Classification

Species of Organisms

- **There are 13 billion known species of organisms**

- **This is only 5% of all organisms that ever lived!!!!!**

- **New organisms are still being found and identified**

What is Classification?

Classification is the arrangement of organisms into orderly **groups** based on their **similarities**

Classification is also known as **taxonomy**

Taxonomists are scientists that identify & name organisms

Benefits of Classifying

- **Accurately & uniformly** names organisms

- Prevents **misnomers** such as starfish & jellyfish that aren't really fish

- Uses **same language (Latin or some Greek)** for names

Sea"horse"??

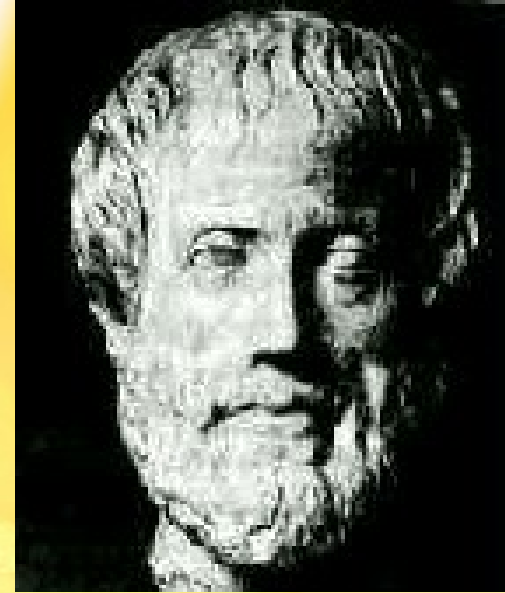# Confusion in Using Different Languages for Names

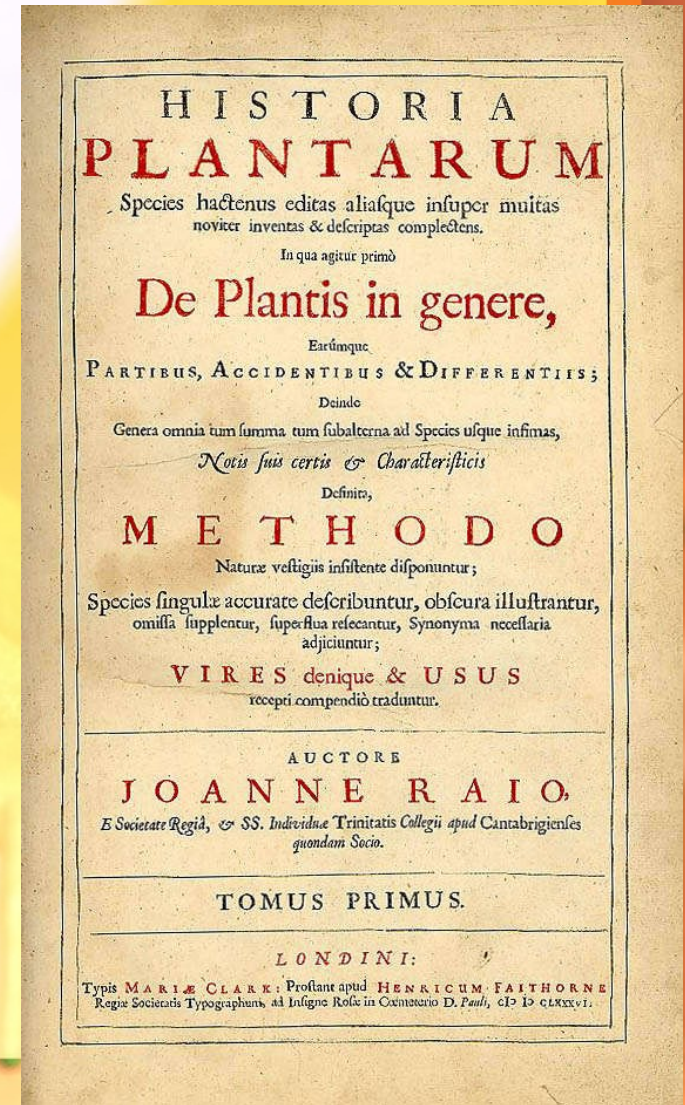# Latin Names are Understood by all Taxonomists

