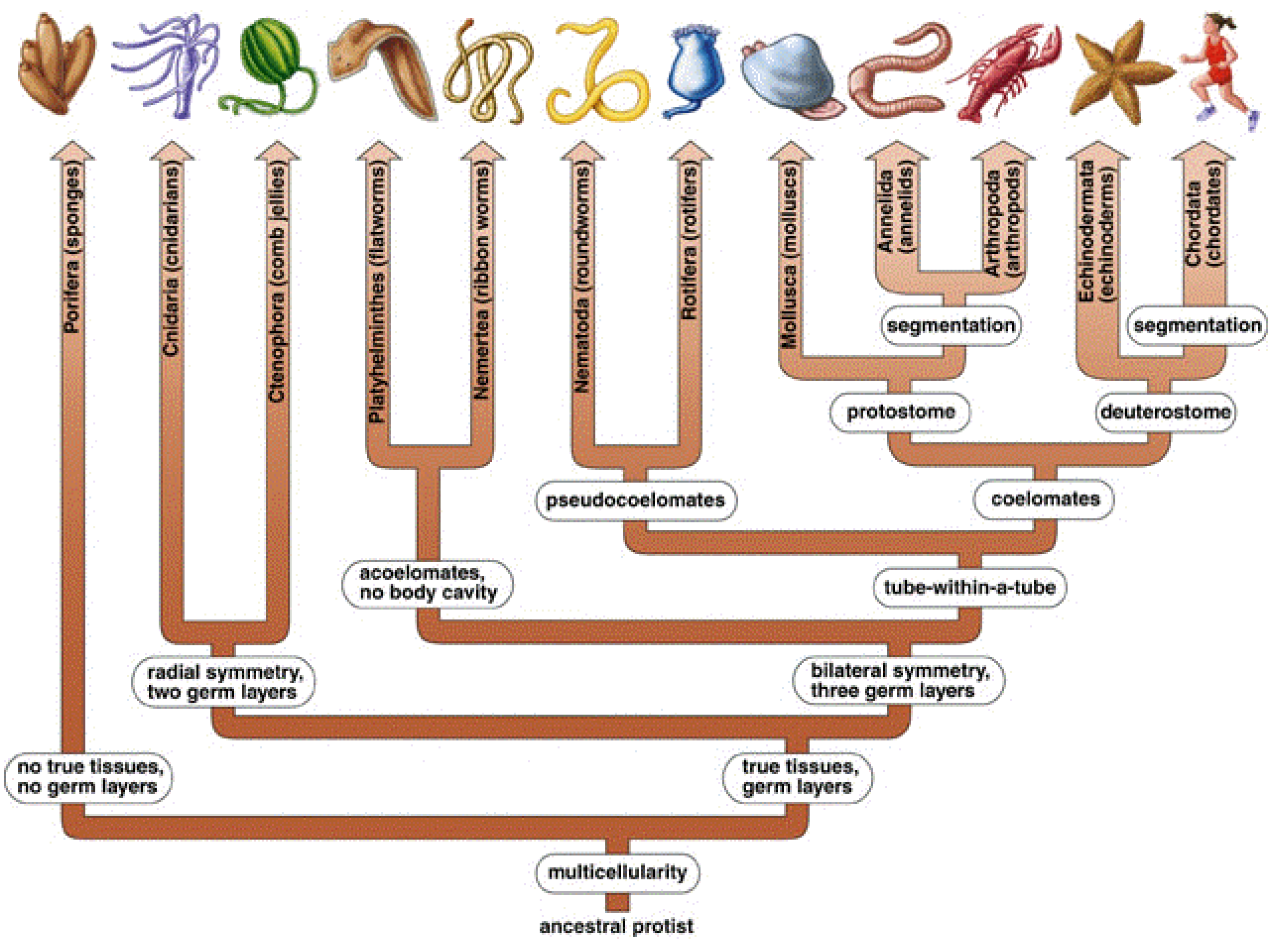
What is an Animal?
How do we organize and classify members of the Animal Kingdom?

Organizing Kingdom Animalia

- The Animal Kingdom is an extremely diverse collection of organisms with a wide range in degree of complexity

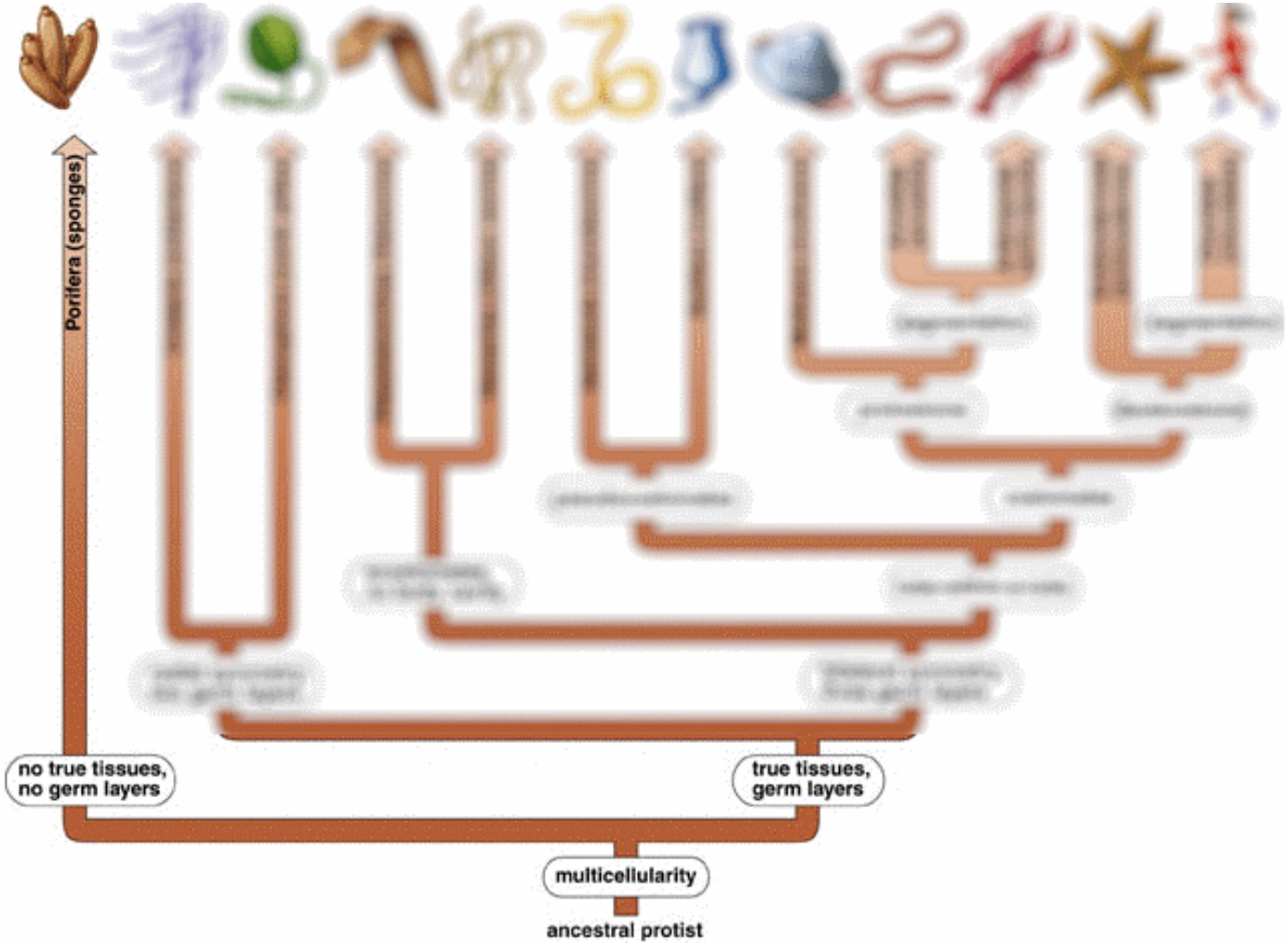
- The 9 major Animal Phyla are organized based on four degrees of complexity:

