Classification

 1

SB3

Students will derive the relationship between single-celled and multi-celled organism and the increasing complexity of systems.

ଔ C. Examine the evolutionary basis of the modern classification system.

Essential Questions

₧ Why do we classify living organisms?

₧ Why has the system of classification changed?

₧ What does the current method of classification tell us about the relationships between organisms?

Did You Know?

- 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 also known as taxonomy, the science of naming and classifying organisms.

- o Arranging organisms based on their similarities

⏀Taxonomists are scientists that identify & name organisms


White oak: Quercus alba

Benefits of Classifying

Accurately & uniformly names organisms

Prevents misnomers such as starfish & jellyfish that aren't really fish
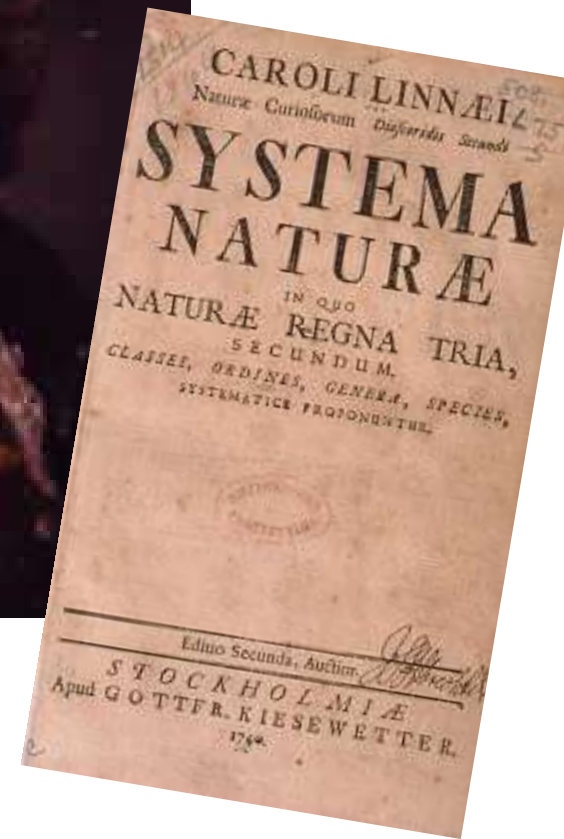
Sea"horse"??

Early Taxonomists
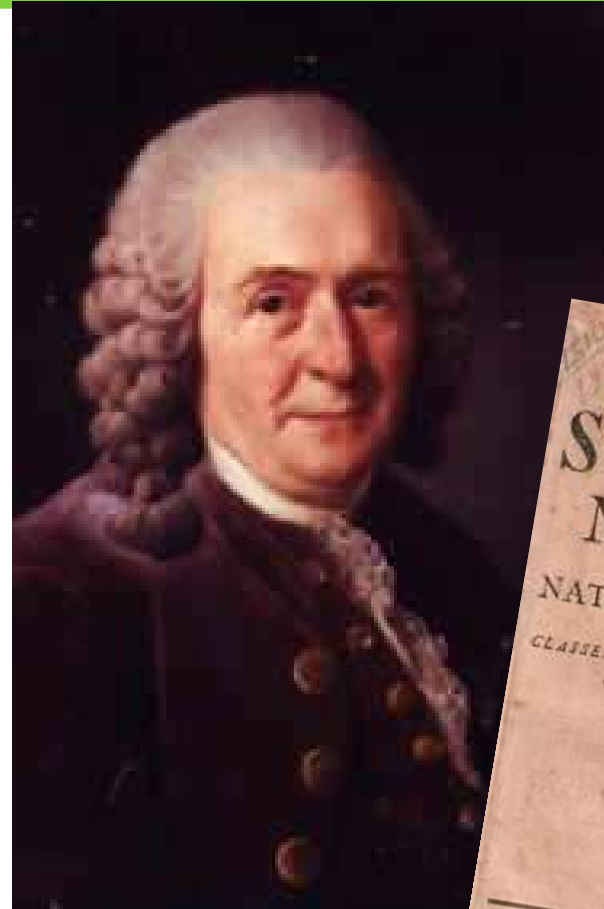
- 2000 years ago, Aristotle was the first taxonomist
- Aristotle divided organisms into plants & animals
- Classified based on habitat ---land, sea, or air dwellers
  - Problem: not all organisms fit into these limited categories
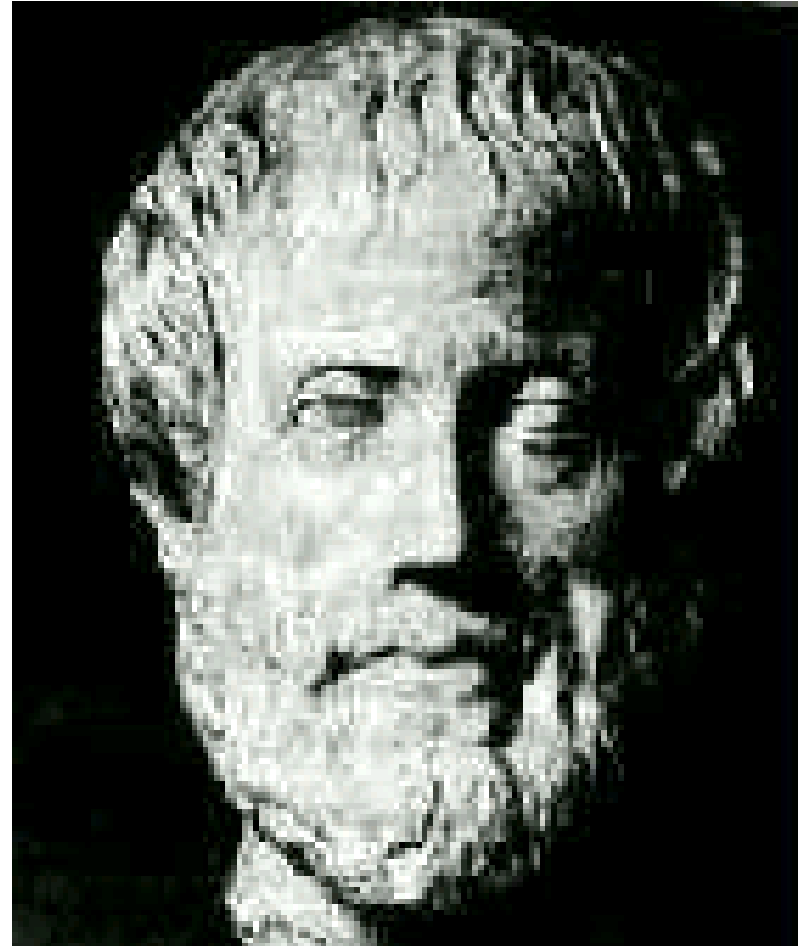
Carolus Linnaeus
1707 – 1778