Early Taxonomists

- **2000** years ago, **Aristotle** was the first taxonomist

- Aristotle divided organisms into **plants & animals**

- He **subdivided** them by their **habitat** ---land,
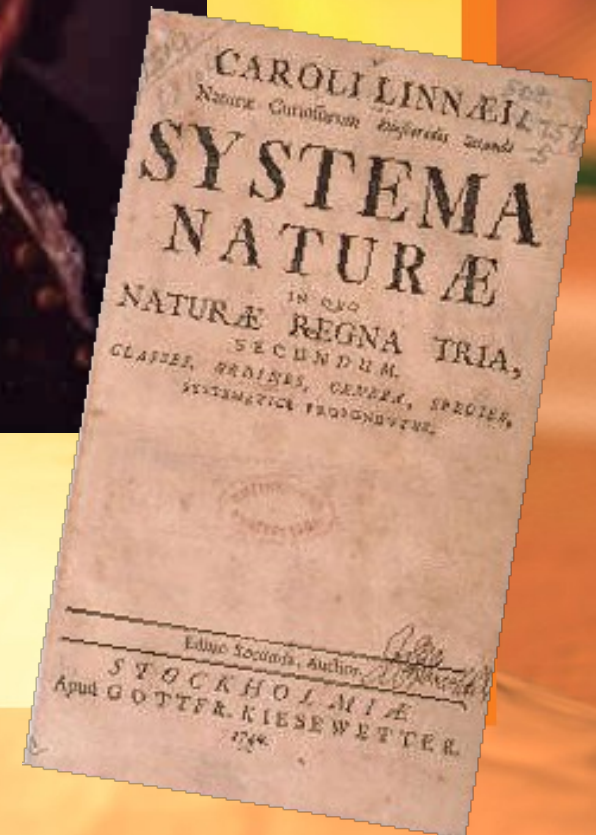
Early Taxonomists

- **John Ray, a botanist,** was the first to use Latin for naming

- His **names** were **very long** descriptions telling everything

Carolus Linnaeus
1707 – 1778

- **18th century** taxonomist

- Classified organisms by their structure

- Developed naming system still used today

Carolus Linnaeus

- Called the "Father of Taxonomy"

- Developed the modern system of naming known as binomial nomenclature

- Two-word name (Genus & species)

Standardized Naming

- **Binomial nomenclature** used
- *Genus species*
- Latin or Greek
- **Italicized** in print
- **Capitalize genus,** but NOT species
- **Underline when** writing