1. **Cellular Organization**
   - Does the animal have true tissues and germ layers?
2. **Tissue Organization**
   - How many germ layers does the animal have and how are the tissues arranged?
3. **Organ Organization**
   - Does the animal have a body cavity?
   - How complex are the animals' organ systems?
   - How did the animal embryo develop?
4. **Segmentation**
   - Does the animal have specialized regions of their bodies?
   - Vertebrate of Invertebrate?


Porifera (sponges)
Cnidaria (cnidarians)
Ctenophora (comb jellies)
Platyhelminthes (flatworms)
Nemertea (ribbon worms)
Nematoda (roundworms)
Rotifera (rotifers)
Mollusca (molluscs)
Annelida (annelids)
Arthropoda (arthropods)
Echinodermata (echinoderms)
Chordata (chordates)
segmentation
segmentation
protostome
deuterostome
coelomates
pseudocoelomates
acoelomates, no body cavity
tube-within-a-tube
radial symmetry, two germ layers
bilateral symmetry, three germ layers
no true tissues, no germ layers
true tissues, germ layers
multicellularity
ancestral protist

Kingdom Animalia
organized at the
Cellular Level

- The most basic forms of Animal life lack true tissues, organ and body section development
- These types of animals form the **Phylum Porifera**



Phylum Porifera

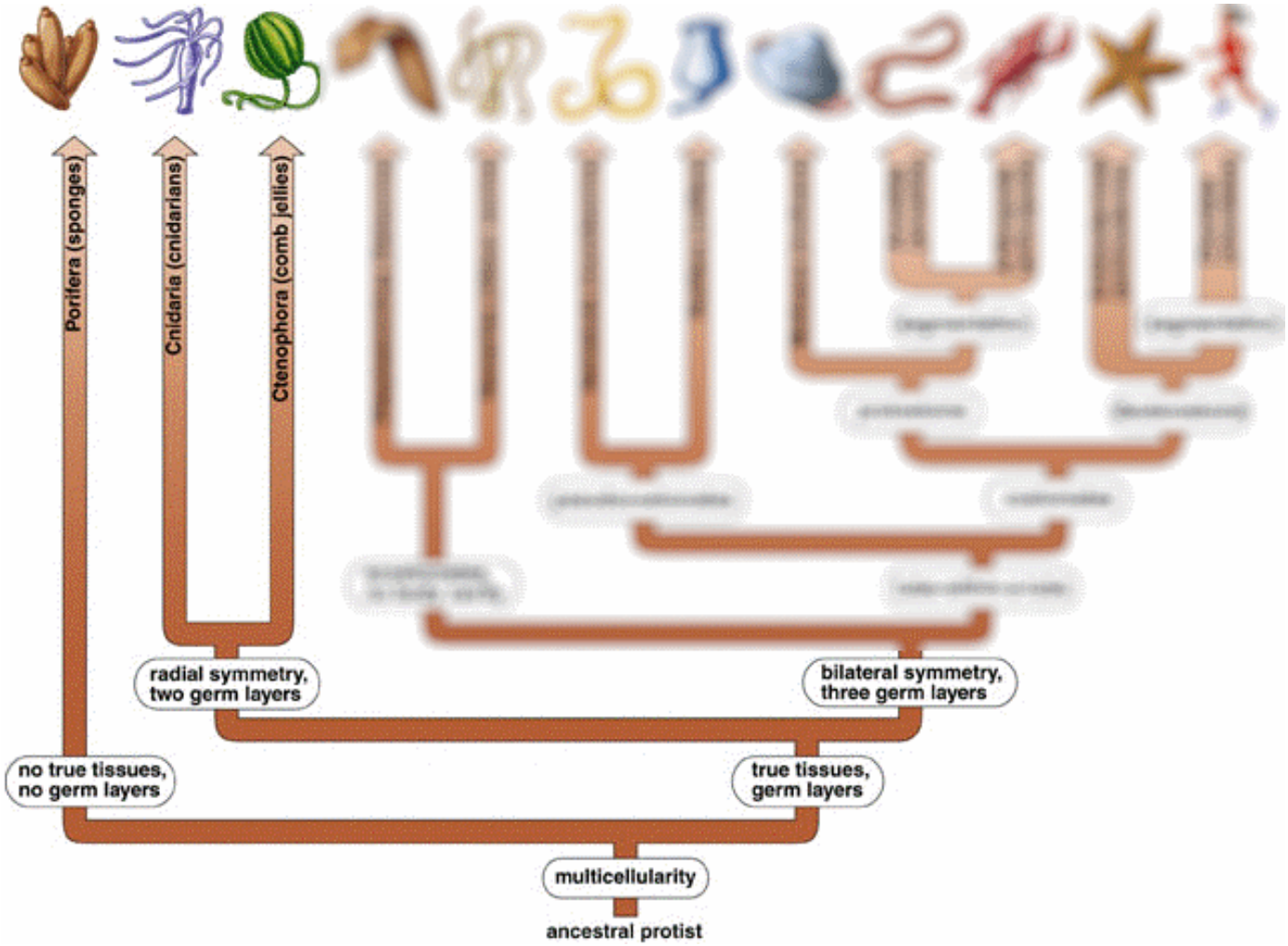
- **Sponges**
- simplest form of animal life
- live in water (aquatic)
- Do not move around (***non – motile***)
- no symmetry (***asymmetrical***)
  - No body plan
- Pores (holes) all over body
- 5000 species
- **Filter feeders**