- 18th century taxonomist
- Called the "Father of Taxonomy"
- Classified organisms by their physical and structural similarities
  - Not based on DNA evidence
- Developed naming system called binomial nomenclature

CAROLI LINNÆI
Naturæ Curioforum Diofcoridis Secundi
SYSTEMA
NATURÆ
IN QUO
NATURÆ REGNA TRIA,
SECUNDUM,
CLASSES, ORDINES, GENERA, SPECIES,
SYSTEMATICE PROPONUNTUR.

Editio Secunda, Auctior.

STOCKHOLMIÆ
Apud GOTTFR. KIESEWETTER.
1740.

SB3C

Standardized Naming

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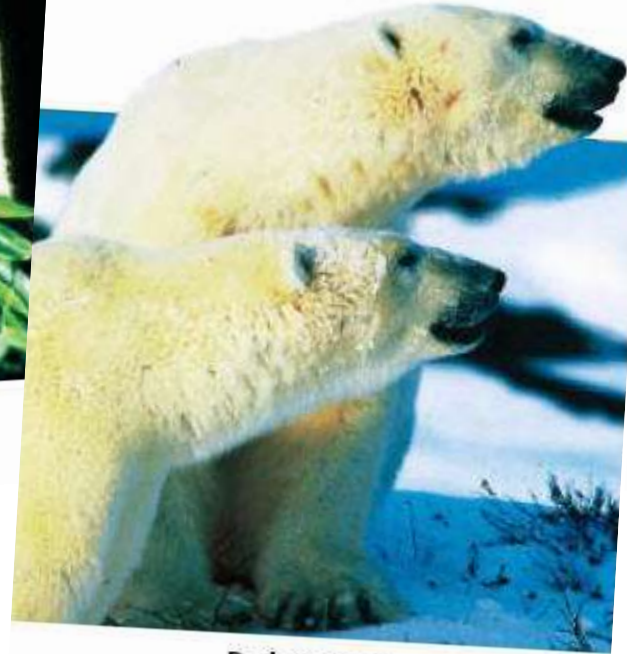- **Capitalize genus, but NOT species**

