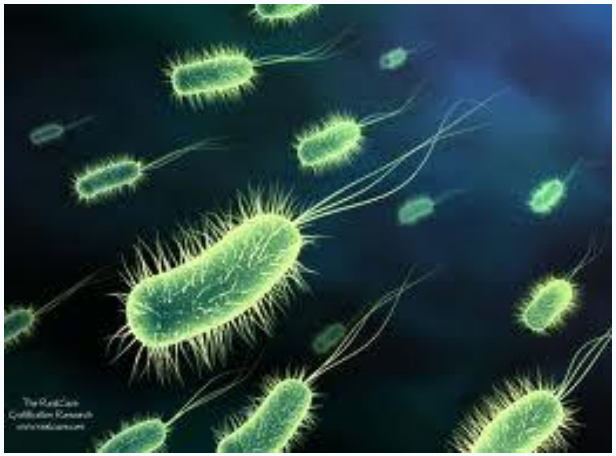
Go to the "Slide Show" shade above

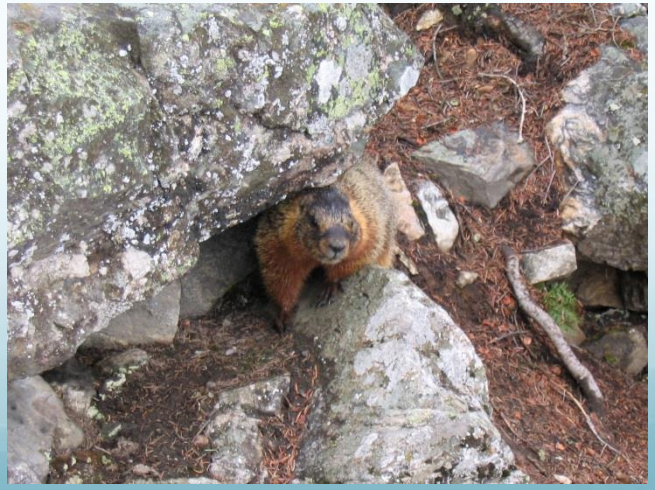
Click on "Play from Beginning"

Classification



CHAPTER 20

of



Living Things

Classify the Family

Classify the members of your family so that you can describe them to an outsider and they could figure out who you are talking about.

WARM-UP

Classify the Family

Classify the members of your family so that you can describe them to an outsider and they could figure out who you are talking about.

- Height, skin color, hair color, eye color, body build, facial features, etc.

Lesson Objectives

By the end of this lesson, you should be able to:

- Explain the need for and benefits of classification. What is the scientific name for classification?
- Describe the process (history) of the modern system of classification (People, Basis, Language, Categories).
- Explain how modern taxonomy takes into account other types of evidence when attempting to classify an organism.
- Understand the progression of classifying kingdoms and domains.
- Define a virus and its components, noting why they are significant.

- **Science Practice: Six Kingdom Identification & Viruses**

Scientists have described and named over:

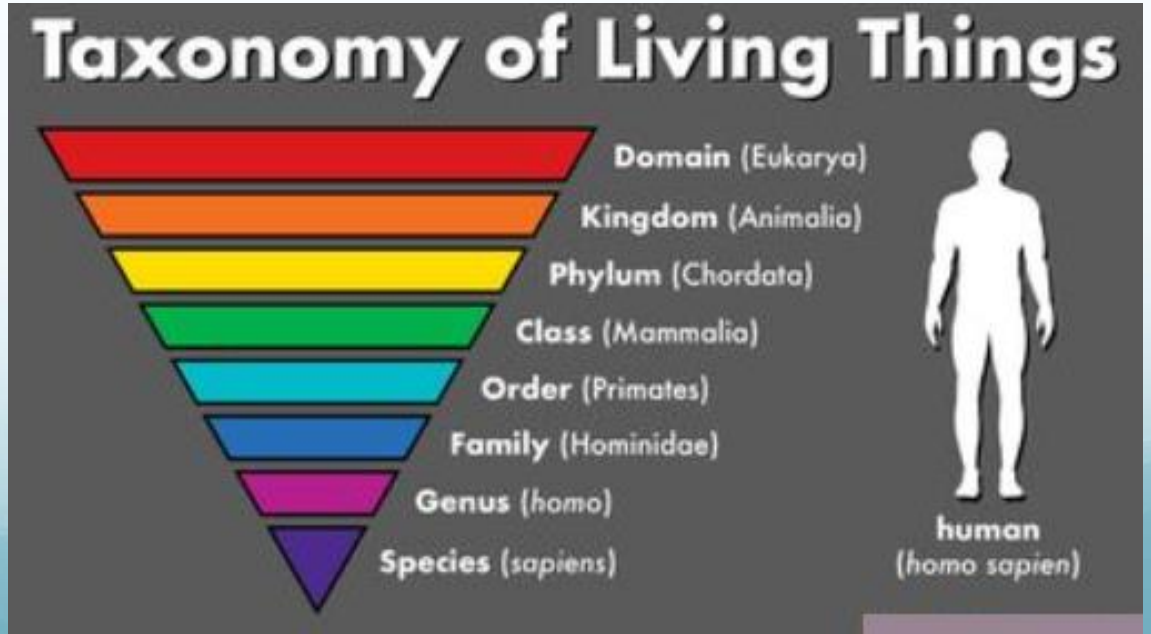
1.5 million species.

It is estimated that the total number of species is about:

10 million.

Why is there a need for classification?

- Innate need for order and organization
- New organisms can be added more easily
- Elimination of the problem of communication between scientists of the same country, different countries, language, culture, etc.



Scientists attempt to order the natural world by grouping and classifying all living organisms.

As technologies improve, so have our systems of classification.

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

TAXONOMY

The branch of biology that classifies organisms and assigns each organism a universally accepted name.

Benefits of Taxonomical Classification

- Accurately and uniformly names organisms.

- Prevents misnomers such as "starfish" and "jellyfish" that aren't really fish.
- Uses same language (Latin) for all names.

Theory of Classification

~400 BC

- **Aristotle**

Plants (*categorized according to structure*)

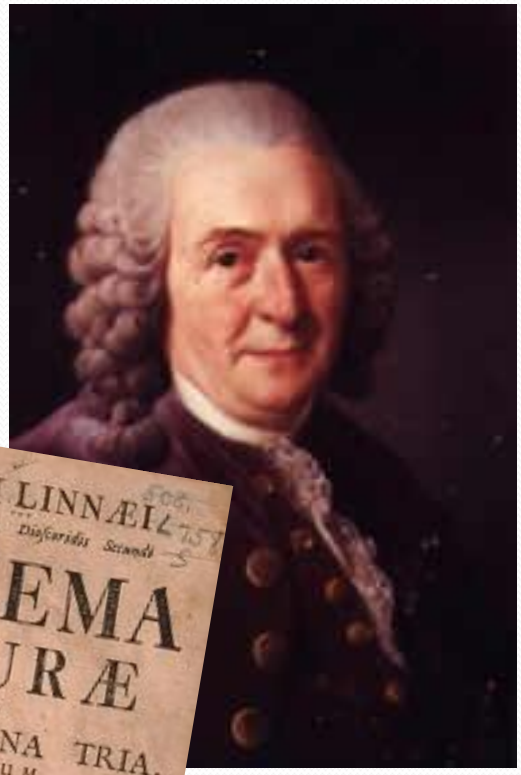
1. Herbs – soft stems
2. Shrubs – several woody stems
3. Trees – single woody stem

Animals (*categorized according to where they live*)

1. Water dwellers
2. Land dwellers
3. Air dwellers

Carolus Linnaeus

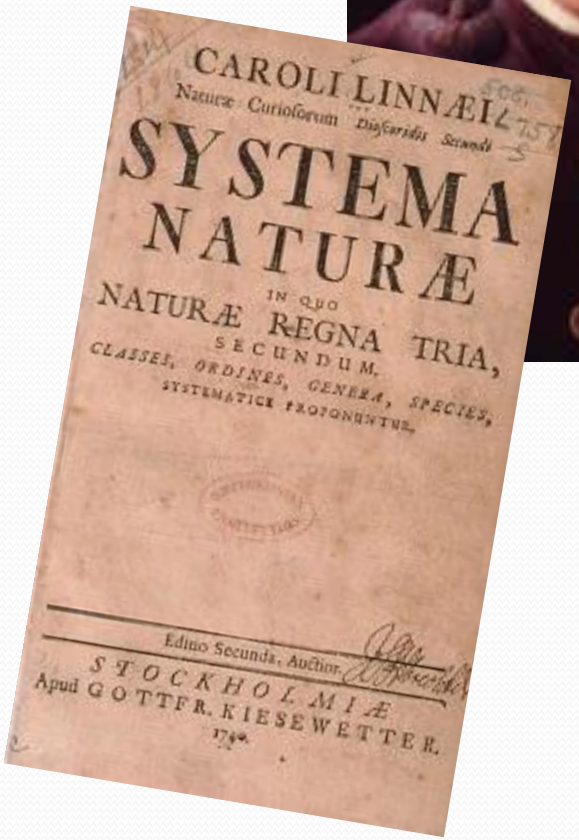
1707 – 1778



- "**Father of Taxonomy**"
- Classified organisms by their **structure (Morphology)**.
- Discarded common names and used Latin (universal):

Binomial Nomenclature

  - Two-Name naming system (**Genus** and **species**)



