

Taxonomy and Classification Notes

Early Systems of Classification

Classification is the grouping of objects or organisms based on a set of criteria.

Biologists use a system of classification to organize information about the diversity of living things.

→ Looking @ differences (physical structures)

Linnaeus's system of classification was based on observations of morphology and habitat.

→ Where they LIVE

The Linnaean system was the first formal system of taxonomy - the discipline of identifying, naming, and classifying organisms.

Appearance

Linnaeus's method of naming organisms, called binomial nomenclature, gives each species a scientific name with two parts.

(First Name)

The first part is the genus name, and the second part is the specific epithet, or specific name, that identifies the species.

When writing a scientific name, scientists use these rules:

(Last Name)

- The first letter of the genus name always is capitalized, but the rest of the genus name and all letters of the specific epithet are lowercase.
- For example Crotalus atrox → H. sapians
- After the scientific name has been written completely, the genus name will be abbreviated to the first letter in later appearances (e.g., C. atrox Western Diamondback rattlesnake).

Humans: Homo sapians

→ H. sapians

(Has to be italic)

Taxonomic Categories

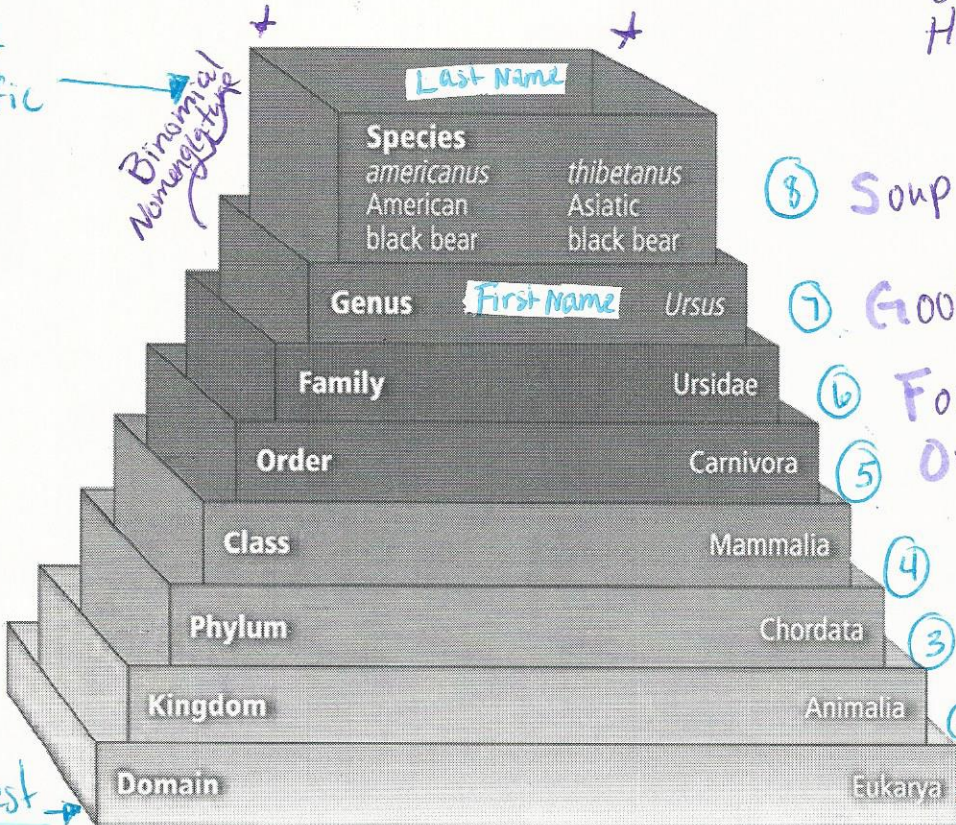
The taxonomic categories used by scientists are part of a nested-hierarchical system.

Each category is contained within another, and they are arranged from broadest to most specific.

