

What is Taxonomy?

- Taxonomy is the science of naming and classifying things.
- In biology this refers to organizing species into different groups.

Carolus Linnaeus



father of taxonomy

- Carolus Linnaeus (1707-1778) was a Swedish scientist who grouped living things into *hierarchical* categories.
- Linnaeus based his system on **observable characteristics**, and introduced the seven levels of classification.

Linnaeus' classification system

- Each level is included in the level above it.
- Levels get increasingly specific from kingdom to species.



- The complete classification of humans is:

Kingdom **Animalia**

Phylum **Chordata**

Class **Mammalia**

Order **Primates**

Family **Hominidae**

Genus **Homo**

Species **Sapiens**



Devil Cat



Ghost Cat



Mountain Lion



Screaming Cat



Puma



Florida Panther



Cougar

- There are at least 50 common names for the animal shown on the previous slides.
- Common names vary according to region.

Binomial Nomenclature

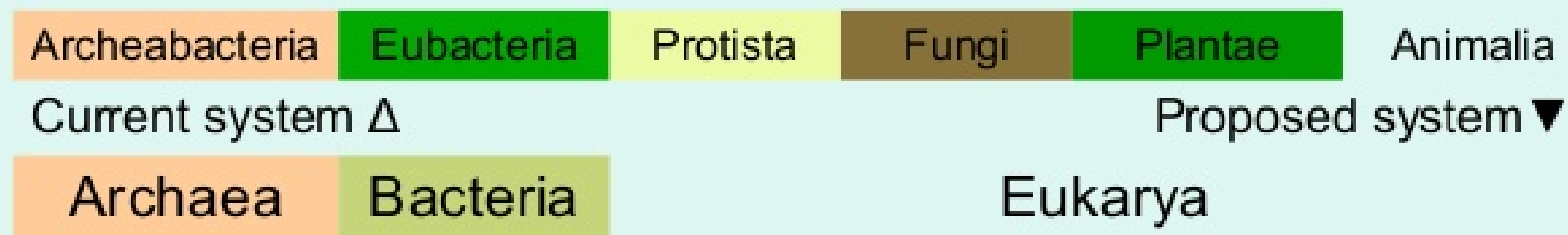
- Linnaeus also introduced the method of scientific naming called **binomial nomenclature**.
 - He identified each organism by using a combination of its **Genus** and **Species** name.
 - He made sure that **no two** creatures had the same combination of genus & species name.
 - He used Latin (widely read by educated people at that time)
 - The genus name was always a Latinized noun, the species name was a Latin adjective.

The Six kingdoms

- Since Linnaeus' time there has been frequent debate about how many kingdoms are needed...
- Linnaeus recognized two: plants & animals
- Later, we separated the fungi from plants
- When microscopic organisms were discovered we added kingdom ~~protista~~.
- With bacteria we first added monera,
- But then divided monera into eubacteria and archaebacteria

The Domain System

- Some taxonomists have suggested that we replace Linnaeus' system of kingdoms with three "Domains"
 - Domain Bacteria (= Kingdom Eubacteria)
 - Domain Archaea (= Kingdom Archaeobacteria)
 - Domain Eukarya (Plants, Animals, Fungi, Protists)