- *Transport of Nutrients, Respiration and the Excretion of Nitrogen Waste, in these organisms are accomplished through* ***Diffusion***
- *Nervous System consists of* ***simple nerve nets*** *that allow the organism to detect heat and light*

- Examples: Tube Sponge, Glass Sponge, Sea Sponge

Kingdom Animalia
organized at the
Tissue Level

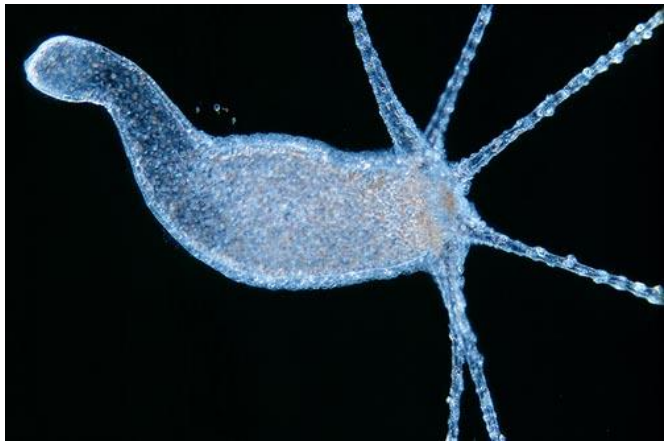
- Over time, animal life began to develop tissues from growing masses of eukaryotic animal cells
- **Tissues** are groups of cells with a specialized function
- With the development of tissues arose the development of **body plans**



Body Plans

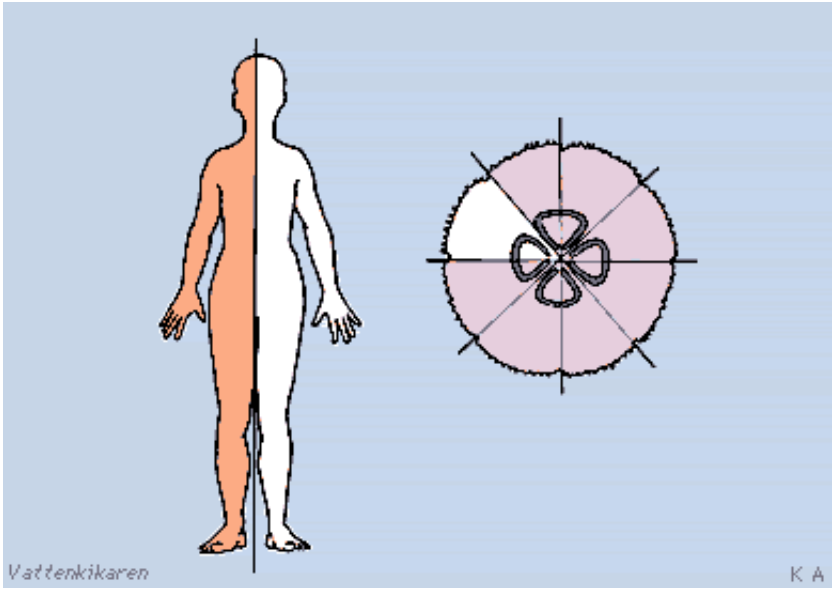
- Animals that are irregular in shape are asymmetrical.

- Animals that are regular in shape are symmetrical.



- An animal has **radial symmetry** if it can be divided along any plane, through a central axis, into equal halves.

- An animal has **bilateral symmetry** if it can be divided down its length into similar right and left halves forming mirror images of each other**.**



Which figure has bilateral symmetry?
Which has radial symmetry?

Evolutionarily Speaking…

- Bilateral Symmetry made Animal movement easier
  - Animals with Bilateral Symmetry could make directed movements which made it easier to avoid predators and hunt prey
- Bilateral Symmetry favoured the formation of more complex and centralized nervous systems
  - Animals with Bilateral Symmetry exhibited quicker and more precise response to stimulation
- Bilateral Symmetry favoured the development of digestive tracts
  - Animals with Bilateral Symmetry developed "tube in tube" digestive tracts with the mouth at one end and the anus at the other in most cases
- Most Animal Phyla are Bilaterally Symmetrical
- **Phylum Cnidaria** is the only **Radially Symmetrical** Animal Phyla