Standardized Naming

Binomial nomenclature

- Latin
- ***Genus species***
- **CAPITALIZE Genus, but NOT species**
- ***ITALICIZE* in print**
- **<u>UNDERLINE</u> when handwriting**

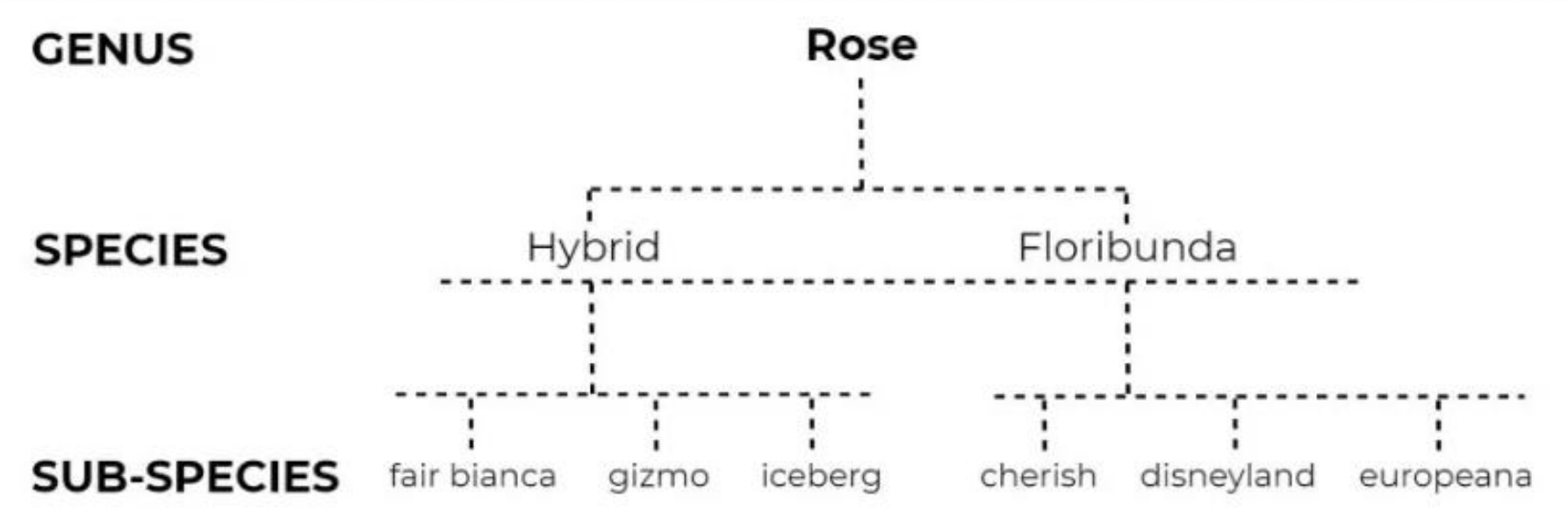
Turdus migratorius

American Robin

No two organisms can have the same name.

Genus

- ***A group of closely related species.***
- **The name is CAPITALIZED & underlined or italicized.**



"variety"

species

- Structurally similar (identical) to each other and different from all other organisms.
- Can interbreed to produce viable offspring.
- The name is Uncapitalized and underlined or italicized.

Homo sapiens or Homo sapiens

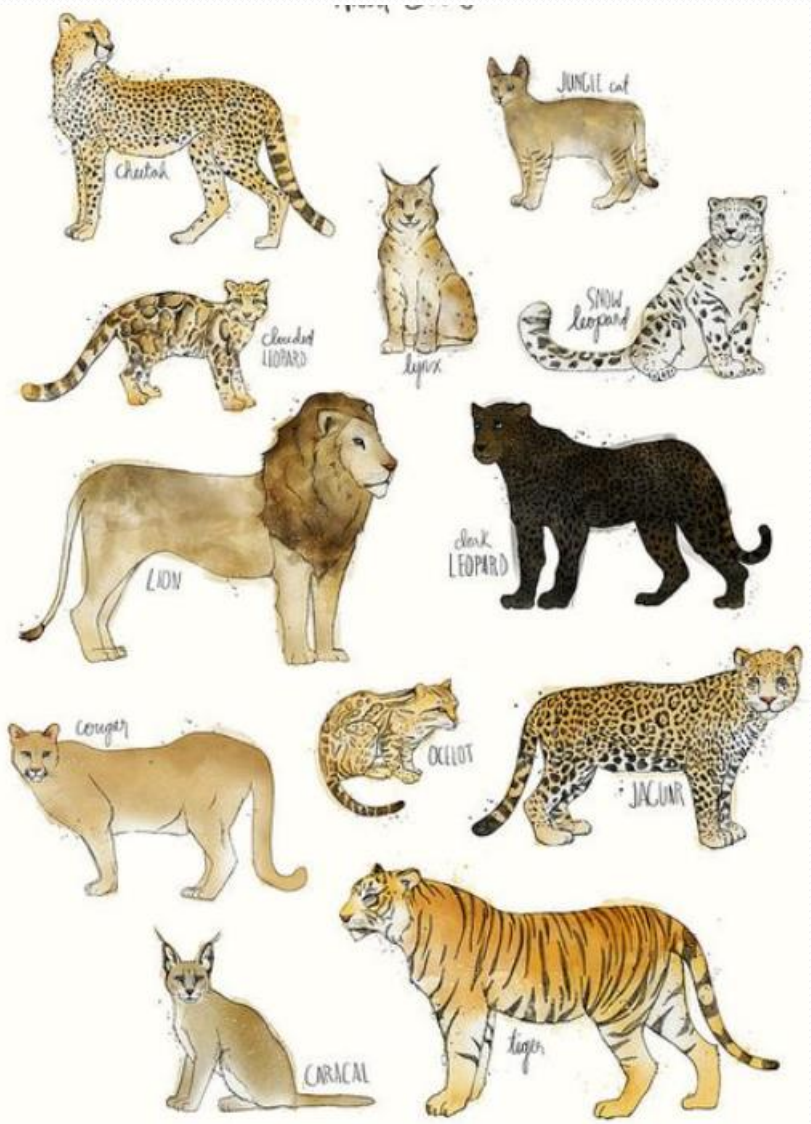
Same Genus
Different species

Different Genus
Same species

Standardized Naming

Binomial nomenclature

- **Felis leo** (lion)
- **Felis tigris** (tiger)
- **Felis domestica** (cat)
- **Felis concolor** (panther, silver lion, american lion, mountain screamer, king cat, varmit, brown tiger, red tiger, deer killer, mountain demon)



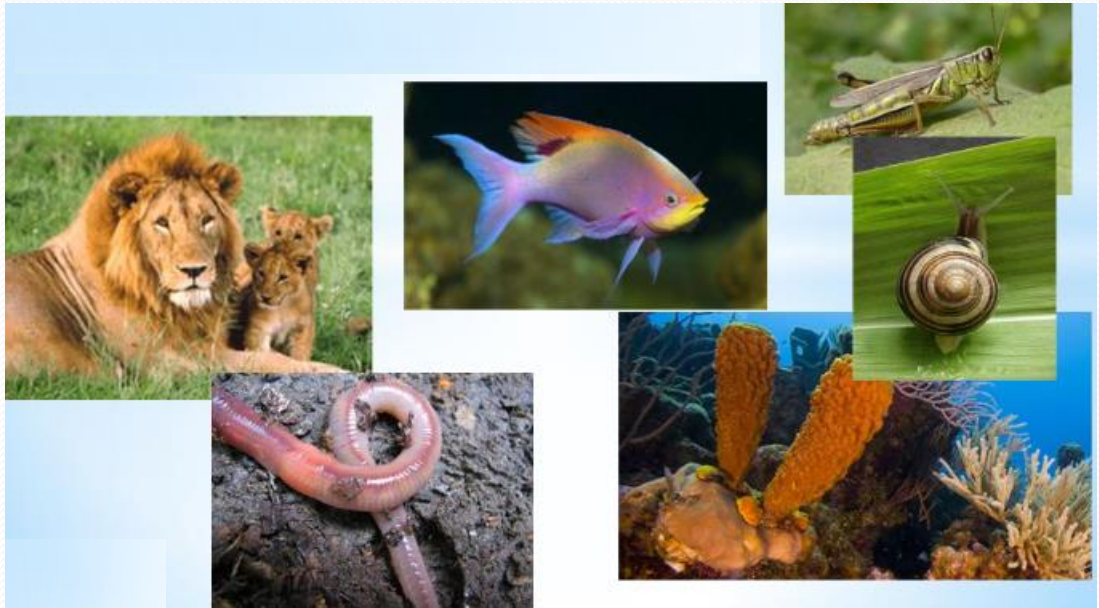
Basis of Classification

A. Homologous structures

1. Appendages – arms/wings, legs, antennae
2. Organs – heart, brain, lungs
3. Tissues – nervous, muscle, blood vessels

B. Biochemical similarities

1. Proteins
2. Carbohydrates
3. Water
4. DNA, RNA, etc.



SYSTEM of Classification

TRY IT

A. Establishment of categories from general (broad) to specific (narrow)

Using GPS, how would you relay your address information to someone in another country so they can locate you?

SYSTEM of Classification

TRY IT

A. Establishment of categories from general (broad) to specific (narrow)

Using GPS, how would you relay your address information to someone in another country so they can locate you?

1. Continent
2. Country
3. State
4. County
5. City
6. Street
7. House # or Apartment Building #
8. Apartment # or Letter

SYSTEM of Classification

B. Standard Nomenclature

King Phillip Came Over From Germany Smiling

King Phillip Cried Out For Goodness Sake!