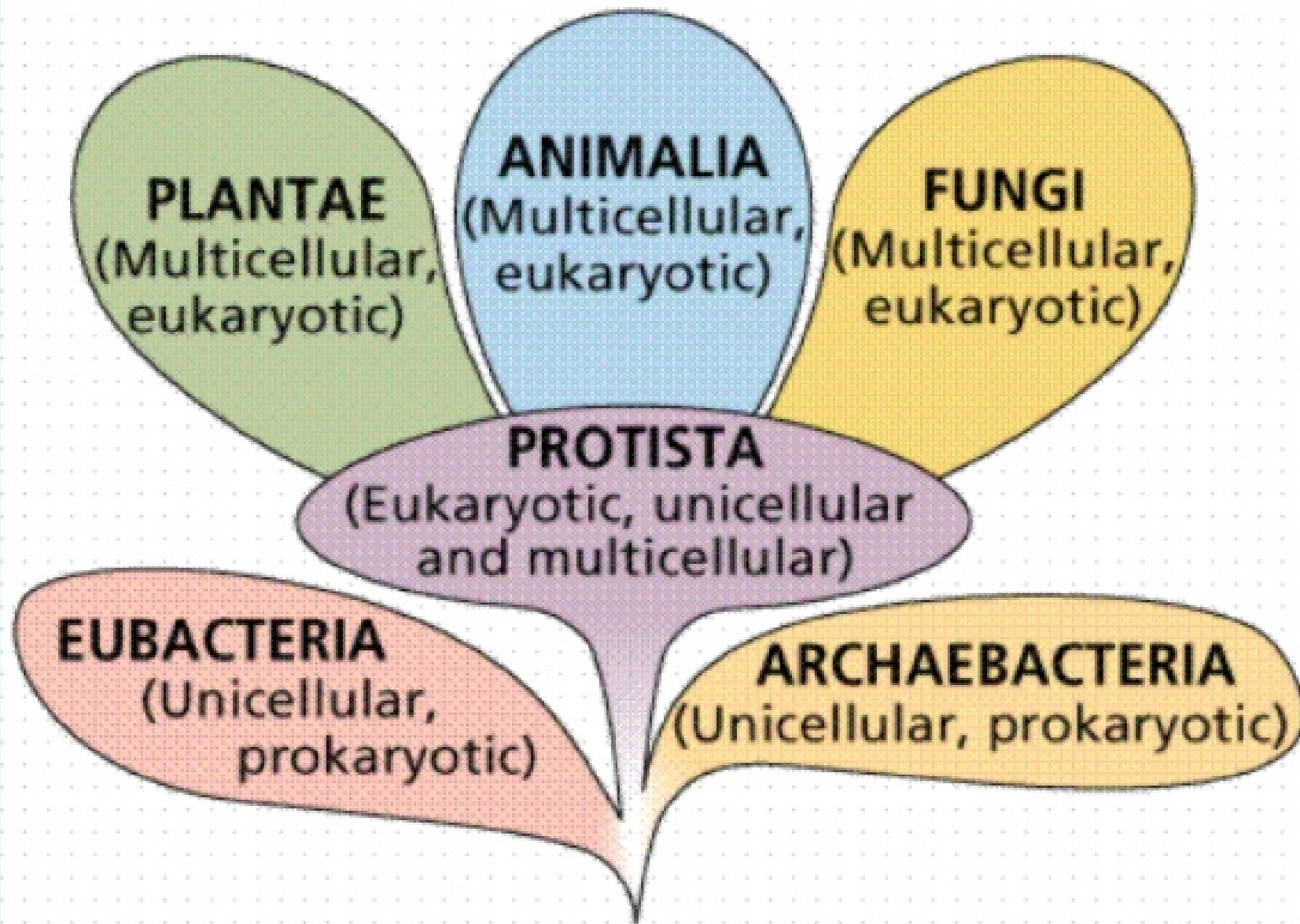
Systems of Classification

Linnaeus 1735 2 kingdoms	Haeckel 1866 3 kingdoms	Chatton 1937 2 empires	Copeland 1956 4 kingdoms	Whittaker 1969 5 kingdoms	Woese 1977 6 kingdoms	Woese etc. 1990 3 domains	Cavaliere-Smith 2004 6 kingdoms
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	Protista	Prokaryota	Mychota	Monera	Eubacteria	Bacteria	Bacteria
					archeabacteria	Archaea	(Archeabacteria)
		Eukaryota	Protoctista	Protista	Protista	Eukarya	Protozoa
Vegetabilia	Plantae			Fungi	Fungi		Chromista
			Plantae	Plantae	Plantae		Fungi
Animalia	Animalia		Animalia	Animalia	Animalia		Plantae
							Animalia

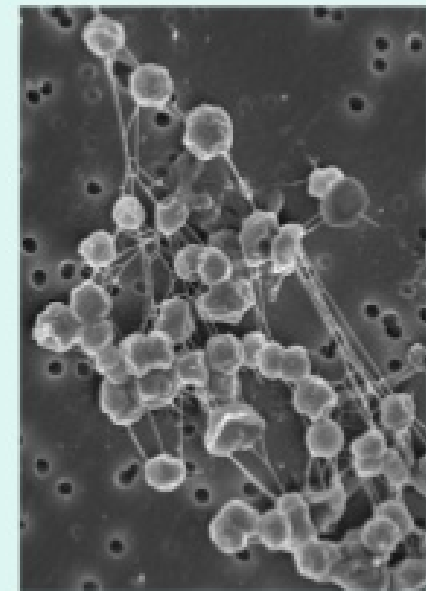
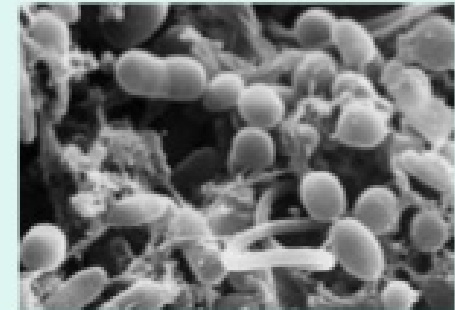
I will use this system →

Kingdoms of Organism



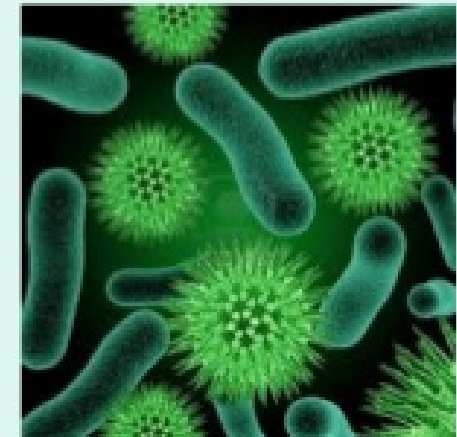
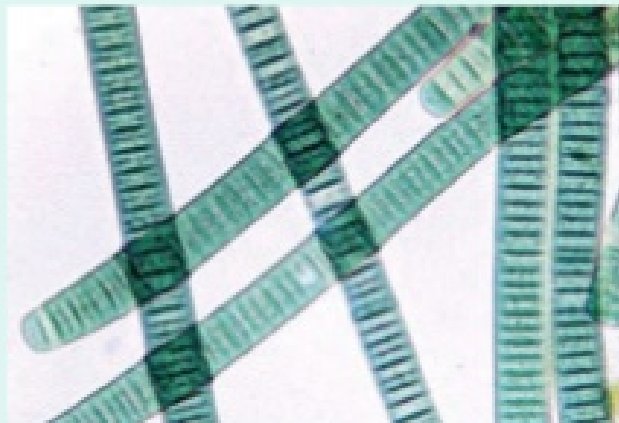
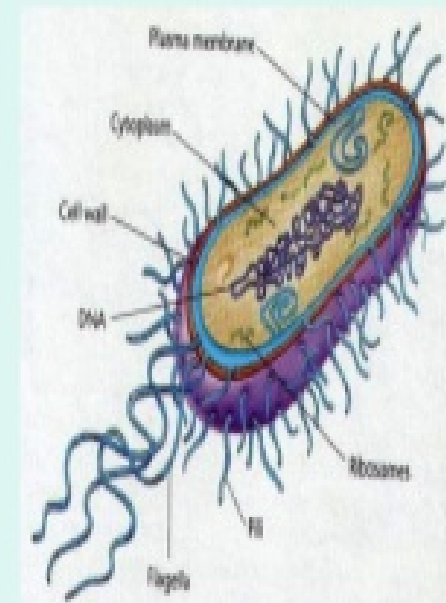
Domain Archaea

- Kingdom Archaeobacteria (AKA. Archae, formerly part of Monera)
 - Unicellular, prokaryotic bacteria of ancient origin
 - **Methanogens** are anaerobic unicellular organisms, that release methane as a waste product of cellular metabolism
 - **Chemosynthetic bacteria** synthesize organic compounds, using energy derived from the oxidation of organic or inorganic materials without the aid of light.
 - Halophiles
 - Thermophiles