Turdus migratorius

American Robin

Binomial Nomenclature

Giant Panda
Ailuropoda melanoleuca

Polar Bear
Ursus maritimus

Grizzly Bear
Ursus arctos

Genus vs Species

- A genus includes one or more physically similar species
  - Species in the same genus are thought to be closely related.
  - Genus name is always capitalized.
- A species descriptor is the second part of a scientific name
  - Always lowercase
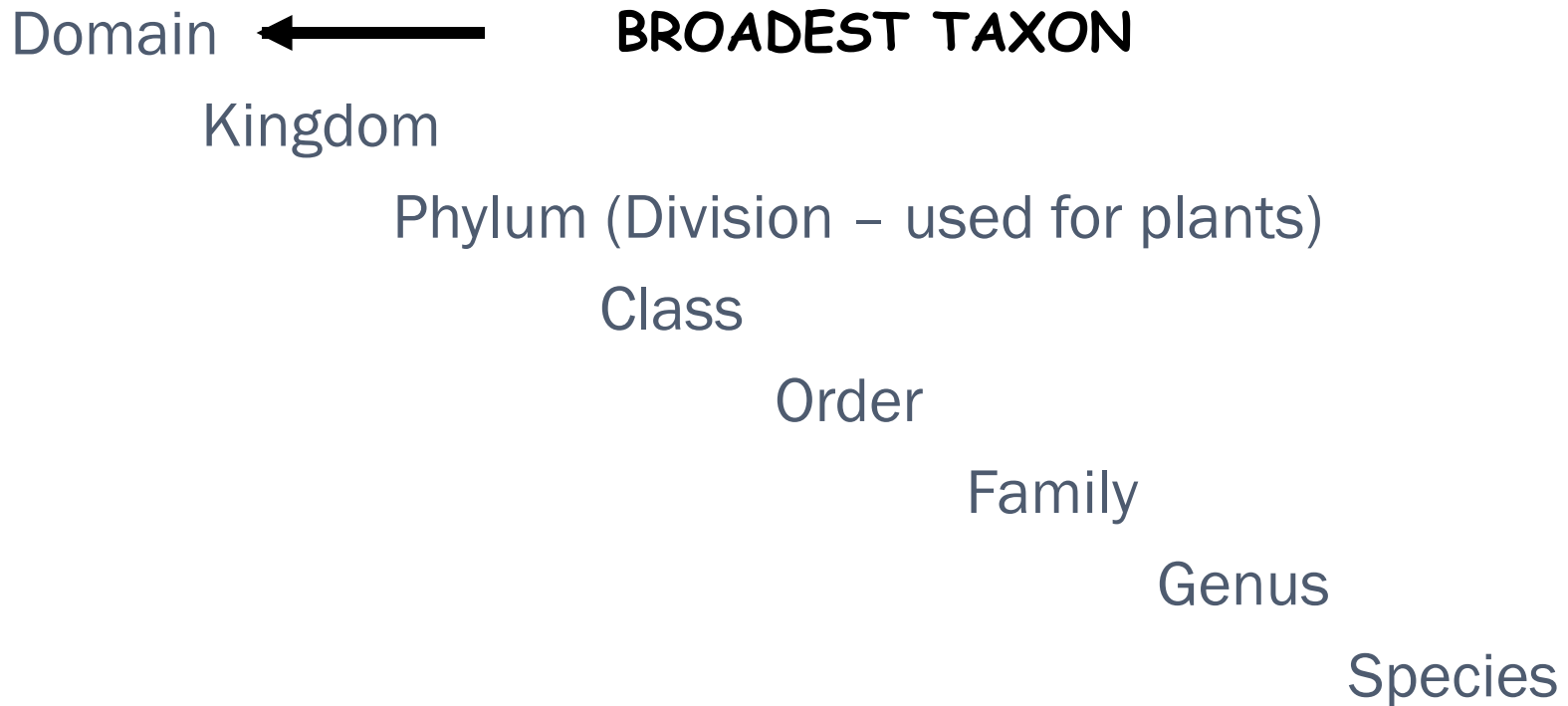 - Always follows genus name; never written alone

Tyto alba

Classification Groups

- Taxon (taxa-plural) is a group of organisms in a classification system

- 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

Genus

Species

King

Phillip

Came

Over

From

Germany

Saturday!

2/14/2013

Dichotomous Keying

- Used to identify objects or organisms
- Characteristics are given in paired statements
- Read both statements and either go to another set of characteristics OR identify the organism

Dichotomous Key – Family: Candius

1a. Candy is chewy.........................2
1b. Candy is hard..........................7

2a. Candy is wrapped.....................3
2b. Candy is not wrapped................Ursa gummius

3a. Candy is rounded.....................4
3b. Candy is not rounded................5

4a. Wrapper is all white...................Saltus taffinia
4b. Wrapper is not all white..............5

5a. Wrapper is brown and white........Tutus rollus
5b. Wrapper is not brown and white....6

6a. Wrapper is silver.....................Chocolatus cyssan
6b. Wrapper varies in color.............Stellaria explodus

