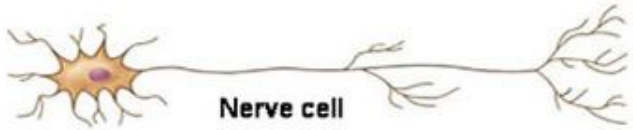
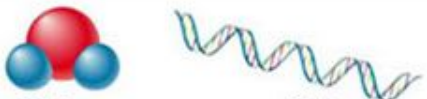
The Organization of Life

Defining an Ecosystem

Ecosystems are communities of organisms and their abiotic environment

Do not have clear boundaries

Biosphere	The part of Earth that contains all ecosystems	
Ecosystem	Community and its nonliving surroundings	
Community	Populations that live together in a defined area	
Population	Group of organisms of one type that live in the same area	 Bison herd
Organism	Individual living thing	 Bison
Groups of Cells	Tissues, organs, and organ systems	 Nervous tissue Brain Nervous system
Cells	Smallest functional unit of life	 Nerve cell
Molecules	Groups of atoms; smallest unit of most chemical compounds	 Water DNA

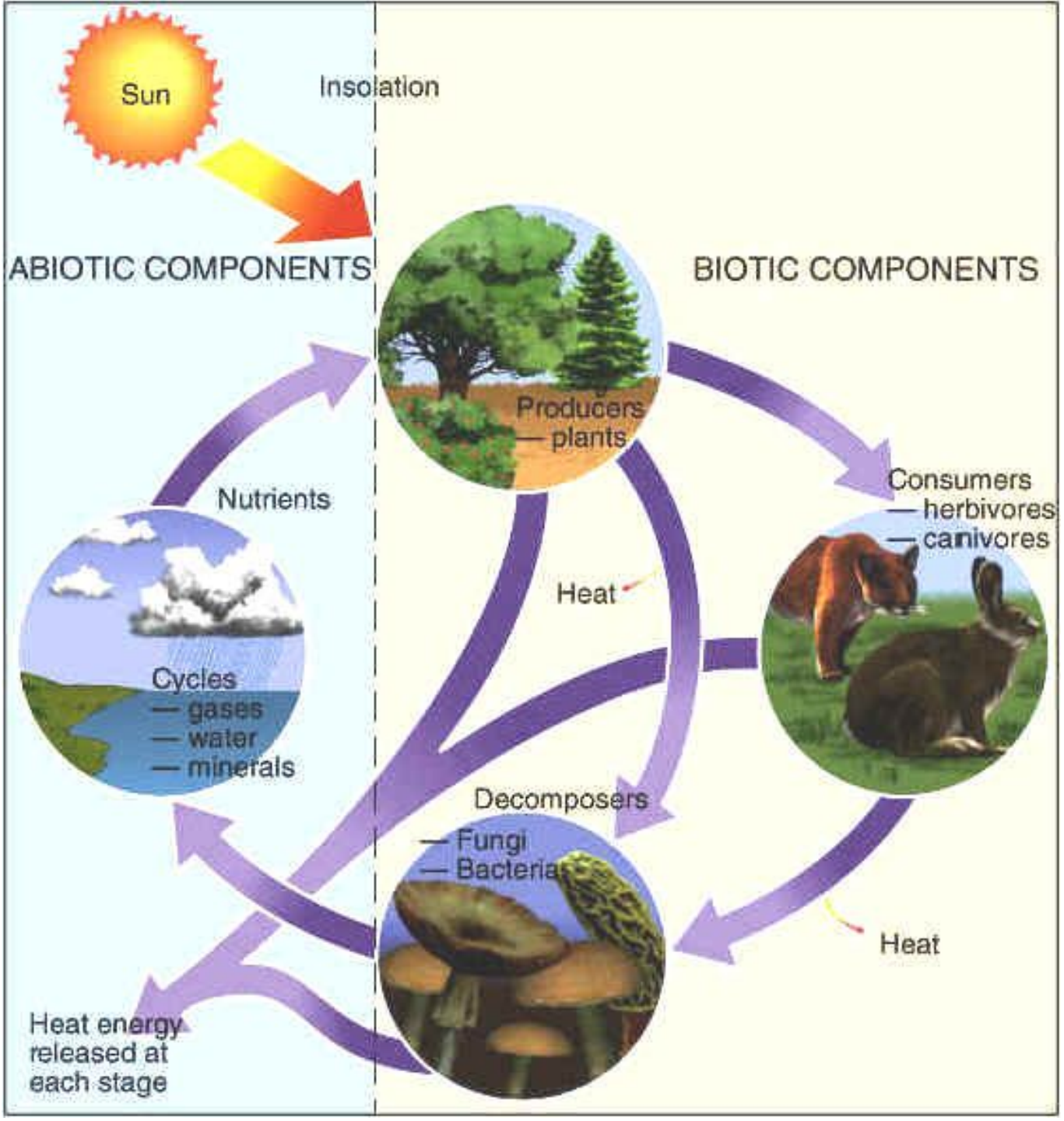
The Components of an Ecosystem

In order to survive, ecosystems need five basic components: energy, mineral nutrients, water, oxygen, and living organisms

Biotic factors= living

Abiotic factors= nonliving

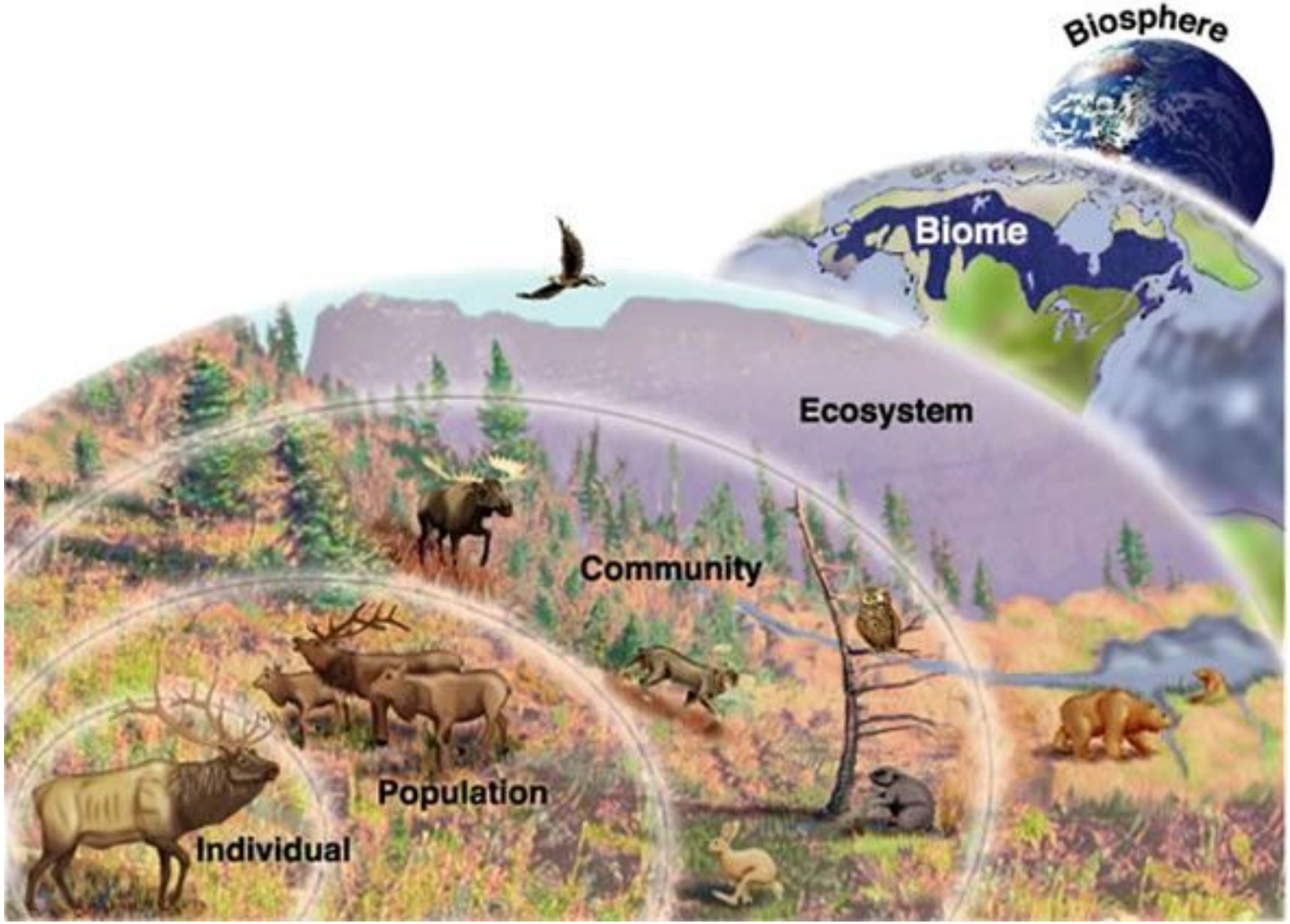
Organism < species < population < community < ecosystem < biome