Domain Bacteria

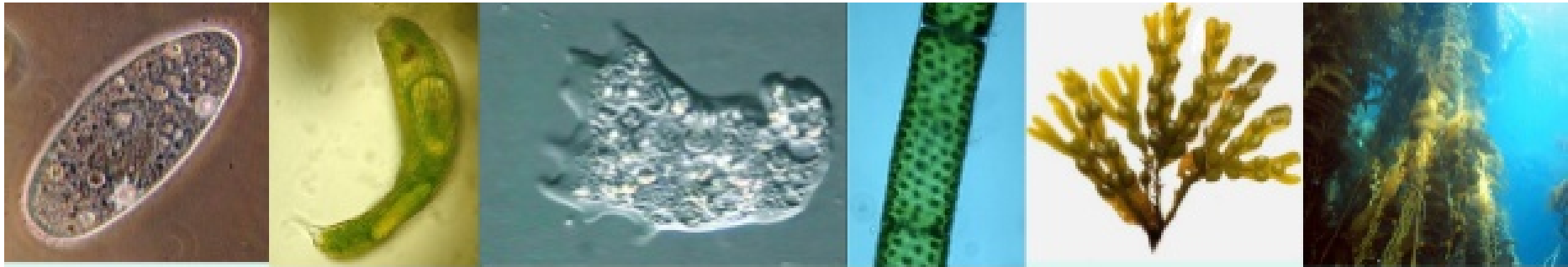
- Kingdom Eubacteria (AKA. Bacteria, formerly part of Monera)
 - Unicellular, prokaryotic bacteria of more recent origin.
 - Include most common bacteria.
 - Cyanobacteria



Domain Eukarya

- Kingdom Protist
- Kingdom Fungi
- Kingdom Plantae
- Kingdom Animalia



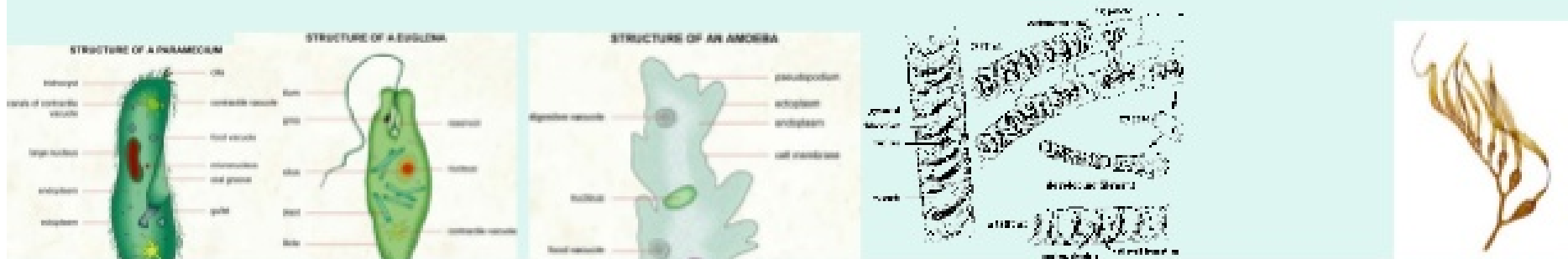


- Kingdom Protista (the “protists”)

Protozoa (animal - like protist)

Algae (plant - like protist)

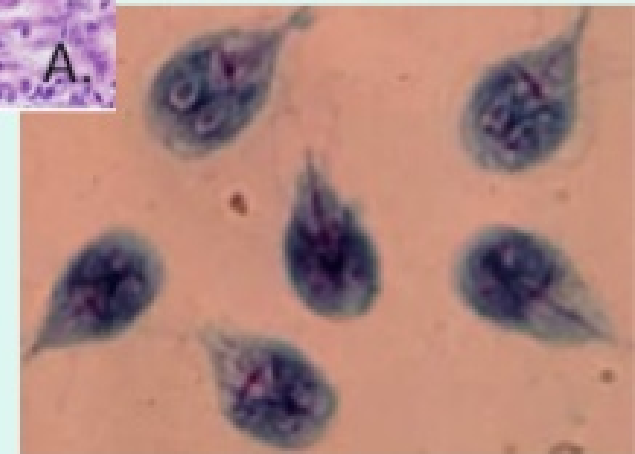
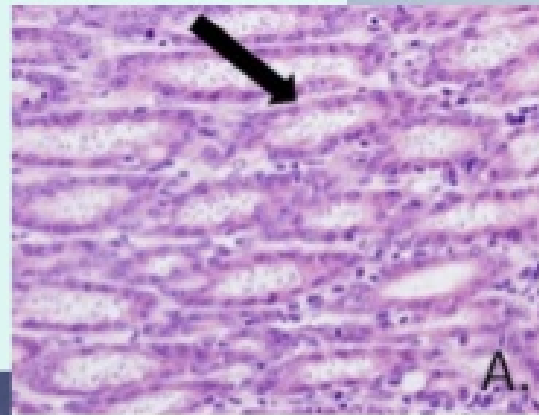
Myxomycota (fungus - like protist)



Groups of Protist

- **Protozoans** are animal-like protists (heterotrophs) grouped according to how they move.

- Rhizopoda
- Flagellates
- Ciliophora
- Sporozoa



Plant-like protists are **Algae**.

