Classification Notes

UNIT 8 TOPIC 3

Classification

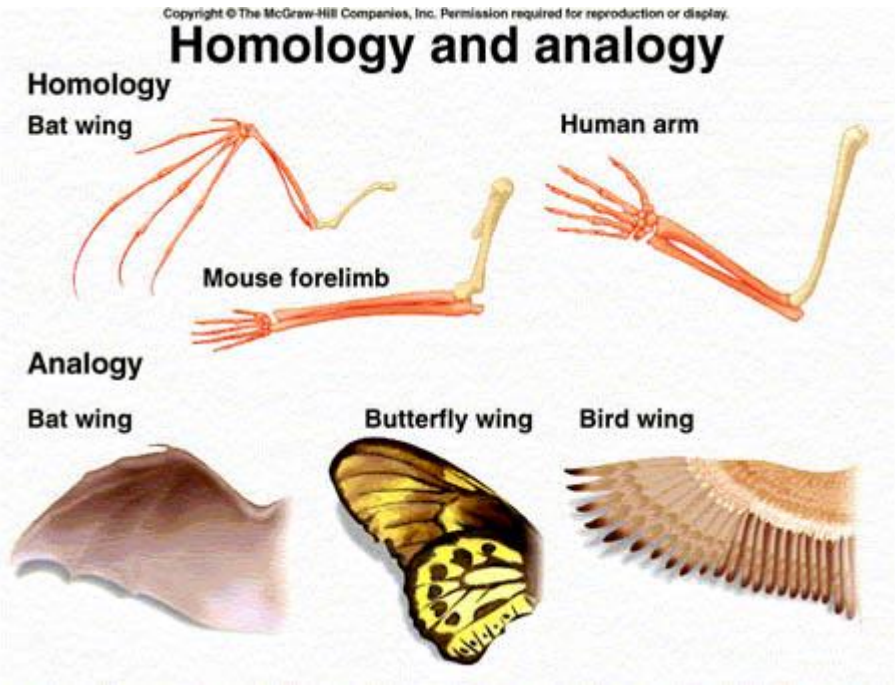
Putting organisms into groups based on their similarities

How? – Using comparative anatomy. When comparing the anatomies of different organisms, researchers look at

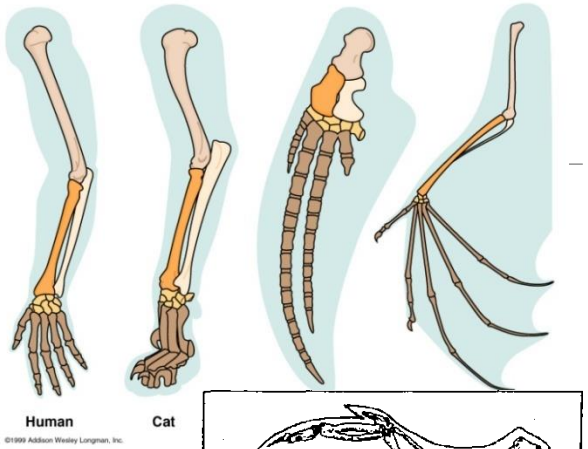
1) Homologous structures

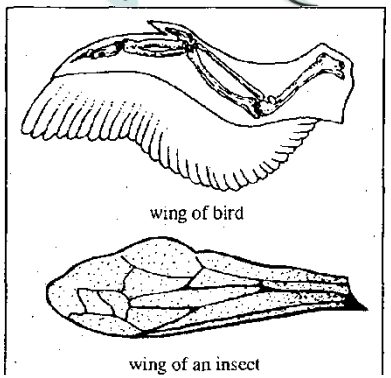
2) Analogous structures

3) Vestigial structures/organs



Review of Comparative Anatomy

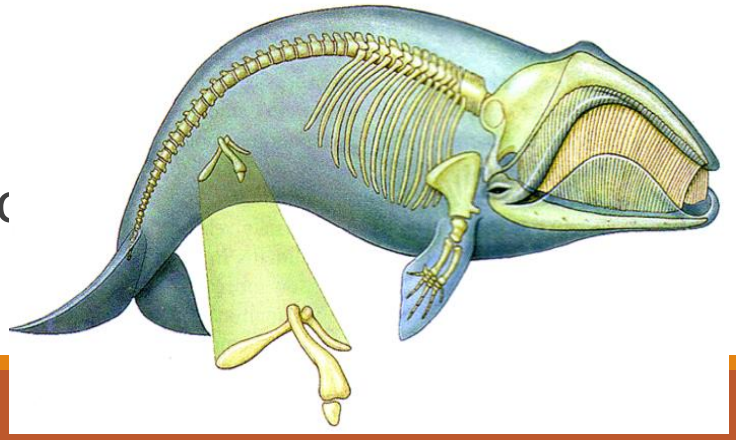




Homologous Structures = common ancestor; different environments + functions

Analogous structures = different ancestors; same environments + functions

Vestigial structures = organs that were useful in an ancestor, but are no longer useful