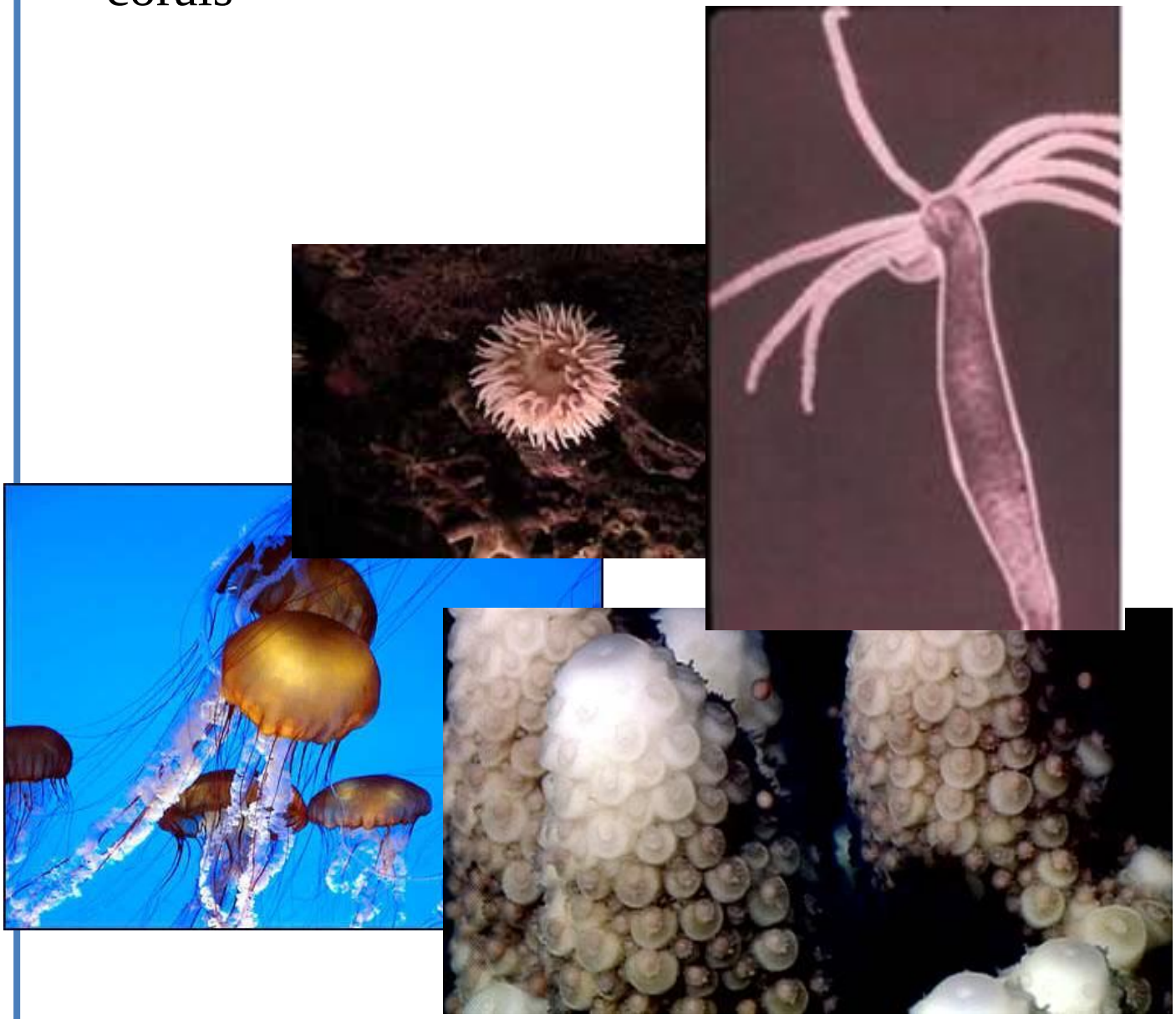
Phylum Cnidaria

- **Live in water**
- Most have tentacles (*tissue)*
- catch food with stinging cells called nematocysts
- **gut for digesting** *(sac digestive systems)*
- *Respiration, Excretion of Nitrogen Waste are done via* ***Diffusion***
- *Have* ***Centralized Nervous Systems*** *to coordinate movements of tentacles*

2 different shapes

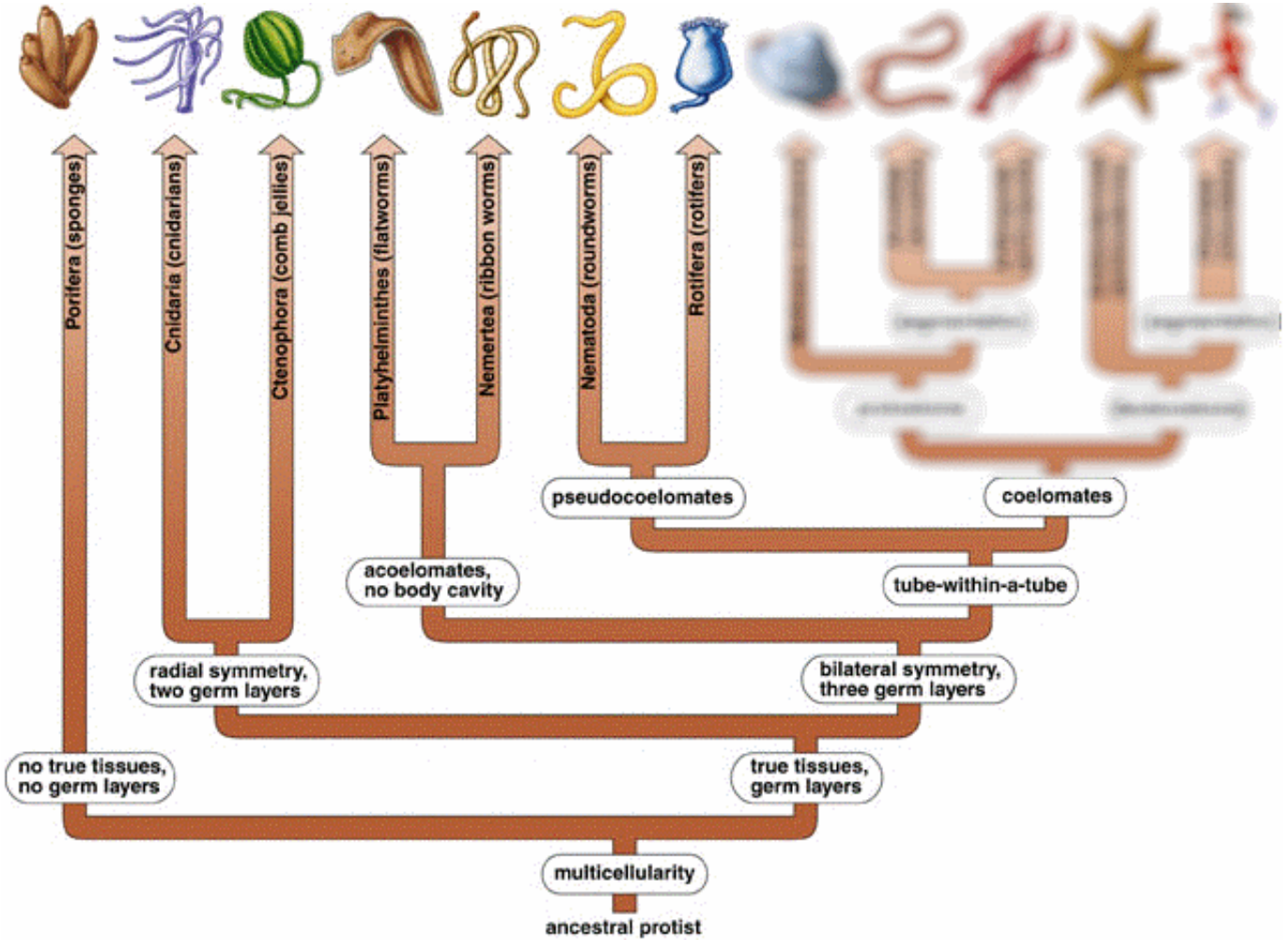
- *Medusa* - like a jellyfish
- *Polyp* - like a hydra