Turdus migratorius

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American Robin

Binomial Nomenclature

Giant Panda
Ailuropoda melanoleuca

Polar Bear
Ursus maritimus

Grizzly Bear
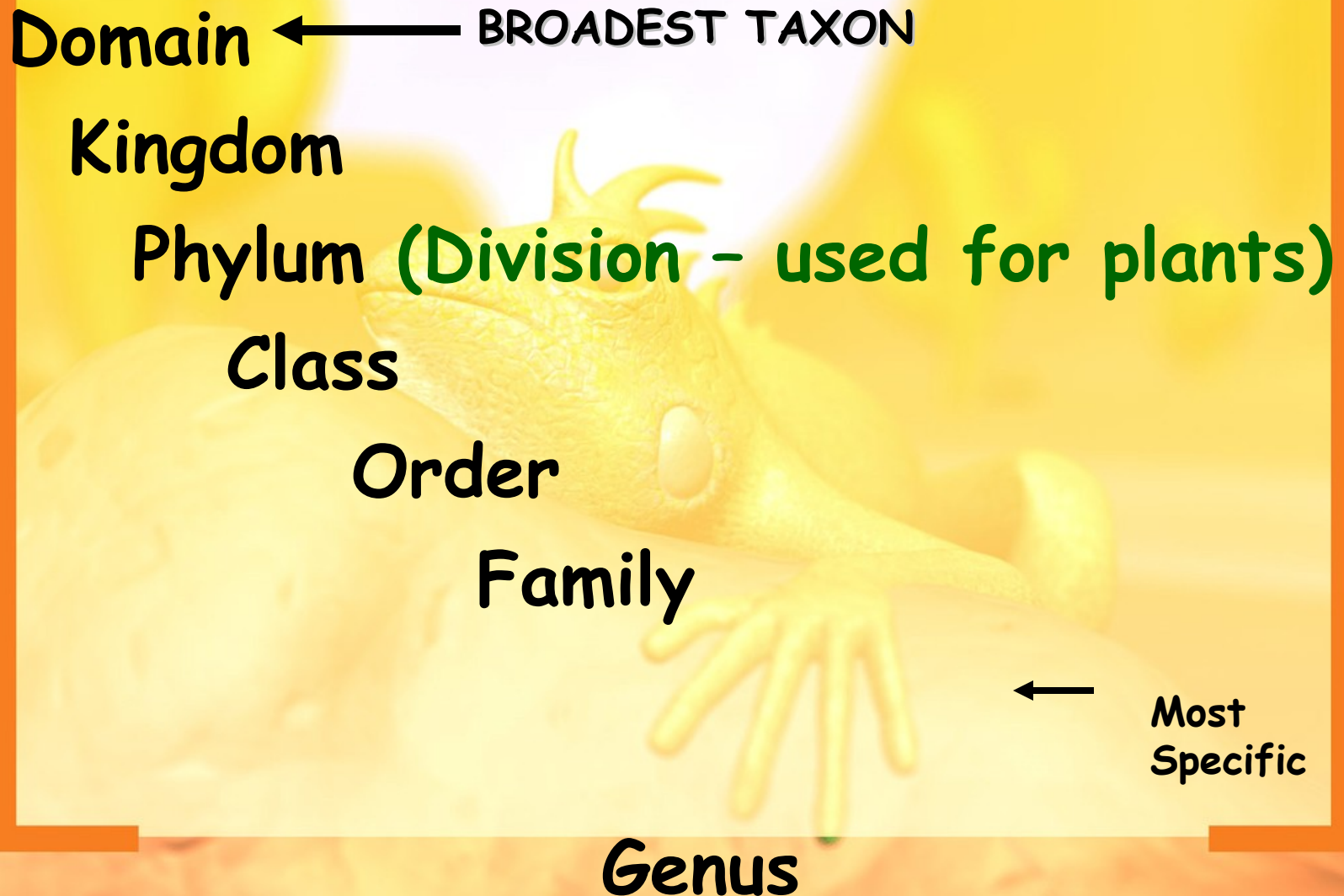*Ursus arctos*

Which TWO are more closely related?

Rules for Naming Organisms

- The *International Code for Binomial Nomenclature* contains the rules for naming organisms

- All names must be approved by International Naming Congresses (International Zoological Congress)

- This prevents duplicated names

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*

Hierarchy-Taxonomic Groups

Domain ← BROADEST TAXON

Kingdom

Phylum (Division – used for plants)

Class

Order

Family

← Most Specific

Genus

Grizzly bear	Black bear	Giant panda	Red fox	Abert squirrel	Coral snake	Sea star

KINGDOM Animalia

PHYLUM Chordata

CLASS Mammalia
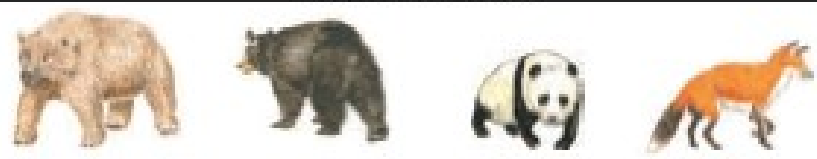
ORDER Carnivora

FAMILY Ursidae
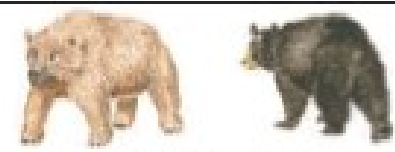
GENUS Ursus
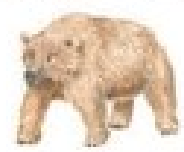
SPECIES *Ursus arctos*

Dumb

King

Phillip

Came

Over

For

Gooseberry

Soup!

Table 1.1 Classification of Humans

Classification Category	Characteristics
Domain Eukarya	Cells with nuclei
Kingdom Animalia	Multicellular, motile, ingestion of food
Phylum Chordata	Dorsal supporting rod and nerve cord
Class Mammalia	Hair, mammary glands
Order Primates	Adapted to climb trees
Family Hominidae	Adapted to walk erect
Genus *Homo*	Large brain, tool use
Species *Homo sapiens**	Body proportions of modern humans

Domains

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

ARCHAEA

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

ARCHAEAN

Methanosarcina mazei, an archaean
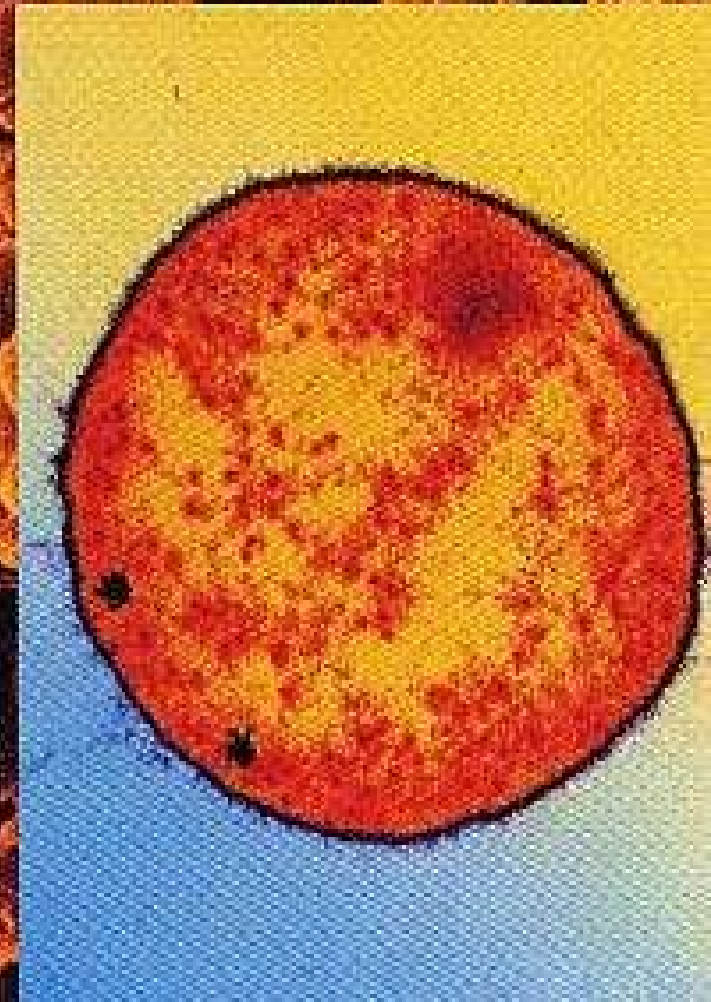
EUBACTERIA

- Some may cause DISEASE
- Found in ALL HABITATS except harsh ones
- Important decomposers for environment
- Commercially important in making cottage cheese, yogurt, buttermilk, etc.