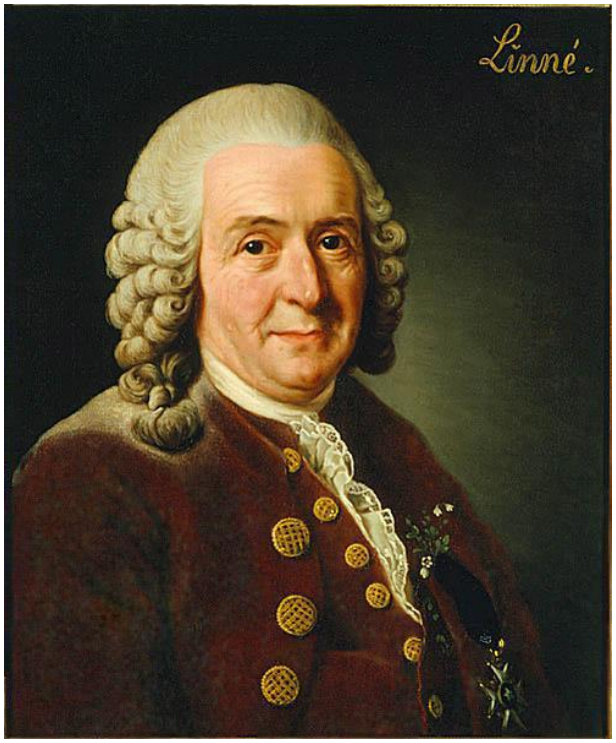


Taxonomy

The science of classifying organisms is called taxonomy

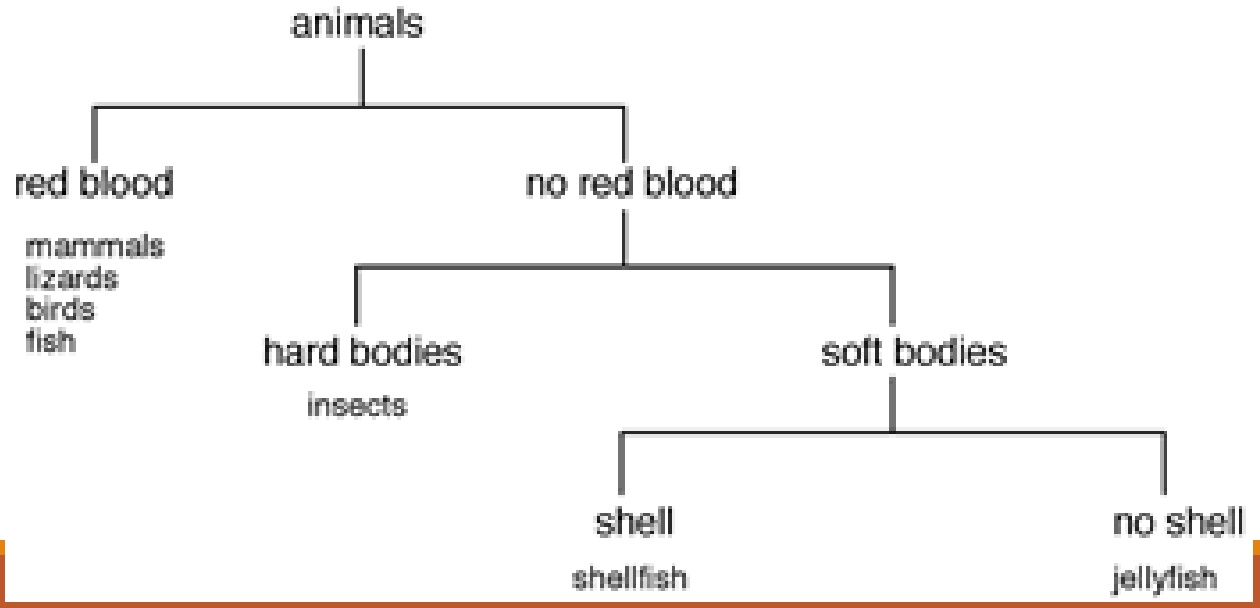
First scientist to use modern system of taxonomy = Carolus Linnaeus

He is called the Father of Modern Taxonomy



Aristotle's Classification

- 2000 years ago, Aristotle was the first taxonomist
- Aristotle divided organisms into plants & animals
- He subdivided them by their habitat ---land, sea, or air dwellers



Linnaeus's System

Linnaeus developed a naming system using the following:

1) levels of relatedness

2) Based groupings on morphological (STRUCTURAL) differences of organisms

3) Divided organisms into two groups: Animalia and Plantae

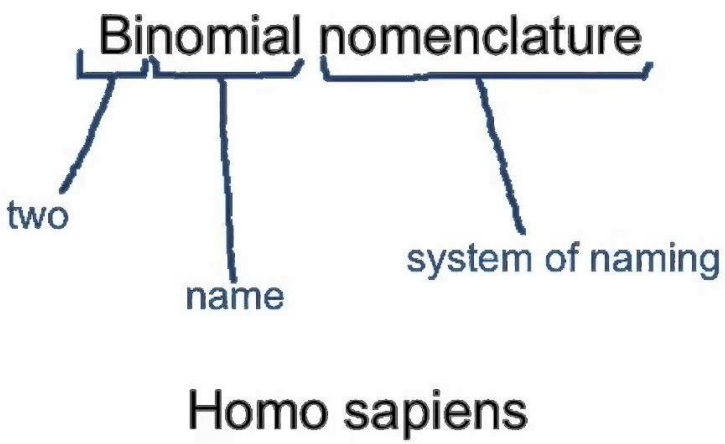
Modern Classification

Today, scientists use Linnaeus's system – the binomial system of nomenclature.

Nomenclature = NAMING (putting organisms into named groups!)

This system is based on a

ranking system or hierarchy



Modern Classification

Again, the modern system is called the binomial system (bi = two ; nom = name)

This system gives each organism 2 names

(bi = two ; nom = name)

These names include the genus and the species

Binomial Nomenclature

When writing the scientific name of an organism, both words must be <u>underlined</u> or *italicized*. The genus is always capitalized, and the species always begins with a lower case letter.

Homo sapiens = human beings

Felis domesticus = domestic cat

Binomial Nomenclature

Scientific names are always written in Latin or ancient Greek so that they have the same name everywhere!

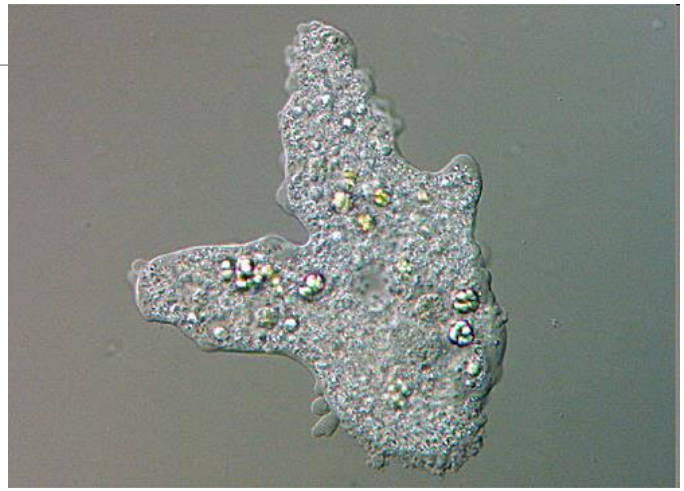
Can abbreviate the genus with one letter

(ex: *H. sapiens)*

Genus = a group of similar species

How did we define a species in our evolution notes? (*organisms able to interbreed)*

Binomial Nomenclature



Scientific names may describe the organism (Ex: *Chaos chaos)*

They may also honor a person or suggest the habitat of the organism (*(Linnaea borealis)*

- Accurately & uniformly names organisms
- Prevents misnomers such as starfish & jellyfish that aren't really fish


Mephitis mephitis!
Mephitis
mephitis

Binomial Nomenclature

Giant Panda
Ailuropoda melanoleuca

Polar Bear
Ursus maritimus

Grizzly Bear
Ursus arctos

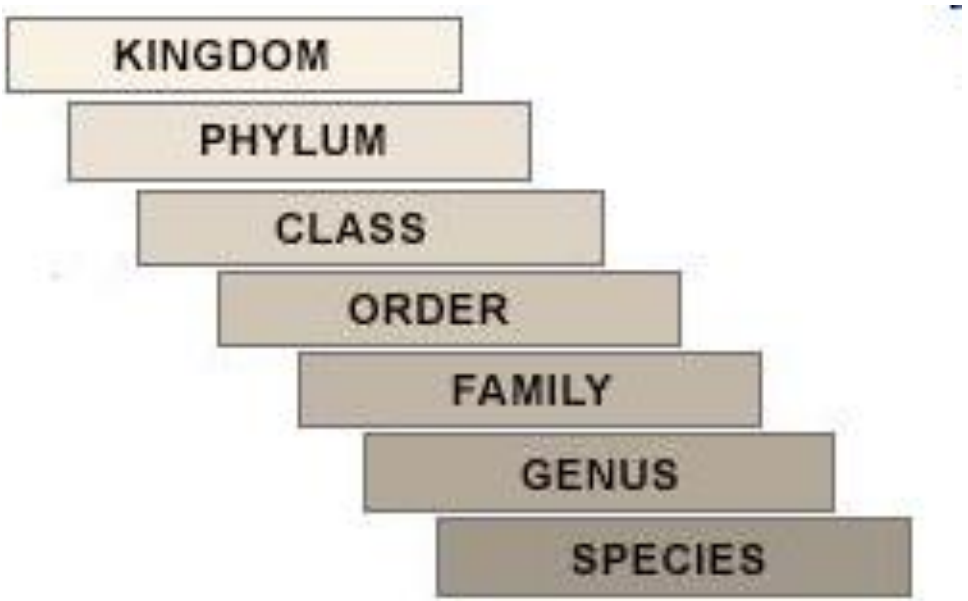
Which TWO are more closely related?