Sun
Insolation
ABIOTIC COMPONENTS
BIOTIC COMPONENTS
Producers
— plants
Consumers
— herbivores
— carnivores
Nutrients
Heat
Cycles
— gases
— water
— minerals
Decomposers
— Fungi
— Bacteria
Heat
Heat energy
released at
each stage

Habitat

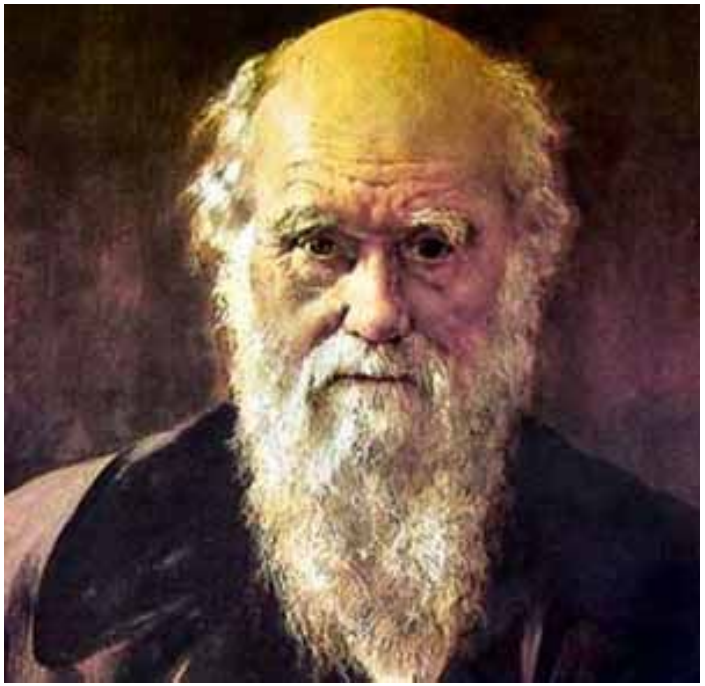
Habitats are places where an organism usually lives

Most organisms are adapted to live in a certain habitat


Biosphere
Biome
Ecosystem
Community
Population
Individual

Evolution by Natural Selection

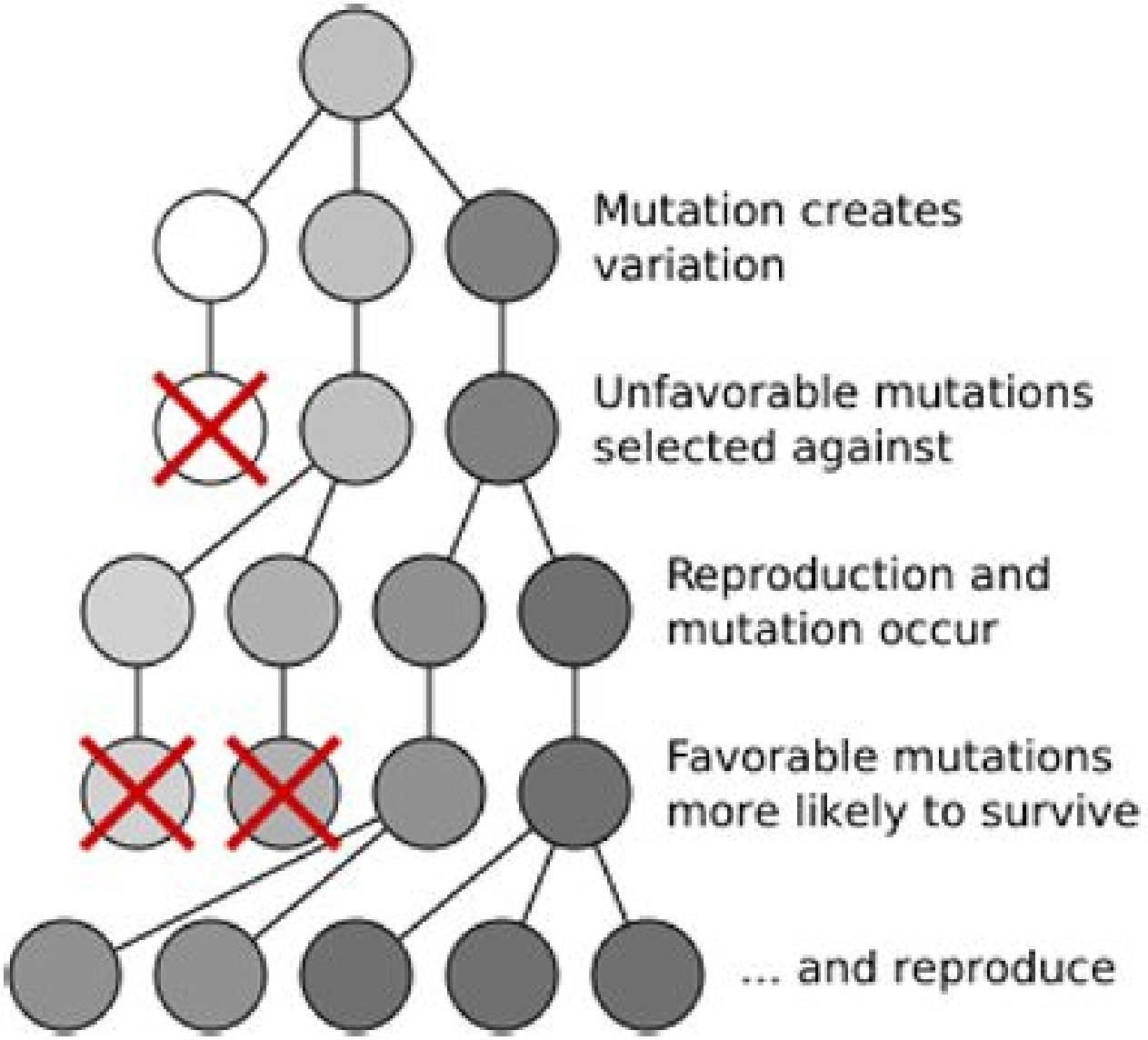
Charles Darwin (1809-1882)

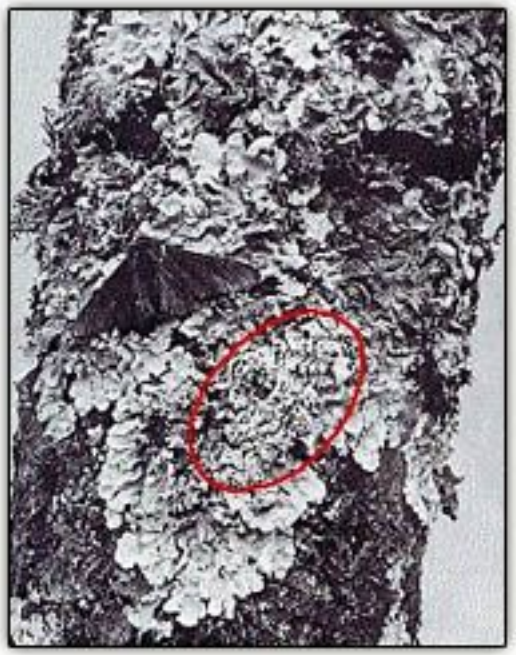


Evolution by Natural Selection

Natural selection is the process by which individuals that have favorable variations and are better adapted to their environment survive and reproduce more successfully than less well adapted individuals do

Evolution is a change in the characteristics of a population from one generation to the next


Mutation creates variation
Unfavorable mutations selected against
Reproduction and mutation occur
Favorable mutations more likely to survive
... and reproduce