Live in the intestines of animals

Escherichia coli, a bacterium

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)

- Cell walls made of **chitin**

Plantae

- **Multicellular**

- **Autotrophic**

- Absorb **sunlight** to make glucose – Photosynthesis

- Cell walls made of **cellulose**
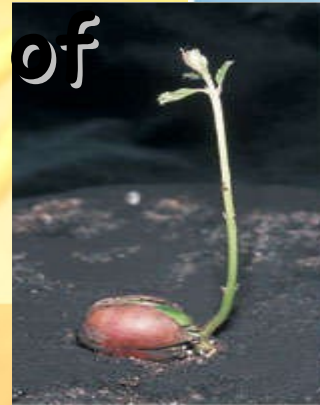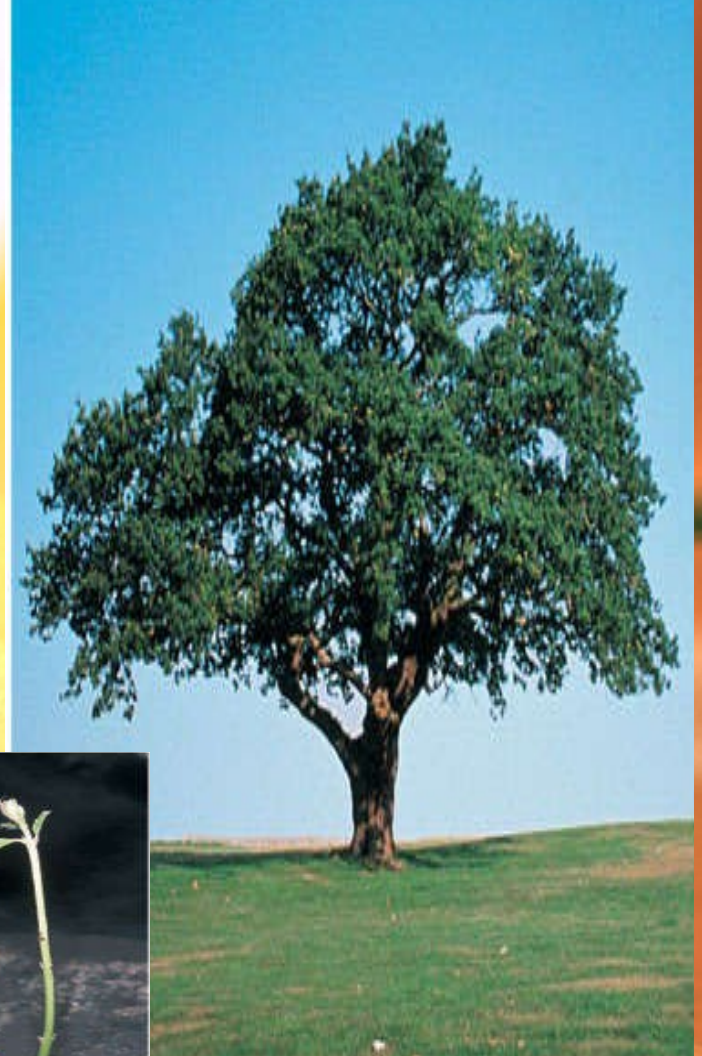
Animalia

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

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.

Taxons

- Most **genera** contain a number of similar species

- The genus *Homo* is an exception (only contains modern humans)

