

# Classification

## Chapter 3

# Why Classify?

- To study the diversity of life, biologists use a classification system to name organisms and group them in a logical manner.

- Common names can be confusing . An organism may have the same name in different languages. It can be misleading!
- Also common names often refer to more than one organism. What we call corn is wheat in Britain
- Scientist use scientific names to exchange info and be certain that they are referring to the same organism

- When taxonomists classify organisms, they organize them into groups that have biological significance.
- In the discipline of taxonomy, scientists classify organisms and assign each organism a universally accepted name.
- In a good system of classification, organisms placed into a particular group are more similar to each other than they are to organisms in other groups.



# Assigning Scientific Names

- Common names of organisms vary from country to country (or even within countries), so scientists assign one specific scientific name for each species.
- Because 18<sup>th</sup> century scientists around the world understood Latin and Greek, they used those languages for scientific names.
- This practice is still followed in naming new species.



# Assigning Scientific Names

- Early Efforts at Naming Organisms
- The first attempts at standard scientific names described the physical characteristics of a species in great detail.
- The name of a wild violet might be: “small purple flower with four petals and heart shaped leaves that grows by the brook in the spring.”
- These names were not standardized because different scientists described different characteristics.

# Assigning Scientific Names

- Binomial Nomenclature

- What is binomial nomenclature?

- Carolus Linnaeus developed a naming system called binomial nomenclature.

- In binomial nomenclature, each species is assigned a two-part scientific name.

- \*\*The scientific name is italicized, and only the first word in the name is capitalized.

- \*\*For example: humans are *Homo sapiens*.

# Assigning Scientific Names

- The first part of the name is the genus to which the organism belongs. A **genus** is a group of closely related species. The genus name is capitalized.
- The second part of the name is unique to each species within the genus. This part of the name often describes an important trait or where the organism lives. The species name is lowercased.
- The grizzly bear's scientific name is *Ursus arctos*.

- Scientists use the Latin language when choosing a name for a species. Two different organisms can not be assigned the same scientific name. Organisms in different genres cannot have the same genus but can share the second word or species of their scientific names. The species name often describes the appearance or lifestyle of an organism. Sometimes scientific names are a tribute to the discoverer of a species.

# One example is:

- The green anole lizard and the chickadee share the name *carolinensis* (species) because they both occur in North and South Carolina.



*Anolis carolinensis*



*Parus carolinensis*

# Linnaeus's System of Classification

- Linnaeus not only named species, he also grouped them into categories. Linnaeus named two kingdoms, Plantae and Animalia.
- What is Linnaeus's system of classification?

# Linnaeus's System of Classification

● Linnaeus's seven levels of classification are—  
from largest to smallest—

- kingdom
- phylum
- class
- order
- family
- genus
- species

# Linnaeus's System of Classification

- Each level is called a taxon, or taxonomic category.
- Species and genus are the two smallest categories.

Grizzly  
bear

Black  
bear



**GENUS *Ursus***

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**SPECIES *Ursus arctos***

- Genuses that share many characteristics are grouped in a larger category, the family.

Grizzly  
bear



Black  
bear



Giant  
panda



**FAMILY Ursidae**

# Linnaeus's System of Classification

- An order is a broad category composed of similar families.

Grizzly  
bear



Black  
bear



Giant  
panda



Red  
fox



**ORDER Carnivora**

# Linnaeus's System of Classification

- The next larger category, the class, is composed of similar orders.

Grizzly  
bear



Black  
bear



Giant  
panda



Red  
fox



Abert  
squirrel



**CLASS Mammalia**

- Several different classes make up a phylum.

Grizzly bear



Black bear



Giant panda



Red fox



Abert squirrel



Coral snake



PHYLUM Chordata

● The kingdom is the largest and most inclusive of Linnaeus's taxonomic categories.

Grizzly bear

Black bear

Giant panda

Red fox

Abert squirrel

Coral snake

Sea star



KINGDOM Animalia

# Linnaeus's System of Classification

Grizzly bear

Black bear

Giant panda

Red fox

Albert squirrel

Coral snake

Sea star



**KINGDOM** Animalia



**PHYLUM** Chordata



**CLASS** Mammalia



**ORDER** Carnivora



**FAMILY** Ursidae



**GENUS** *Ursus*



**SPECIES** *Ursus arctos*

- The science of classifying living things is called Taxonomy
- Taxonomists are the scientists who practice taxonomy.
- This system of classification was developed by Linnaeus. It classified living things into a hierarchy in which individuals are assigned to groups, groups are collected into larger groups and the larger groups are part of still larger groups.