Generation 1

Generation 2

Generation 3

Evolution by Natural Evolution

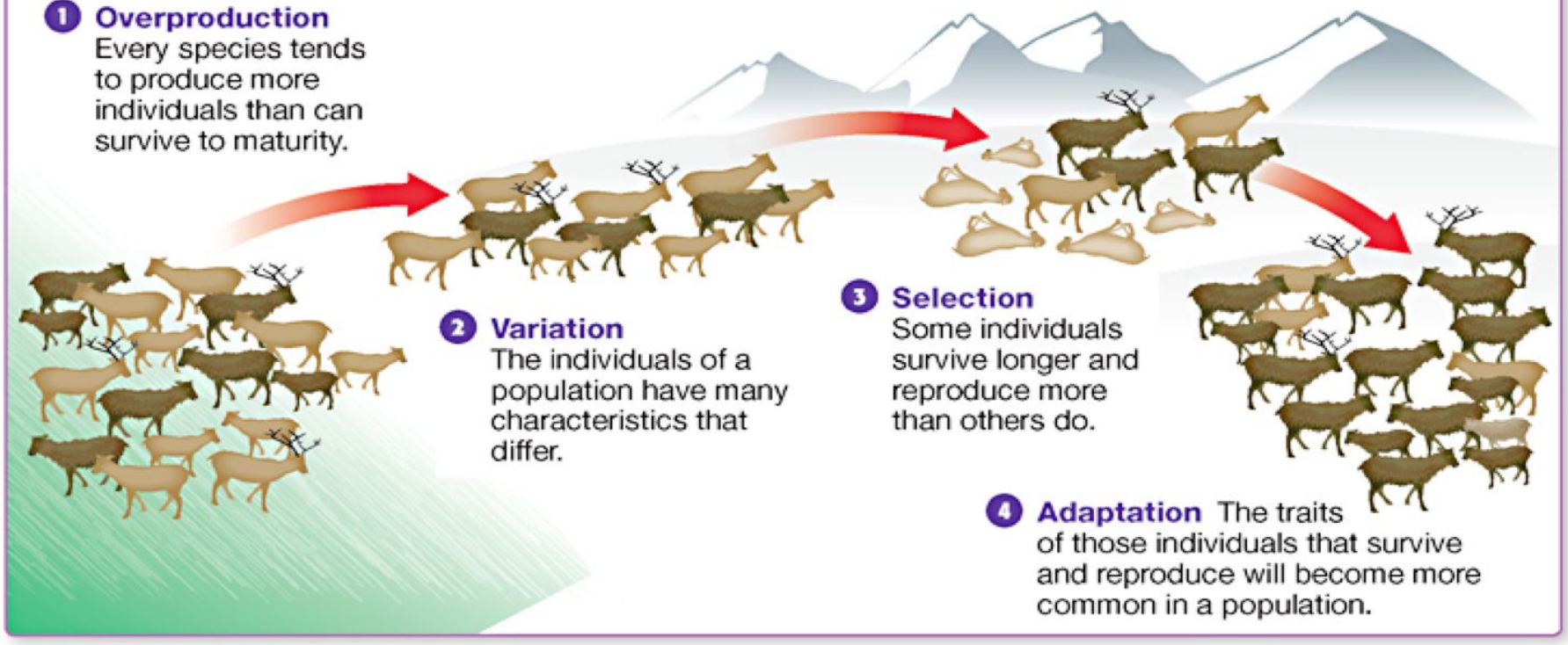
Required for evolution to occur

Evolution by Natural Selection	
1. Organisms produce more offspring than can survive.	In nature, organisms have the ability to produce more offspring than can survive to become adults.
2. The environment is hostile and contains limited resources.	The environment contains things and situations that kill organisms, and the resources needed to live, such as food and water, are limited.
3. Organisms differ in the traits they have.	The organisms in a population may differ in size, coloration, resistance to disease, and so on. Much of this variation is inherited.
4. Some inherited traits provide organisms with an advantage.	Some inherited traits give organisms an advantage in coping with environmental challenges. These organisms are more likely to survive longer and produce more offspring; they are "naturally selected for."
5. Each generation contains proportionately more organisms with advantageous traits.	Because organisms with more advantageous traits have more offspring, each generation contains a greater proportion of offspring with these traits than the previous generation did.

Nature Selects

Adaptation is the process of becoming adapted to an environment. It is an anatomical, physiological, or behavioral change that improves a population's ability to survive

The Theory of Evolution by Natural Selection



Coevolution

The process of two species evolving in response to long-term interactions with each other is called **coevolution**

Hawaiian honeycreeper

Evolution by Artificial Selection

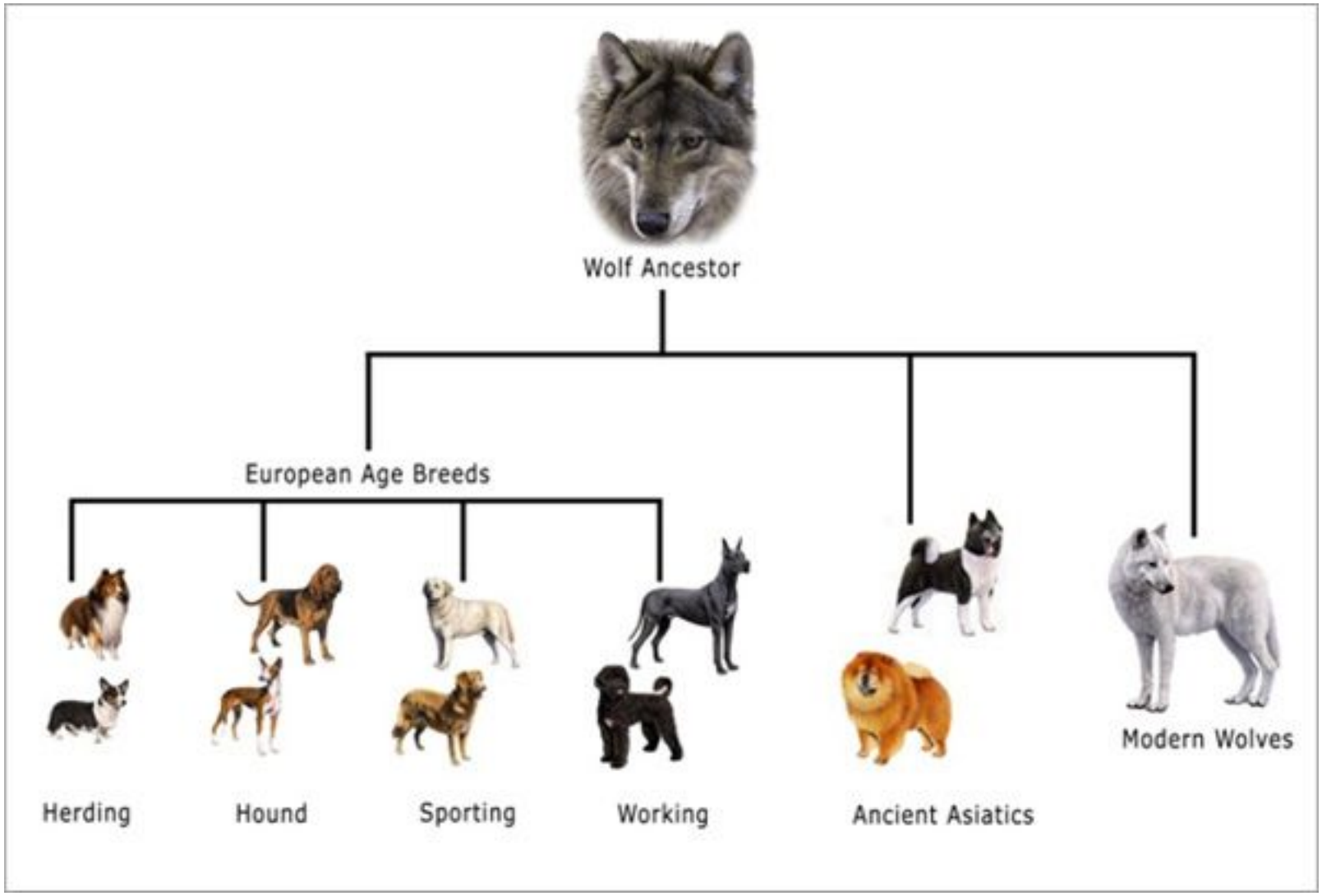
Artificial selection is the selective breeding of organisms, by humans, for specific desirable characteristics