Classification Groups

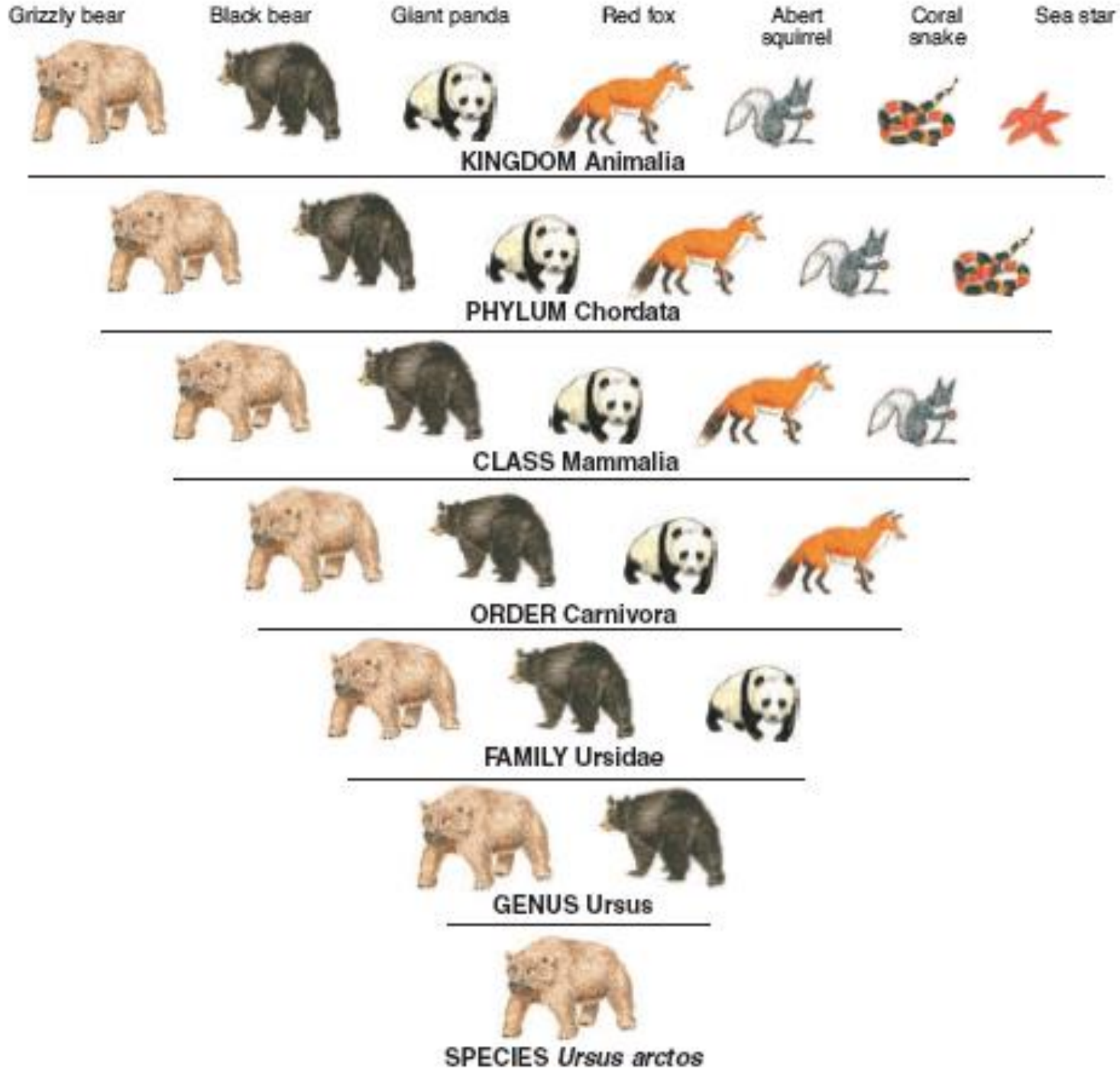
- Taxon (taxa-plural) is a category into which related organisms are placed
- There is a hierarchy of groups (taxa) from broadest to most specific
- Domain, Kingdom, Phylum, Class, Order, Family, *Genus, species*

Linnaeus's Levels

The hierarchy which is used today consists of SEVEN groups.



The largest group is the kingdom, and the smallest group is the species


Grizzly bear
Black bear
Giant panda
Red fox
Abert squirrel
Coral snake
Sea star
KINGDOM Animalia
PHYLUM Chordata
CLASS Mammalia
ORDER Carnivora
FAMILY Ursidae
GENUS Ursus
SPECIES *Ursus arctos*

Modern System a Nested Hierarchy- Seven Levels of Organization

Modern System:

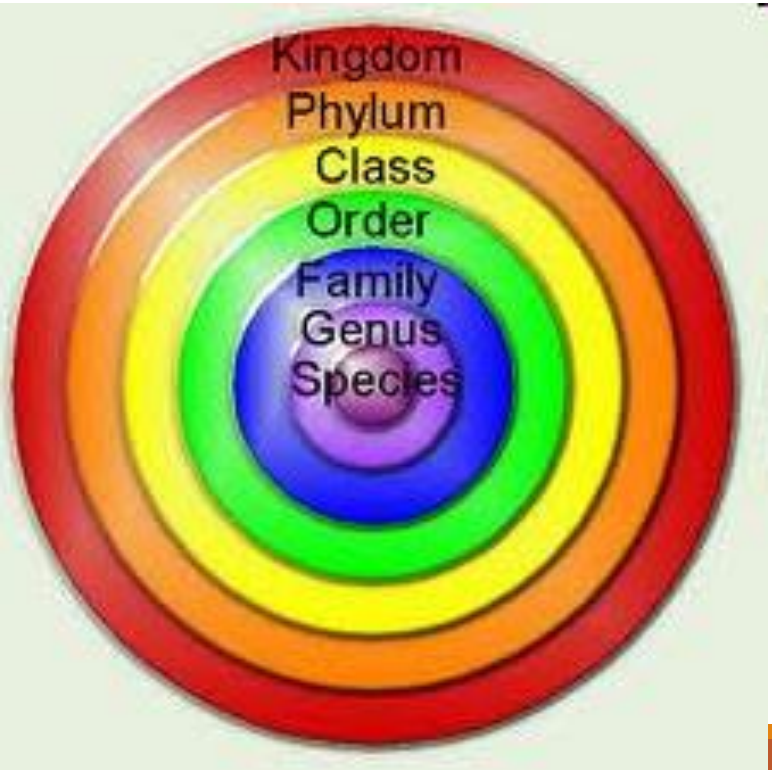
- **Each kingdom (plant and animal) was divided into a phylum* (division for plants)**
- **Each phylum into a smaller groups called class.**
- **Each class was divided into an order.**
- **Each order was divided into family (families).**
- **Each family was divided into a genus (plural-genera)**
- **Each genus was divided into a species. (scientific name)**