7a. Candy is spherical (ball-shaped)....8
7b. Candy is not spherical..............9

8a. Candy is wrapped....................11
8b. Candy is unwrapped.................Mandibulus crackus

9a. Wrapper is transparent...............10
9b. Wrapper tells the flavor............Joyous rancheria

10a. Wrapper is clear....................Mintus stripus
10b. Wrapper is yellow..................Ranunculus scotchus

11a. Candy is on a stick.................Moronus moronus
11b. Candy is not on a stick............Spherus combustus

Example of Dichotomous Key

1a Tentacles present – Go to 2
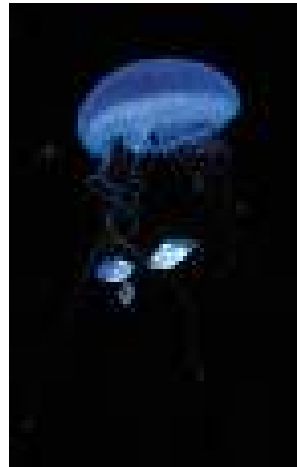1b Tentacles absent – Go to 3

2a Eight Tentacles – Octopus
2b More than 8 tentacles – 3

3a Tentacles hang down/upright – go to 4
3b Tentacles bent–Sea Anemone

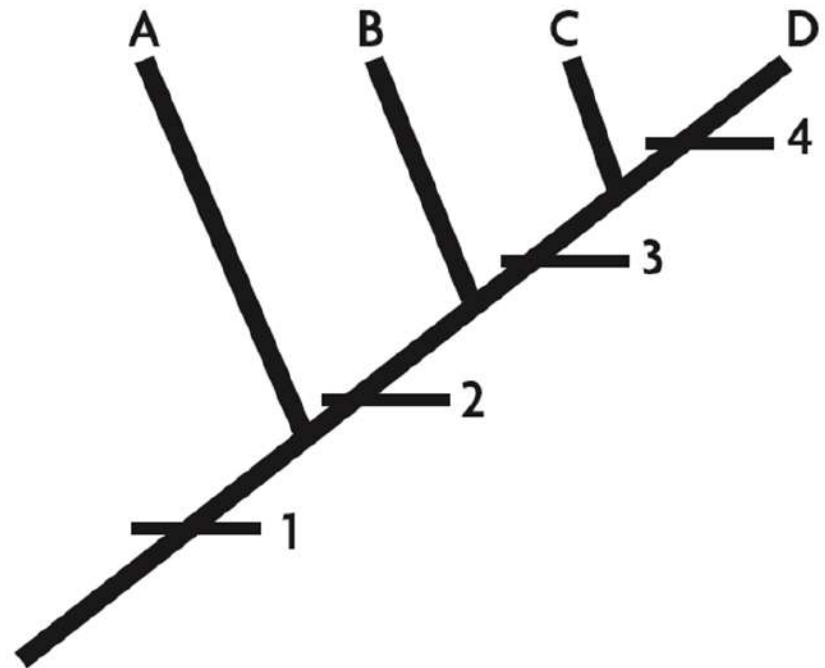4a Balloon-shaped body–Jellyfish
4b Body NOT balloon-shaped –Polyp Hydra

Phylogeny

ဢ Shows the evolutionary history for a group of species.

ဢ Can be shown as branching tree diagrams.

o Branches show how family members are related and how they are different.

Cladistics

Common method to make an evolutionary tree

- Based on common ancestry
- Species placed in order that they descended from common ancestor