- Examples - Jellyfish, Hydra, sea anemones, and corals



Kingdom Animalia
organized at the
Organ Level

- Over time, animal life began to develop organs from growing masses of tissues
- Animal life diverged in complexity at this level due to:
  1. **The Emergence of Body Cavities**
  2. **The Manner in which the Body Cavity is Formed (Embryonic Development)**

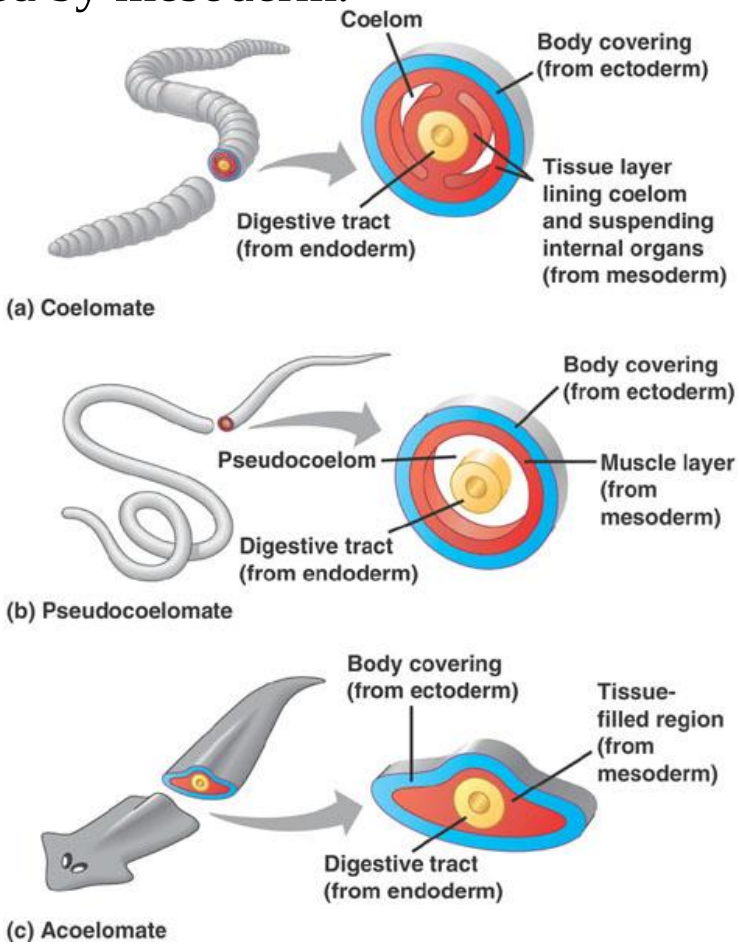


Evolutionarily Speaking about the presence of a Body Cavity…

- Most animals develop from a zygote becoming a single layer of cells surrounding a fluid-filled space forming a hollow ball of cells called a **gastrula.**

- The gastrula is made up of three parts:
  - **Ectoderm**, a layer of cells on the outer surface of the gastrula, grows and divides developing into skin and nervous tissue.
  - **Endoderm,** a layer of cells lining the inner surface of the gastrula, develops into the lining of the animal's digestive tract.
  - **Mesoderm,** made up of two layers of cells lying between the ectoderm and endoderm, forms muscles, reproductive organs and circulatory vessels.

- **Acoelomates** – animals have three cell layers with a digestive tract but no body cavities.
- **Pseudocoelomates** – animals with a fluid-filled body cavity partly lined with mesoderm.
- **Coelomates** – animals with a body cavity completely surrounded by mesoderm.



- Animals with **Coelomes** (body cavities) have the space to develop organ systems
  - Coelomates often have a more complex nervous system, digestive system, respiratory system, circulatory system and reproductive system than acoelomates
  - ***Members of Phylum Mollusca*, *Echinodermata, Annelida, Arthropoda and Chordata are Coelomates***

- Animals with **Pseudocoelomes** (fluid filled body cavities) tend to have space to develop more complex digestive and nervous systems
  - ***Members of Phylum Nematoda are Pseudocoelomates***

- **Acoelomate** Animals (no body cavities) tend to have specialized tissue and developed nervous systems but lack the space to develop organ systems
  - ***Members of Phylum Platyhelminthes are Acoelomates***

Phylum Plathelminthes

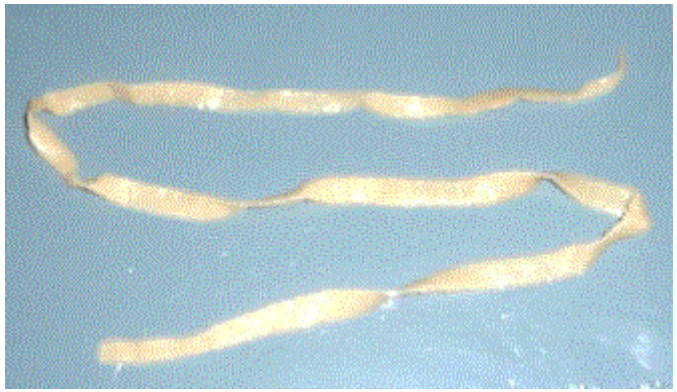
- **Flatworms**
- Flat, ribbon-like body
- Live in water or are parasites
- ***Exhibit bilateral symmetry***
- ***Acaolomate*** *(no body cavity)*

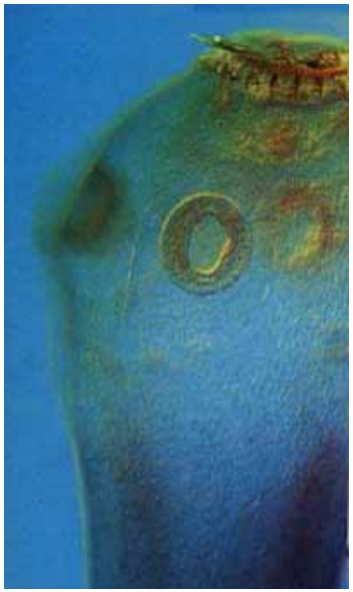
Examples: Planaria

- eyespots detect light
- food and waste go in and out the same opening

Examples: Tapeworm

- Parasite that lives in intestines of host absorbing food





Examples: Fluke

- **parasite**
- lives inside of host

Phylum Nematoda

- **Roundworms**
  - Round, tubular body, ***pseudocoelomate***
  - small or microscopic
  - ***Exhibit bilateral symmetry***
  - ***have both a mouth and anus***
  - Live in water or are parasites

Examples:

- Hookworm

- Trichinella

Evolutionarily Speaking about the way a Body Cavity (Coelom) is formed…

(embryonic development)

- Most animals develop from a zygote becoming a single layer of cells surrounding a fluid-filled space forming a hollow ball of cells called a **gastrula.**

- The gastrula is made up of three parts:
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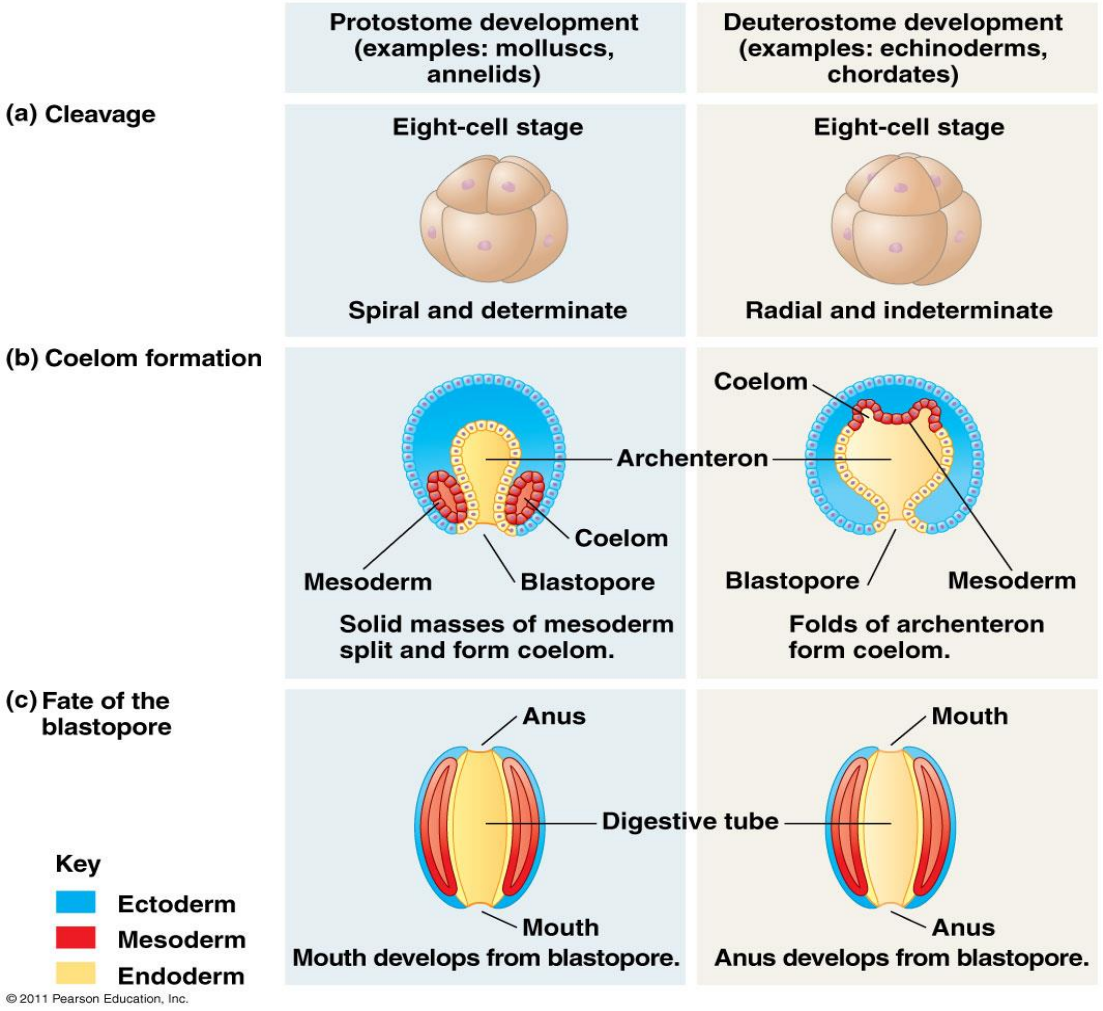
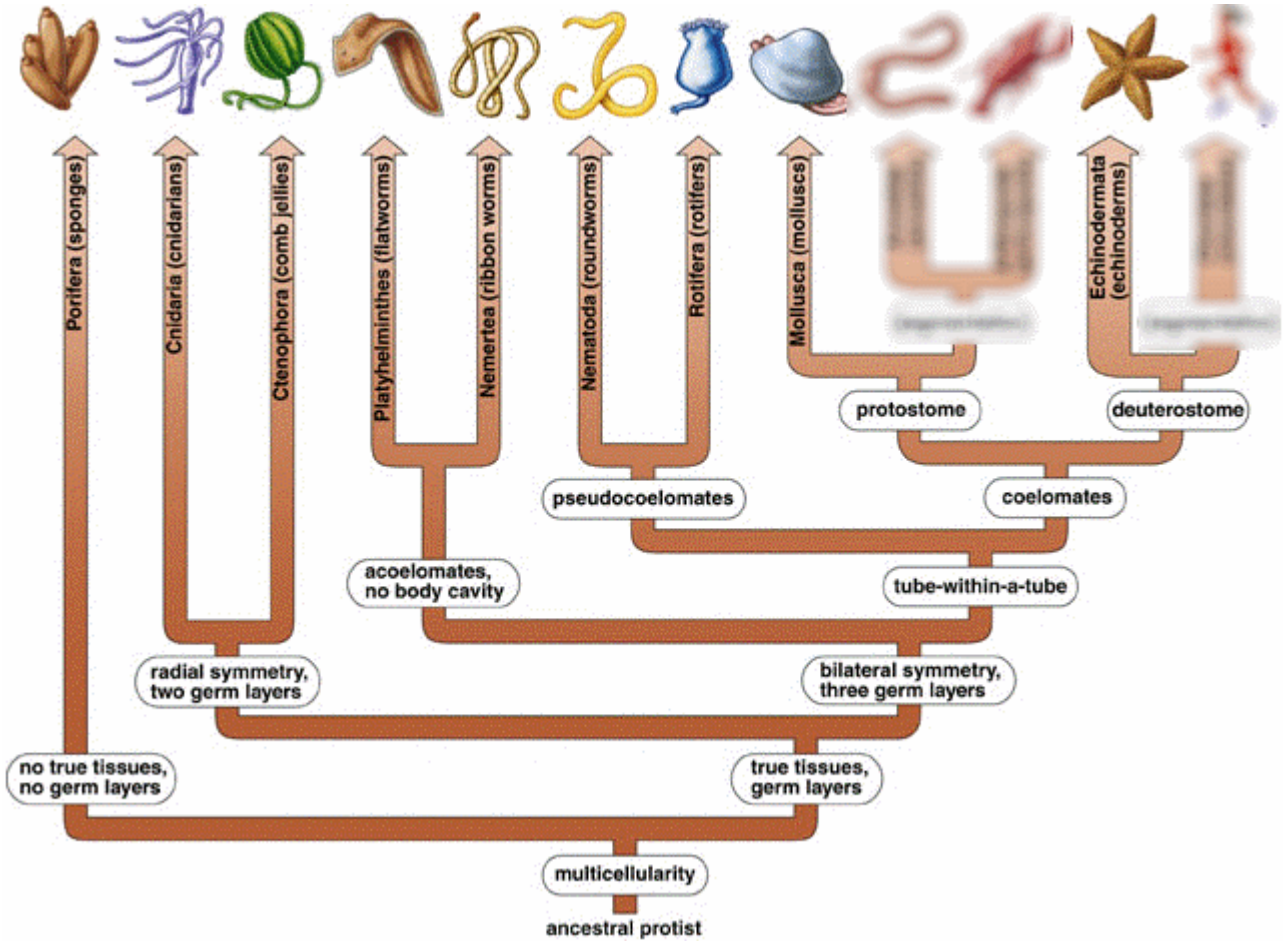
- Animals that develop a **mouth first** from the indented space in the gastrula are **protostomes.**