***Note: Phyla and family were not in Linnaeus's classification system but were added by modern scientists.**

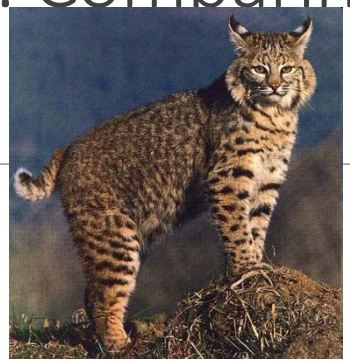
Linnaeus's Levels

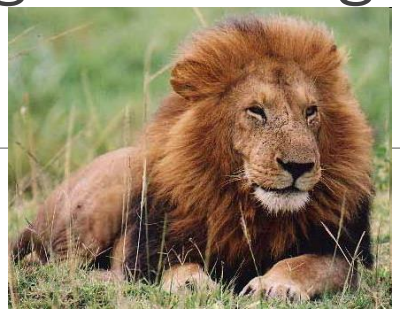
Another way of looking at the levels

Memory Trick: **K**ing **P**hillip **C**ame **O**ver **F**or **G**ood **S**oup



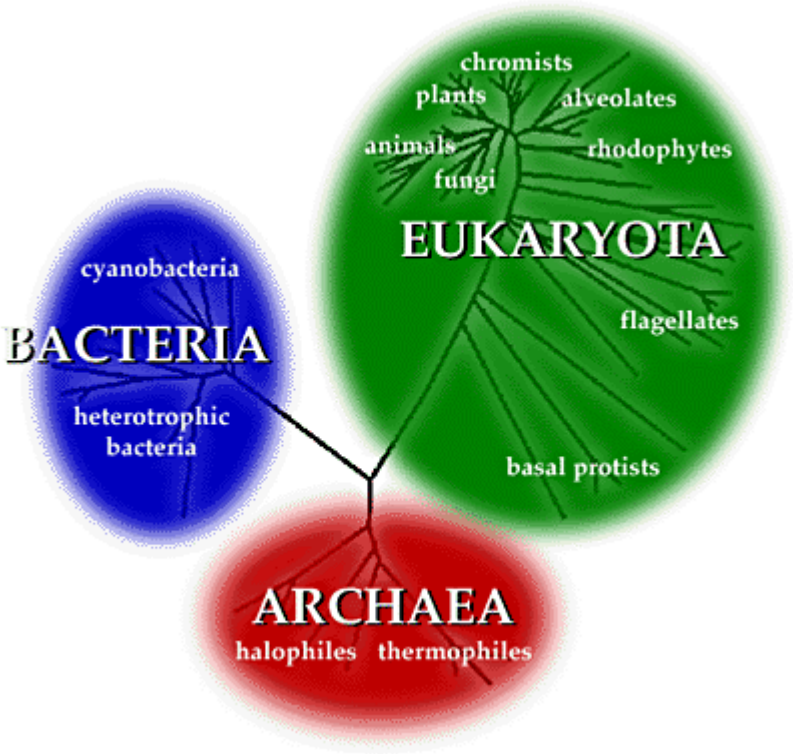
Linnaeus's Levels: Comparing Three Organisms

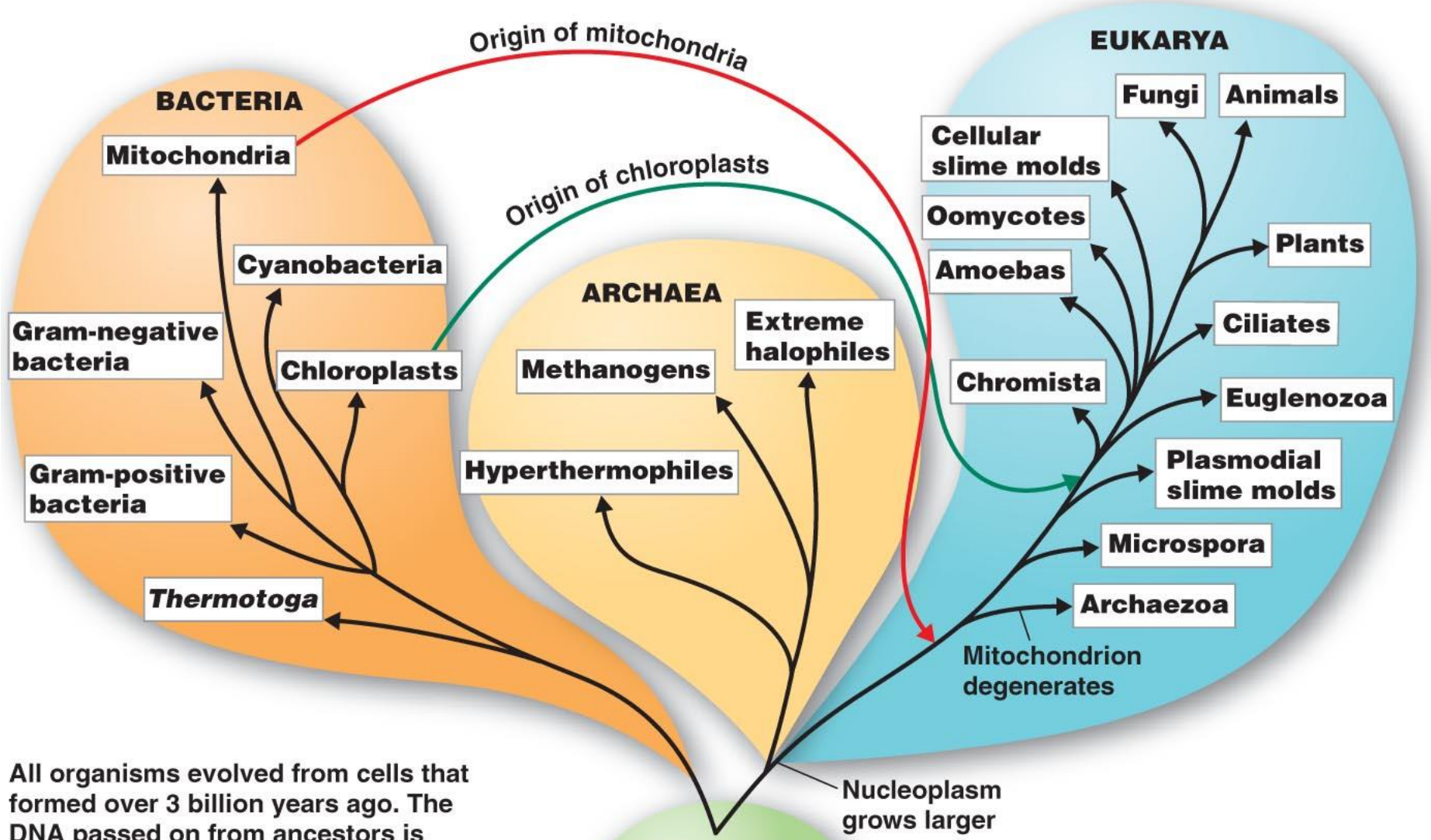




	Bobcat	**Lion**	**Human**
Kingdom	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Chordata
Class	Mammalia	Mammalia	Mammalia
Order	Carnivora	Carnivora	Primata
Family	Felidae	Felidae	Hominidae
Genus	*Lynx*	*Panthera*	*Homo*
Species	*Lynx rufus*	*Panthera leo*	*Homo sapien*