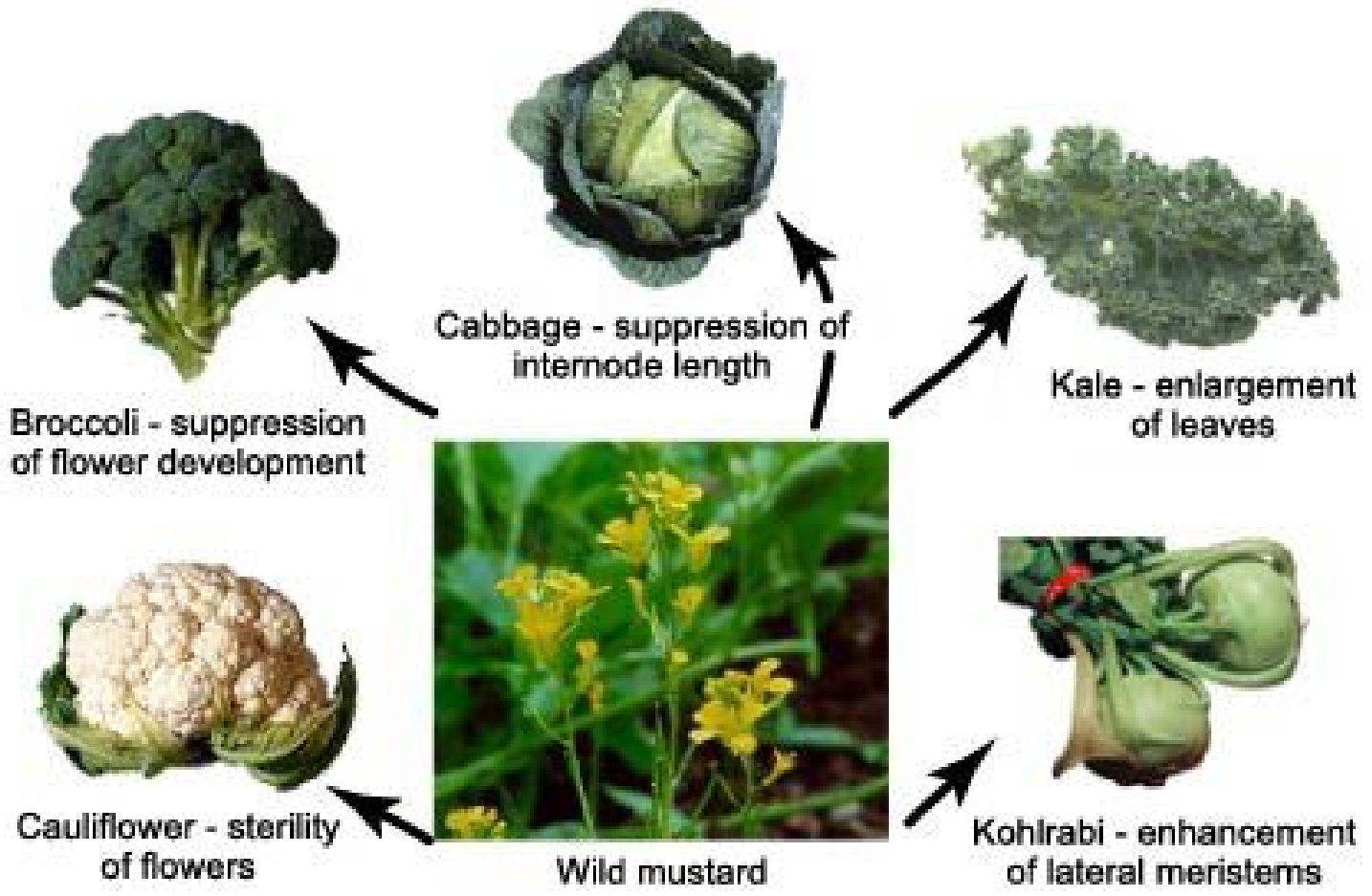
Dogs

Fruits

Grains

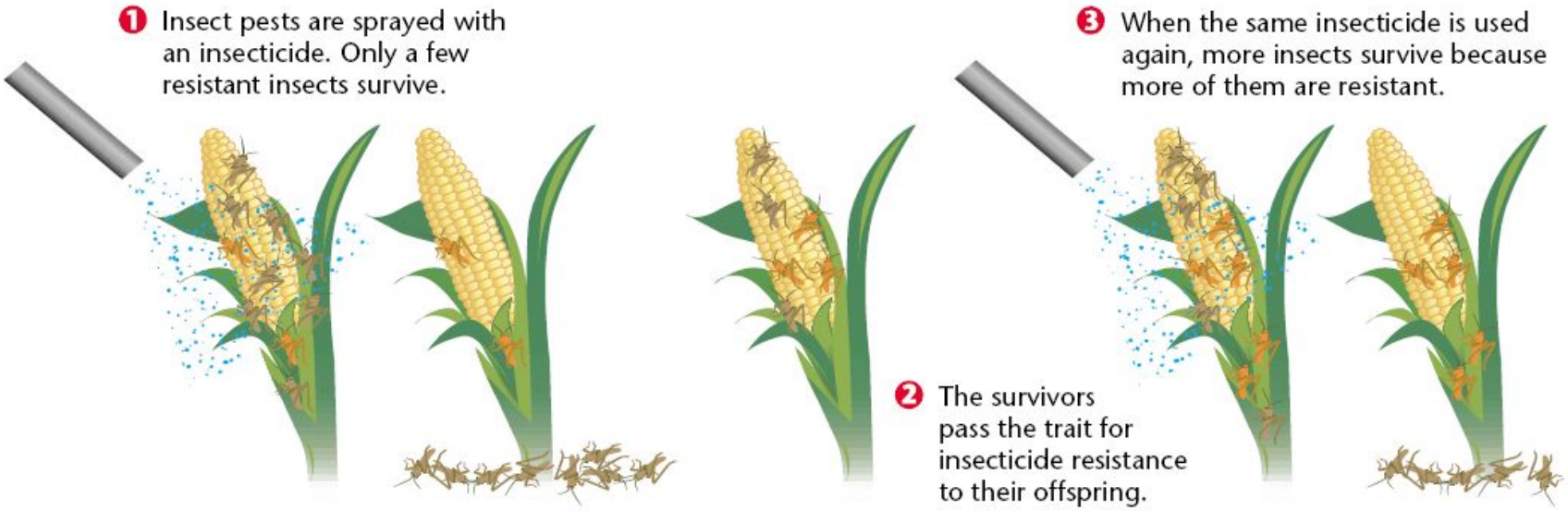
Vegetables


Wolf Ancestor
European Age Breeds
Herding
Hound
Sporting
Working
Ancient Asiatics
Modern Wolves


Cabbage - suppression of internode length
Broccoli - suppression of flower development
Kale - enlargement of leaves
Cauliflower - sterility of flowers
Wild mustard
Kohlrabi - enhancement of lateral meristems

Evolution of Resistance

Resistance is the ability of an organism to tolerate a chemical or disease-causing agent



Pesticide Resistance

A pesticide sprayed on corn to kill grasshoppers, for example, may kill most of the grasshoppers, but those that survive happen to have a gene that protects them from the pesticide. These surviving insects pass on this resistant gene to their offspring.

Each time the corn is sprayed, more resistant grasshoppers enter the population. Eventually the entire population will be resistant, making the pesticide useless.

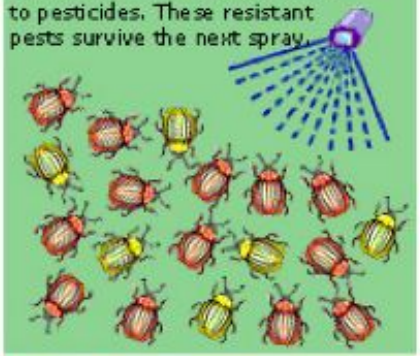
Susceptible Pest

Resistant Pest

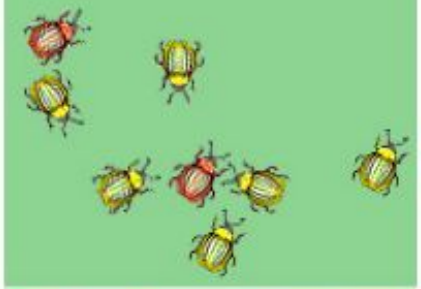
In any pest population there may be some pests with the genetic ability to survive a pesticide application.

After pesticide application, most sucheptible pests are killed whereas the resistant ones survive.

A number of the offspring of the survivors inherit the resistance to pesticides. These resistant pests survive the next spray.