- Animals that develop an **anus first** from the opening in the gastrula are **deuterostomes.**



- In **Protostomes** the cells of the gastrula are **differentiated** (already have specific jobs)
  - The fate of the tissue formed from these cells is determined as the cells are formed (less variation)

- In **Deuterostomes** the **undifferentiated** (unspecialized) until later stages of development
  - **Many of these cells remain undifferentiated and become Stem Cells**
  - The fate of tissues formed from these cells is **NOT** determined until later in development
  - This developmental process allows for the development of more complex body systems and larger and more complex body plans and body cavities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Phylum Mollusca

- Soft bodies
- Hard Shells
- Live on land or in water
- **have a circulatory system and a complex nervous system.**
- Important food source for humans

Class Gastropoda

- **snails and slugs**
- may have 1 shell
- stomach-footed - move on stomach

Class Bivalves

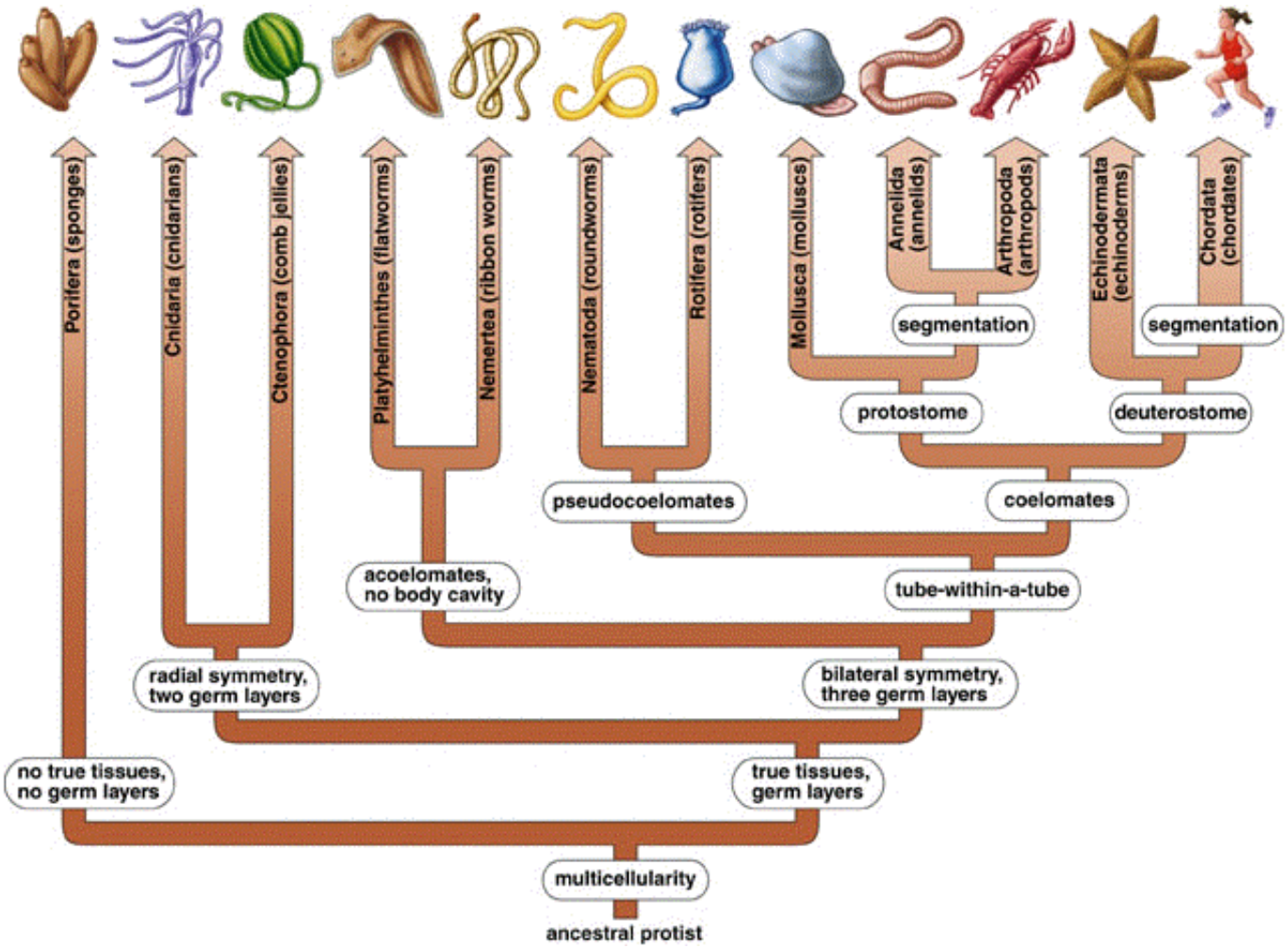
- 2 shells hinged together
- **clams, oysters, scallops and mussels**

Class Cephalopods

- **squids and octopuses**
- internal mantel

Kingdom Animalia
organized by
Segmentation

- Animal life's final leap in complexity occurs as body cavities (coeloems) are divided into functional units



Evolutionarily Speaking about Segmentation

In Annelids

- Segmentation developed as the creation of independent, repetitive subunits.
- This form of segmentation allowed annelids to function more efficiently

In Arthropods

- Segmentation developed as the creation of three distinct and specialized regions
  1. The Head which contains the brain, eyes antenna and jaw
  2. The Thorax which contained jointed appendages, wings, legs, and limbs
  3. The Abdomen which contained digestive and reproductive systems

In Chordates

- Segmentation developed at the **embryonic level.**
- This form of development led to more complex and integrated cephalic (head), thoracic and abdominal regions

Protection and Support

- Though not all animals have a skeleton, those that do can be divided into two groups:
  - Those with an **exoskeleton** – a hard, waxy coating on the outside of the body that protects internal organs, provides a framework for support, and a place for muscle attachment.
  - Those with an **endoskeleton** – support framework within the body that protects some organs and a brace for muscles to pull against.