- Classification is based on **evolutionary relationships**

KINGDOM ANIMALIA

insects
751,000

other animals
281,000

vascular
plants
248,400

bryophytes
16,600

viruses
1000

KINGDOM
EUBACTERIA
bacteria 4800

KINGDOM
MYCOTA
fungi
69,000

KINGDOM PLANTAE

algae
26,900

KINGDOM
PROTISTA
protozoans
30,800
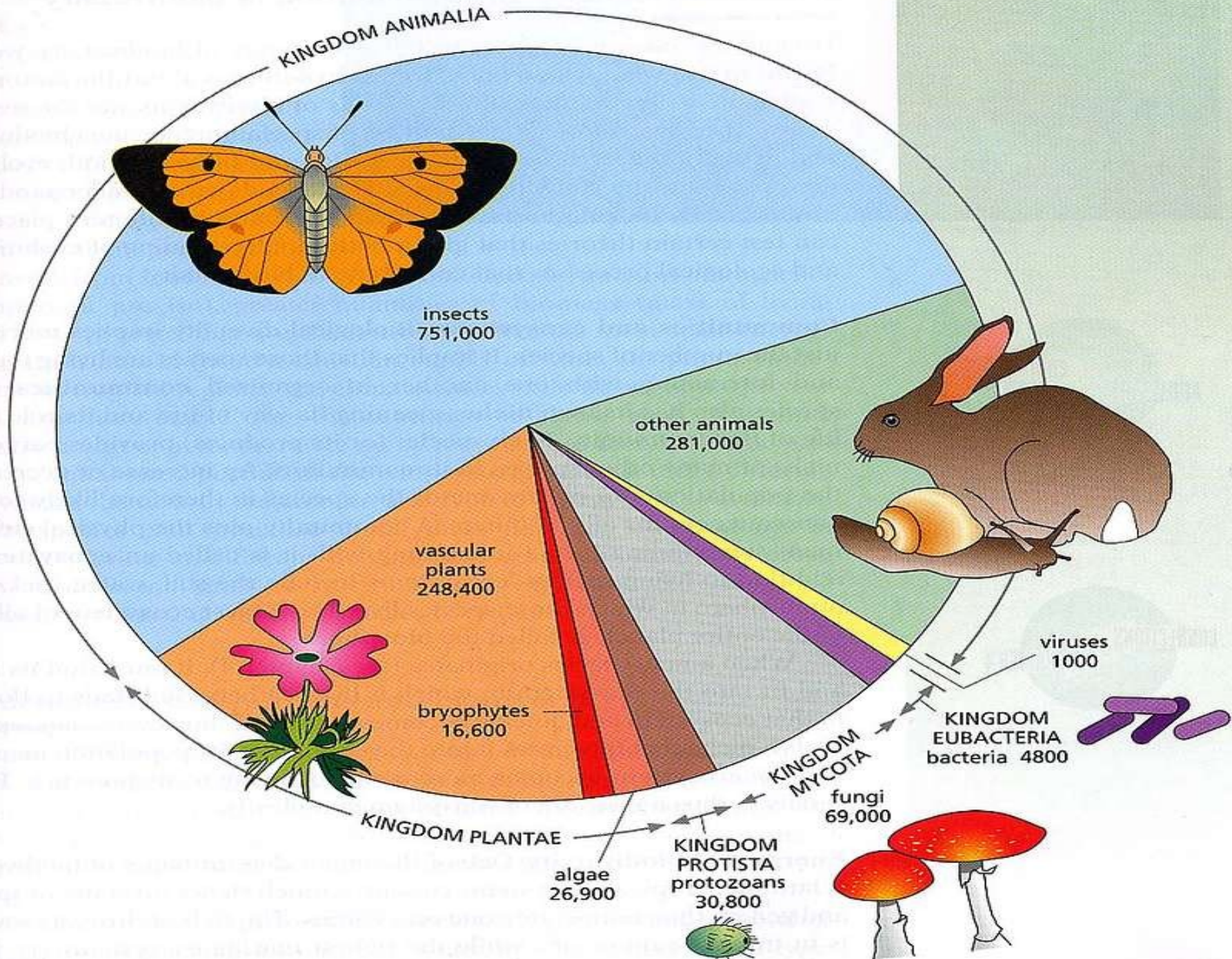
Basis for Modern Taxonomy

- **Homologous structures** (same structure, different function)