The Three Domains



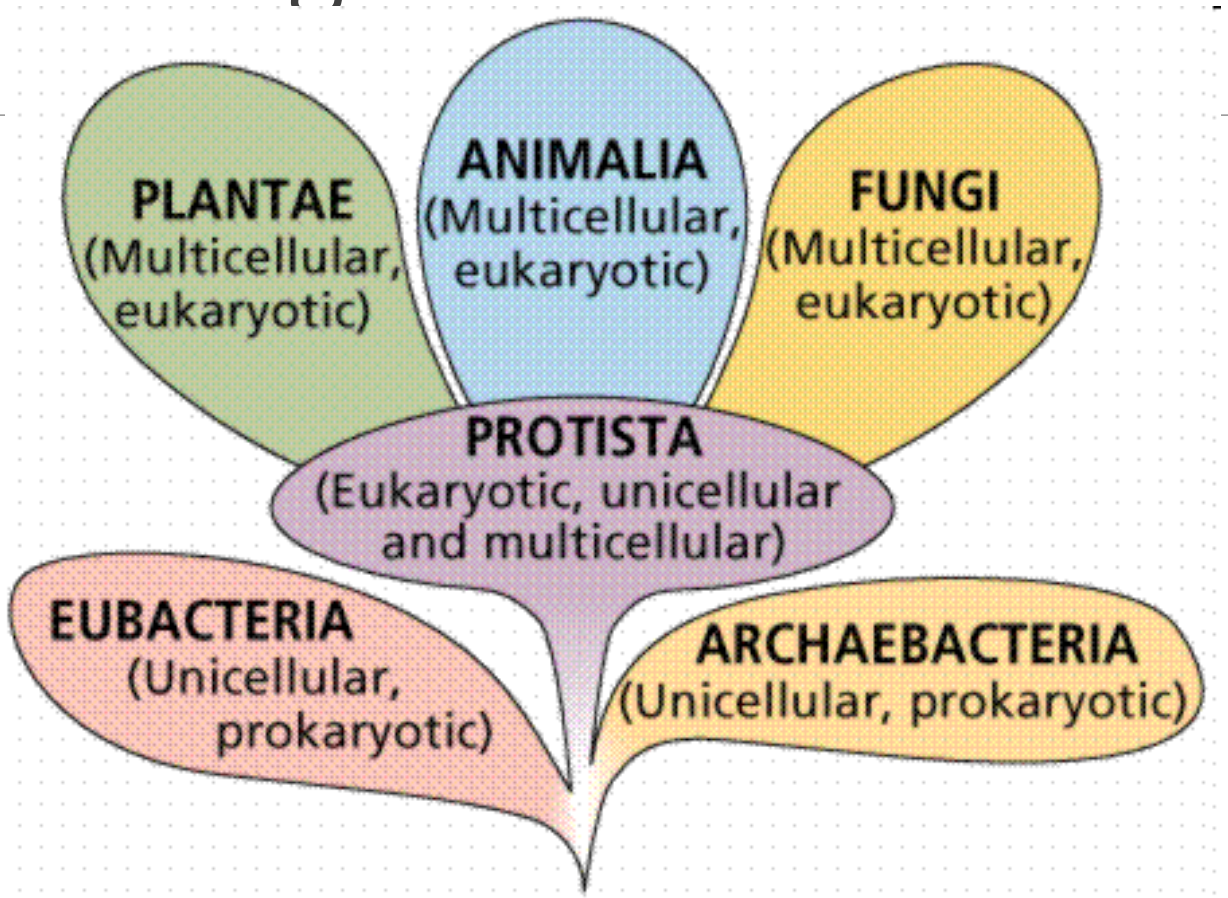


All organisms evolved from cells that formed over 3 billion years ago. The DNA passed on from ancestors is described as conserved. The Domain Eukarya includes the kingdoms Fungi, Plantae, and Animalia. It also includes the protists, discussed on page 281.

Key Concept

Based on similarities in ribosomal RNA, living organisms are classified into three domains: Bacteria, Archaea, and Eukarya.

The Six Kingdoms



Used to be FIVE kingdoms…the two bacteria types were combined under one kingdom (Monera)

Domains

- Broadest, most inclusive taxon
- Three domains
- Archaea and Bacteria are unicellular prokaryotes (no nucleus or membrane-bound organelles)
- Eukarya are more complex and have a nucleus and membrane-bound organelles

ARCHAEA

- Kingdom - ARCHAEBACTERIA
- Probably the 1st cells to evolve
- Live in HARSH environments
- Found in:
  - Sewage Treatment Plants (Methanogens)
  - Thermal or Volcanic Vents (Thermophiles)
  - Hot Springs or Geysers that are acid
  - Very salty water (Dead Sea; Great Salt Lake) - Halophiles