Sapians → Species (last Name)  
Homo → genus (First Name)

Most specific

Binomial Nomenclature



- 8 Soup - Most specific Smashed
  - 7 Good
  - 6 For
  - 5 Over
  - 4 Came
  - 3 Philip
  - 2 King
  - 1 Dumb → Broad Dumb
- Get Freeway on Catch Playing Kids

Broadest

## Systematics applications

Taxonomy is part of a larger branch of biology called systematics.

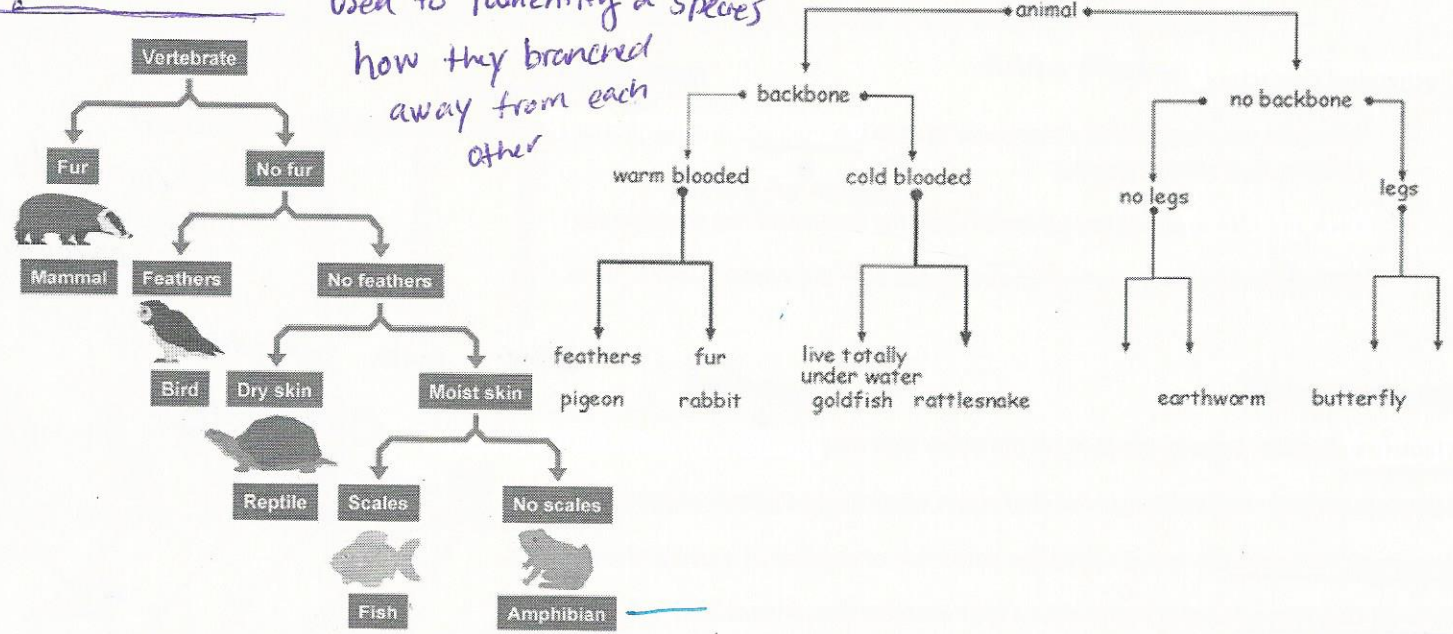
*→ change over time*

**Systematics** is the study of biological diversity with an emphasis on evolutionary history.

Taxonomists can produce detailed guides to identify different organisms.

Through the use of dichotomous keys, which provide a series of choices between alternate characteristics, users can identify organisms they encounter.

*used to identify a species  
how they branched  
away from each  
other*



## Typological species concept

The concept of what determines a species has changed through time.

Aristotle and Linnaeus used the typological species concept – each species a distinctly different group of organisms based on physical similarities.

*Even though species may look similar, they may not always be related.*

Based on the idea that species are unchanging, distinct, and natural types.