Clades

Clade- group of species that share a common ancestor
- Each species shares some trait with ancestor
- Each species has traits that have changed
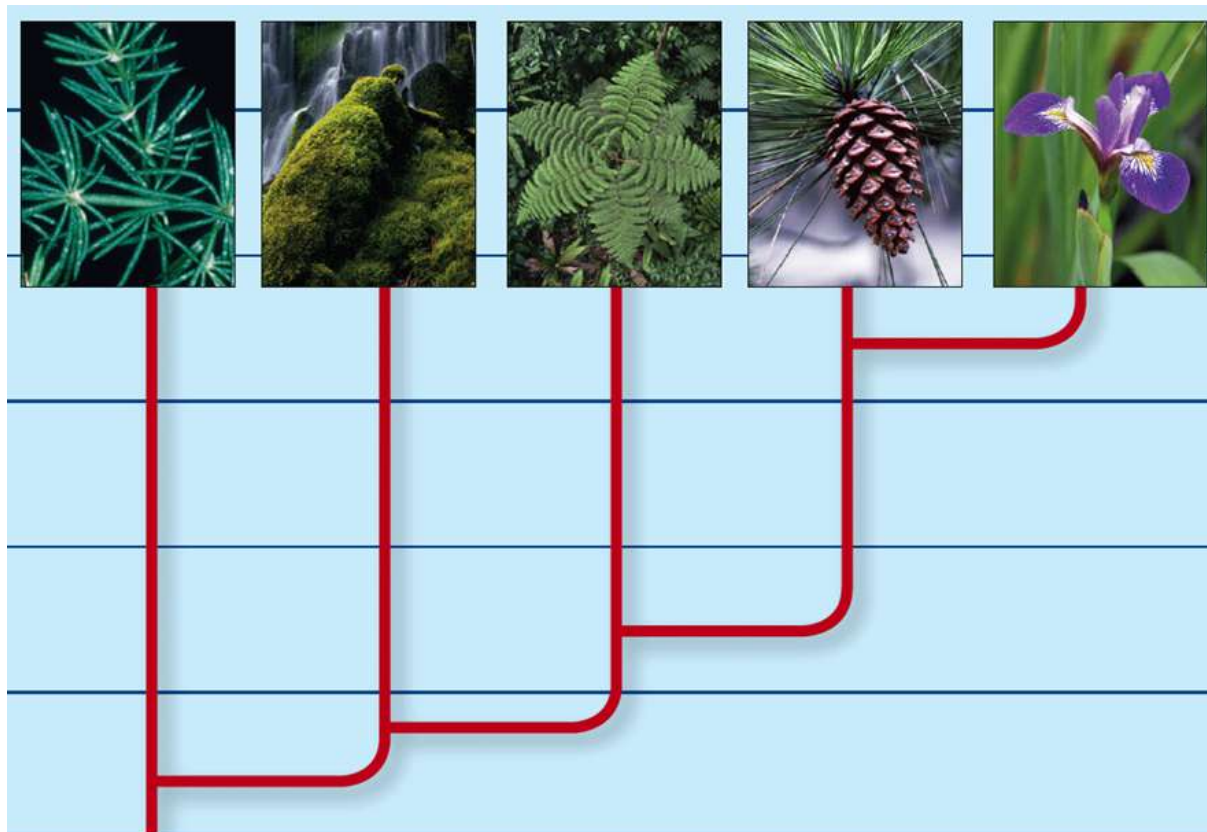
Derived Characteristics and Nodes

- Traits shared by clade members
  - Basis for arranging species in cladograms
  - More closely related species share more derived characteristics
  - Represented on cladograms as hash marks
- Nodes represent the most recent common ancestor of a clade

① Tetrapoda clade
② Amniota clade
③ Reptilia clade
④ Diapsida clade
⑤ Archosauria clade

FEATHERS & TOOTHLESS BEAKS.