- Similar **embryo development**

- **Molecular Similarity** in *DNA, RNA*, or *amino acid* sequence of Proteins
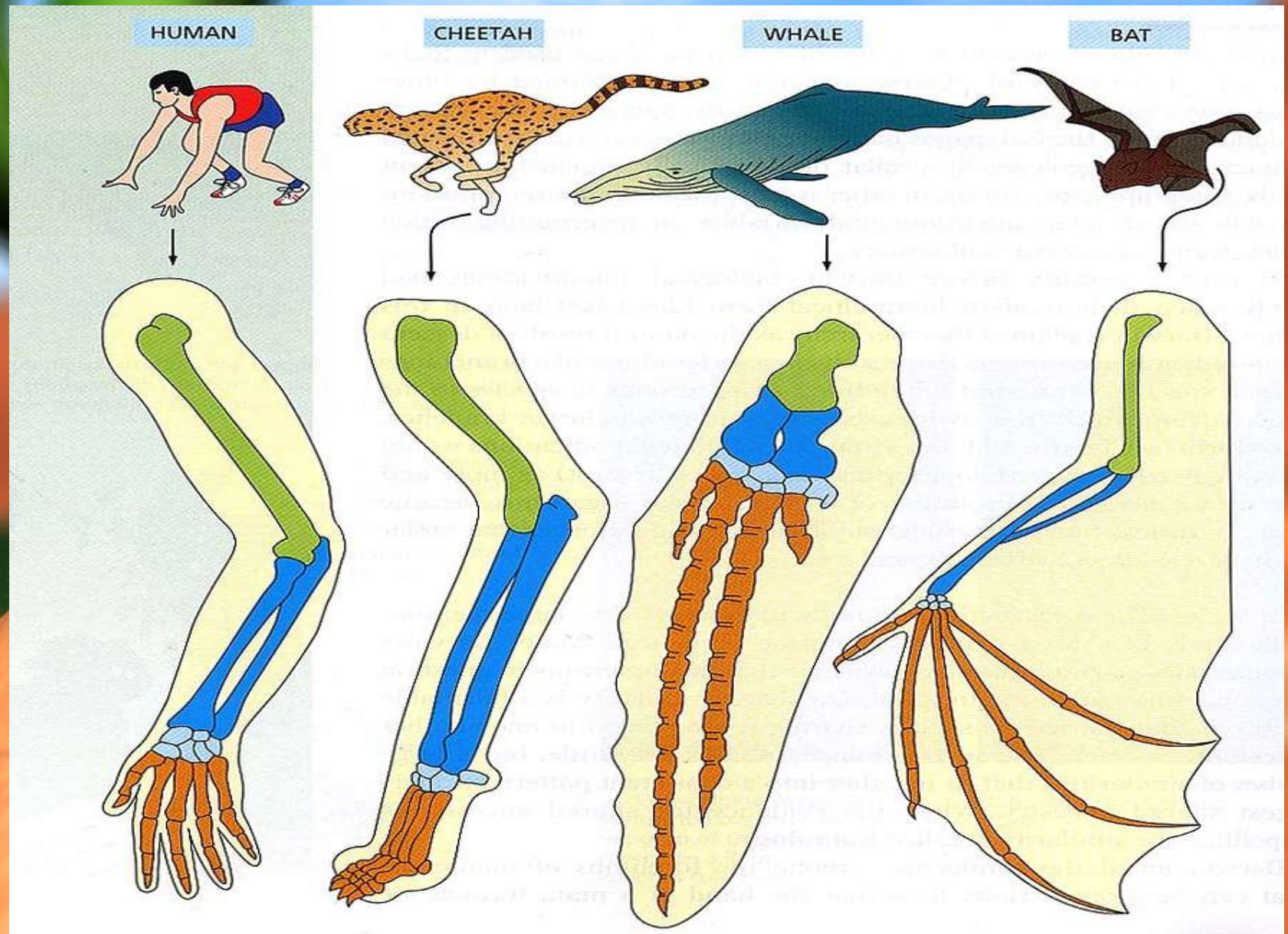
Homologous Structures (BONES in the FORELIMBS) shows Similarities in mammals.