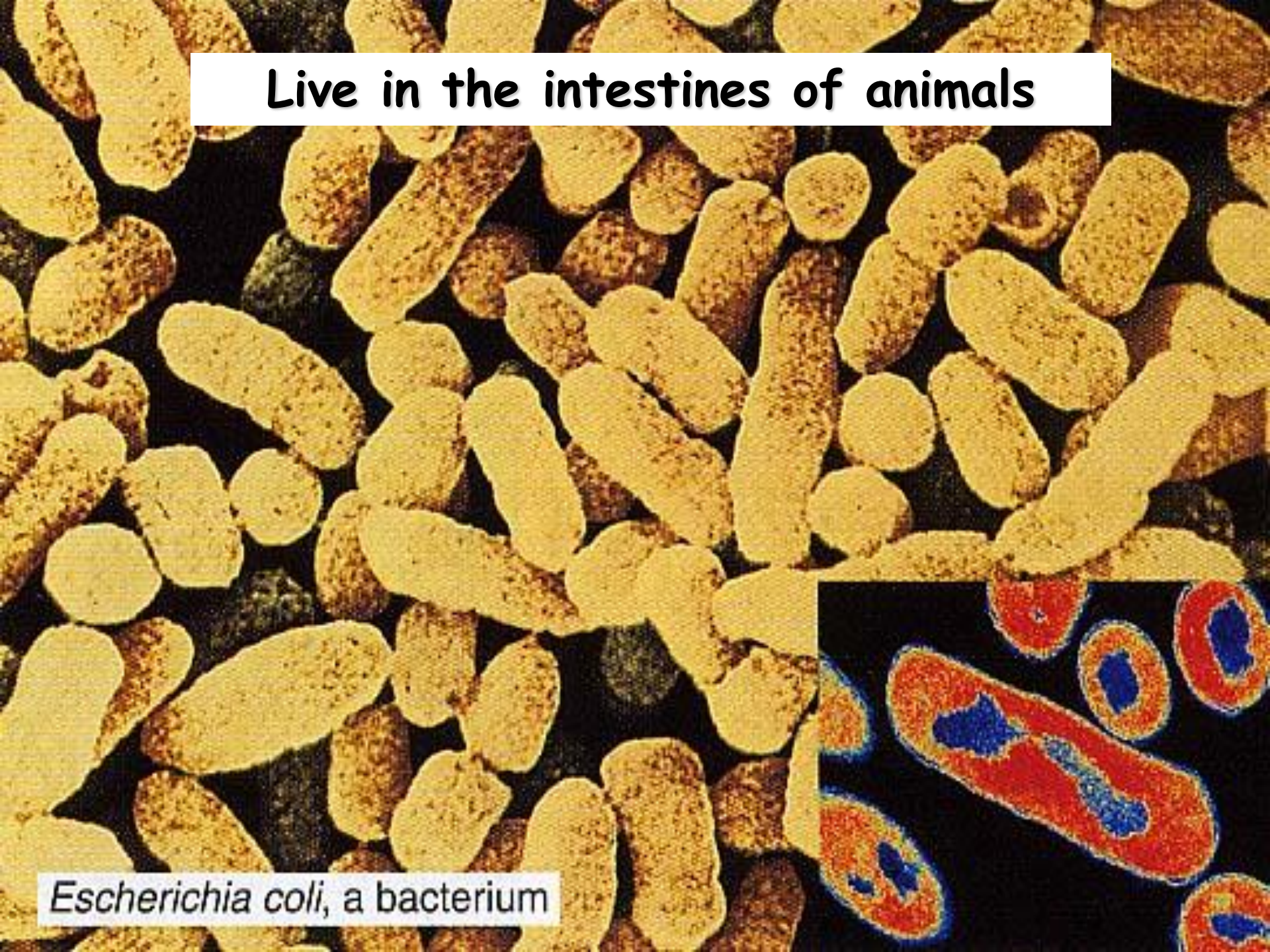
ARCHAEAN

Methanosarcina mazei, an archaean

BACTERIA

- Kingdom - EUBACTERIA
- Some may cause DISEASE
- Found in ALL HABITATS except harsh ones
- Are both auto- and heterotrophic
- Important decomposers for environment
- Commercially important in making cottage cheese, yogurt, buttermilk, etc.

Live in the intestines of animals



Escherichia coli, a bacterium

Bacteria, overall

The Combined Kingdoms, Archaebacteria and Eubacteria include the greatest number of living things on Earth.

ALL OF THE PROKARYOTES ARE IN THESE TWO KINGDOMS.

Both reproduce by binary fission, but they do have some ways to recombine genes, allowing evolution to occur.

Domain Eukarya is Divided into Kingdoms

- Protista (protozoans, algae…)
- Fungi (mushrooms, yeasts …)
- Plantae (multicellular plants)
- Animalia (multicellular animals)

Protista

- Most are unicellular
- Some are multicellular
- Some are autotrophic, while others are heterotrophic
- Aquatic

Fungi

- Multicellular, except yeast
- Absorptive heterotrophs (digest food outside their body & then absorb it)

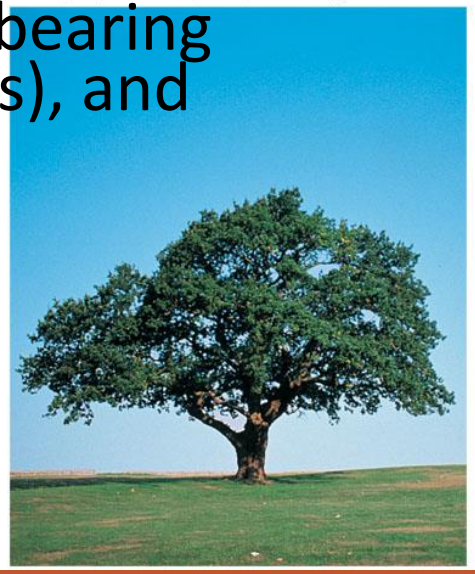
obtain their nutrients by releasing digestive enzymes into a food source.

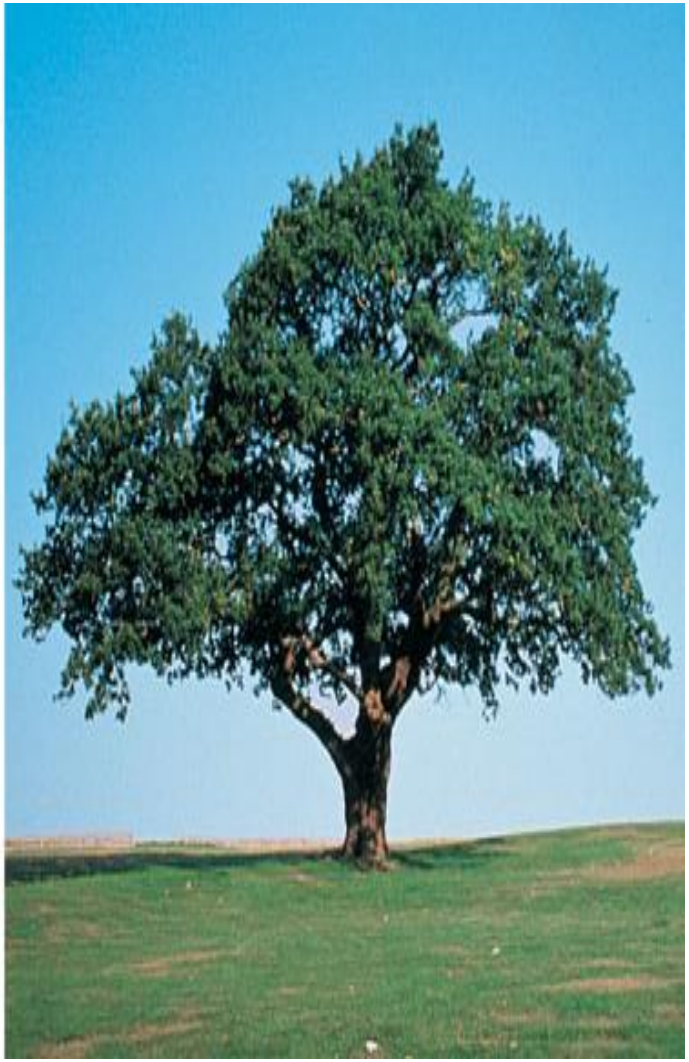
They absorb their food after it has been digested by the enzymes.

- Cell walls made of chitin

Plantae

- Multicellular
- Autotrophic
- Absorb sunlight to make glucose – Photosynthesis
- Cell walls made of cellulose
- Kingdom Plantae includes mosses, ferns, cone-bearing plants (gymnosperms), and flowering plants (angiosperms).





Animalia

- Multicellular
- Ingestive heterotrophs (consume food & digest it inside their bodies)
- Feed on plants or animals

Most members of the Animal Kingdom can move from place to place.

Some are permanently attached to surfaces such as sponges and barnacles.

Fish, Birds, Reptiles, Amphibians, and mammals- including humans belong to the Kingdom Animalia.