## Biological species concept

The biological species concept defines a species as a group of organisms that is able to interbreed and produce fertile offspring in a natural setting.

*Ex: purebreeding of Dogs.*

Does not account for extinct species or species that reproduce asexually.

## Phylogenetic species concept → Physical Characteristics

Phylogeny is the evolutionary history of a species.

The phylogenetic species concept defines a species as a cluster of organisms that is distinct from other clusters and shows evidence of a pattern of ancestry and descent.

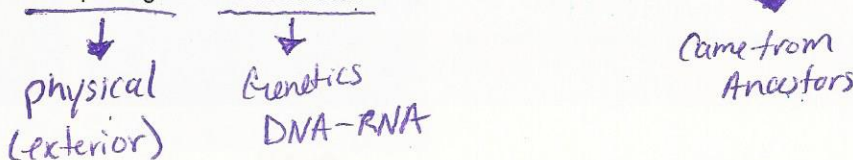
*Similar to Homologous Structures.*

### Characters

*1 bone, 2 bone, many bones + digits*

To classify a species, scientists construct patterns of descent by using characters – inherited features that vary among species.

Characters can be morphological or biochemical.



## Movement

Some won't move  
↓

Some prokaryotes are stationary, others move with flagella. → Tail

Cilia - Hairlike structures

Flagella help prokaryotes to move toward materials that they need to survive - light, oxygen, chemicals.

Other prokaryotes move by gliding over a layer of secreted slime

## \*Domain Archaea\*

• Archaea are thought to be more ancient than bacteria and yet more closely related to our eukaryote ancestors.

• Lack peptidoglycan in their cell walls, and have some of the same proteins as eukaryotes.

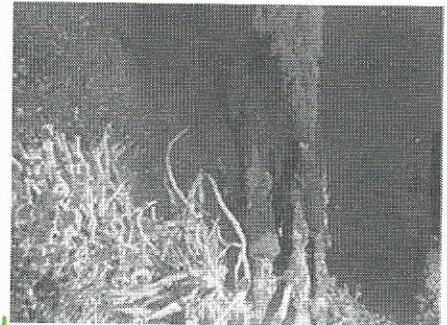
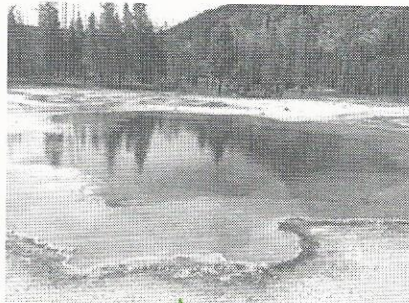
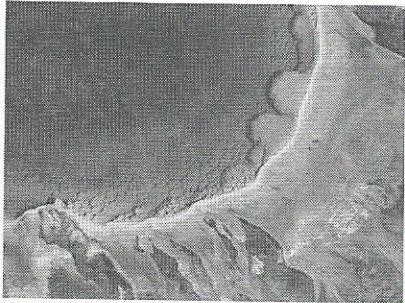
Don't have same cell wall as bacteria

• Archaea are diverse in shape and nutrition requirements. (Can eat a lot of different things)

ARE in the form of MANY shapes

Most are heterotrophs, some are extremophiles that can survive extreme conditions (e.g. high temperature, salinity)

Some are Autotrophs



Domain Eukarya → Eukaryotes → You! → Animals + plants + protist + Fungi

• All eukaryotes have a membrane-bound nucleus and other membrane-bound organelles.

E.R., ribosomes, Lysosomes, Mitochondria ect. etc.

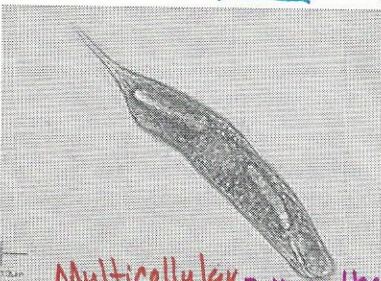
• Domain Eukarya contains Kingdoms Protista, Fungi, Plantae, and Animalia.