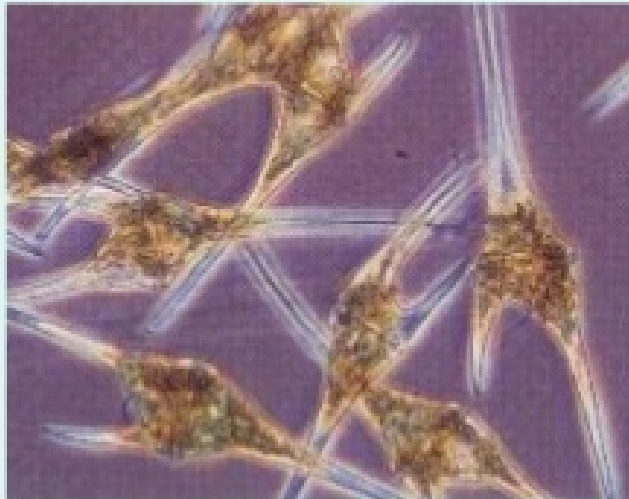
- There are three unicellular phyla of algae:



Euglenophyta



Bacillariophyta



Dinoflagellata

Multicellular algae are classified by color



Brown Algae (Phaeophyta)



Green Algae (Chlorophyta)

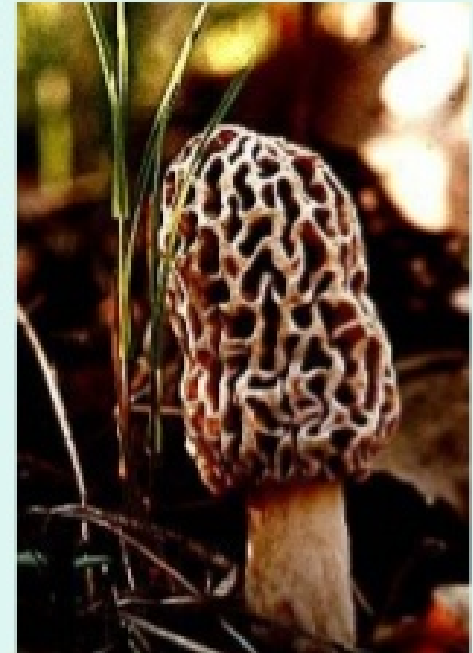


- Fungus-like protists, Myxomycota are decomposers.
- Myxomycota are made up of plasmodial slime molds.





- Kingdom Fungi (all the fungus)
 - Heterotrophic (no photosynthesis)
 - Unicellular and multi-cellular (microscopic to very large)
 - Most have cell walls (like plants) but lack chlorophyll. Many are multi-nucleate.
 - Includes molds, mildews, rusts, smuts, mushrooms, puffballs, morels, truffles, and any other types of fungus.



KINGDOM FUNGI



Kingdom Fungi – There are 5 Major Phyla

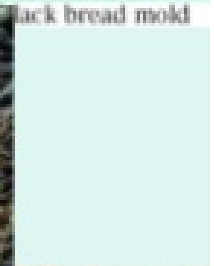
1. Phylum Zygomycota = the Bread Molds

Rhizopus – black bread mold



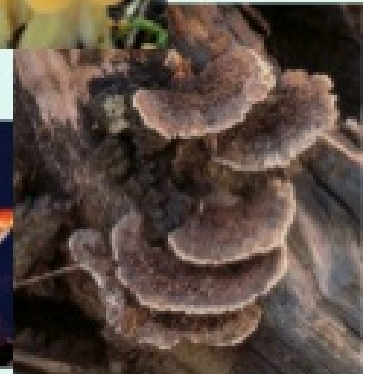
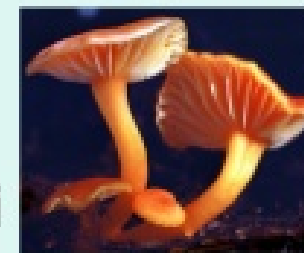
2. Oomycota = the Water Molds

Water mold, potato blight, mildew



3. Phylum Ascomycota = the Sac Fungi

Yeast, morels, truffles



4. Phylum Basidiomycota = the Club Fungi

Mushrooms, puffballs, bracket fungi, rusts, smuts, toadstools

5. Phylum Deuteromycota = the Fungi Imperfecti

Kingdom Plantae

- Nearly all plants are autotrophs (make their own food)
- Multi-cellular, and some can grow quite large
- Nearly all plants use photosynthesis as their main source of food.
 - *Pitcher plants and Venus Fly Traps get extra nutrients from insects.*



Classification of Plants



THE ANIMAL KINGDOM



Division of animals



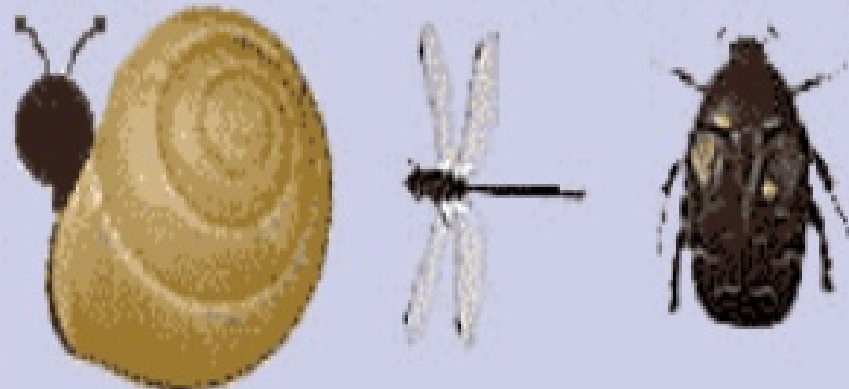
VERTEBRATES



Animals with backbones



INVERTEBRATES



Animals without backbones

Sub Kingdom: Invertebrates

- Phyla Include:
- Echinoderms
- Sponges
- Cnidarians
- Worms
- Mollusks
- Arthropoda



PHYLUM PORIFERA

Sponges



Sponges

- **Simplest form of animal**
- Sponges are sessile animals
(they spend their lives attached to rocks)