# The Tree of Life Evolves

- The Tree of Life Evolves
  - Systems of classification adapt to new discoveries.
  - Linnaeus classified organisms into two kingdoms—animals and plants. The scientific view of life is much more complicated now.
  - The only known differences among living things were the fundamental traits that separated animals from plants. Animals were mobile and used food for energy, while plants are green and immobile and perform photosynthesis.

# The Tree of Life Evolves

- Biologists soon realized that microorganisms such as the protist and the bacterium are significantly different from plants and animals. Scientists soon agreed that these microorganisms merited their own kingdom, which was named Protista.
- Mushrooms, yeasts and molds were separated from the plants and placed into their own kingdom, Fungi.
- Finally, scientists realized that bacteria lack the nuclei, mitochondria, and chloroplasts found in other forms of life. They were placed into the kingdom Monera.

# The Tree of Life Evolves

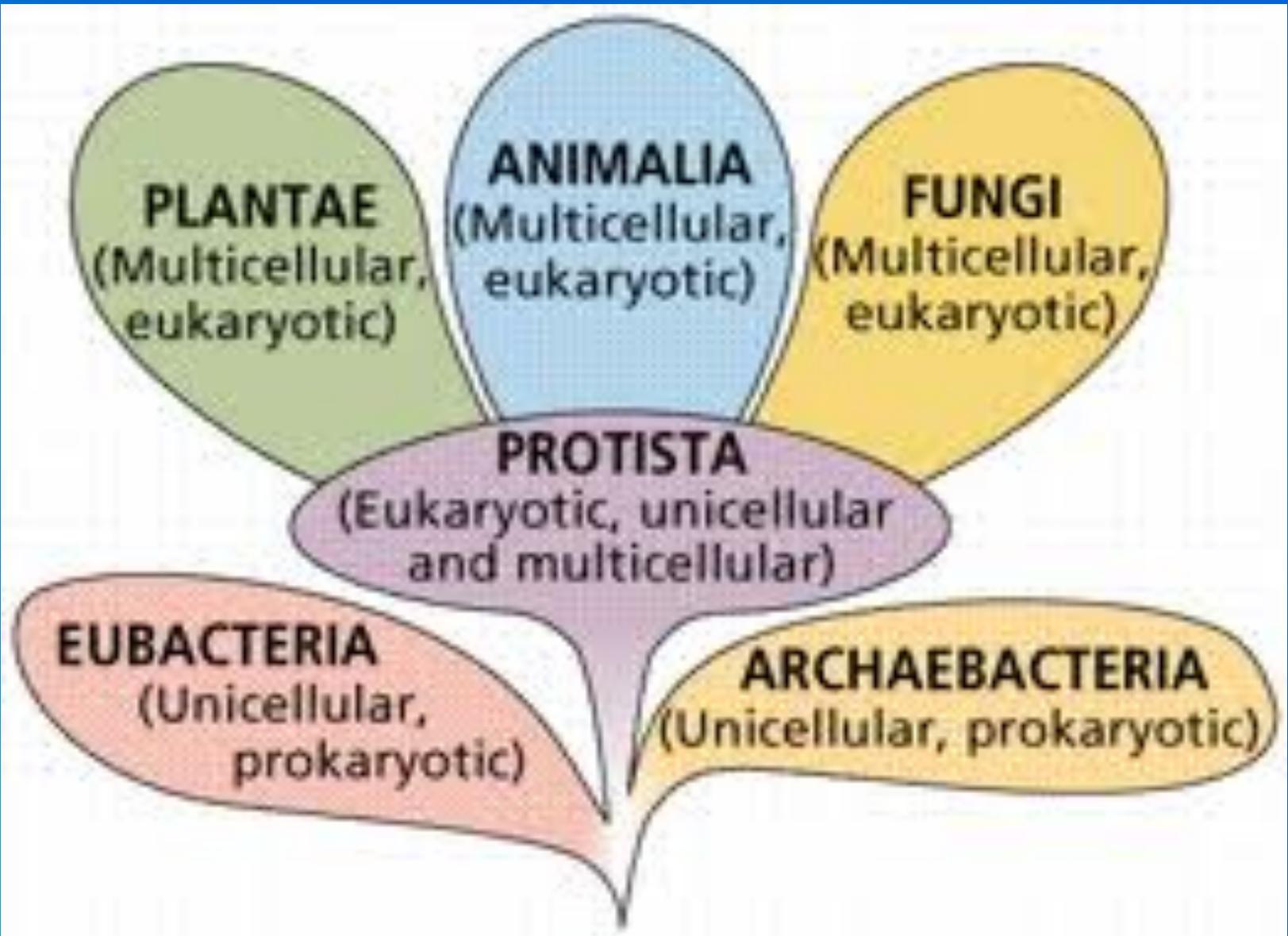
- Five Kingdoms
- Scientists realized there were enough differences among organisms to make 5 kingdoms:
  - Monera
  - Protista
  - Fungi
  - Plantae
  - Animalia

# The Tree of Life Evolves

- Six Kingdoms
  - Recently, biologists recognized that Monera were composed of two distinct groups: Eubacteria and Archaeobacteria.