## \*Kingdom Protista\*

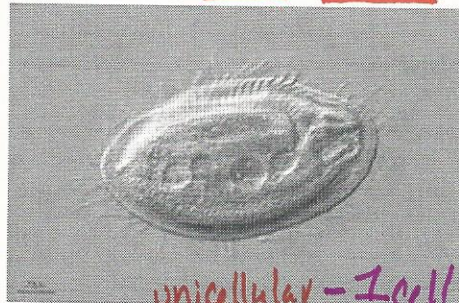
• Protists are eukaryotic organisms that can be unicellular, colonial, or multicellular.

• Protists are classified into three different groups - plantlike, animal-like, and fungus-like.

Characteristics



Multicellular - more than 1 cell many cells



unicellular - 1 cell



colonial - Make a colony

## Kingdom Fungi

• A fungus is a unicellular or multicellular eukaryote that absorbs nutrients from organic materials in its environment.

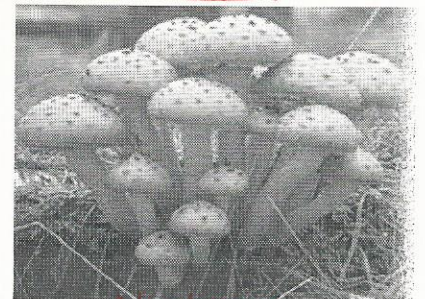
• Heterotrophic, lack motility, have cell walls containing chitin.

• Have threadlike structures called hyphae for feeding, growth, and reproduction

(Carbon)

Kingdom Animalia - Animals that have cells and tissues, and are mobile. → move

Kingdom Plantae - mostly multicellular, have cell wall, and chloroplast. → photosynthesis to make its own Food!



Mushroom

Higher taxa

An **order** contains related families.

A **class** contains related orders.

A **phylum** or **division** contains related classes.

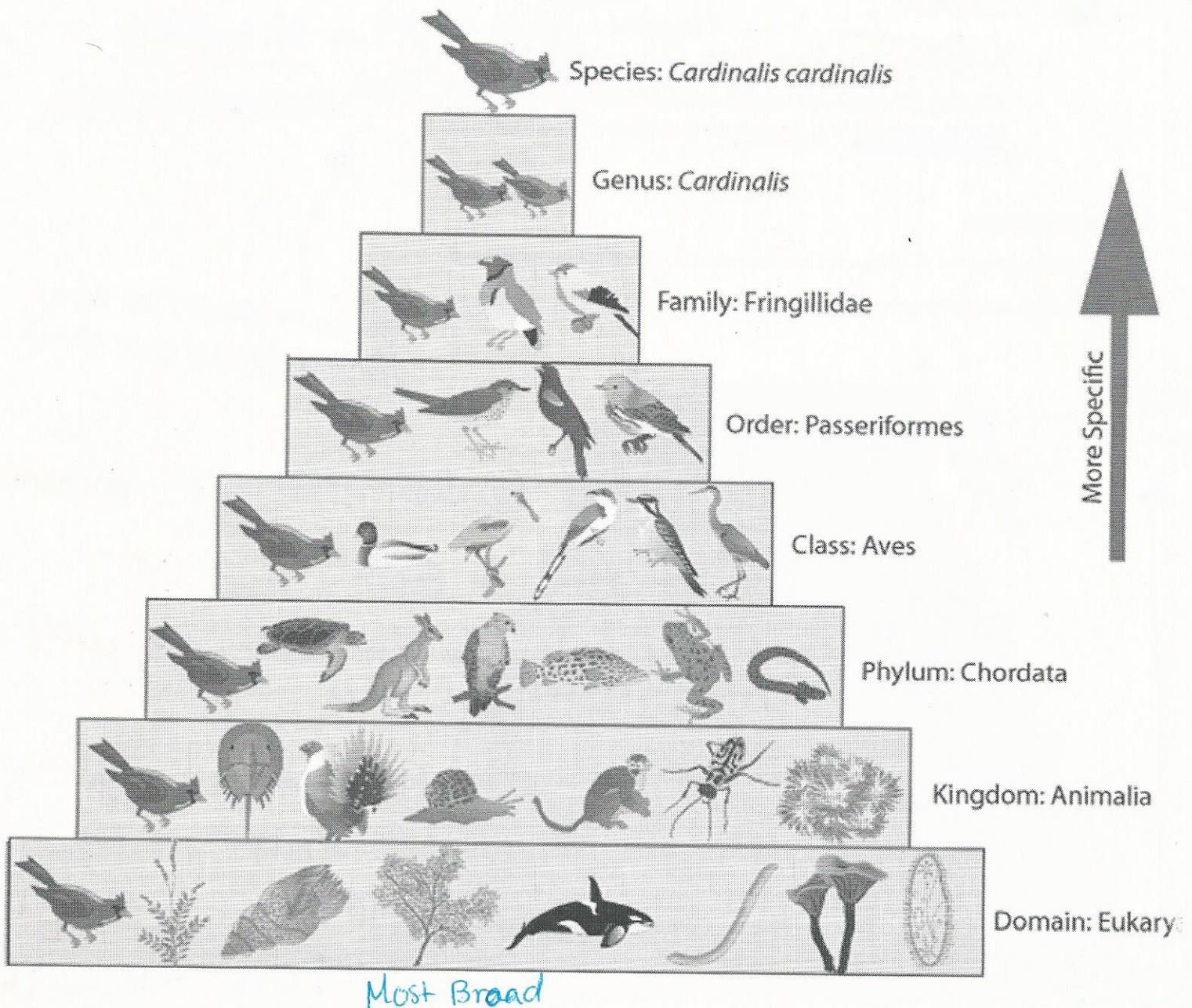
A **kingdom** contains related phyla.