PHYLUM CNIDARIA



Jellyfish



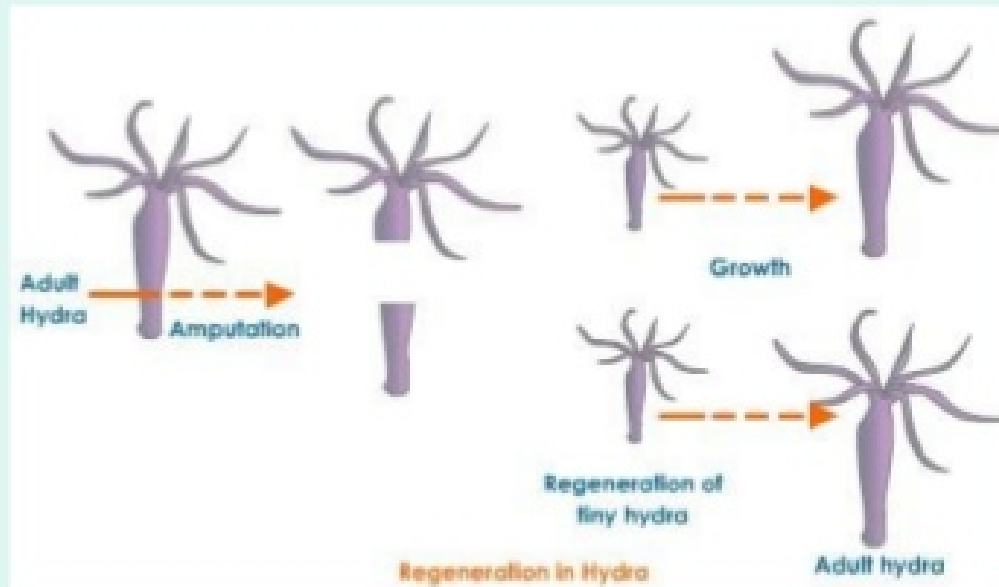


Phylum Cnidaria



Corals

Phylum Cnidaria (Hydra)





Sea Anemone



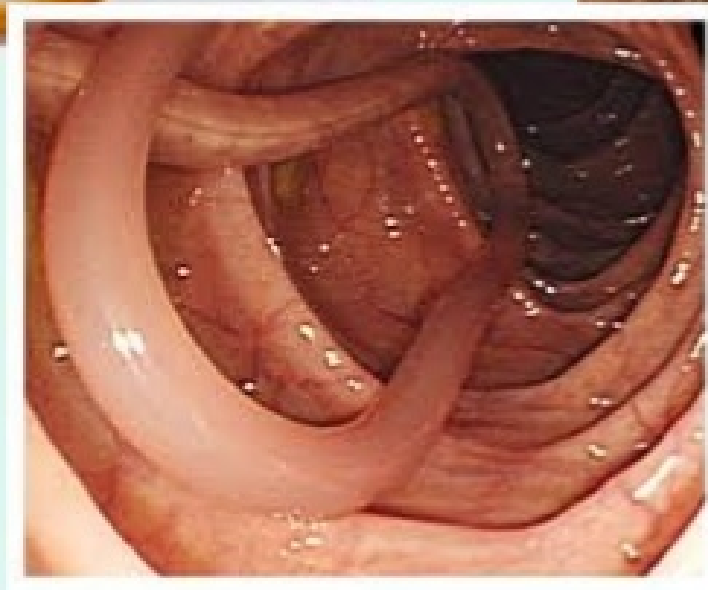
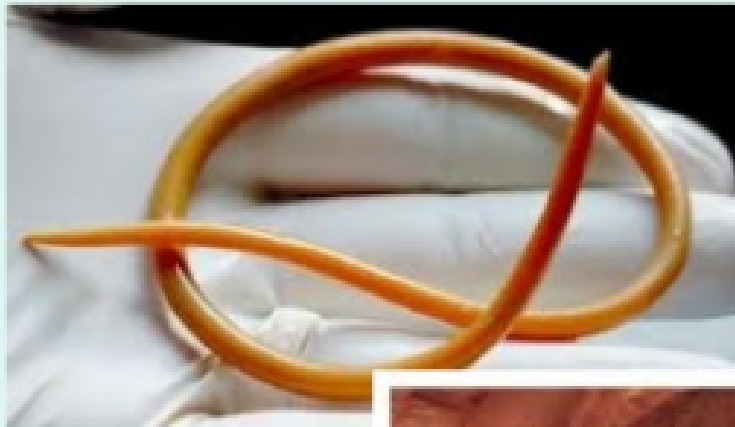
PHYLUM PLATYHELMINTHES