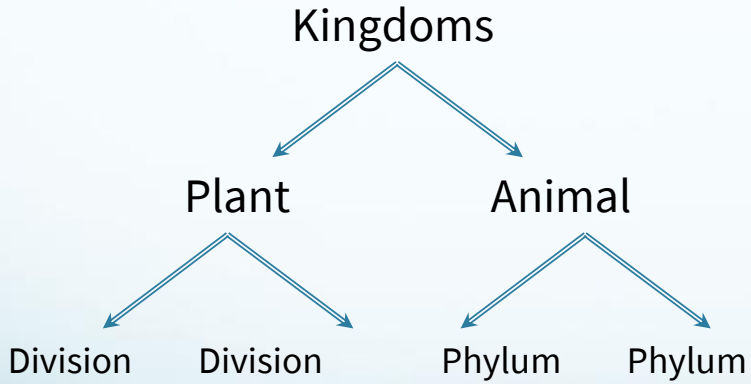
1. Kingdom
2. Phylum
3. Class
4. Order
5. Family
6. Genus
7. species
8. variety

SYSTEM of Classification

		Cat	Man
1.	Kingdom	Animalia	Animalia – *complex food*
2.	Phylum	Chordata	Chordata – *notochord, gill slits*
3.	Class	Mammalia	Mammalia – *milk glands, hair or fur*
4.	Order	Carnivora	Primate – *flat nails on fingers*
5.	Family	Felidae	Hominidae – *flat face, color vision, bipedal*
6.	Genus	Felis	Homo - *large brain*
7.	Species	domesticus	sapien – *prominent chin, sparse body hair, high forehead*
8.	Variety	*Siamese*	*Oriental*

Linnaeus first divided all organisms into large groups that he called kingdoms. He based his classification on **TWO** kingdoms: plants & animals.

A kingdom would be further subdivided into smaller groups.



Each subset was further subdivided until he had developed **7 levels or TAXONS** of classification.

Each subdivision of a kingdom is called a phylum in the animal kingdom,

or a division in the plant kingdom.

Organisms are placed in the same species if:

they can mate

and produce fertile offspring.

In the system developed by Linnaeus, the **kingdom** was the biggest, broadest group. More recently scientists have added an additional level above the kingdom called a "**domain**".

A **Species** contains only one type of organism.

Hierarchy-Taxonomic Groups

Kingdom ← **BROADEST**

Phylum or Division

Class

Order

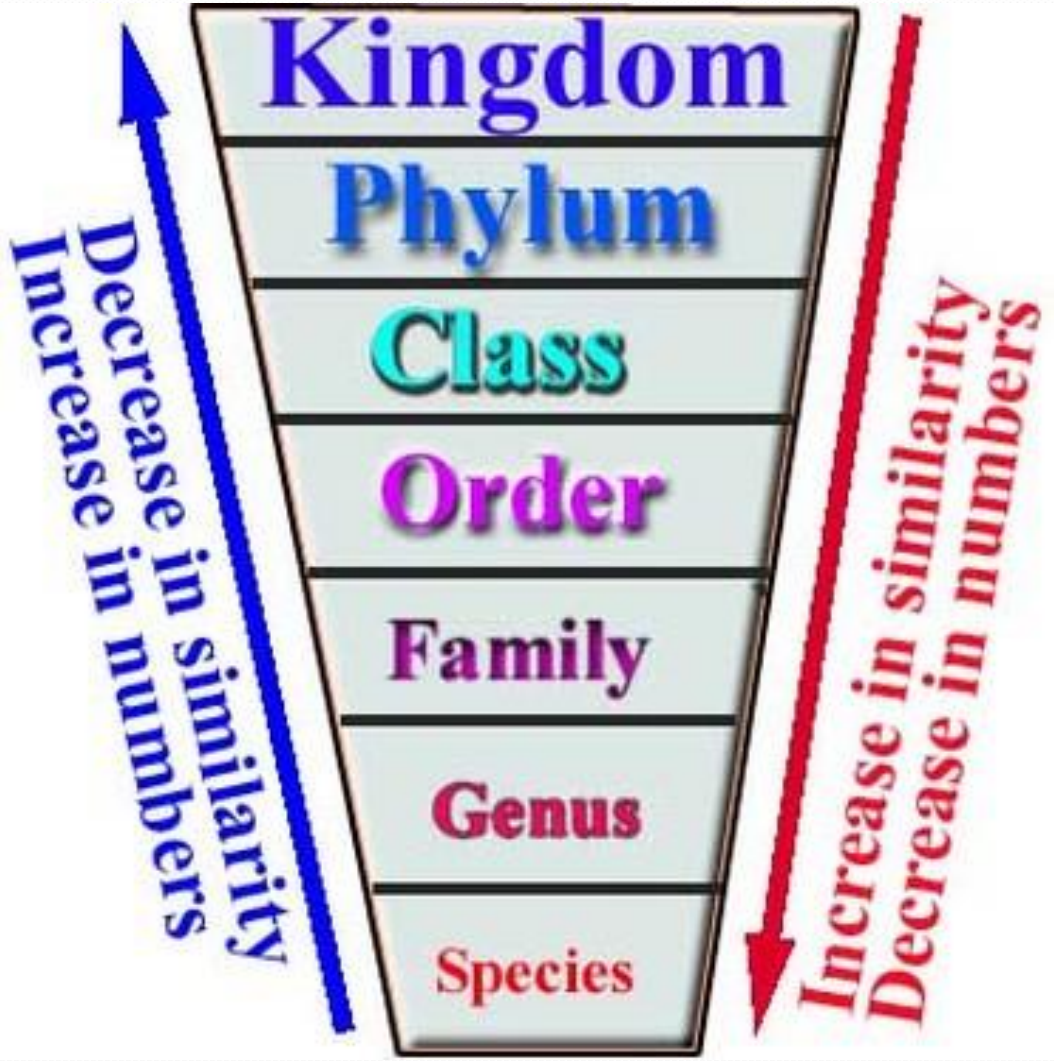
Family

Genus

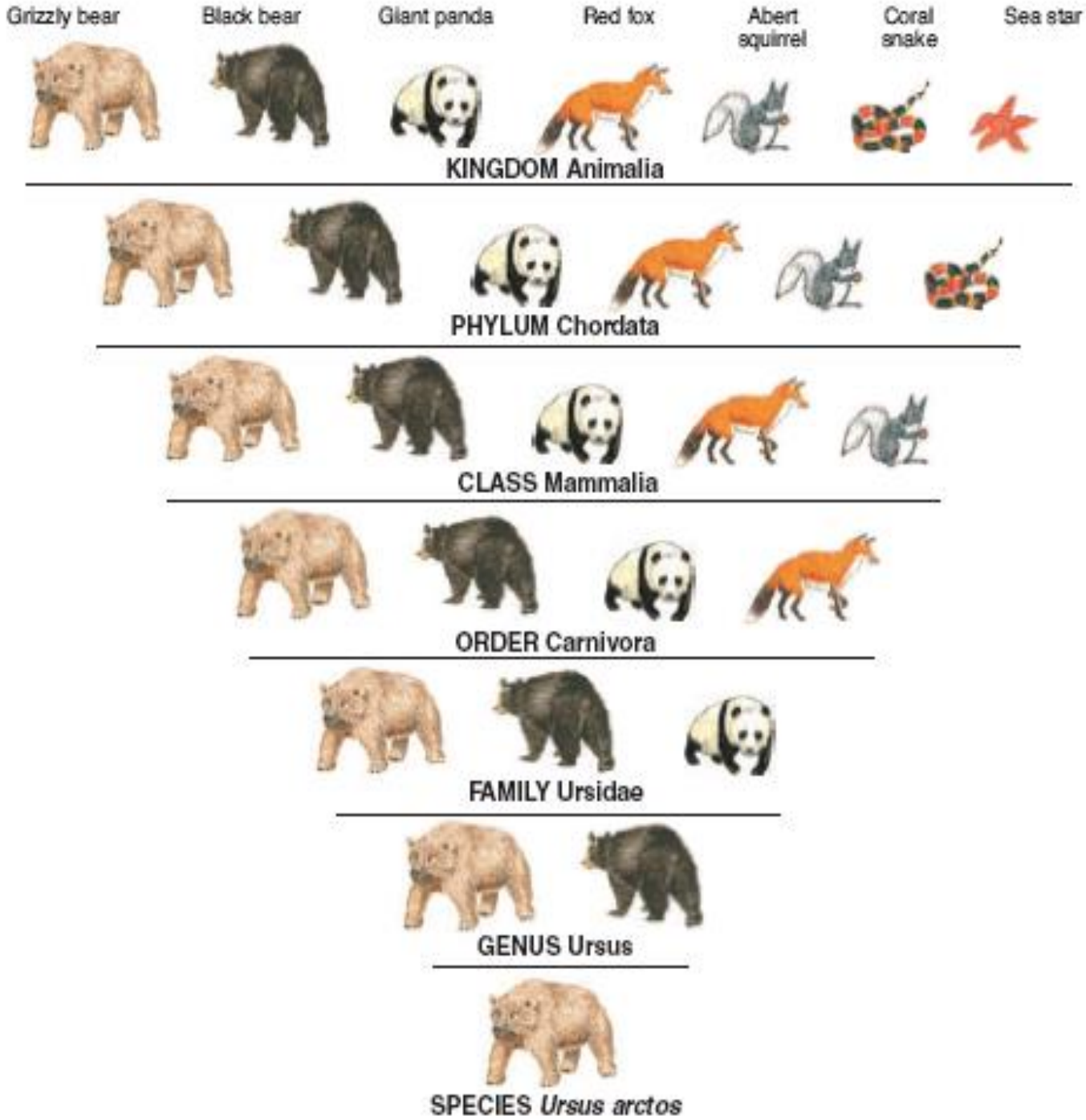
Species ← **MOST SPECIFIC**

Species are subdivided into "varieties"

Hierarchy-Taxonomic Groups



"variety"



King

Phillip

Cried

Out

For

Goodness

Sake!