The **domain** is the broadest of all the taxa and contains one or more kingdoms.

A named group of organisms is called a **taxon**.

A **genus** is a group of species that are closely related and share a common ancestor.

A **family** is the next higher taxon, consisting of similar, related genera

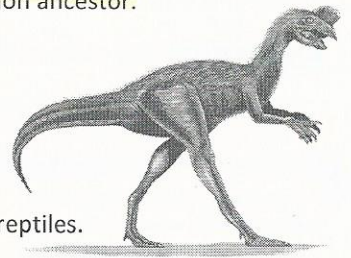


**Morphological characters**

Shared morphological characters suggest that species are related closely and evolved from a recent common ancestor.

**Birds and dinosaurs:**

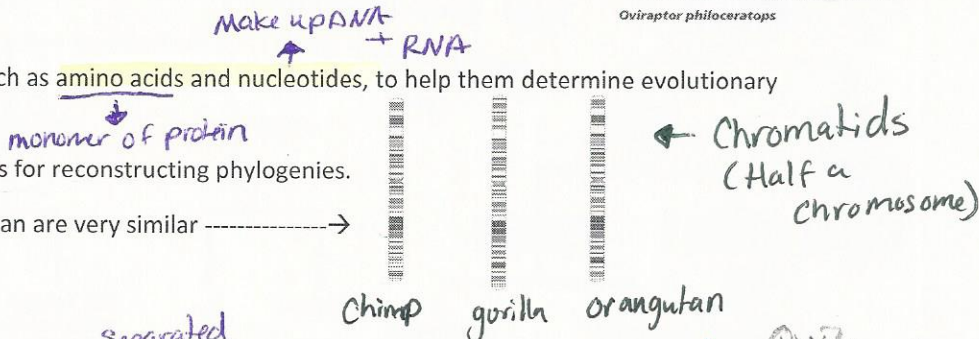
- Modern birds may not look closely related to dinosaurs.
- Both birds and dinosaurs have hollow bones
- Theropods have hip, leg, wrist, and shoulder structures more similar to birds than living reptiles.