# The Tree of Life Evolves

- The six-kingdom system of classification includes:
  - Eubacteria
  - Archaeobacteria
  - Protista
  - Fungi
  - Plantae
  - Animalia



# The Tree of Life Evolves

## Changing Number of Kingdoms

First Introduced	Names of Kingdoms					
<b>1700s</b>	<b>Plantae</b>				<b>Animalia</b>	
<b>Late 1800s</b>	<b>Protista</b>		<b>Plantae</b>		<b>Animalia</b>	
<b>1950s</b>	<b>Monera</b>		<b>Protista</b>	<b>Fungi</b>	<b>Plantae</b>	<b>Animalia</b>
<b>1990s</b>	<b>Eubacteria</b>	<b>Archaeobacteria</b>	<b>Protista</b>	<b>Fungi</b>	<b>Plantae</b>	<b>Animalia</b>

# The Three-Domain System

- The Three-Domain System
- Molecular analyses have given rise to a new taxonomic category that is now recognized by many scientists.
- The domain is a more inclusive category than any other—larger than a kingdom.
- The 3 domains are: Bacteria, Archaea, Eukarya

# The Three-Domain System

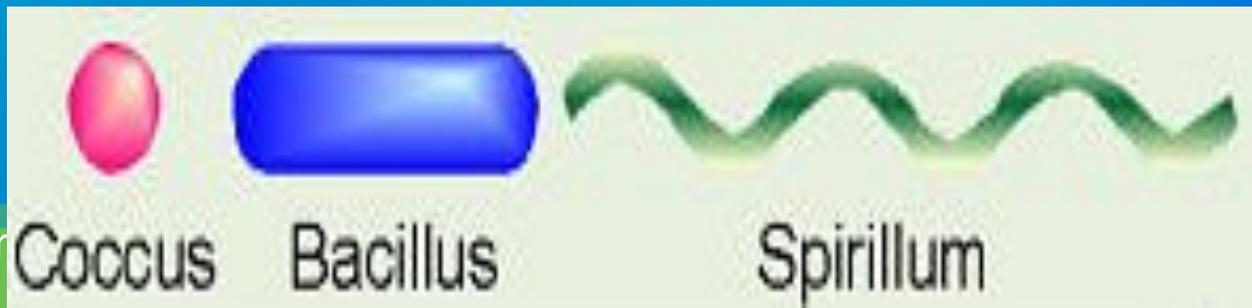
- The three domains are:
  - Bacteria, which corresponds to the kingdom Eubacteria. Ex: strep; E.coli – affect YOU
  - Archaea, which corresponds to the kingdom Archaeobacteria. Ex: methanogens - rare
  - Eukarya, which is composed of protists (amoeba), fungi (mushrooms), plants (trees), and animals (fish, mammals). – all have a nucleus

# The Three-Domain System

- Modern classification is a rapidly changing science.
- As new information is gained about organisms in the domains Bacteria and Archaea, they may be subdivided into additional kingdoms.

# Domain Bacteria

- Domain Bacteria
- Members of the domain Bacteria are unicellular prokaryotes.
- Their cells have thick, rigid cell walls that surround a cell membrane.
- Their cell walls contain peptidoglycan.
- The domain Bacteria corresponds to the kingdom Eubacteria



# Domain Archaea

- Domain Archaea

- Members of the domain Archaea are unicellular prokaryotes.
- They live in extreme environments—volcanic hot springs, brine pools, and black organic mud totally devoid of oxygen. Many of these bacteria can survive only in the absence of oxygen.
- Their cell walls lack peptidoglycan, and their cell membranes contain unusual lipids not found in any other organism.

# Domain Archaea

- The domain Archaea corresponds to the kingdom Archaeobacteria.