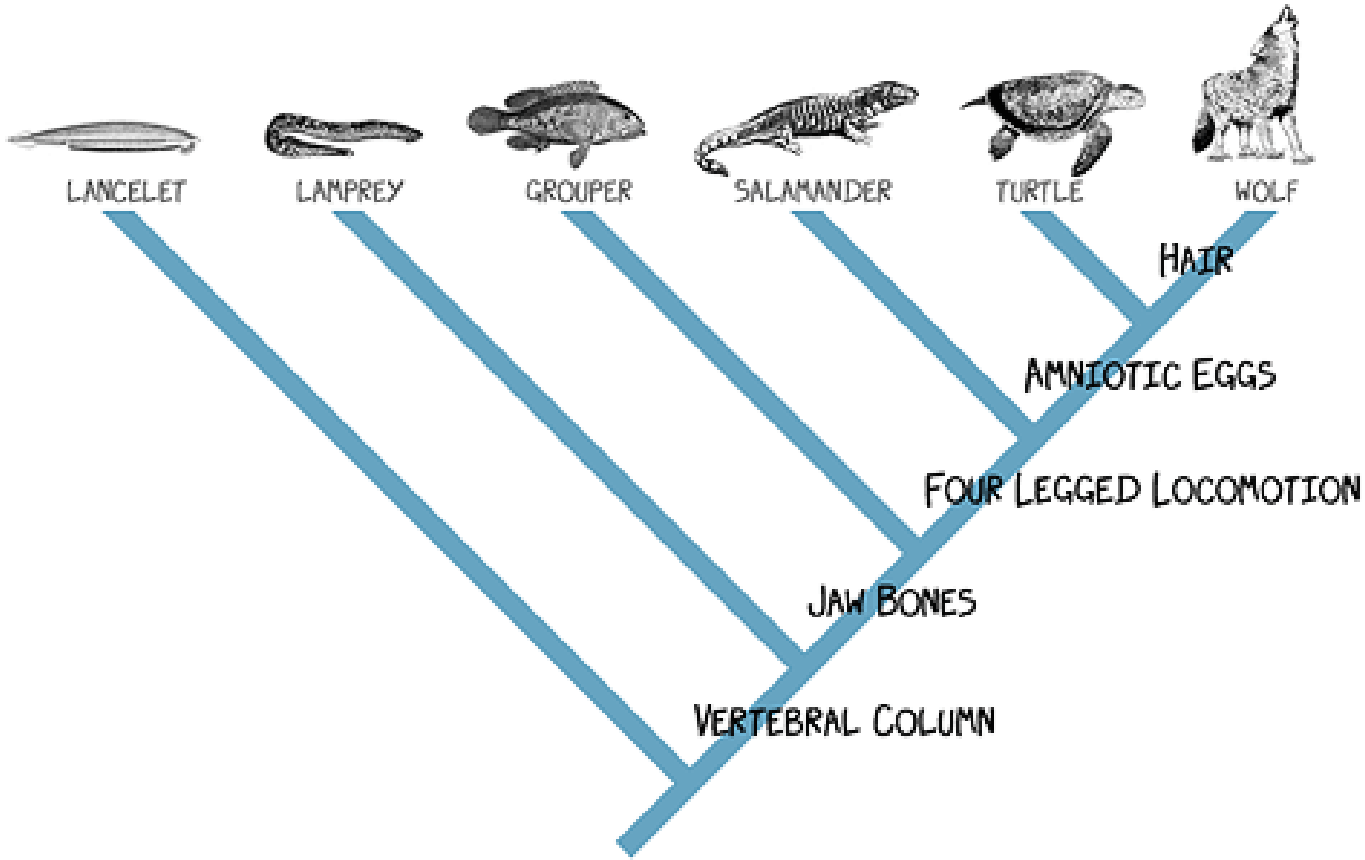
This Kingdom also includes sponges, jellyfish, worms, sea stars, and insects.

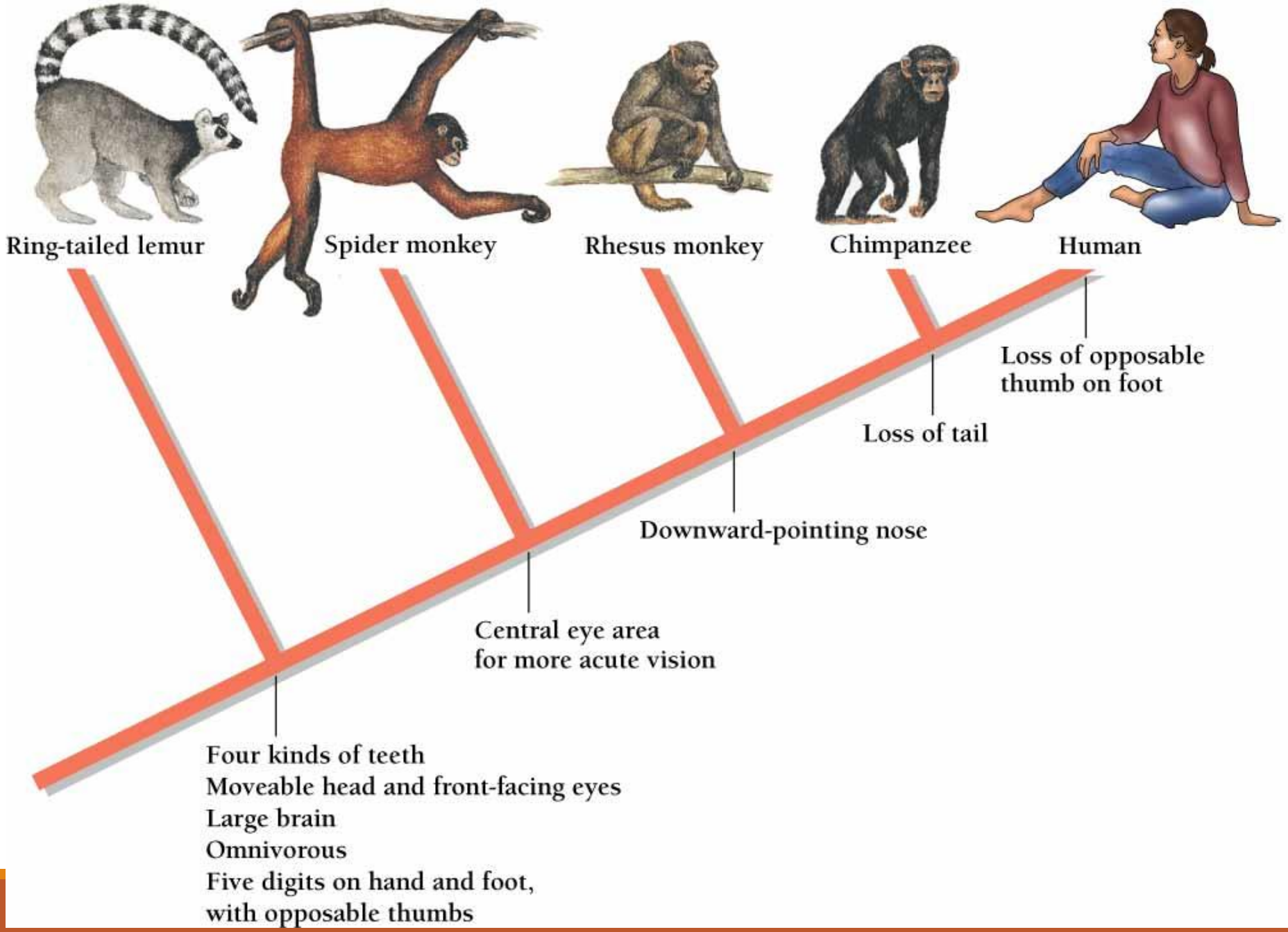
Kingdom	Organization	Type of Nutrition	Representative Organisms				
Protista	Complex single cell, some multicellular	Absorb, photo-synthesize, or ingest food	paramecium	euglenoid	slime mold	dino-flagellate	Protozoans, algae, water molds, and slime mold
Fungi	Some unicellular, most multicellular filamentous forms with specialized complex cells	Absorb food	black bread mold	yeast	mushroom	bracket fungus	Molds, yeast, and mushrooms
Plantae	Multi-cellular form with specialized complex cells	Photo-synthesize food	moss	fern	pine tree	nonwoody flowering plant	Mosses, ferns, nonwoody and woody flowering plants
Animalia	Multi-cellular form with specialized complex cells	Ingest food	coral	earthworm	blue jay	squirrel	Invertebr-ates, fishes, reptiles, amphibians, birds, and mammals

c. Domain Eukarya
Eukaryotes, structurally diverse and organized into the four kingdoms depicted here.