SKULL OPENINGS IN FRONT OF THE EYE & IN THE JAW

OPENING IN THE SIDE OF THE SKULL

SKULL OPENINGS BEHIND THE EYE

EMBRYO PROTECTED BY AMNIOTIC FLUID

FOUR LIMBS WITH DIGITS

DERIVED CHARACTER

Cladogram Example

LANCELET   LAMPREY   GROUPER   SALAMANDER   TURTLE   WOLF

HAIR

AMNIOTIC EGGS

FOUR LEGGED LOCOMOTION

JAW BONES

VERTEBRAL COLUMN

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
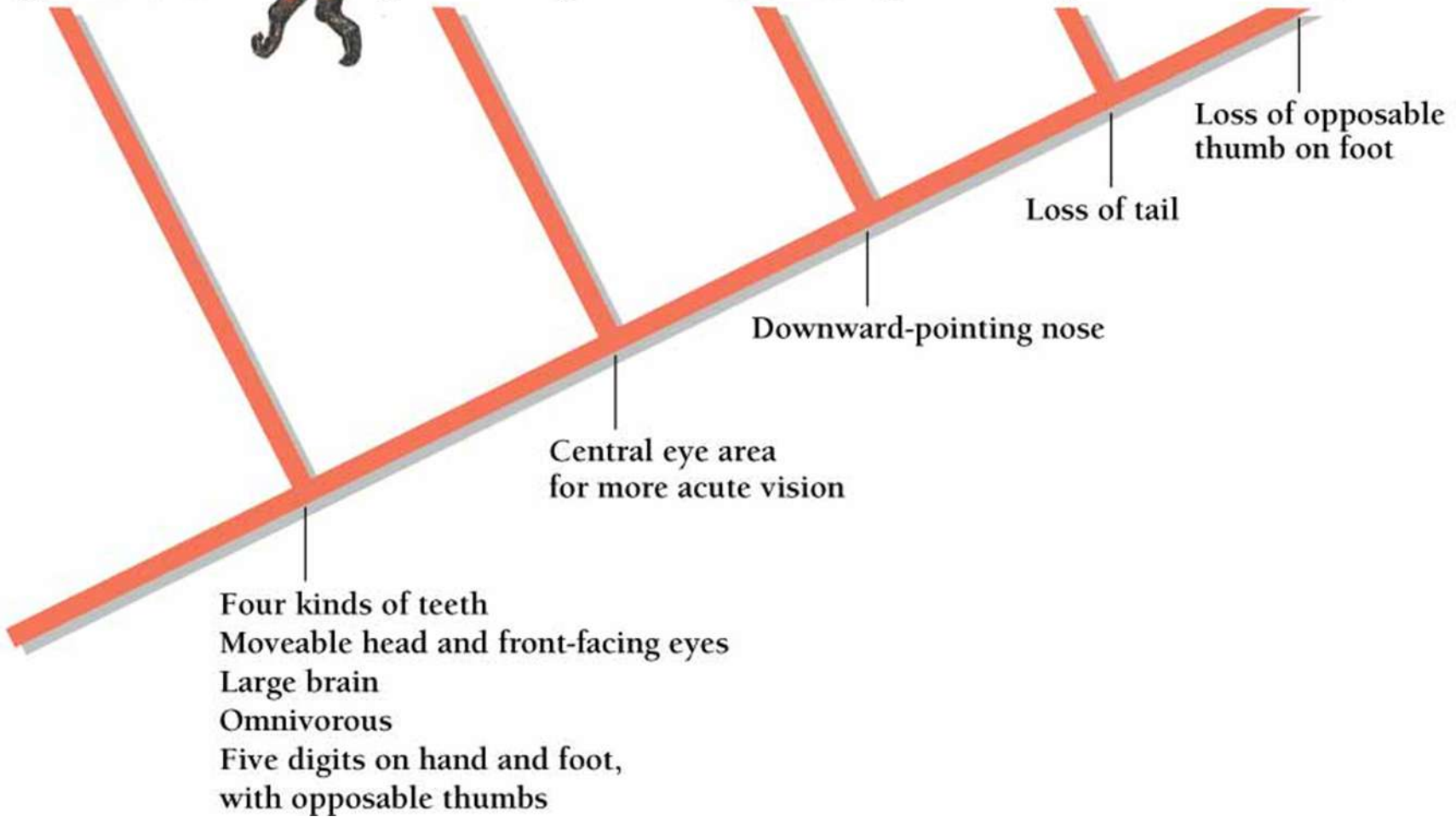
Interpreting a Cladogram

A, B, C, F, G, & H are derived characteristics
D & E are nodes
Organisms are located at the endpoints

www.biologycorner.com
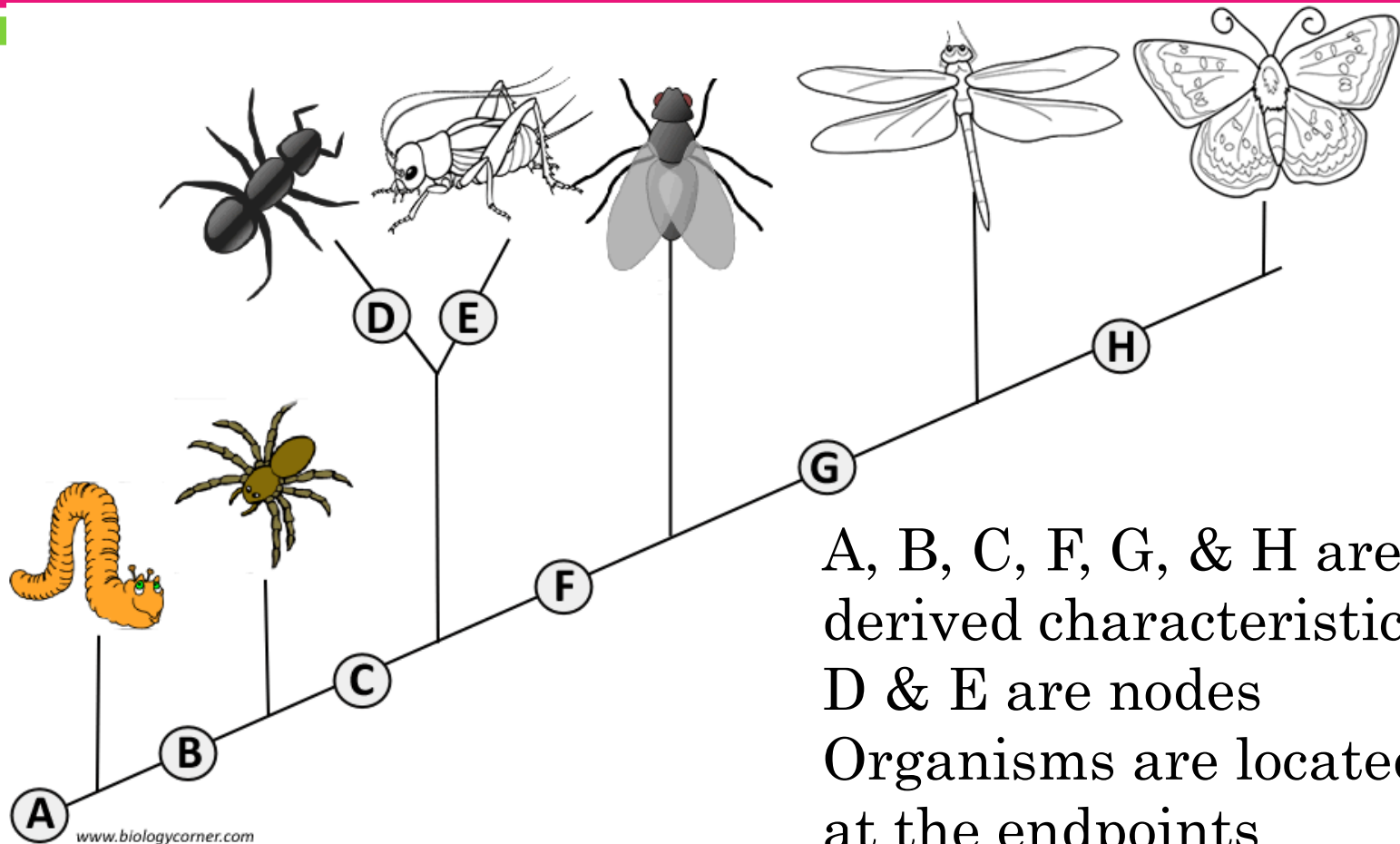
Classification Methods