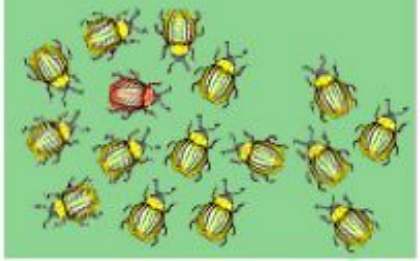


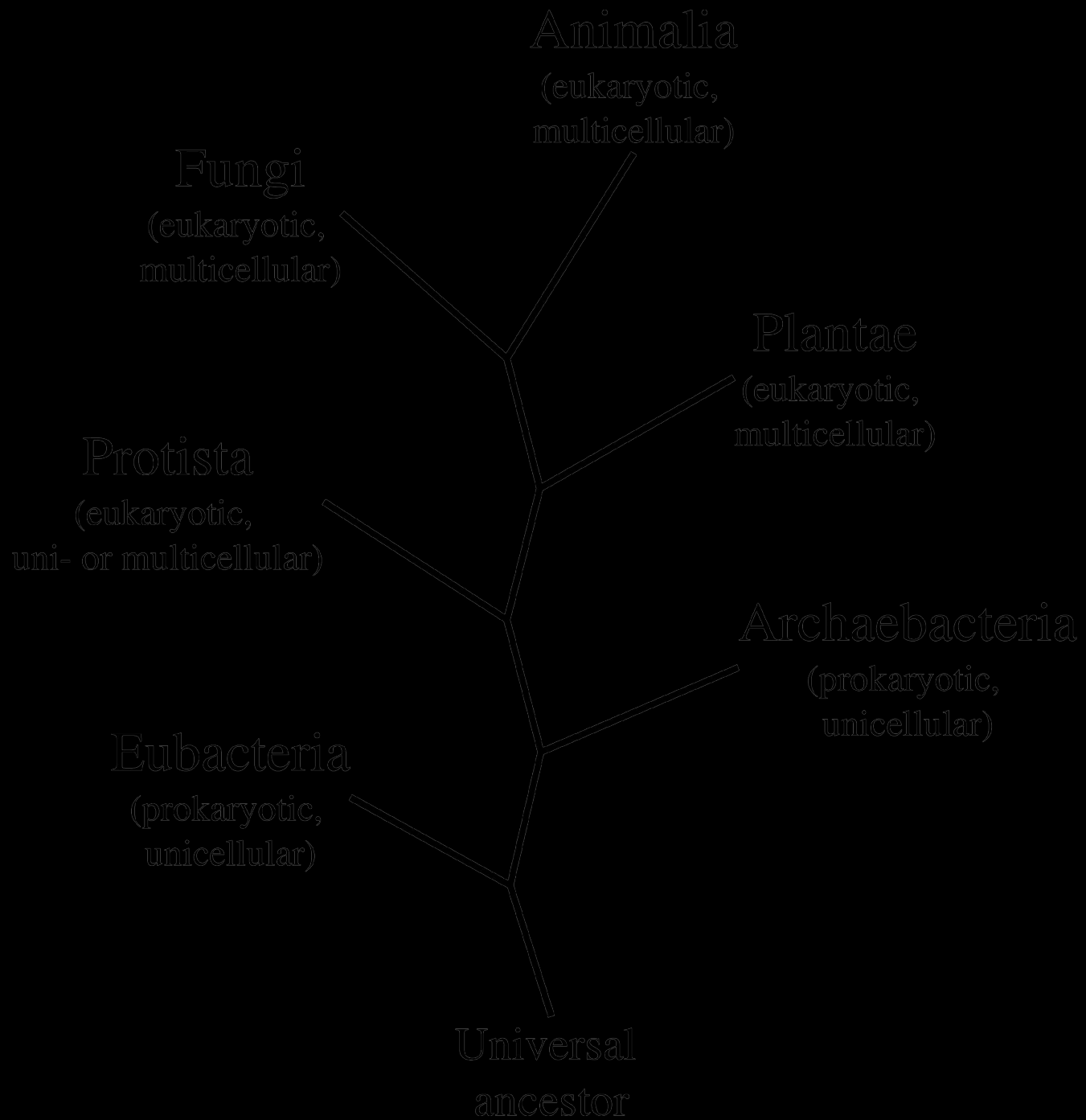
After a subsequent application, an even higher proportion of the survivors will be resistant to the insecticide.



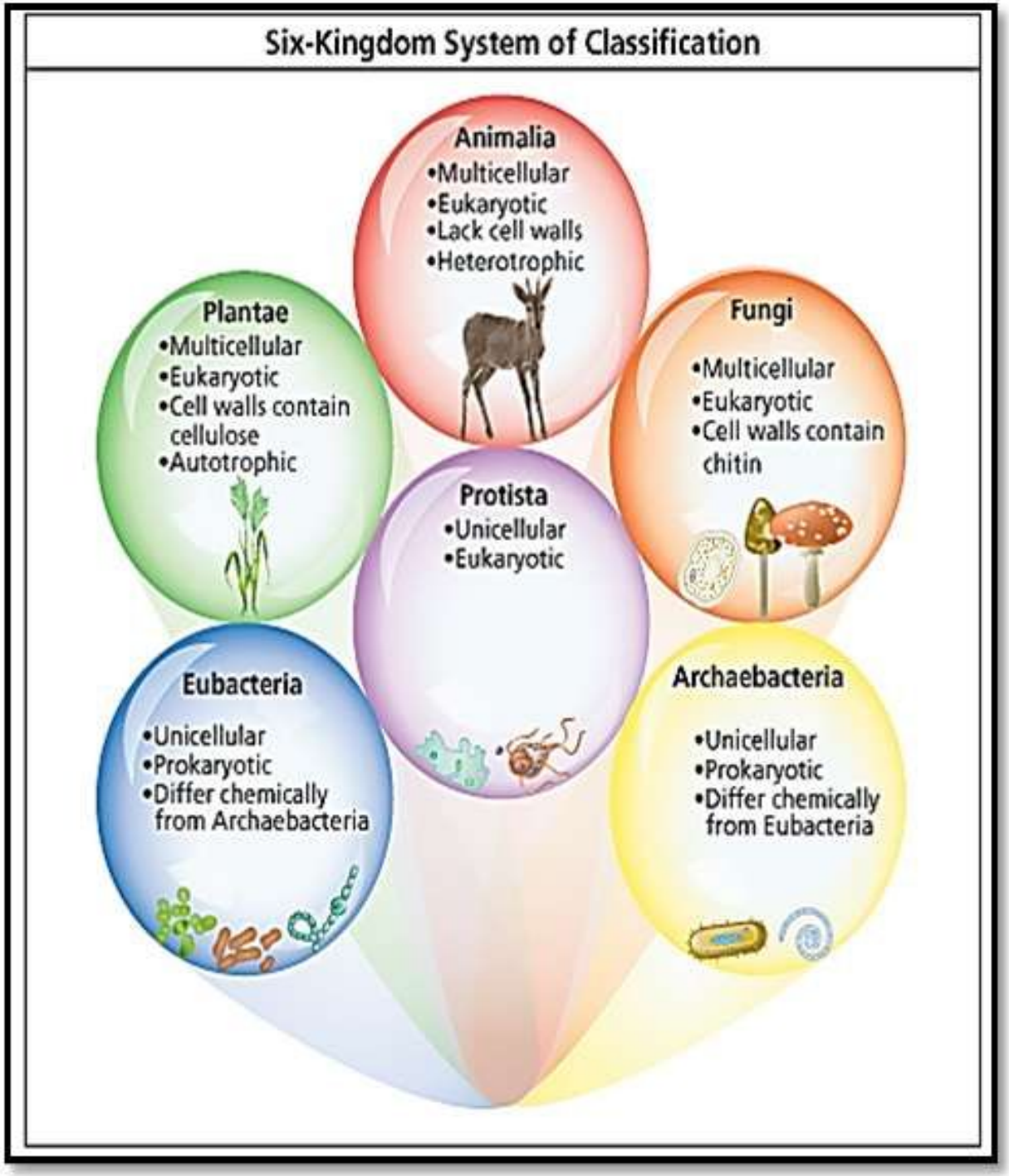
If a similar pesticide is applied frequently, the resistant pests will soon make up most of the population.

After several applications of the insecticide, the surviving population will be practically constituted of only resistant individuals.