Classification of Living Things	
DOMAIN	Archaea
KINGDOM	Archaeobacteria
CELL TYPE	Prokaryote
CELL STRUCTURES	Cell walls without peptidoglycan
NUMBER OF CELLS	Unicellular
MODE OF NUTRITION	Autotroph or heterotroph
EXAMPLES	Methanogens, halophiles

# Domain Eukarya

- Domain Eukarya

- The domain **Eukarya** consists of organisms that have a nucleus.
- This domain is organized into four kingdoms:
  - Protista
  - Fungi
  - Plantae
  - Animalia

## Classification of Living Things

DOMAIN	Eukarya			
KINGDOM	Protista	Fungi	Plantae	Animalia
CELL TYPE	Eukaryote	Eukaryote	Eukaryote	Eukaryote
CELL STRUCTURES	Cell walls of cellulose in some; some have chloroplasts	Cell walls of chitin	Cell walls of cellulose; chloroplasts	No cell walls or chloroplasts
NUMBER OF CELLS	Most unicellular; some colonial; some multicellular	Most multicellular; some unicellular	Multicellular	Multicellular
MODE OF NUTRITION	Autotroph or heterotroph	Heterotroph	Autotroph	Heterotroph
EXAMPLES	<i>Amoeba</i> , <i>Paramecium</i> , slime molds, giant kelp	Mushrooms, yeasts	Mosses, ferns, flowering plants	Sponges, worms, insects, fishes, mammals

# Domain Eukarya

## ● Protista

- The kingdom Protista is composed of eukaryotic organisms that cannot be classified as animals, plants, or fungi.
- Its members display the greatest variety.
- They can be unicellular or multicellular; photosynthetic or heterotrophic; and can share characteristics with plants, fungi, or animals.

# Domain Eukarya

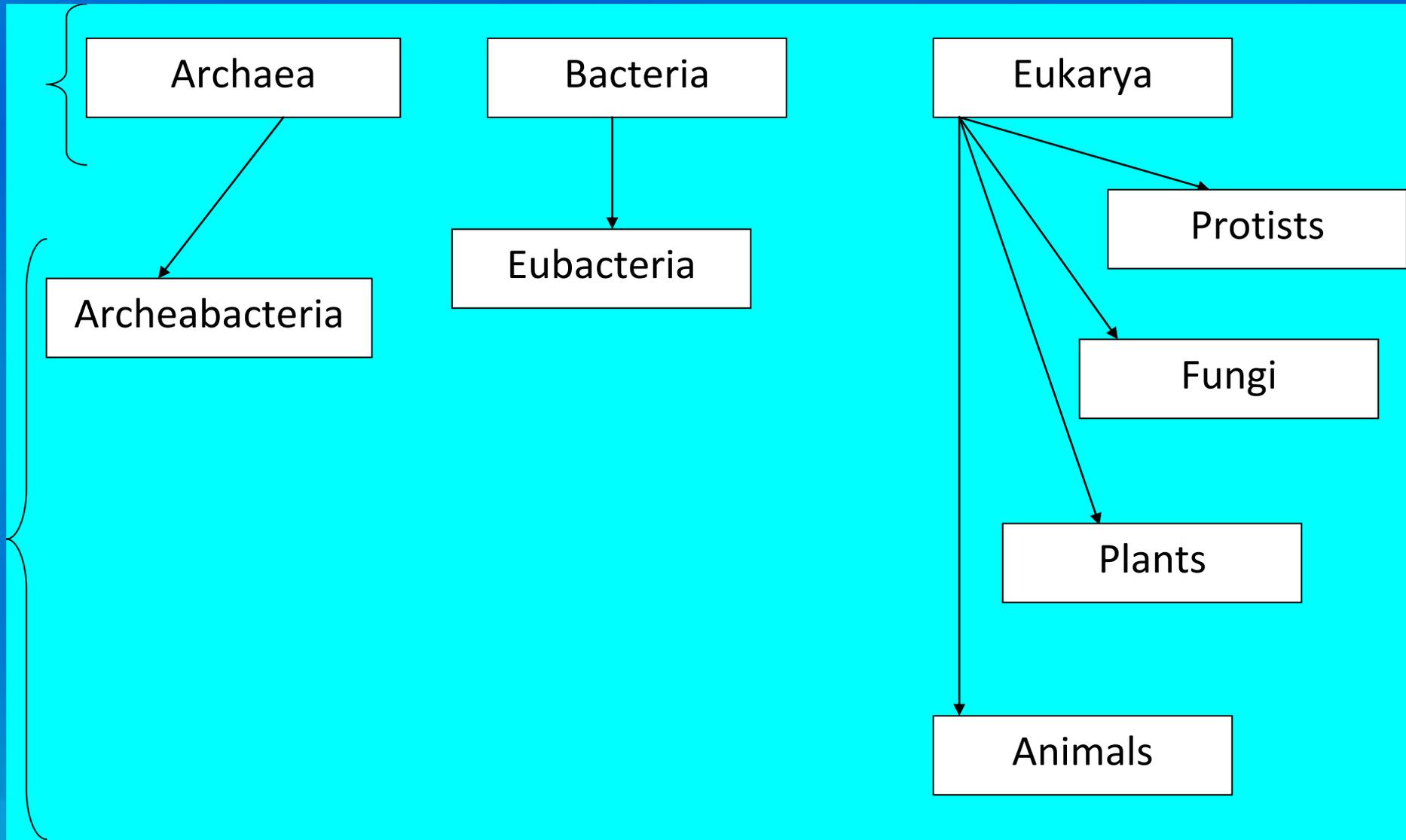
- Fungi
  - Members of the kingdom Fungi are heterotrophs.
  - Most fungi feed on dead or decaying organic matter by secreting digestive enzymes into it and absorbing small food molecules into their bodies.
  - They can be either multicellular (mushrooms) or unicellular (yeasts).