- Similarities in DNA and RNA
  - The genes of many organisms show important similarities at the molecular level.

- Molecular Clocks
  - Uses DNA comparisons to estimate the length of time that two species have been evolving independently.
  - mtDNA is useful for closely related species because it is passed down unshuffled
  - rDNA is useful for studying distantly related species and has a low rate of mutation

Domains

- Broadest, most inclusive taxon

- Three domains
  - Archaea and Eubacteria (Bacteria) are unicellular prokaryotes (no nucleus or membrane-bound organelles)
  - Eukarya are more complex and have a nucleus and membrane-bound organelles

Archaea

Methanosarcina mazei, an archaean
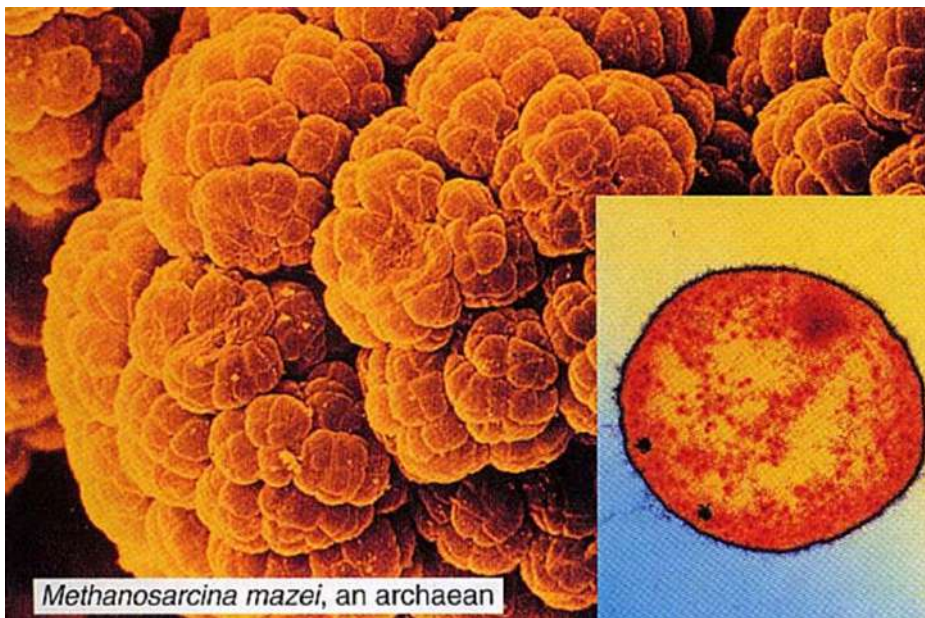
- Unicellular prokaryote
- Cell walls chemically different from bacteria
- Differences discovered by studying RNA
- Known for living in extreme environments
  - Sewage treatment plants, thermal vents, etc.
- May have been the first cells to have evolved

Eubacteria (Bacteria)