Animalia
(eukaryotic,
multicellular)
Fungi
(eukaryotic,
multicellular)
Plantae
(eukaryotic,
multicellular)
Protista
(eukaryotic,
uni- or multicellular)
Archaebacteria
(prokaryotic,
unicellular)
Eubacteria
(prokaryotic,
unicellular)
Universal
ancestor

Six-Kingdom System of Classification



The Kingdoms of Life

The Kingdoms of Life		
Kingdom	**Characteristics**	**Examples**
Archaebacteria	single celled; lack cell nuclei; reproduce by dividing in half; found in harsh environments	methanogens (live in swamps and produce methane gas) and extreme thermophiles (live in hot springs)
Eubacteria	single celled; lack cell nuclei; reproduce by dividing in half; incredibly common	proteobacteria (common in soils and in animal intestines) and cyanobacteria (also called *blue-green algae*)
Fungi	absorb their food through their body surface; have cell walls; most live on land	yeasts, mushrooms, molds, mildews, and rusts
Protists	most single celled but some have many cells; most live in water	diatoms, dinoflagellates (red tide), amoeba, trypanosomes, paramecia, and *Euglena*
Plants	many cells; make their own food by photosynthesis; have cell walls	ferns, mosses, trees, herbs, and grasses
Animals	many cells; no cell walls; ingest their food; live on land and in water	corals, sponges, worms, insects, fish, reptiles, birds, and mammals

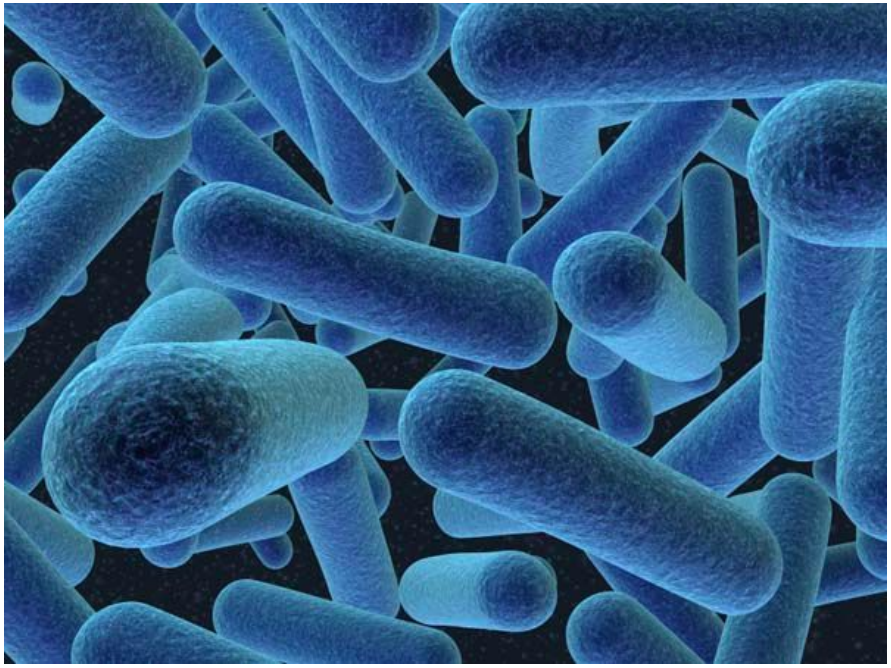
Bacteria

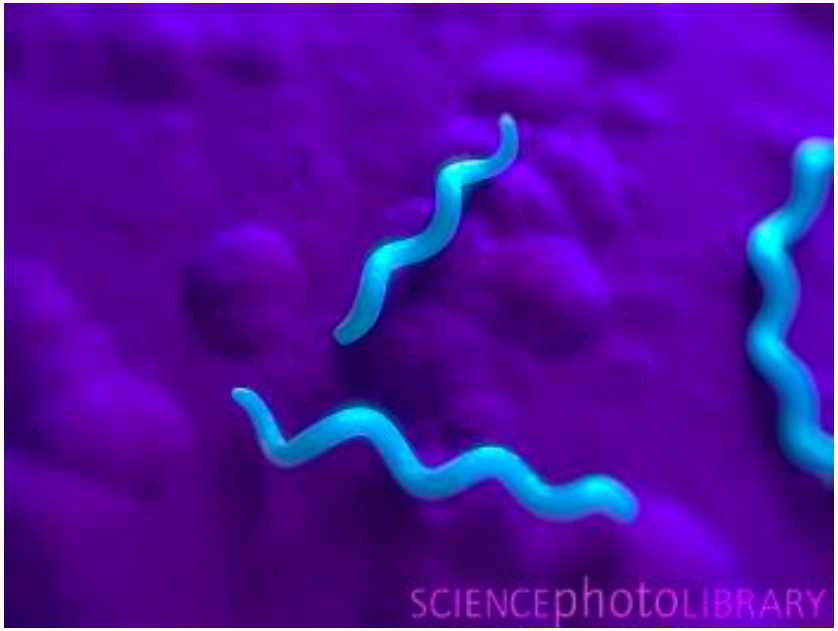
Bacteria are extremely small, single-celled organisms that usually have a cell wall and reproduce by cell division

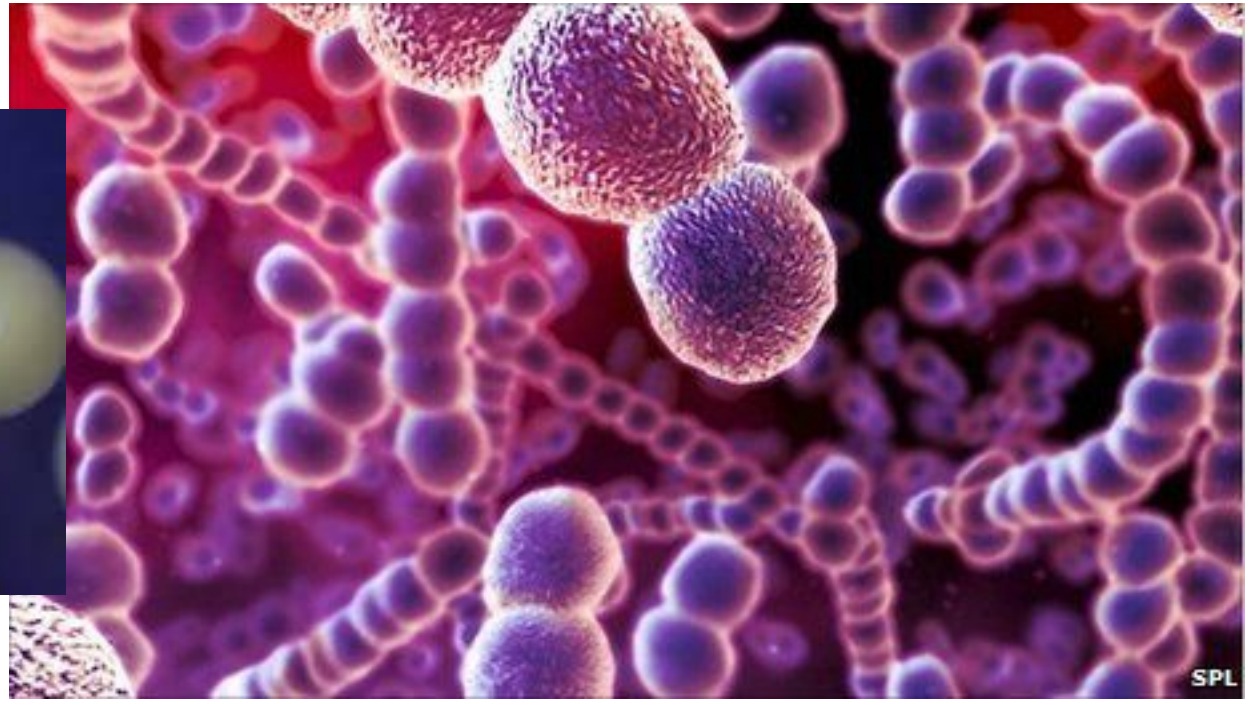
Unlike all other organisms, bacteria lack nuclei **(prokaryotes)**

Archaebacteria

Eubacteria (most bacteria)