QUICK CHECK

Below is a chart showing the classification of four different animals. Use the chart to answer the questions below.

Animal #1	Animal #2	Animal #3	Animal #4
Animalia	Animalia	Animalia	Animalia
Arthropoda	Arthropoda	Arthropoda	Arthropoda
Hexapoda	Hexapoda	Hexapoda	Hexapoda
Lepidoptera	Lepidoptera	Lepidoptera	Lepidoptera
Nymphalidae	Nymphalidae	Papilionidae	Nymphalidae
Danaus	Vanessa	Papilio	Danaus
plexippus	atalanta	rutulus	gilippus

What is the scientific name of Animal #1?

Which of these animals belong to the same phylum?

Which of these animals belong to the same order?

QUICK CHECK

Below is a chart showing the classification of four different animals. Use the chart to answer the questions below.

Animal #1	Animal #2	Animal #3	Animal #4
Animalia	Animalia	Animalia	Animalia
Arthropoda	Arthropoda	Arthropoda	Arthropoda
Hexapoda	Hexapoda	Hexapoda	Hexapoda
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Nymphalidae	Nymphalidae	Papilionidae	Nymphalidae
Danaus	Vanessa	Papilio	Danaus
plexippus	atalanta	rutulus	gilippus

What is the scientific name of Animal #1? ***Danaus plexippus***

Which of these animals belong to the same phylum? **1, 2, 3, and 4**

Which of these animals belong to the same order? **1, 2, 3, and 4**

Below is a chart showing the classification of four different animals. Use the chart to answer the questions below.

QUICK CHECK

Animal #1	Animal #2	Animal #3	Animal #4
Animalia	Animalia	Animalia	Animalia
Arthropoda	Arthropoda	Arthropoda	Arthropoda
Hexapoda	Hexapoda	Hexapoda	Hexapoda
Lepidoptera	Lepidoptera	Lepidoptera	Lepidoptera
Nymphalidae	Nymphalidae	Papilionidae	Nymphalidae
Danaus	Vanessa	Papilio	Danaus
plexippus	atalanta	rutulus	gilippus

Which of these animals is the most distantly related to the others?

Which of these animals belong to the same family?

Below is a chart showing the classification of four different animals. Use the chart to answer the questions below.

QUICK CHECK

Animal #1	Animal #2	Animal #3	Animal #4
Animalia	Animalia	Animalia	Animalia
Arthropoda	Arthropoda	Arthropoda	Arthropoda
Hexapoda	Hexapoda	Hexapoda	Hexapoda
Lepidoptera	Lepidoptera	Lepidoptera	Lepidoptera
Nymphalidae	Nymphalidae	Papilionidae	Nymphalidae
Danaus	Vanessa	Papilio	Danaus
plexippus	atalanta	rutulus	gilippus

Which of these animals is the most distantly related to the others?

Animal #3

Which of these animals belong to the same family?

1, 2, & 4
Nymphalidae

QUICK CHECK

Below is a chart showing the classification of four different animals. Use the chart to answer the questions below.




Animal #1	Animal #2	Animal #3	Animal #4
Animalia	Animalia	Animalia	Animalia
Arthropoda	Arthropoda	Arthropoda	Arthropoda
Hexapoda	Hexapoda	Hexapoda	Hexapoda
Lepidoptera	Lepidoptera	Lepidoptera	Lepidoptera
Nymphalidae	Nymphalidae	Papilionidae	Nymphalidae
Danaus	Vanessa	Papilio	Danaus
plexippus	atalanta	rutulus	gilippus

Which two of these animals are the most closely related? How do you know?

QUICK CHECK

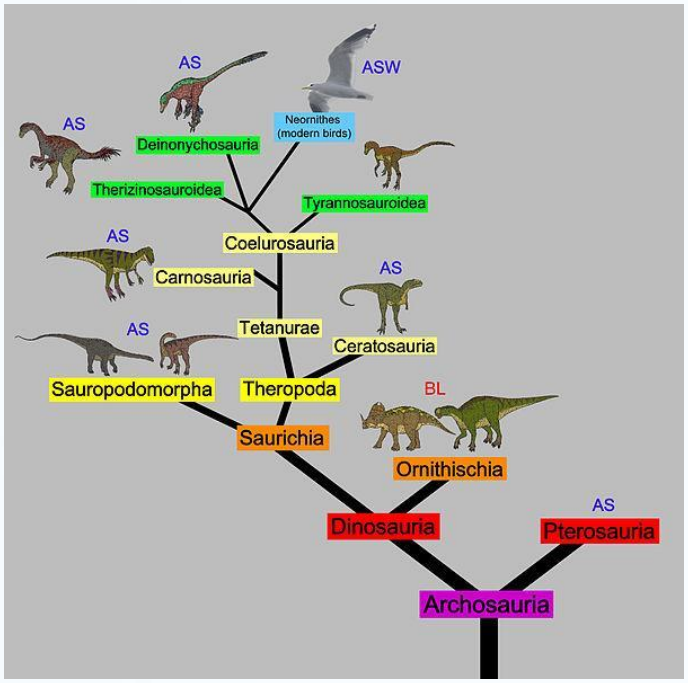
Below is a chart showing the classification of four different animals. Use the chart to answer the questions below.




Animal #1	Animal #2	Animal #3	Animal #4
Animalia	Animalia	Animalia	Animalia
Arthropoda	Arthropoda	Arthropoda	Arthropoda
Hexapoda	Hexapoda	Hexapoda	Hexapoda
Lepidoptera	Lepidoptera	Lepidoptera	Lepidoptera
Nymphalidae	Nymphalidae	Papilionidae	Nymphalidae
Danaus	Vanessa	Papilio	Danaus
plexippus	atalanta	rutulus	gilippus

Which two of these animals are the most closely related? How do you know?

Animals 1 and 4 are the most closely related. They belong to the same genus.



Modern Taxonomy

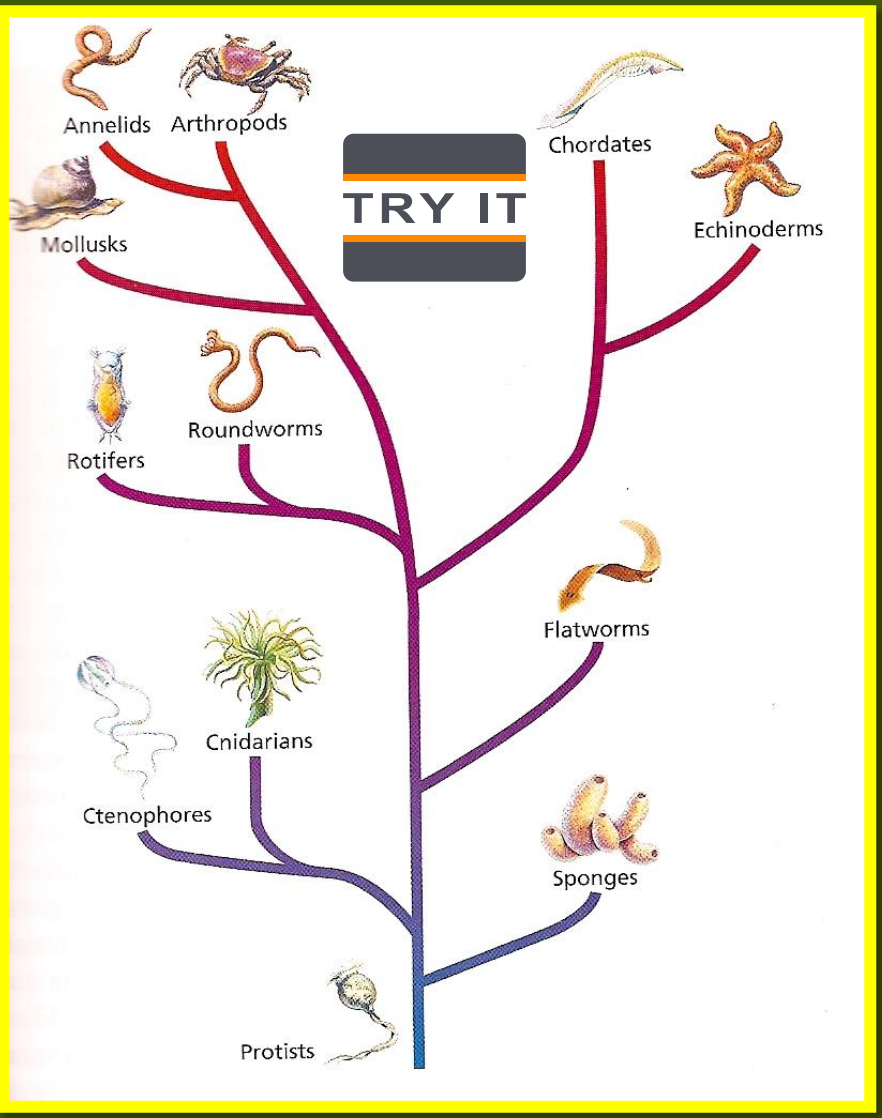
Modern taxonomists consider the **phylogeny** of an organism when attempting to classify it.