Flatworms

PHYLUM NEMATODA

Roundworms



PHYLUM ANNELIDA



**Segmented
Worms**



PHYLUM MOLLUSCA



Gastropods
Bivalves
Cephalopods

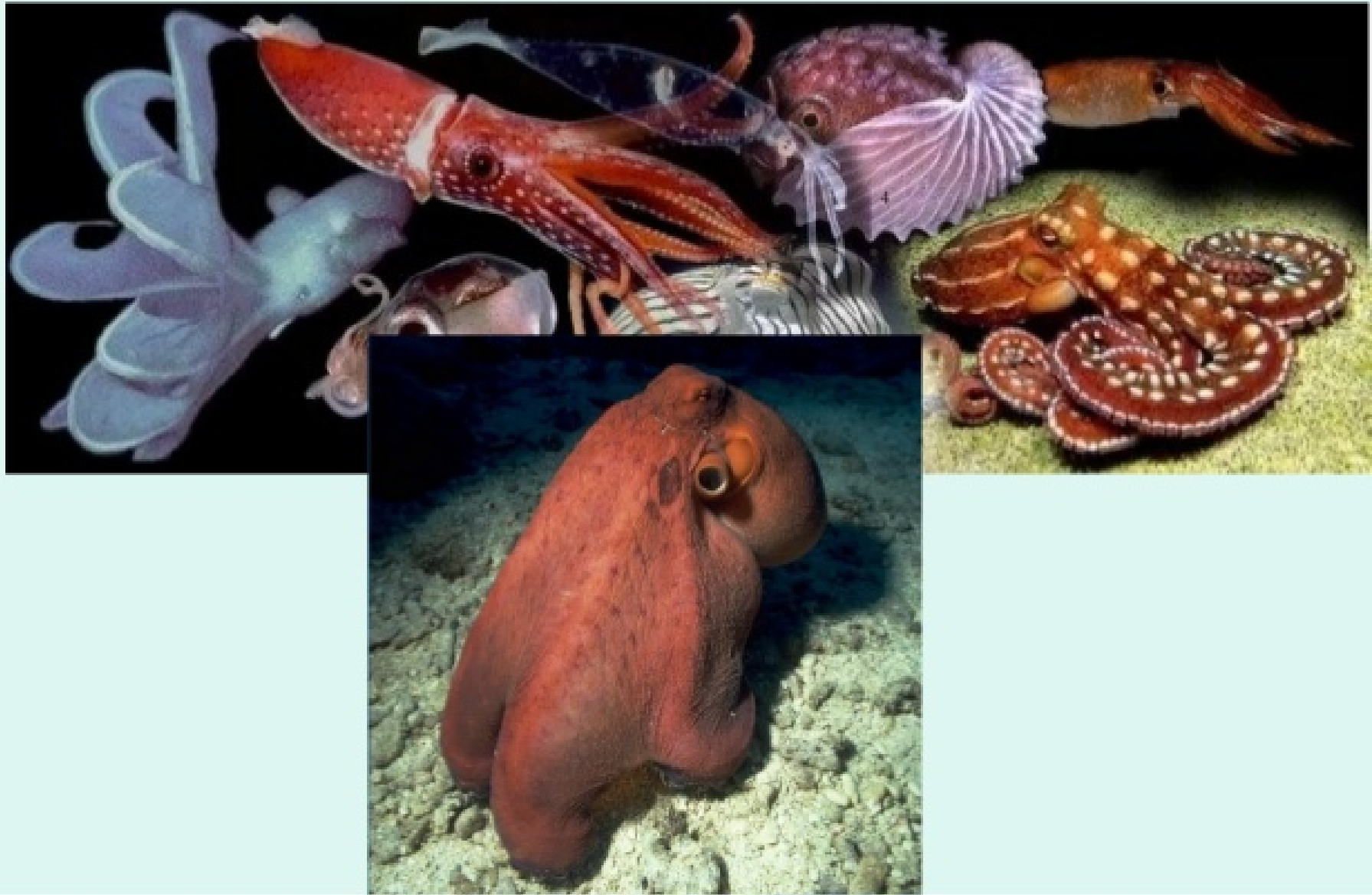
Gastropods



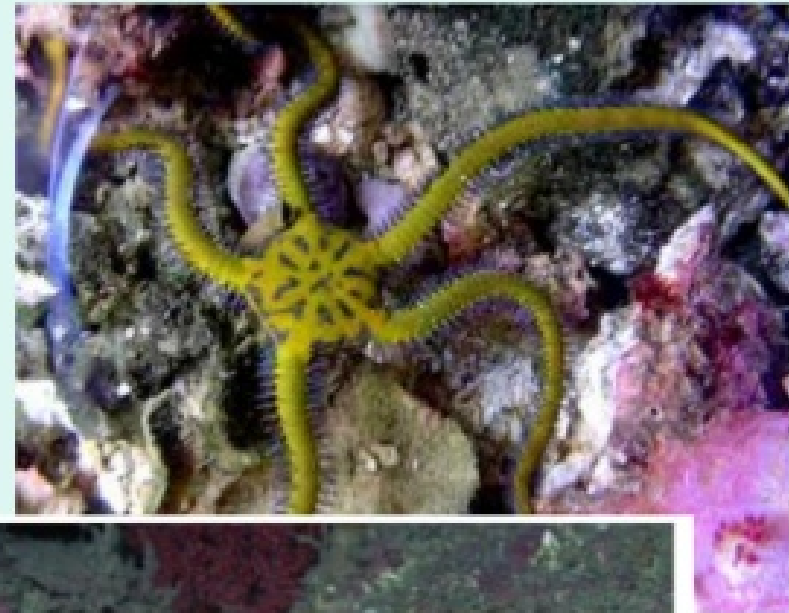
Bivalves



Cephalopods

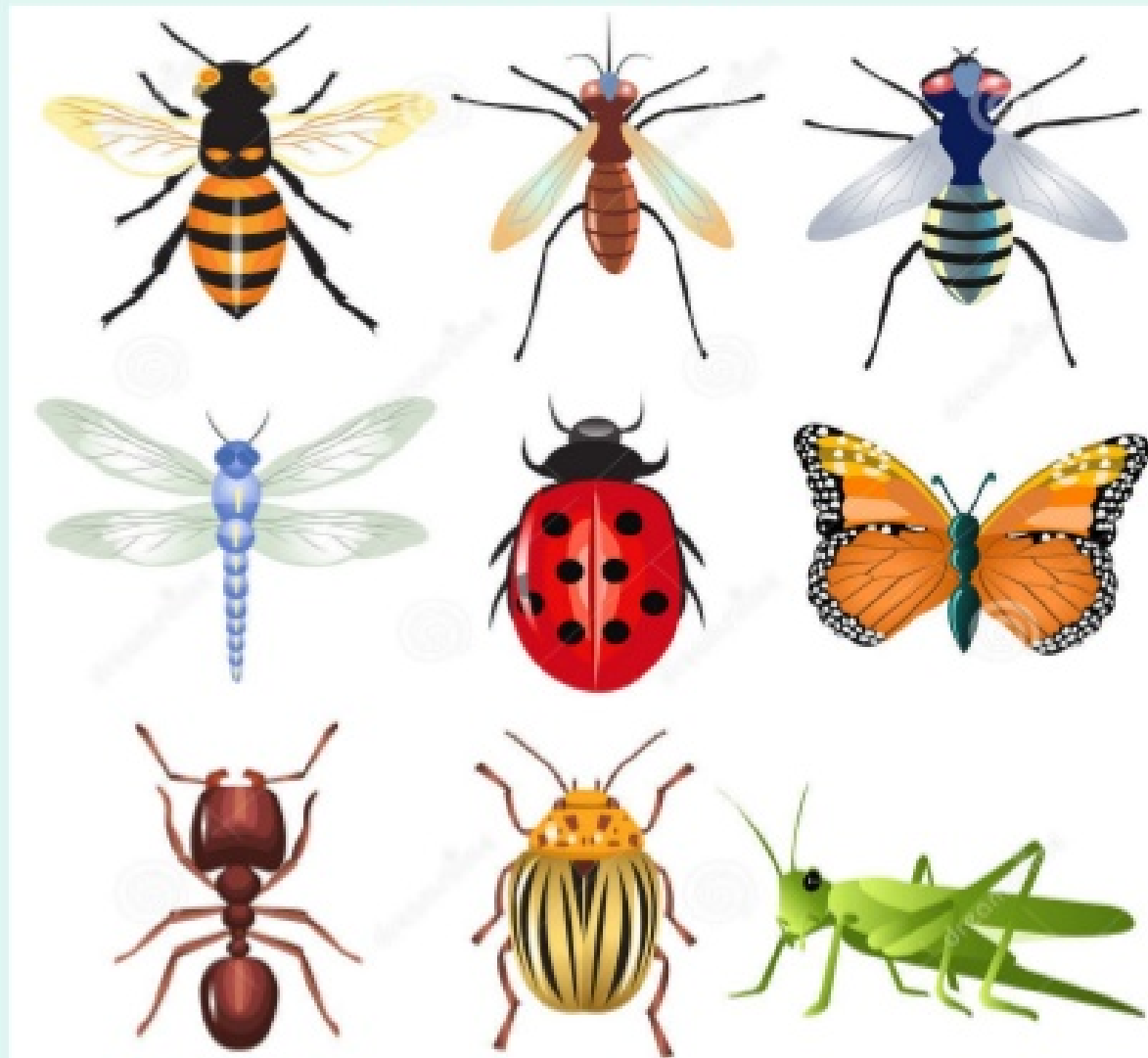


Phylum Echinodermata



PHYLUM ARTHROPODA

Class Insecta



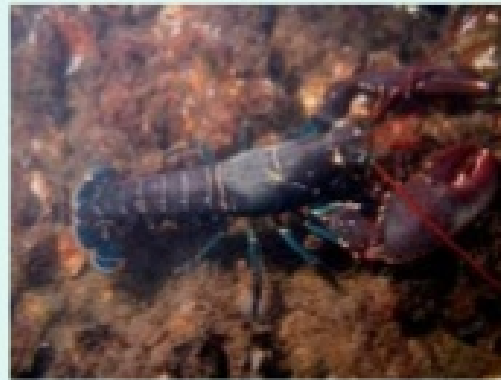
PHYLUM ARTHROPODA

Class Arachnida



PHYLUM ARTHROPODA

Class Crustacea



PHYLUM ARTHROPODA

Class Chilopoda

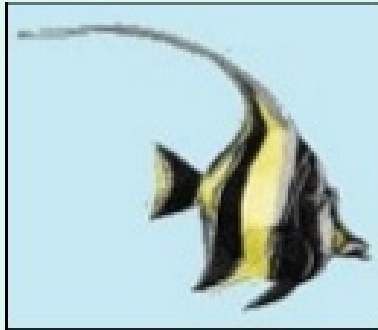


PHYLUM ARTHROPODA

Class Diplopoda



PHYLUM CHORDATA



Phylum Chordata can be subdivided into:

- Subphylum Urochordata – notochord is found during the larval stage
- Subphylum Cephalochordata – notochord is found in the anterior part of the organism
- Subphylum Vertebrata

Subphylum Urochordata

- Tunicates (AKA “sea squirts”)
 - Look similar to other chordates during development, but completely different as adults



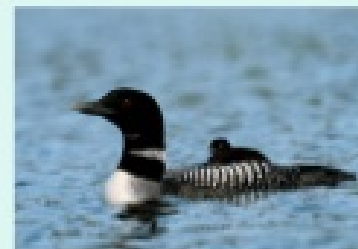