SCIENCEphotoLIBRARY

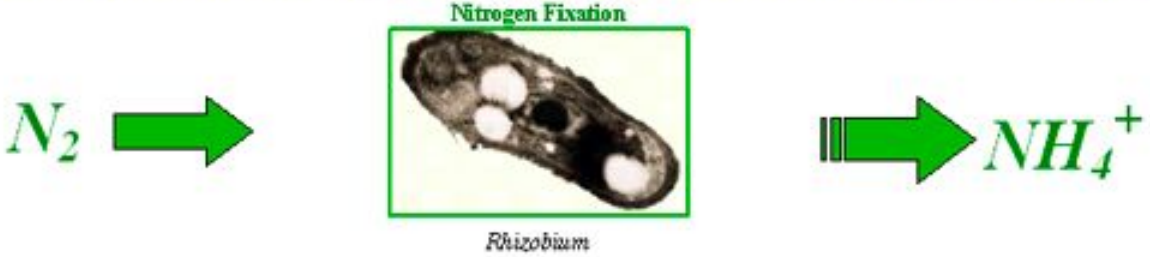

SPL

Bacteria and the Environment

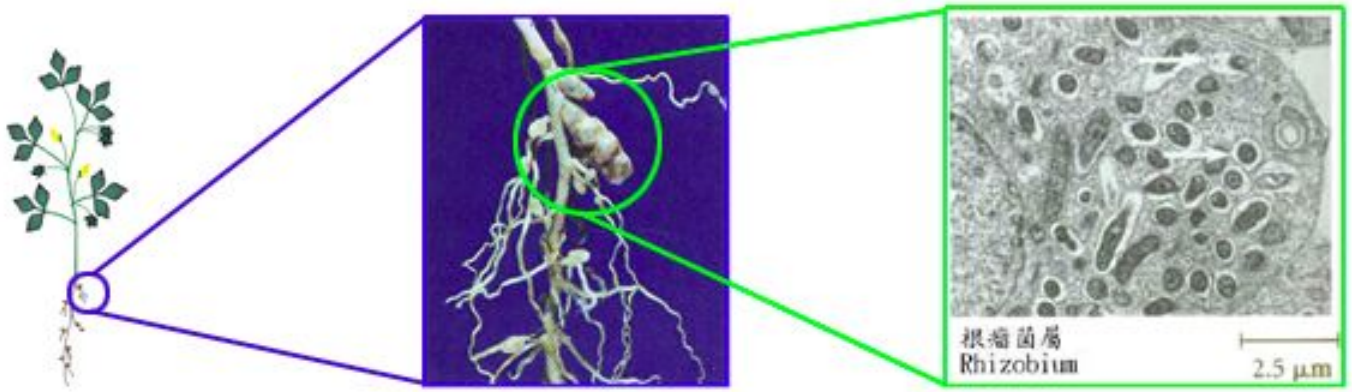
Some kinds of bacteria break down the remains and wastes of other organisms and return the nutrients to the soil

Certain bacteria can convert nitrogen from the air into a form that plants can use. This conversion is important because nitrogen is the main component of proteins and genetic material (nitrogen fixation)

Plants CANNOT use atmospheric Nitrogen (N_2) and CANNOT convert it into the useable form of Ammonium (NH_4^+)…



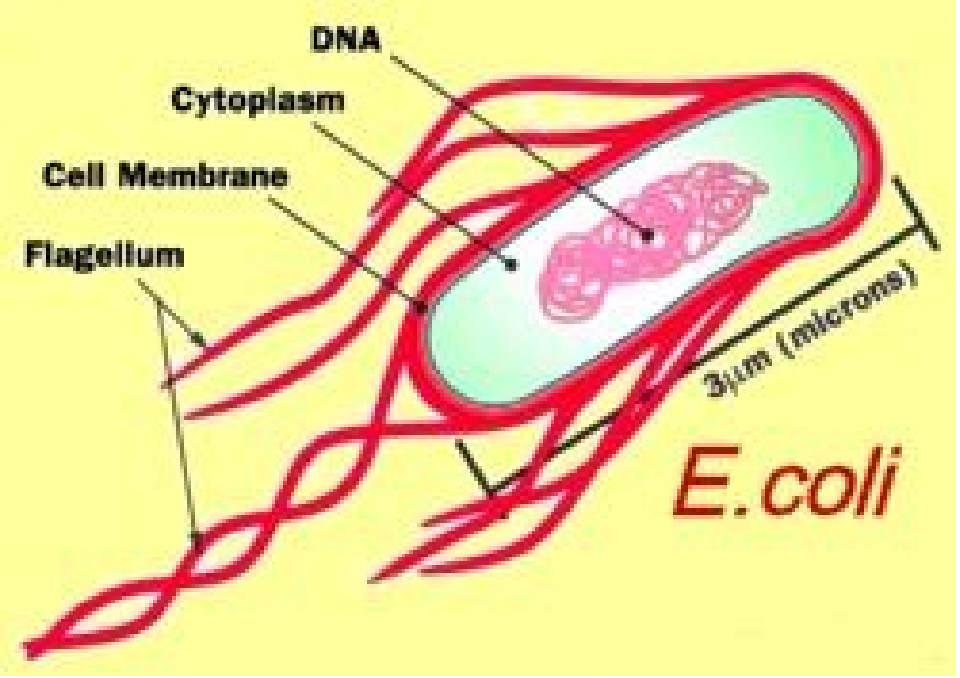
However, Rhizobium, nitrogen-fixing bacteria, CAN convert atmospheric nitrogen (N2) into the useable form of ammonium (NH4+)…



The plant and the bacteria develop a SYMBIOSIS – Where the two organisms live together for the benefit of both…

Bacteria and the Environment

The bacterium, **Escherichia coli** or **E. coli**, is found in the intestines of humans and other animals and helps digest food and release vitamins that humans need (symbiosis)


DNA
Cytoplasm
Cell Membrane
Flagellum
3μm (microns)
E.coli

Fungi

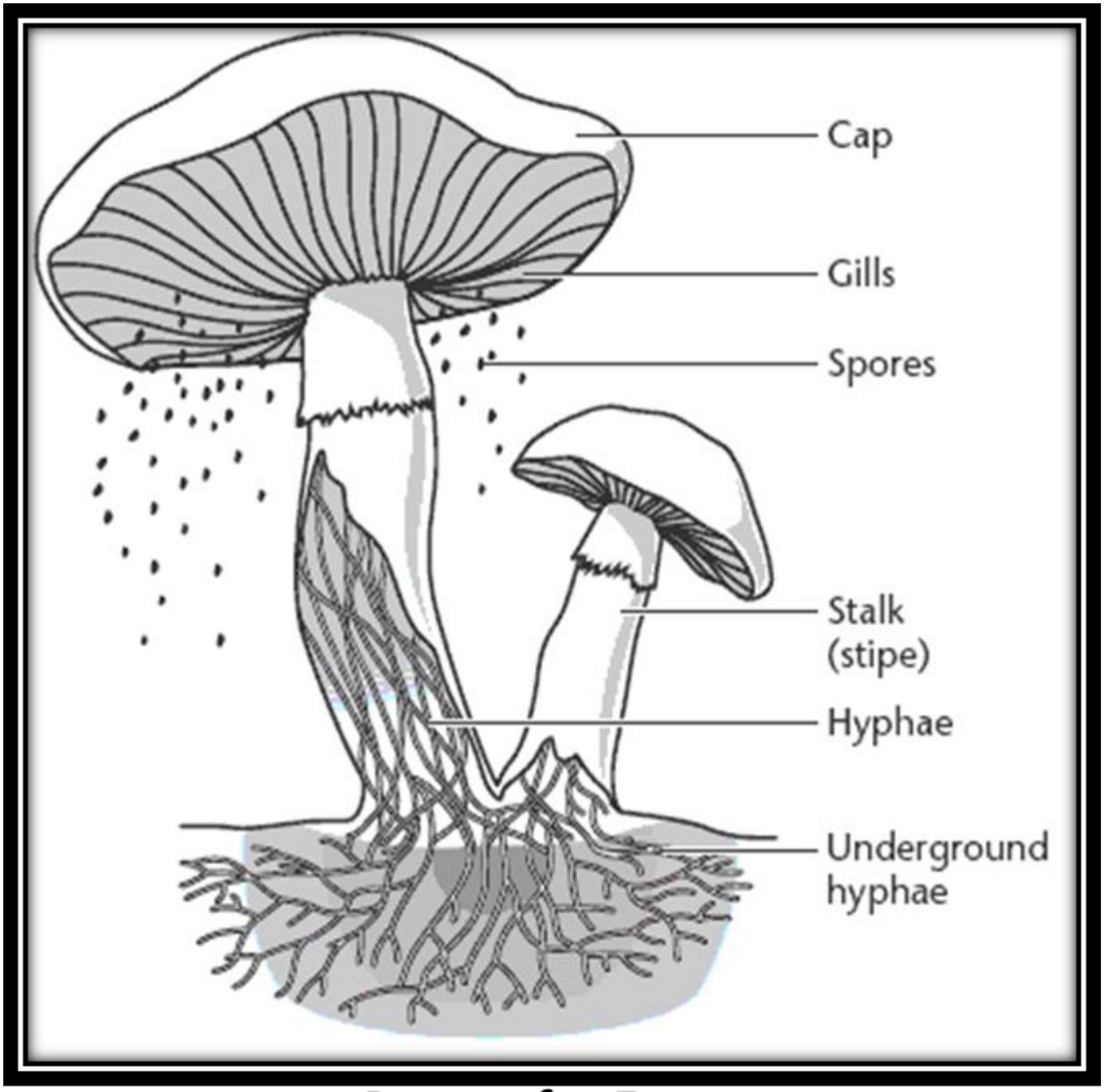
These organisms have 3 basic characteristics:

- They're heterotrophs
  - Most of them feed from dead organisms
- They're multicellular
  - Only few fungi species are unicellular
- They're eukaryotes