PHYLOGENY: The evolutionary history of an organism.

To show the evolutionary relationship between different groups of organisms, scientists construct **PHYLOGENETIC TREES**.

Evolutionists believe that diversity on Earth has arisen through evolution, therefore they believe that Classification should reflect this history.

A phylogenetic tree is a family tree that shows: **the evolutionary relationships thought to exist among different groups of organisms.**



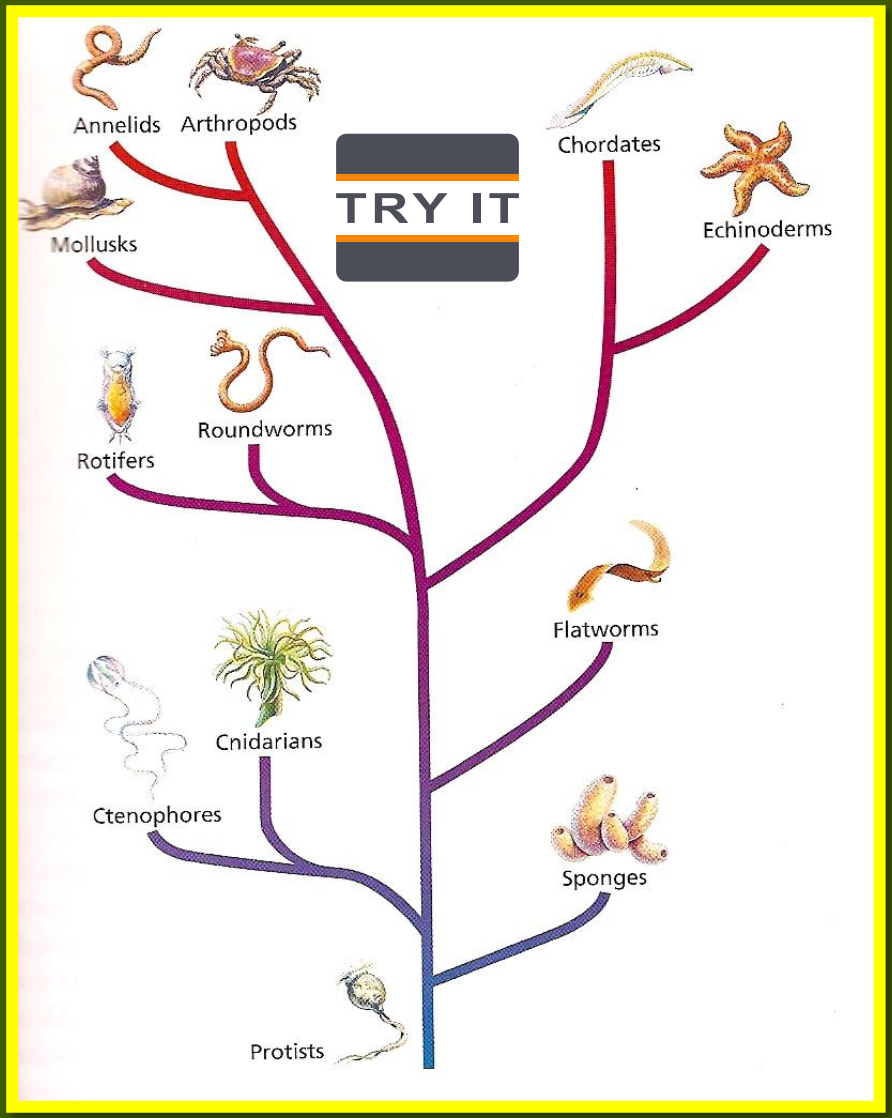
The phylogenetic tree to the left shows a few of the phyla of the Animal Kingdom.

According to this diagram, what is the common ancestor of all organisms shown on this tree?

According to this diagram, are the Cnidarians more closely related to the sponges or to the comb jellies (Ctenophores)?

According to this diagram, what is the closest relative to the Rotifers?

What does a branch point represent?



The phylogenetic tree to the left shows a few of the phyla of the Animal Kingdom.

What is the common ancestor of all organisms shown on this tree?

Protists

Are the Cnidarians more closely related to the sponges or to the comb jellies (Ctenophores)?

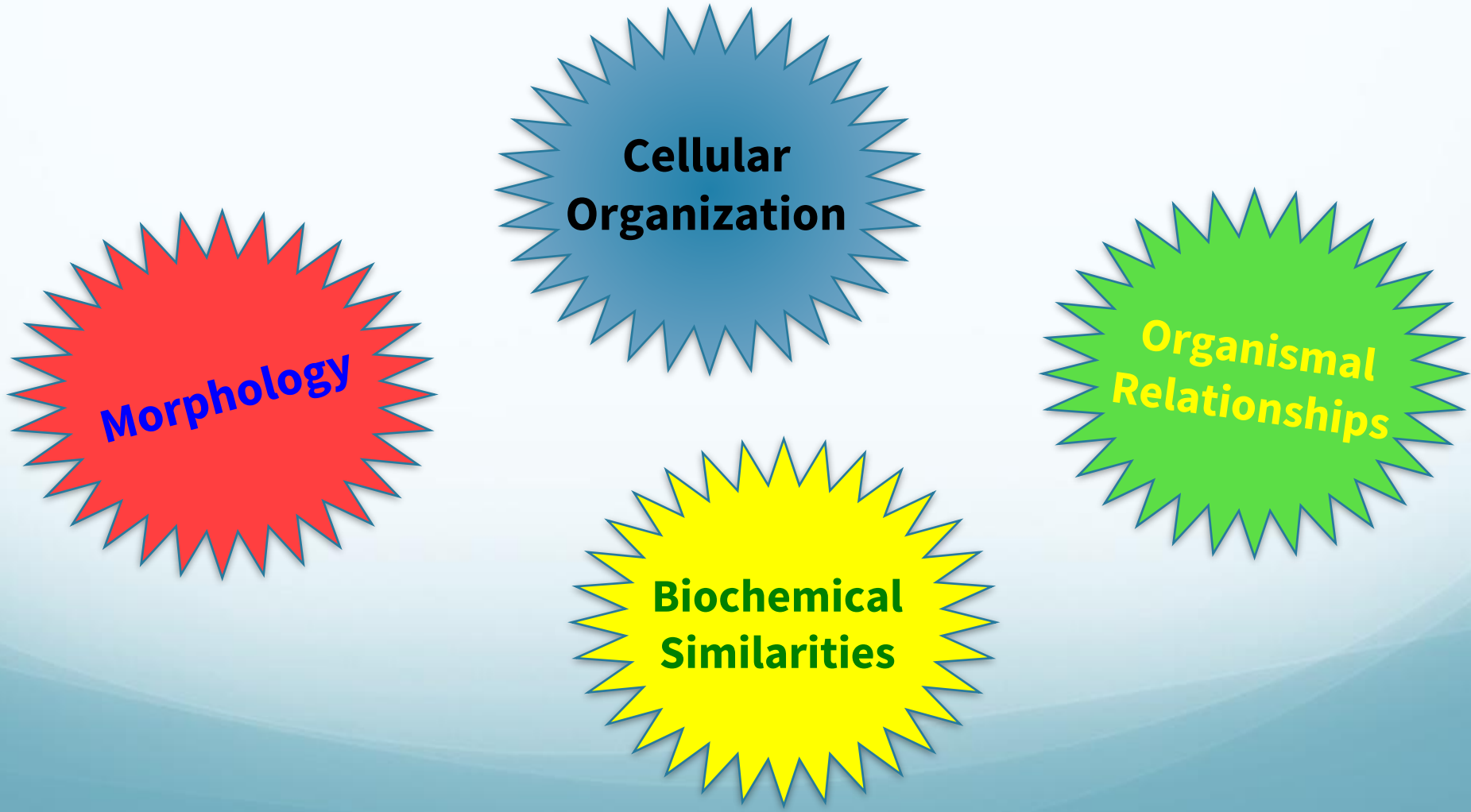
The Ctenophores

What is the closest relative to the Rotifers? Roundworms

What does a branch point represent?

The last common ancestor shared by two or more organisms.

Traditionally, the morphology (structure) of the organism was the basis for its classification. Modern taxonomy now takes into account other types of evidence when attempting to classify an organism.



Morphology

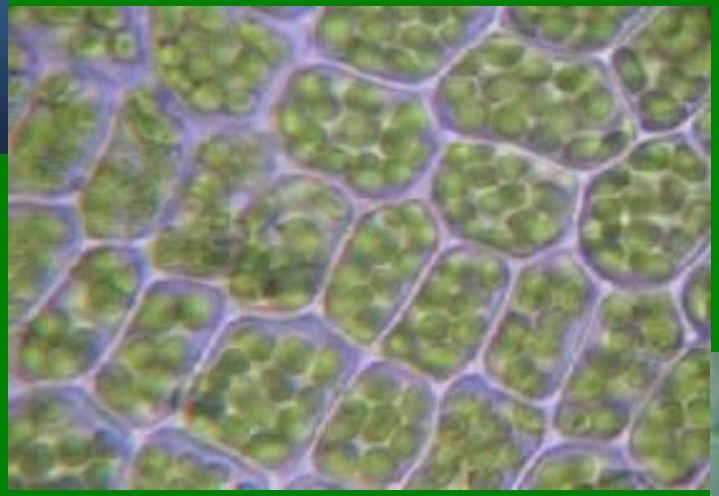
Morphology is classification based on the STRUCTURES possessed by the organism.