Invertebrates

- No backbones
  95% of all animals are in this group

Phylum Annelida

- **Segemented worms**
- Body divided into segments(sections)
- Live in water or underground
- have a nervous and circulatory system

Class Earthworms

- eat soil and breakdown organic matter, wastes provide nutrients to soil

Class bristleworms

Class leeches

- parasites that feed on blood of other animals

Phylum Arthropoda

- Body divided into sections/segments
- Exoskeleton
- Jointed legs
- well developed nervous system
- **largest group of organisms on earth**

3 subphylums:

- Classified into classes according to the number of legs, eyes and antennae they have.

Subphylum Chilicerata

is divided into 3 classes

Arachnida – spiders, scorpions, ticks, mites

Merostomata – horseshoe crabs

Pycnogonida – sea spiders

Subphylum Crustacea

5 Classes

- Aquatic ones have gills
- 2 antennae
- 2 body regions or segmented
- **Shrimp, lobsters, crabs, barnacles, isopods**
- Many species taste delicious in butter

Subphylum Uniramia:

3 classes

- Class **Insecta** (insects)
  - no antennae
  - 3 pairs of legs
  - 2 body regions - head, thorax & abdomen
  - grasshoppers, ants, butterflies, bees

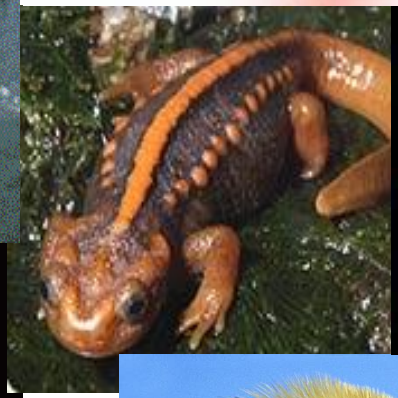
- Class **Diplopoda** (Millipedes)
  - segmented animals
  - Have 2 pairs of legs per segment
  - Primarily herbivores & decomposers

- Class **Chilopoda** (Centipedes)
  - Centipedes Usually terrestrial carnivores
  - Have 1 pair of antennae
  - Are often poisonous, using modified front claws to immobilize prey

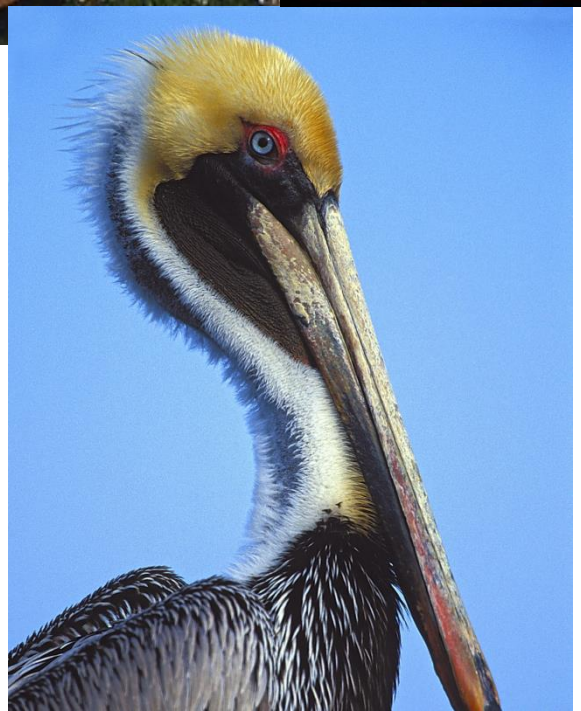
Phylum Chordata

- **Vertebrates**
- 5 classes
  - Fish
  - Mammals
  - Reptiles
  - Amphibians
  - Birds



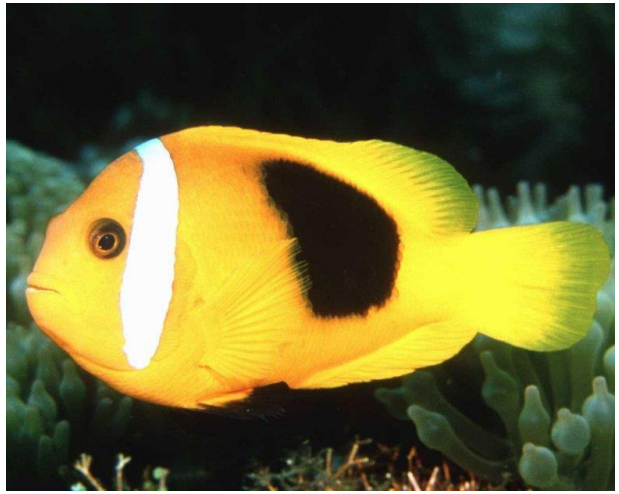







Fish

- Aquatic
- Cold-blooded
- Body covered with wet and slimy scales
- Streamline body for easy movement through water
- Fins for balance and to control movement
- Gills for breathing
- External fertilization



Reptiles

- **Cold-blooded**
- Body covered with dry, hard scales
- Live on land
- Breathe with lungs
- Internal fertilization; lay shelled eggs

Amphibians

- **Cold-blooded**
- Moist, scaleless skin
- Limbs present
  - tetrapods
- Larvae (tadpoles) use gills for breathing; adults use lungs
- External fertilization

Birds

- **Warm-blooded**
- With feathers
- With wings
- Beak for feeding
- Lungs for breathing
- Internal fertilization; lay shelled eggs

Mammals

- **Warm-blooded**
- Hairs on skin
- Females have mammary glands for producing milk
- Lungs for breathing
- Diaphragm present
- Internal fertilization; embryos develop inside mothers' bodies