Oviraptor philoceratops

**Biochemical characters** - DNA + RNA

- Scientists use biochemical characters, such as amino acids and nucleotides, to help them determine evolutionary relationships among species.
- DNA and RNA analyses are powerful tools for reconstructing phylogenies.
- DNA of chimpanzee, gorilla, and Orangutan are very similar ----->



**Character types**

**Cladistics** classifies organisms based on the order that they diverged from a common ancestor.

Scientists consider two main types of characters when doing cladistic analyses:

Ancestral characters are found within the entire line of descent of a group of organisms.

Derived characters are only found after a split from the descendent line.

A **cladogram** is a branching diagram that represents a proposed phylogeny of a species or group.

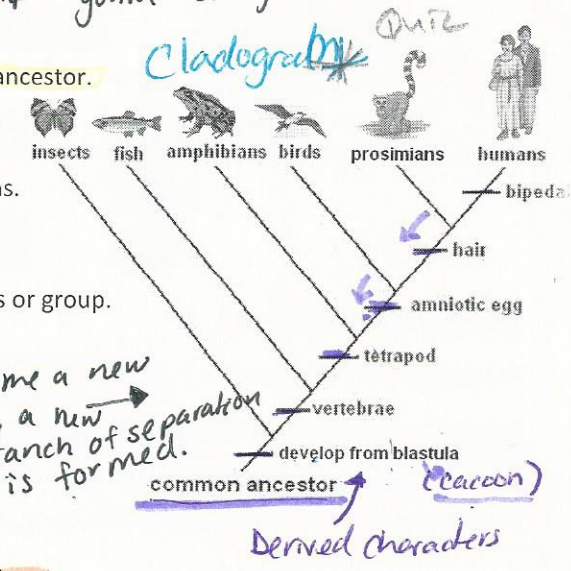
One branch of a cladogram is called a clade.

Branch

Derived Character

Each time a new branch of separation is formed.

The broadest category in the classification used by most biologists is the domain.



Quiz

- Three domains: Bacteria, Archaea, Eukarya
- Six kingdoms: Bacteria, Archaea, Protists, Fungi, Plantae, and Animalia

- Organisms are classified into domains based on cell type and structure
- Organisms are classified into kingdoms based on cell type, structure, and nutrition

**Domain Bacteria**

- Bacteria are members of both Domain and Kingdom Bacteria

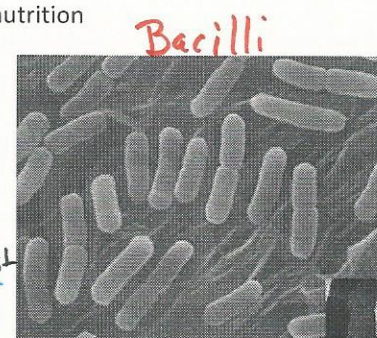
**Prokaryotes**  
oldest cells -> 1st species on earth  
Cell walls contain peptidoglycan

- Diverse group that can survive many different environments *warm + moist*
- Most bacteria are heterotrophs that get their energy from other organisms
- Most abundant organism on the planet (the most amount) *If green - photosynthetic*

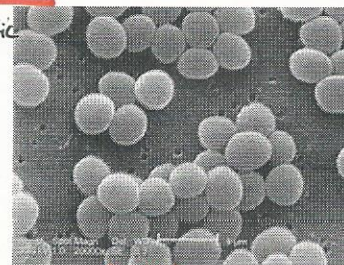
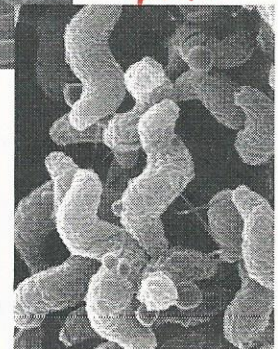
**Prokaryote Characteristics**

Shapes- Cocci (spherical or round), Bacilli (rod-shaped), Spirilli (spiral-shaped)

Autotrophs



Spirilli



Cocci