Mushrooms

Mold

Mildew



Parts of a Fungus

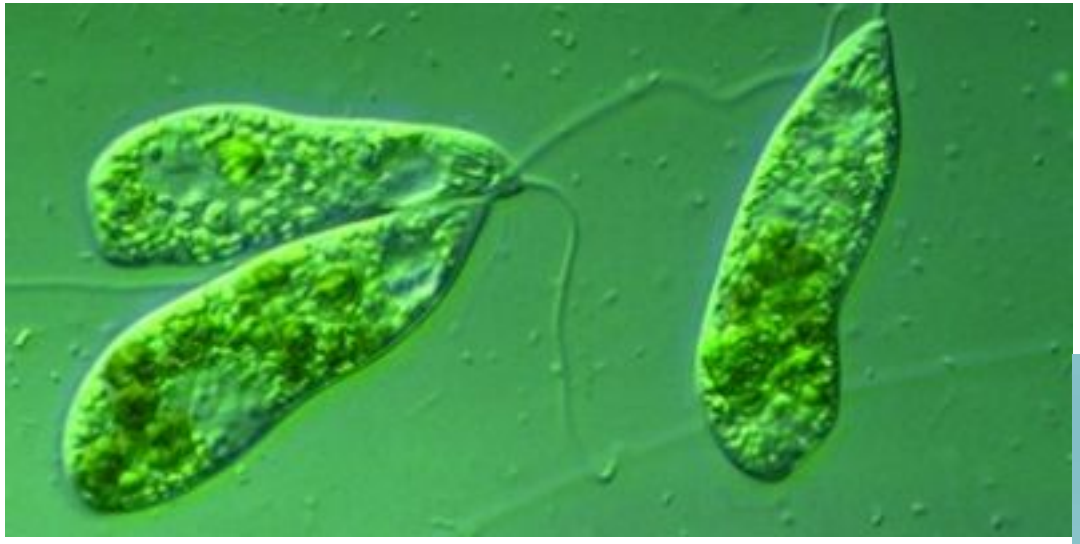
Fungi

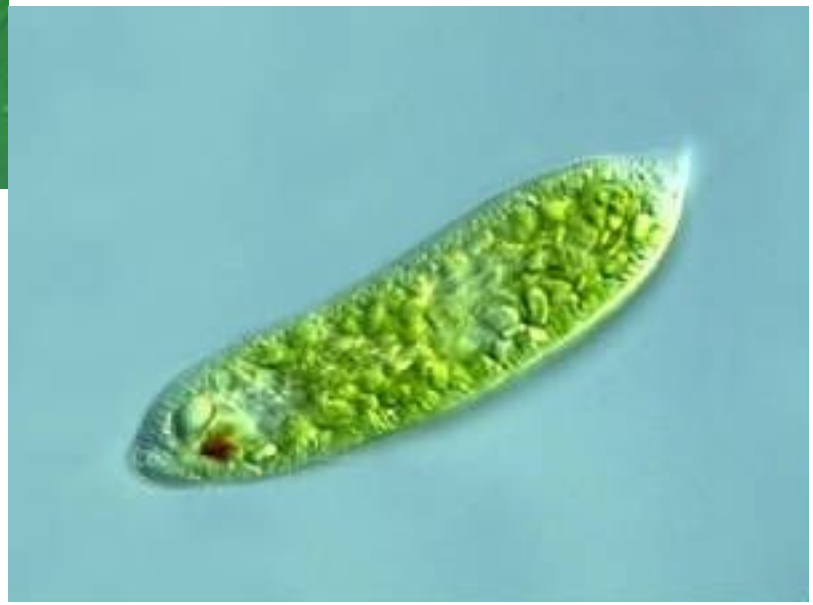
Fungi can cause disease

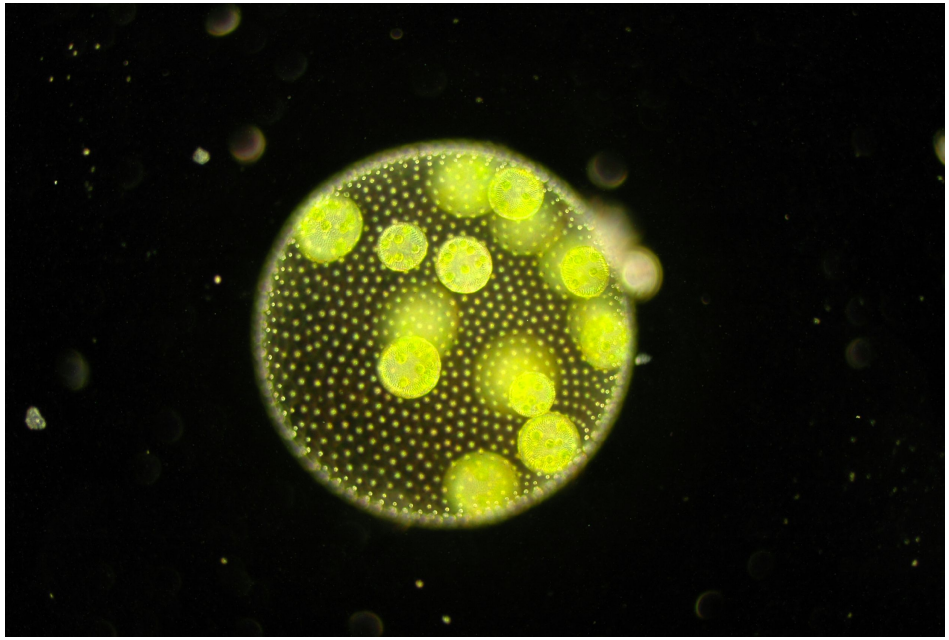
Fungi can be made into food

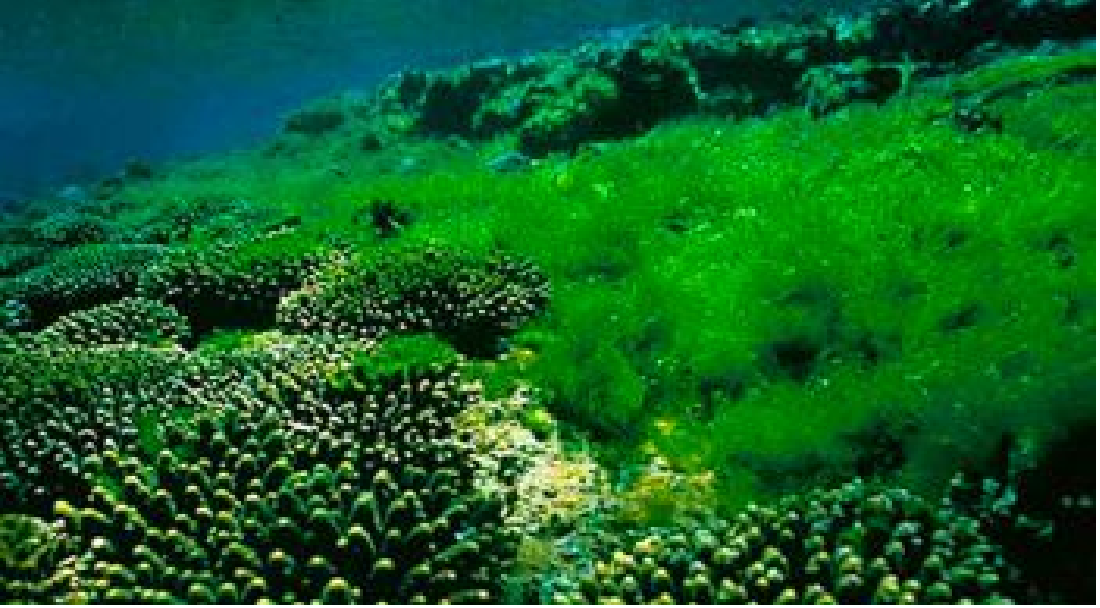
Characteristics Chart

Kingdom	Protista
Cell Type	
Cell Structures	Have a nucleus, mitochondria, some have chloroplasts
Body Form	
Nutrition	Autotrophic or Heterotrophic
Examples	Ameba, paramecium









Plants

Autotrophs

$6H_2O + 6CO_2 \rightarrow C_6H_{12}O_6 + 6O_2$


©Science Magazine

Gymnosperms

Gymnosperms

Some have cones

Use to make building products and paper

Angiosperms

Angiosperms have fruit and flowers

Reproduce with pollen

Used to make building materials and as a food source

Animals

Heterotrophs

Eukaryotes

Animal cells also have no cell walls

Can be invertebrates

- **Insects are important pollinators**

Can be vertebrates