Cladogram

Diagram showing how organisms are related based on shared, derived characteristics such as feathers, hair, or scales

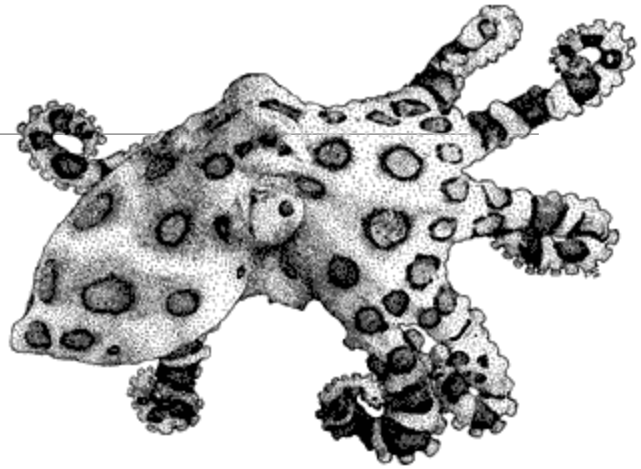




Dichotomous Key

- Used to identify organisms
- Characteristics given in pairs
- Read both characteristics and either go to another set of characteristics OR identify the organism

Example of Dichotomous Key



1a Tentacles present – Go to 2

1b Tentacles absent – Go to 3

2a Eight Tentacles – Octopus

2b More than 8 tentacles – 3

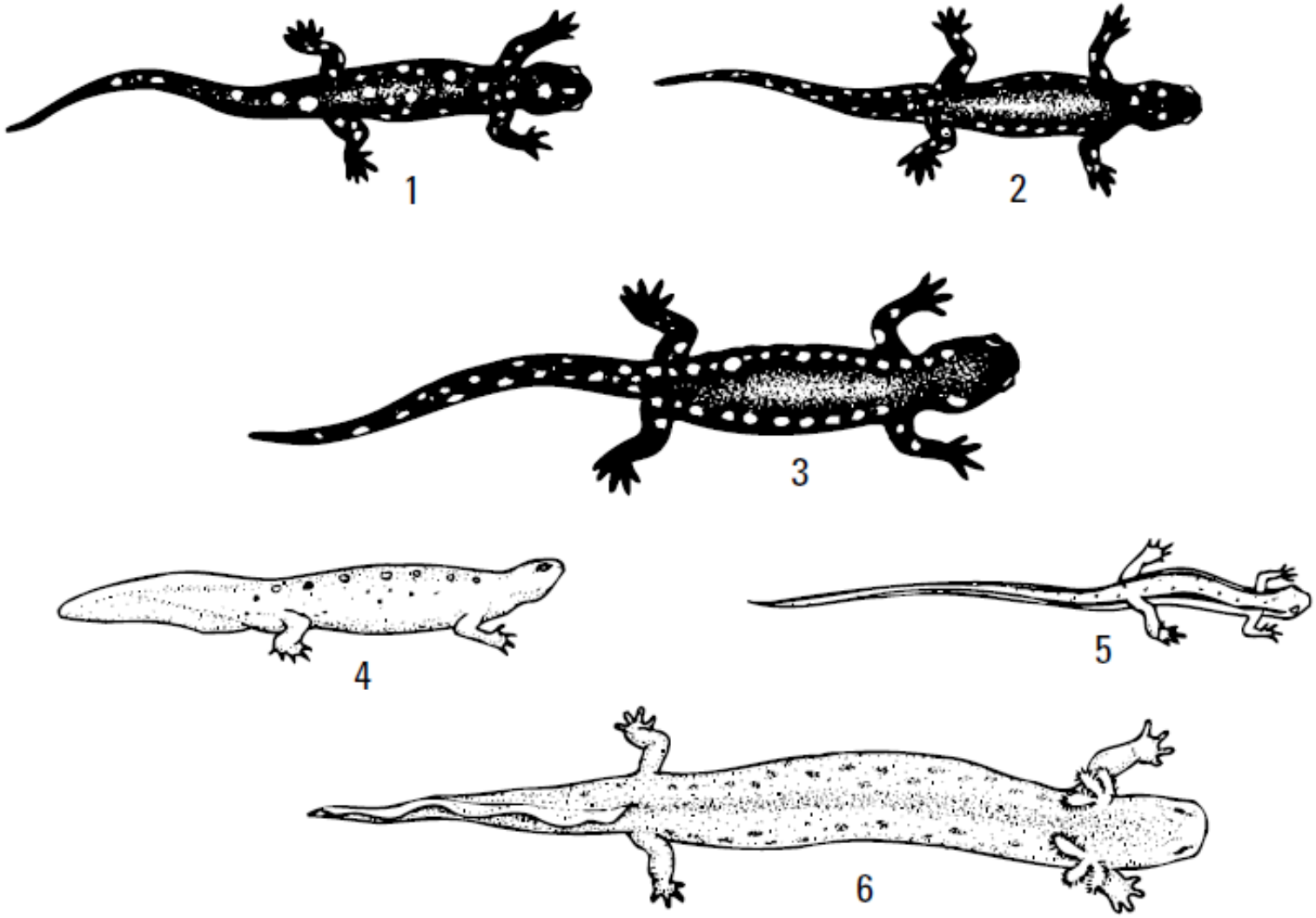
3a Tentacles hang down – go to 4

3b Tentacles upright–Sea Anemone

4a Balloon-shaped body–Jellyfish

4b Body NOT balloon-shaped - 5

Practice



1	a	Hind limbs absent	*Siren intermedia*, siren
	b	Hind limbs present	Go to 2
2	a	External gills present in adults	*Necturus maculosus*, mud puppy
	b	External gills absent in adults	Go to 3
3	a	Large size (over 7 cm long in Figure 1)	Go to 4
	b	Small size (under 7 cm long in Figure 1)	Go to 5
4	a	Body background black, large white spots variable in size completely covering body and tail	*Ambystoma tigrinum*, tiger salamander
	b	Body background black, small round white spots in a row along each side from eye to tip of tail	*Ambystoma maculatum*, spotted salamander
5	a	Body background black with white spots	Go to 6
	b	Body background light color with dark spots and/or lines on body	Go to 7
6	a	Small white spots on black background in a row along each side from head to tip of tail	*Ambystoma jeffersonianum*, Jefferson salamander
	b	Small white spots scattered throughout a black background from head to tip of tail	*Plethodon glutinosus*, slimy salamander
7	a	Large irregular white spots on a black background extending from head to tip of tail	*Ambystoma opacum*, marbled salamander
	b	No large irregular black spots on a light background	Go to 8
8	a	Round spots scattered along back and sides of body, tail flattened like a tadpole	*Triturus viridescens*, newt
	b	Without round spots and tail not flattened like a tadpole	Go to 9
9	a	Two dark lines bordering a broad light middorsal stripe with a narrow median dark line extending from the head onto the tail	*Eurycea bislineata*, two-lined salamander
	b	Without two dark lines running the length of the body	Go to 10
10	a	A light stripe running the length of the body and bordered by dark pigment extending downward on the sides	*Plethodon cinereus*, red-backed salamander
	b	A light stripe extending the length of the body without dark pigment on the sides	*Hemidactylium scutatum*, four-toed salamander