Similarities in Vertebrate Embryos

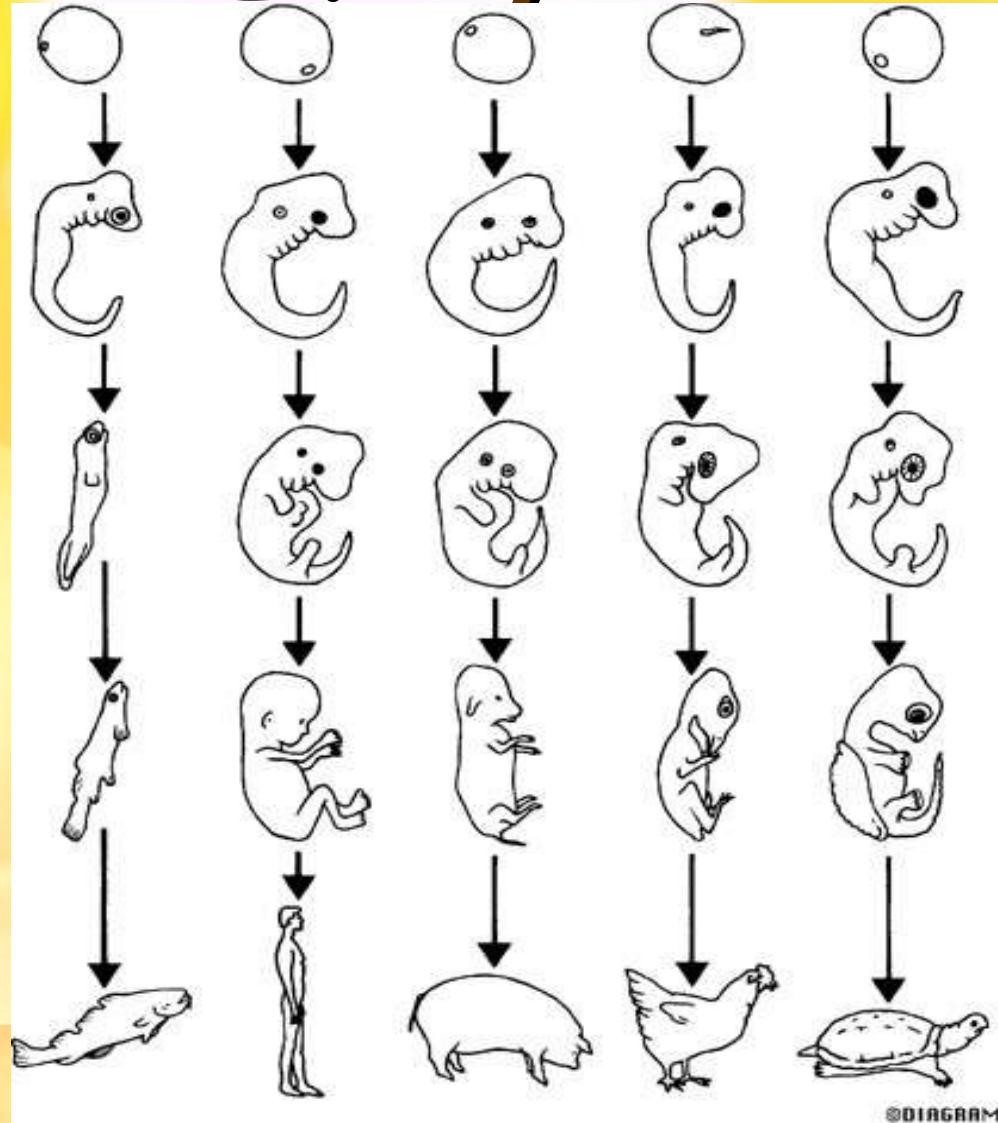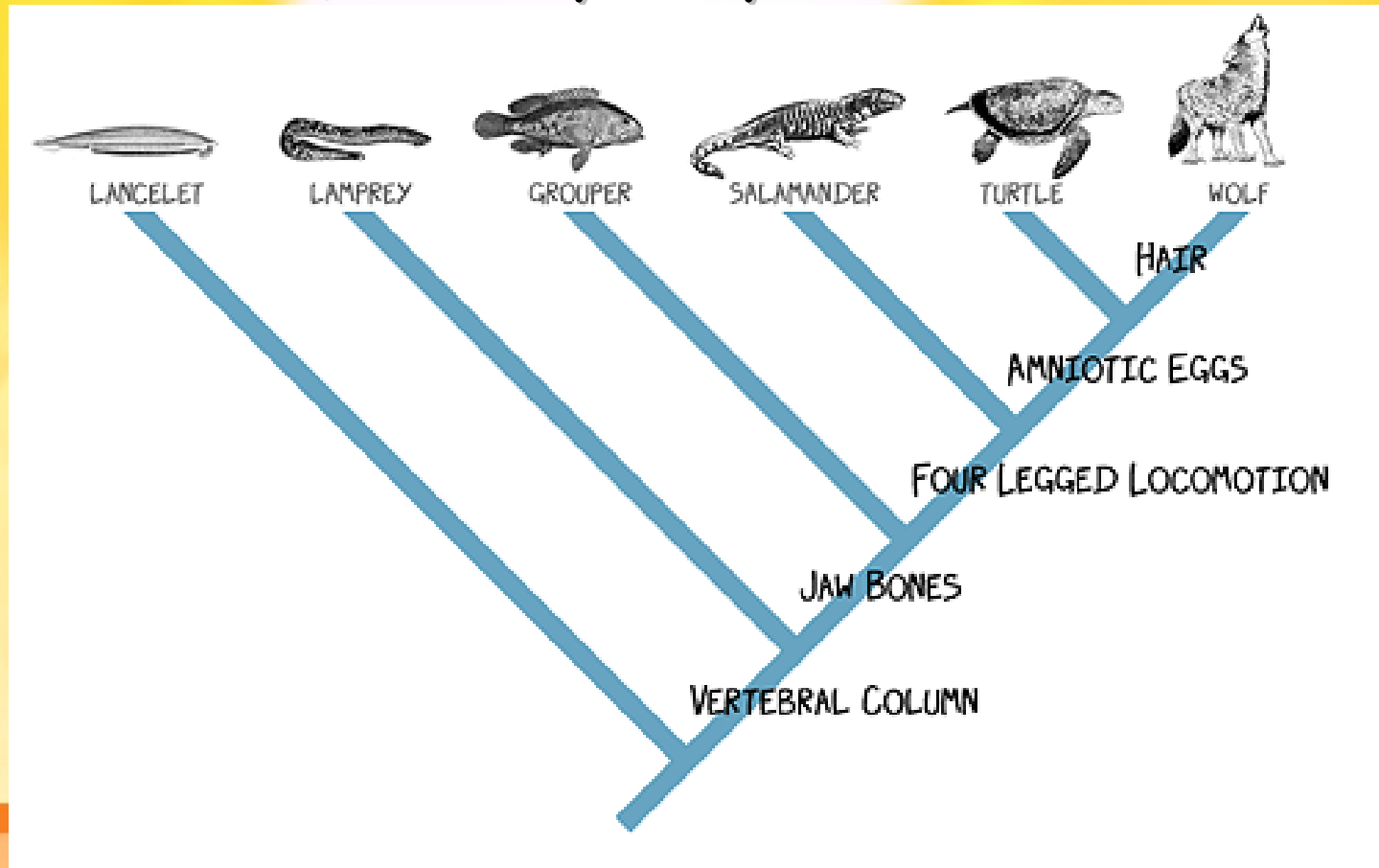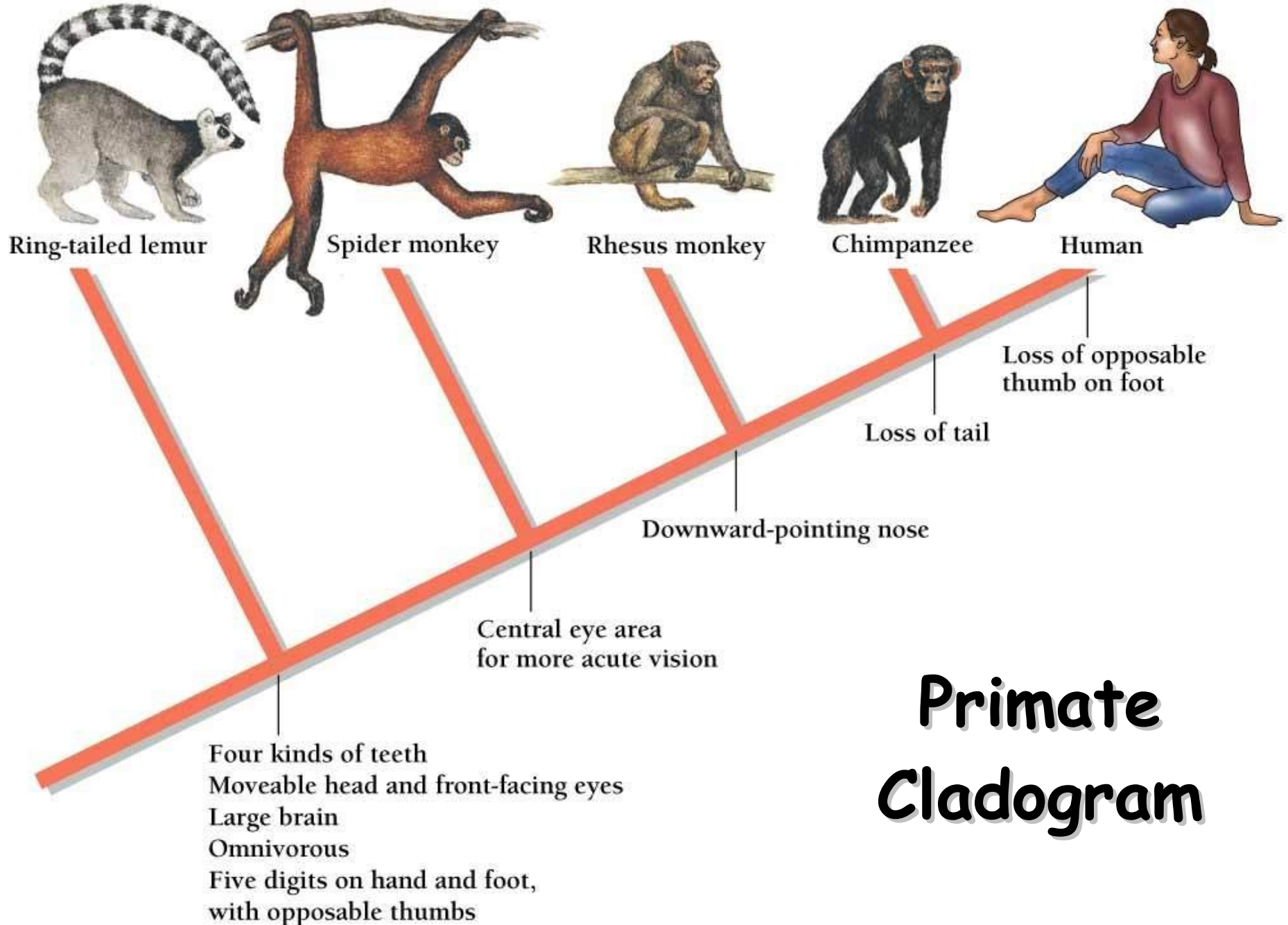# Cladogram

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

LANCELET   LAMPREY   GROUPER   SALAMANDER   TURTLE   WOLF

HAIR

AMNIOTIC EGGS

FOUR LEGGED LOCOMOTION

JAW BONES

VERTEBRAL COLUMN

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Ring-tailed lemur   Spider monkey   Rhesus monkey   Chimpanzee   Human

Loss of opposable
thumb on foot

Loss of tail

Downward-pointing nose

Central eye area
for more acute vision

Four kinds of teeth
Moveable head and front-facing eyes
Large brain
Omnivorous
Five digits on hand and foot,
with opposable thumbs

Primate
Cladogram

Dichotomous Keying

- 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