# Domain Eukarya

- Plantae
  - Members of the kingdom Plantae are multicellular, photosynthetic autotrophs.
  - Plants are nonmotile—they cannot move from place to place.
  - Plants have cell walls that contain cellulose.
  - The plant kingdom includes cone-bearing and flowering plants as well as mosses and ferns.

Amoeba





# Intro to Plants

- Plants dominate the landscape.
- Where plants are plentiful other organisms thrive such as animals, fungi, and microorganisms
- Plants provide the base for food chains, shade, shelter, and oxygen for animals of every size and kind.



# Intro to Plants

- Plants belong to the kingdom Plantae and they are multicellular eukaryotes that have cell walls and they carry out photosynthesis using green pigments called chlorophyll
- Plants include trees, flowers, moss, ferns, shrubs, and grasses.
- Plants are autotrophs meaning they make their own food.
- Plants are different from animals but are still living things – they are made of cells, grow, and reproduce!

# Intro to Plants

- Plants have a life cycle like all living things.
- To survive they need:
  - Sunlight
  - Water
  - Minerals
  - Gas exchange



# Intro to Plants

- Sunlight

- Plants use energy from sunlight to do photosynthesis. They gather sunlight with leaves that are arranged on the stem as to maximize light absorption

- Water & Minerals

- Cells require water. Water is used in photosynthesis so it is used up quickly. As they absorb water they absorb minerals and nutrients in the soil that are needed for plant growth

# Intro to Plants

- Gas Exchange
  - Plants require oxygen & carbon dioxide to support respiration and do photosynthesis
- Movement of water & nutrients
  - Plants take up water & minerals through their roots and make food in their leaves.



# Intro to Plants



- The first plants looked much like algae. Algae is green; it does photosynthesis – making it a producer BUT algae is NOT a plant
- Plants eventually evolved into moss-like organisms that grew close to the ground
- And to adapt to their location plants took on many different forms. This is why some plants live and thrive well in some locations but not others.

# Intro to Plants

- The plant kingdom is divided into 4 groups which we will be studying based on 3 features: water conducting tissues, seeds, and flowers
- Today botanist can use DNA testing to classify plants
- The four groups are:
  - Mosses (15,600 species)
  - Ferns (11,000 species)
  - Cone-bearing (760 species)
  - Flowering (235,000 species)

## ● REVIEW QUESTIONS

- What is the difference in a common name and a scientific name
- What language is used for scientific names
- What is binomial nomenclature
- How many names are in a scientific name
- What is the genus? What is the species
- How is a scientific name written
- How many organism can have the same scientific name
- Who came up with the classification system
- In order what are the levels of classification from largest to smallest
- What is the largest most broadest level

- What level is composed of orders (HINT: what is larger than an order)
- The classification of living things is called what
- What were the original 2 levels of classification
- What level are yeast and mushrooms in
- What level are all bacteria in?
- What is a domain
- The KINGDOM Eubacteria belong to what DOMAIN
- All living things that have a nucleus belong to what DOMAIN
- What is a protist
- What is a fungus
- How are plants classified

- How are plants and animals different
- What can be found where plants are plentiful
- What things do plants provide
- List examples of plants
- What does autotroph mean
- Are plants living?
- What do plants need to survive
- Why is sunlight important
- Do cells require water?
- What do plants get from the soil
- What did the first plants look like
- What are the 4 groups of plants