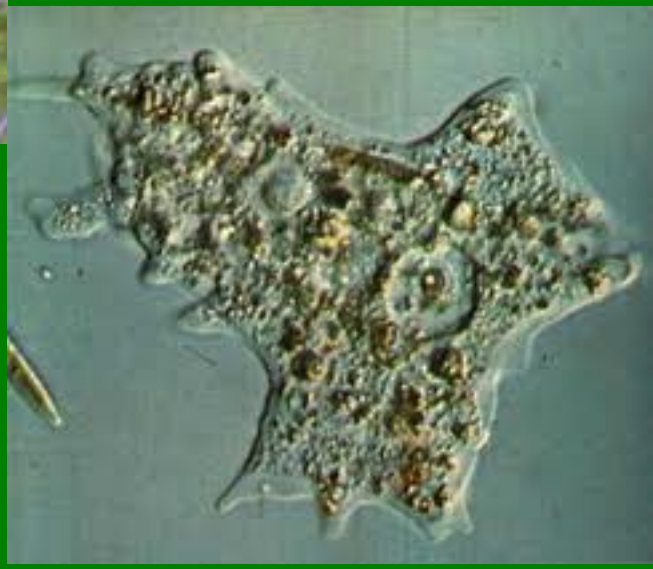
This was the basis for Linnaeus' system of classification.

For Example: Color, Size, etc.

Cellular Organization

Similarity in cell structures provides evidence that organisms may be related.





Does the cell possess a nucleus?

Is there a cell wall present?

What is the cell wall composed of?

Organismal Relationships

Fossils show that organisms alive today are similar to organisms that are now extinct.

Example: 25 breeds of dogs all came from a wolf-like ancestor.

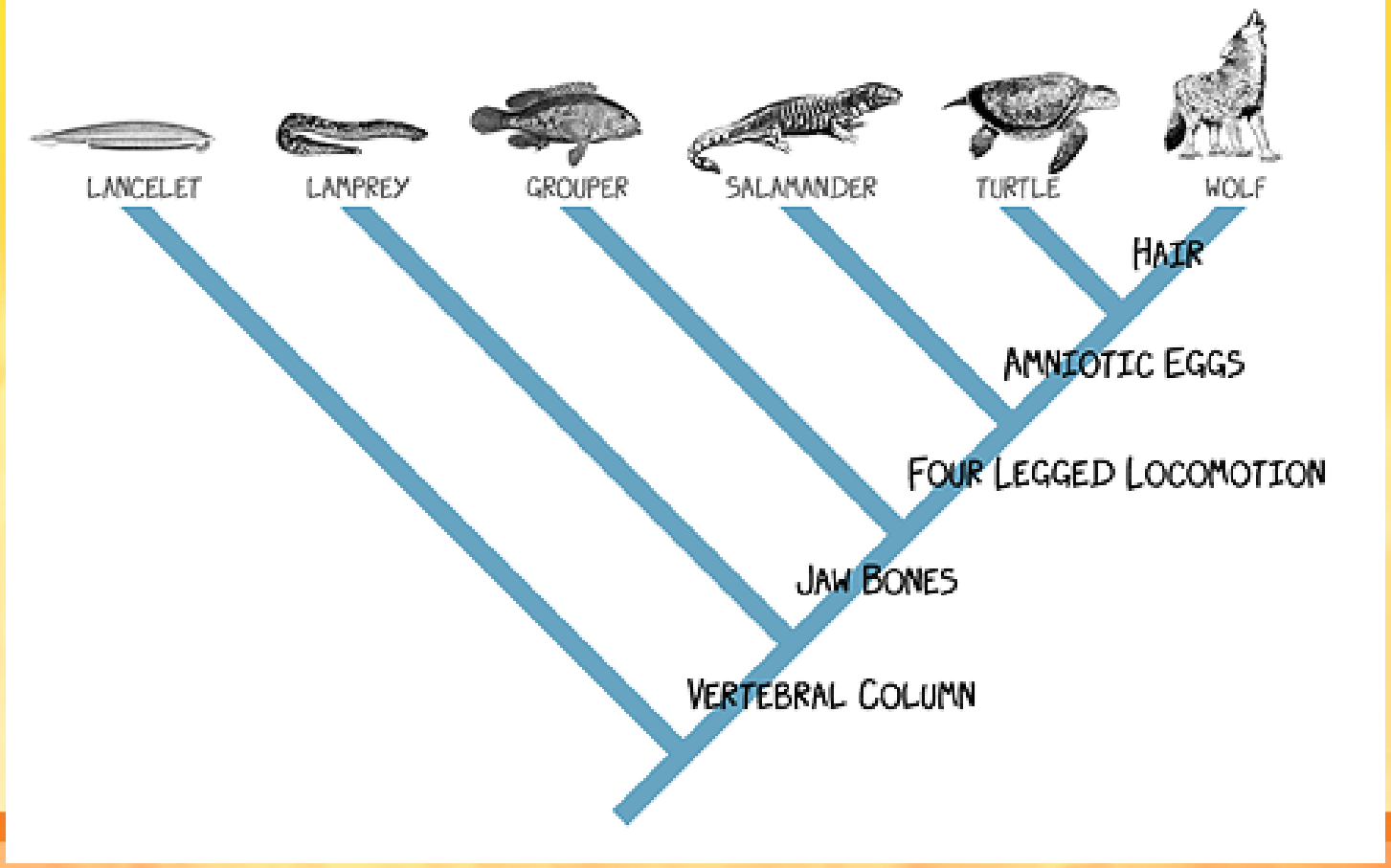
Biochemical Similarities

Sometimes as more is learned about a particular organism's biochemistry, its particular classification may change.

- For Example, **Horseshoe Crabs** (*Limulus polyphemus*) were considered true crabs.
- As their biochemistry has been better understood, they have been found to be more similar to other arthropods: **Spiders**.
- Their subphylum was changed from Crustacea (crabs) to **Chelicerata** (spiders).

Cladogram

Diagram that shows the evolutionary relationships among a group of organisms based on shared, derived characteristics such as feathers, hair, or scales.



Kingdoms & Domains

As new discoveries have been made, the systems of classification had to be changed. The first attempt at scientific classification was Linnaeus with his 2-kingdom system. Since the time of Linnaeus, many changes have been made in the ways that scientists classify organisms.

A Brief History of Classification Kingdoms

First Introduced	Names of Kingdoms					
1700's	Plantae					Animalia
Late 1800's	Protista			Plantae		Animalia
1950's	Monera		Protista	Fungi	Plantae	Animalia
1990's	Archae-bacteria	**Eubacteria**	Protista	Fungi	Plantae	Animalia

Progression of Kingdoms

A. Two Kingdoms (Linnaeus)

1. Plants
2. Animals

B. Three Kingdoms

1. Plants (*carry on photosynthesis, AUTOTROPH*)
2. Animals (*require complex nutrients, most are motile, HETEROTROPH*)
3. Protist (*cells that lack a nuclear envelope and many internal cell structures; simple, unicellular organisms; e.g. bacteria, blue-green algae*)

Progression of Kingdoms

C. **Five Kingdoms**

1. Prokaryotes (*cells that lack a nuclear envelope and many internal cell structures; simple, unicellular organisms; e.g. bacteria, blue-green algae*)

2. Protists (*unicellular protozoans; e.g. amoeba, paramecia, volvox, more complex algae*)

3. Fungi (*multi-cellular organisms that do not carry on photosynthesis [HETEROTROPHIC]; not green; e.g. mushrooms, yeast*)

4. Plants (*photosynthesis [AUTOTROPHIC]; green; differentiated organs*)

5. Animals (*locomotion; not rigid; complex foods ingested*)

Progression of Kingdoms

D. Six Kingdoms (modern taxonomy)

1. Archaebacteria → live in extreme environments (mostly anaerobic), [*halococcus*]

2. Eubacteria → "small rod" → cell wall, [*cyanobacteria, streptococcus, e coli*]

3. Protists (*unicellular protozoans; e.g. amoeba, paramecia, volvox, more complex algae*)

4. Fungi (*multi-cellular organisms that do not carry on photosynthesis [HETEROTROPHIC]; not green; e.g. mushrooms, yeast*)

5. Plants (*photosynthesis [AUTOTROPHIC]; green; differentiated organs*)

6. Animals (*locomotion; not rigid; complex foods ingested*)

- Scientists noticed that all living things seem to fall naturally into three broad groups.
- In recent years, this led to the establishment of a **3-DOMAIN SYSTEM**
- **DOMAINS** are essentially: super kingdoms, a taxonomic level even higher than the kingdom level.