Escherichia coli, a bacterium

- Unicellular Prokaryotes
- One of largest groups on Earth
- Classified by shape, need for oxygen, and diseases caused

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

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
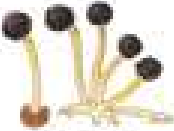
Animalia

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

Domain Archaea

Domain Eukarya

Domain Eubacteria

Protista

More protists

Plantae

More protists

Fungi

Animalia

Archaea

Eubacteria

Universal ancestor
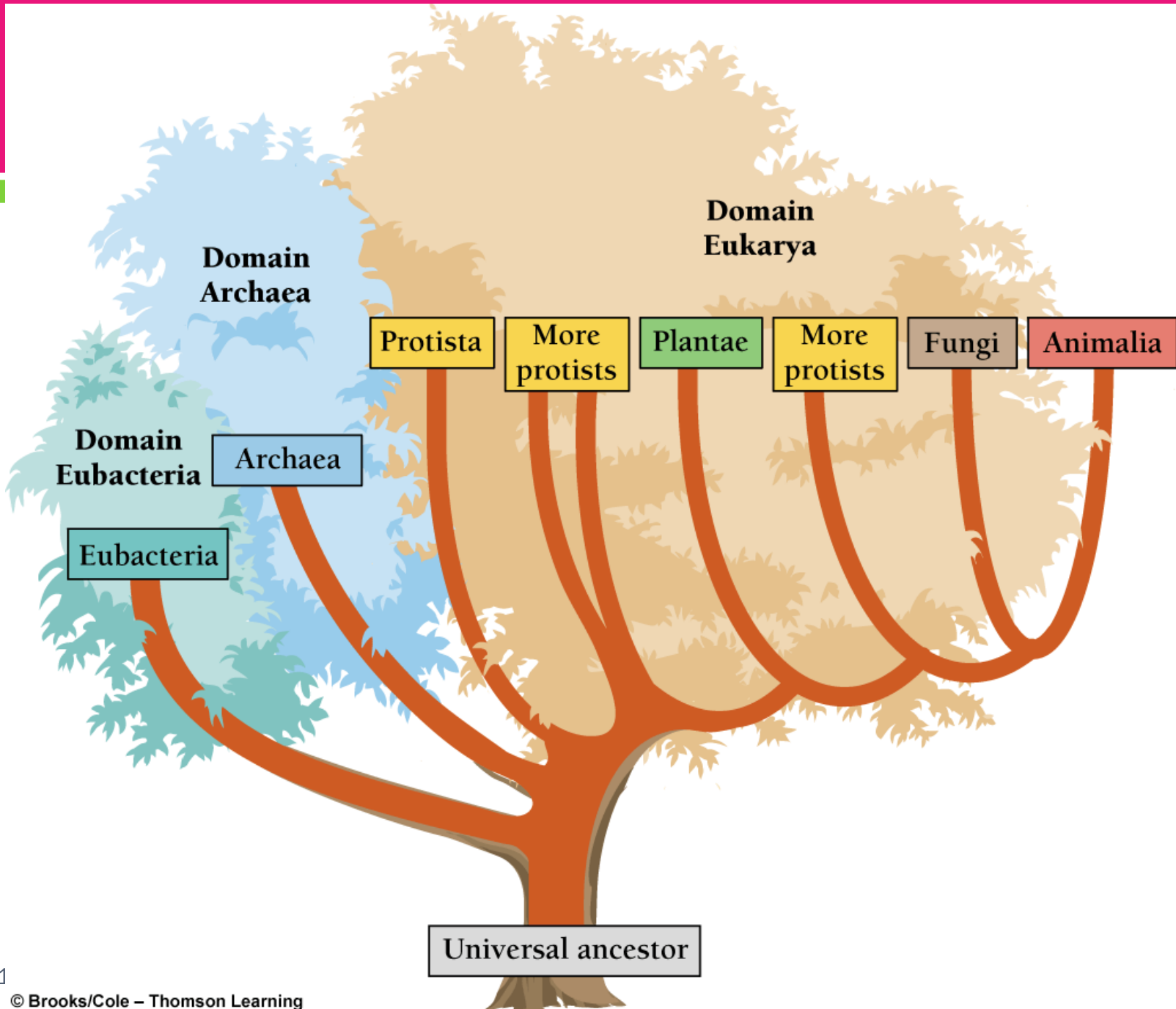
Kingdom	Organization	Type of Nutrition	Representative Organisms				
Protista	Complex single cell, some multicellular	Absorb, photo-synthesize, or ingest food	paramecium	euglenoid	slime mold	dino-flagellate	Protozoans, algae, water molds, and slime mold
Fungi	Some unicellular, most multicellular filamentous 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.