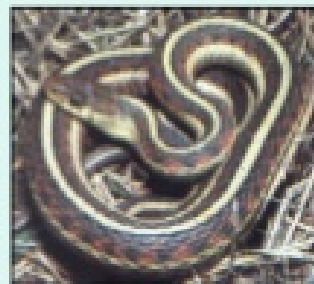
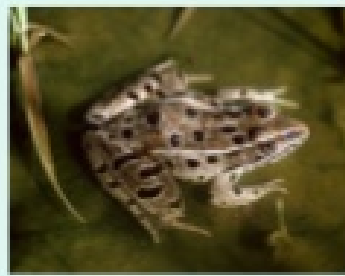
Subphylum Cephalochordata

- Lancelets: live in the ocean with their body buried in sand
 - Have a definite mouth and no jaws
 - Long pharynx with up to 100 gill slits
 - Breathe through their body surface
 - Have a simple digestive system, heart, and closed circulation
 - Use paired muscles to move



Subphylum Vertebrata

- 99% of chordates are vertebrates
 - Fish 24,000 species
 - Amphibian 4,000 species
 - Reptiles 6,000 species
 - Birds 10,000 species
 - Mammals 4,500 species

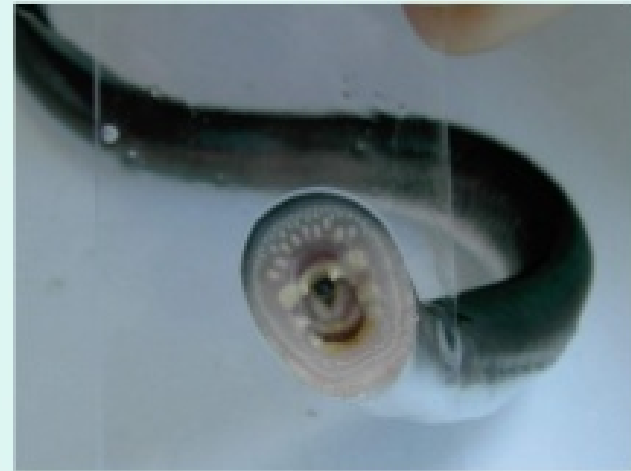


Groups of Fishes

- **Class Cephalospidomorphi** – lamprey
- **Class Myxini** – hagfishes
- **Class Chondrichthyes** – cartilaginous fishes
- **Class Osteichthyes** – bony fishes



Class Cephalospidomorphi - Lamprey



Class Myxini – hagfishes



Class Chondrichthyes

- includes fish whose skeletons are made of cartilage, such as
 - sharks,
 - rays, and skates
 - Sawfish
 - Chimaeras