THE 6-KINGDOM SYSTEM with THREE DOMAINS:

Kingdom Eubacteria	Kingdom Archae-bacteria	Kingdom Protista	Kingdom Plantae	Kingdom Fungi	Kingdom Animalia
Domain Bacteria	**Domain Archaea**	**Domain Eukarya** (all eukaryotes)			

THE 6-KINGDOM SYSTEM with THREE DOMAINS:

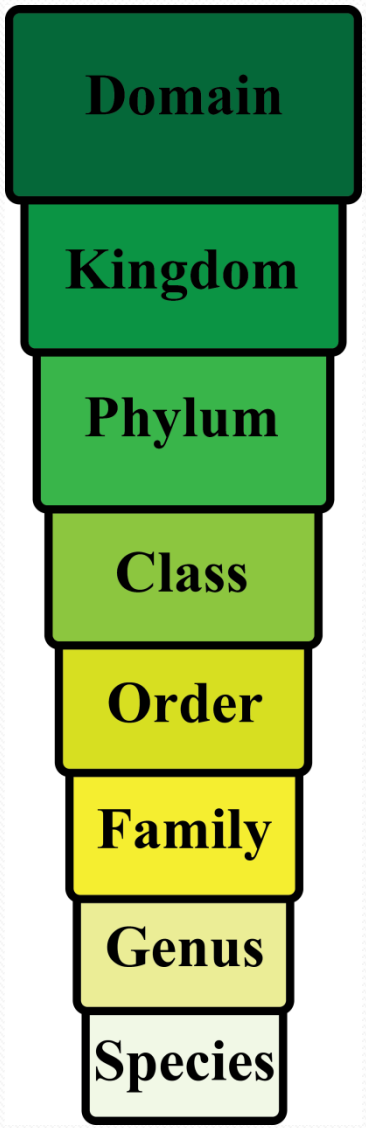
Kingdom Eubacteria	Kingdom Archae-bacteria	Kingdom Protista	Kingdom Plantae	Kingdom Fungi	Kingdom Animalia
Domain Bacteria	**Domain Archaea**	**Domain Eukarya** (all eukaryotes)			

The domain **BACTERIA** contains the Kingdom Eubacteria.

The domain **ARCHAEA** contains the Kingdom Archaebacteria.

The domain **EUKARYA** contains the Kingdoms Protista, Plantae, Fungi, and Animalia.

Hierarchy-Taxonomic Groups



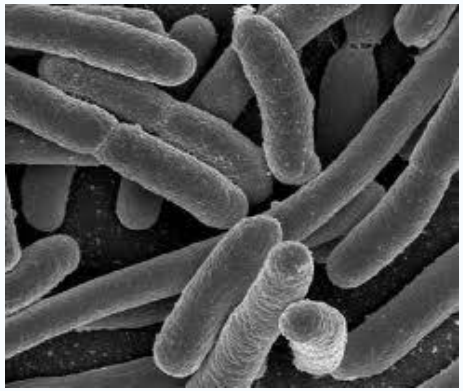
	HUMAN	OSTRICH
DOMAIN	Eukarya	Eukarya
KINGDOM	Animalia	Animalia
PHYLUM	Chordata	Chordata
CLASS	Mammalia	Aves
ORDER	Primate	Struthioniformes
FAMILY	Hominidae	Struthionidae
GENUS	*Homo*	*Struthio*
SPECIES	*sapien*	*camelus*
	variety	5 subspecies	4 subspecies

Six Kingdoms

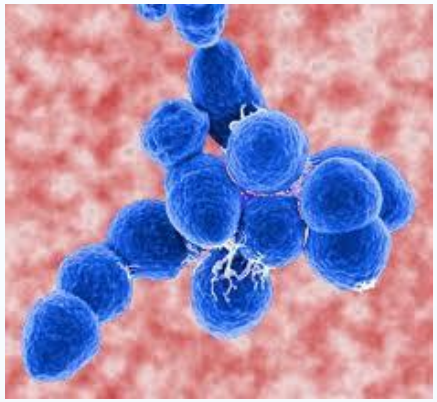
- ✓Archaebacteria
- ✓Eubacteria
- ✓Protista
- ✓Fungi
- ✓Plantae
- ✓Animalia

Kingdom Comparison

Domain	**Bacteria**
Kingdom	**Eubacteria**
Cell Type	**Prokaryotic**
Cell Structures	**Cell walls composed of Peptidoglycans**
Cell Organization	**Unicellular**
Food Getting?	**Autotrophs or heterotrophs**
Examples:	**Strep, staph, E. coli**

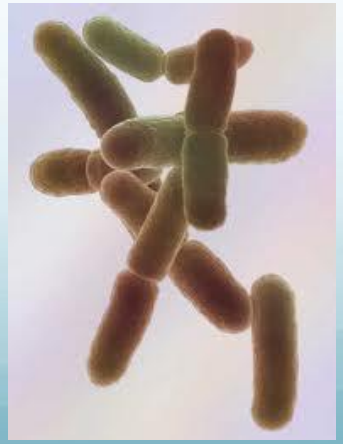


cyanobacteria



strep

staph



E. coli

Kingdom Comparison

Domain	**Archaea**
Kingdom	**Archaebacteria**
Cell Type	**Prokaryotic**
Cell Structures	**Cell walls do NOT contain peptidoglycans.** **Considered very "ancient" and primitive organisms.**
Cell Organization	**Unicellular**
Food Getting?	**Autotroph or heterotrophs**
Examples:	**Methanogens** **Halophiles** **Thermophiles**

Halophiles:
(salt loving)

Thermophiles:
(heat loving)

Domain Eukarya

Kingdom Protista

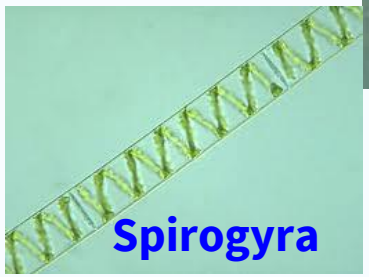
Cell Type Eukaryotic

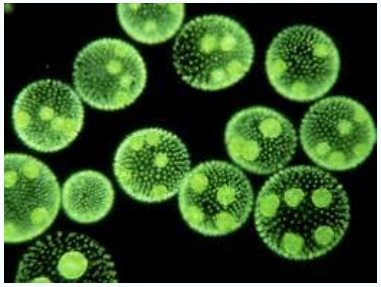
Ameba

Stentor

Cell Structures Cell walls composed of cellulose in some.

Some have chloroplasts.





Volvox

Cell Organization Most are unicellular.
Some are colonial.
Some multicellular.

Food Getting?

Autotrophs or heterotrophs

Diatoms

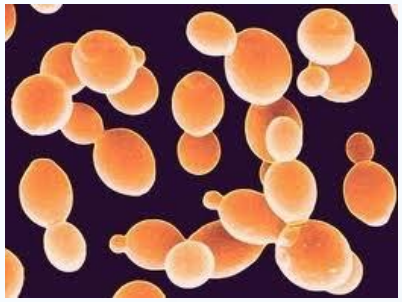
Examples: Ameba, Paramecium, Algae, Slime molds, giant kelp.

Coral fungus

Domain	**Eukarya**
Kingdom	**Fungi**
Cell Type	**Eukaryotic**

Bracket fungus

Cell Structures	**Cell walls are composed of Chitin.** **NO chloroplasts**



Yeasts

mold

Cell Organization	**Most are multicellular.** **Some are unicellular.**

Corn smut

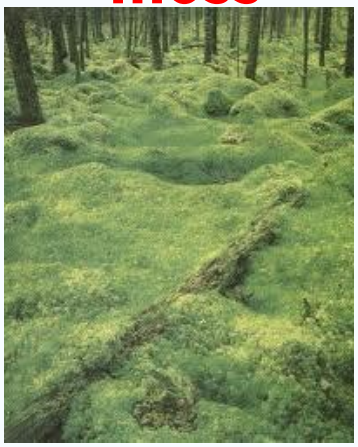
Food Getting?	**Heterotrophs**

Morels

rusts

Examples:	**Mushrooms, yeasts, puffballs, molds, mildews, smuts, and rusts.**

moss



Domain Eukarya

Kingdom Plantae

Cell Type Eukaryotic

liverworts

gingko

Cell Structures

Cells walls are composed of Cellulose.

Chloroplasts are present.

ferns

Organization Multicellular

Food Getting? Autotrophs

Examples: Mosses, ferns, liverworts, cone-bearing plants, flowering plants

Domain Eukarya

Kingdom Animalia

Cell Type Eukaryotic

Cell Structures

No cell walls.

No chloroplasts

Cell Organization

Multicellular

Food Getting?

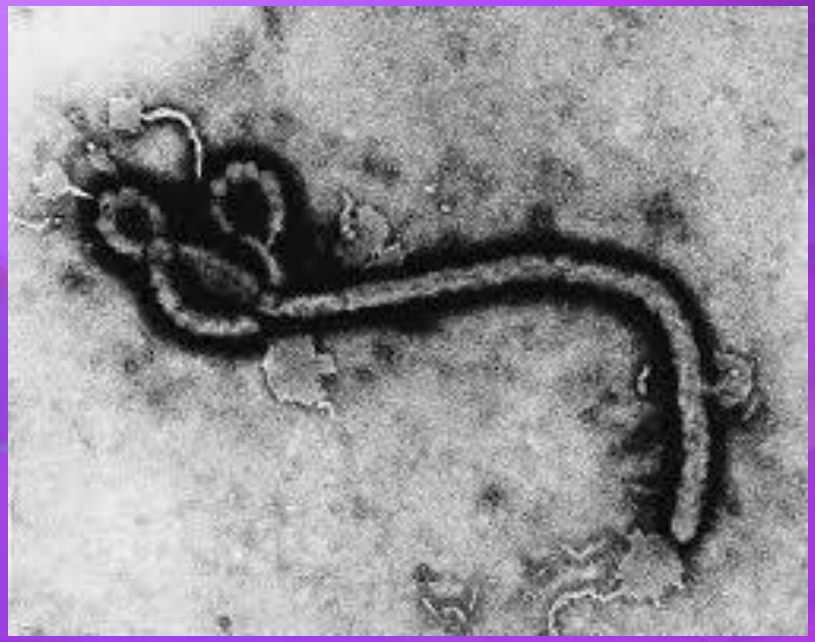
Heterotrophs

Examples:

Sponges, worms, mollusks, arthropods, fish, amphibians, birds, reptiles, mammals.