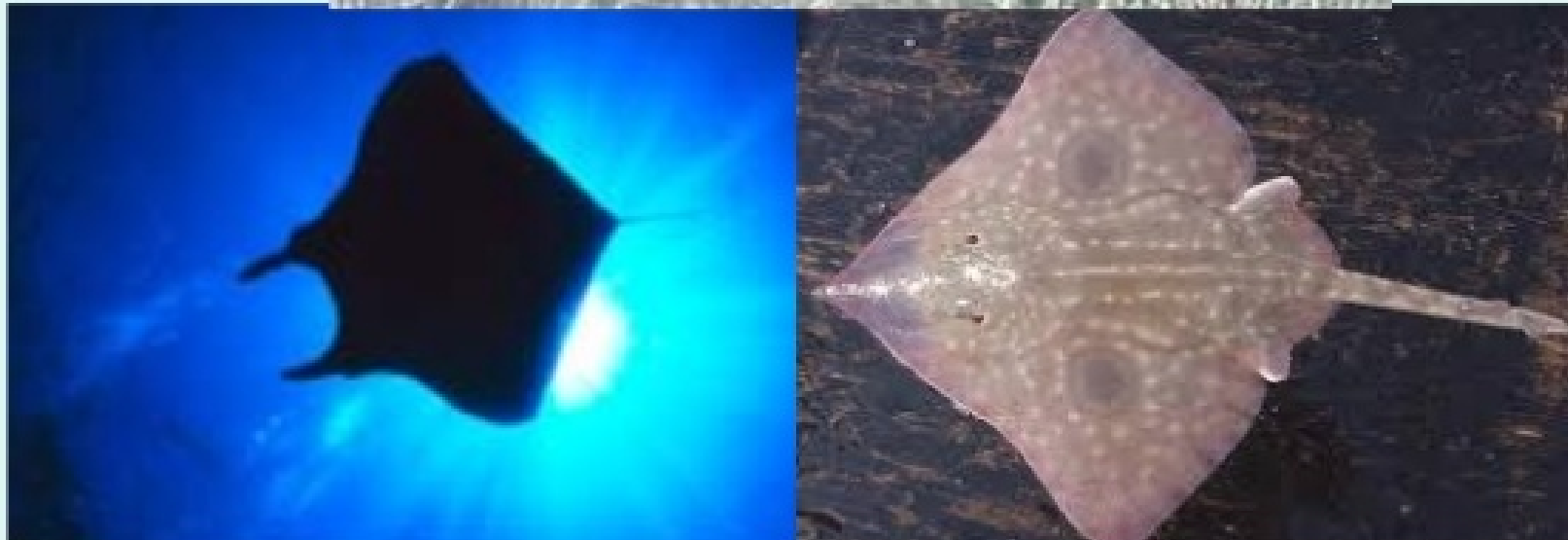
Class Chondrichthyes

Shark



Class Chondrichthyes

Skate & Ray



Class Chondrichthyes (Sawfishes)



Class Osteichthyes (Bony Fishes)

- Skeletons are made of calcified bone

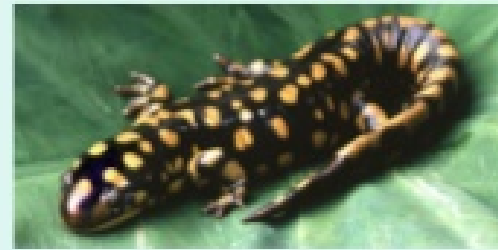
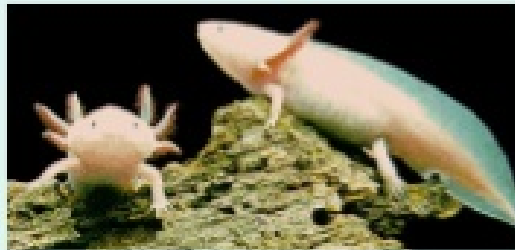


Class Amphibia includes semi-aquatic animals with moist skin. They must return to the water to breed.

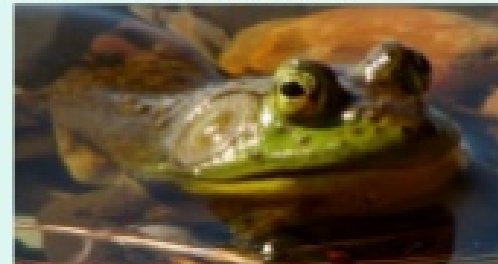


Groups of Amphibians

- **Order Urodela: Salamanders and Newts**



- **Order Anura: Frogs and Toads**



- **Order Apoda: Caecilians**



Class Reptilia

- Land vertebrates with a well developed skull, a backbone and tail, and four limbs
 - Exemptions: snakes have no legs, and turtles have a shell formed of fused vertebrae.



Groups of Reptiles

- **Order Squamata:** lizards and snakes
- **Order Crocodylia:** alligators, crocodiles, caimans, and gavials
- **Order Chelonia:** turtles, tortoises, terrapins
- **Order Rhynchocephalia -**
tuataras



Class Aves

Members of Class Aves have wings and feathers for flight.



Elephant Bird

- Eleven feet tall
- 1100 pounds
- Largest egg ever
- Extinct in late 1600's



Order Struthioniformes



Large flightless bird
Two toes

Order Ciconiiformes



Long legs for wading
Long necks



Order Pelecaniformes
•Gular sac

Order Falconiformes



Hooked bill
Eagle
Hawk
Falcon

Order Strigiformes



Large eyes
Silent flight
Nocturnal
predator
Owls

Order Sphenisciformes



Webbed
feet
Wings as
used for
swimming
Penguins

Class Mammalia

Order Marsupialia



Class Mammalia

Order Monotremata



Class Mammalia

Order Cetacea



Class Mammalia

Order Carnivora



Class Mammalia

Order Chiroptera



Class Mammalia

Order Edentata



Class Mammalia

Order Primate



PhyloCode

- A new system of taxonomy, called ***International Code of Phylogenetic Nomenclature***, or ***PhyloCode*** for short, is currently being drafted.
- It is intended to replace the Linnaean system that we have used for the last 250 years with a new way of looking at taxonomy.
- The current system will continue to exist as a “rank based system” for a long time to come.
 - PhyloCode is currently in its fourth draft, and it has not yet been implemented. For the text of the fourth draft visit the website: <http://www.ohio.edu/phylocode/toc.html>. Although it will soon be used by biologists, it is unlikely to ever be used widely by the general public.