Hierarchy-Taxonomic Groups

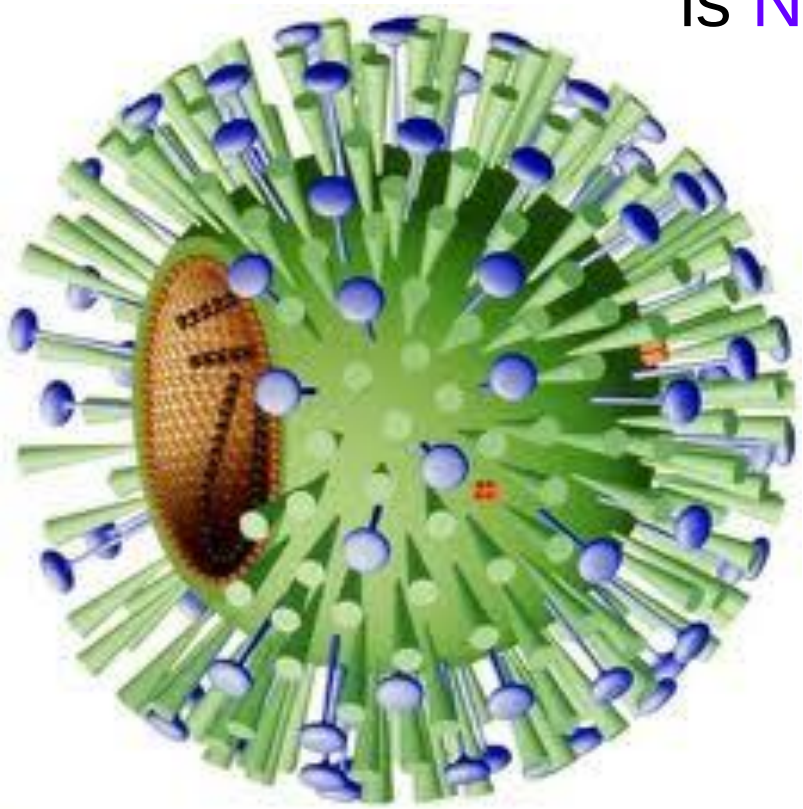
Classification of Living Things						
DOMAIN	**Bacteria**	**Archaea**	**Eukarya**			
KINGDOM	**Eubacteria**	**Archaebacteria**	**Protista**	**Fungi**	**Plantae**	**Animalia**
CELL TYPE	Prokaryote	Prokaryote	Eukaryote	Eukaryote	Eukaryote	Eukaryote
CELL STRUCTURES	Cell walls with peptidoglycan	Cell walls without peptidoglycan	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	Unicellular	Unicellular	Most unicellular; some colonial; some multicellular	Most multicellular; some unicellular	Multicellular	Multicellular
MODE OF NUTRITION	Autotroph or heterotroph	Autotroph or heterotroph	Autotroph or heterotroph	Heterotroph	Autotroph	Heterotroph
EXAMPLES	*Streptococcus, Escherichia coli*	Methanogens, halophiles	*Amoeba, Paramecium,* slime molds, giant kelp	Mushrooms, yeasts	Mosses, ferns, flowering plants	Sponges, worms, insects, fishes, mammals

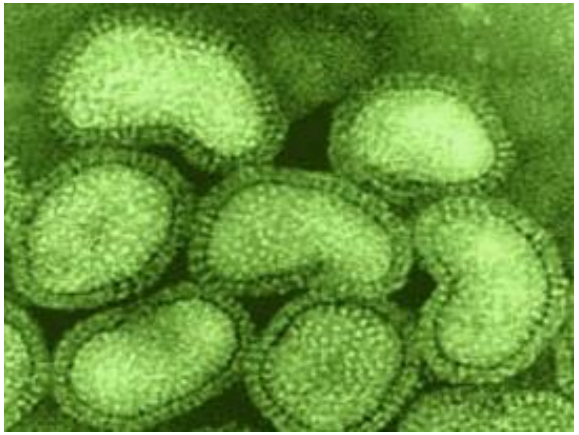


Viruses

What is a virus?

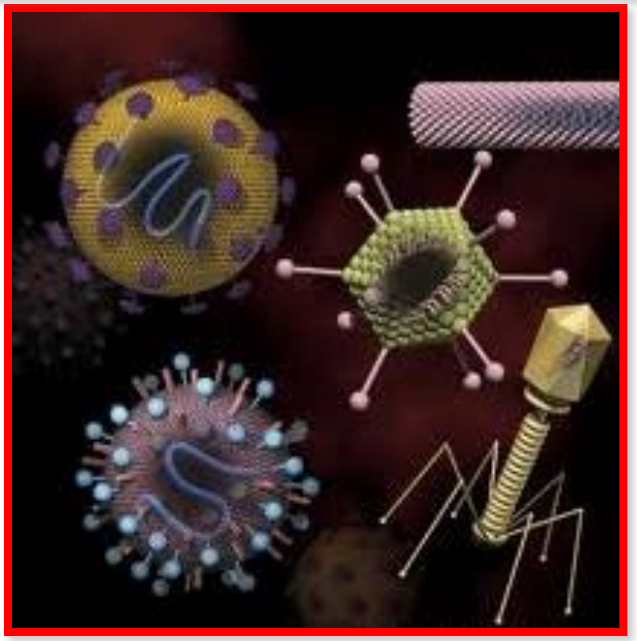
A Virus is an infectious particle that is NONLIVING.





The word virus comes from the Latin word meaning “poison”.

All viruses are Parasites
All viruses Require A Host



Parasites:

Parasites live in or on other living organisms, causing them harm.

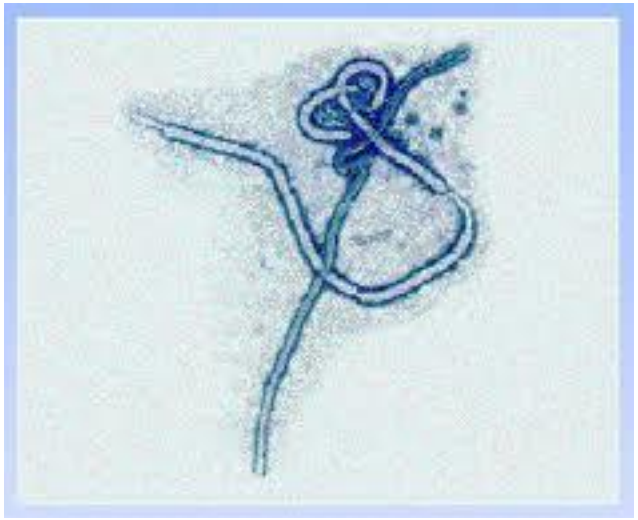
Host:

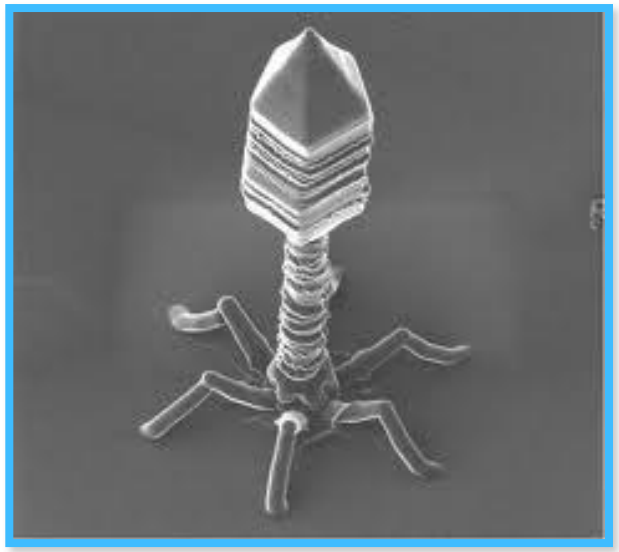
The host is the living organism the parasite lives in or on.

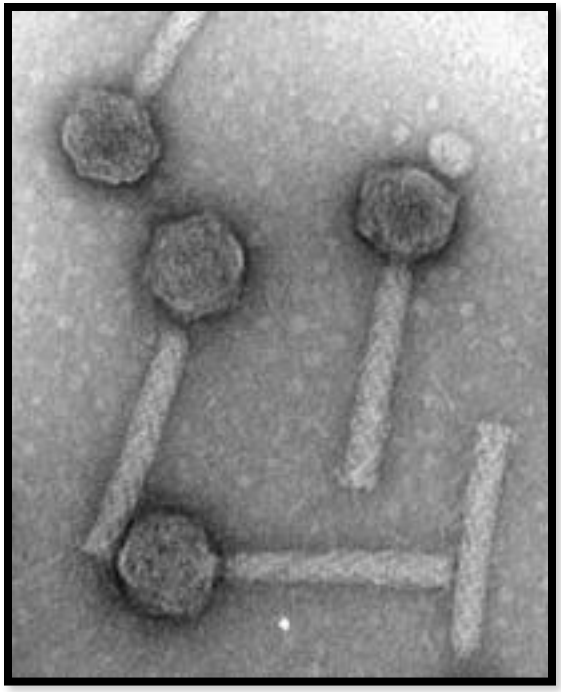
Characteristics of Viruses

Viruses are extremely small.

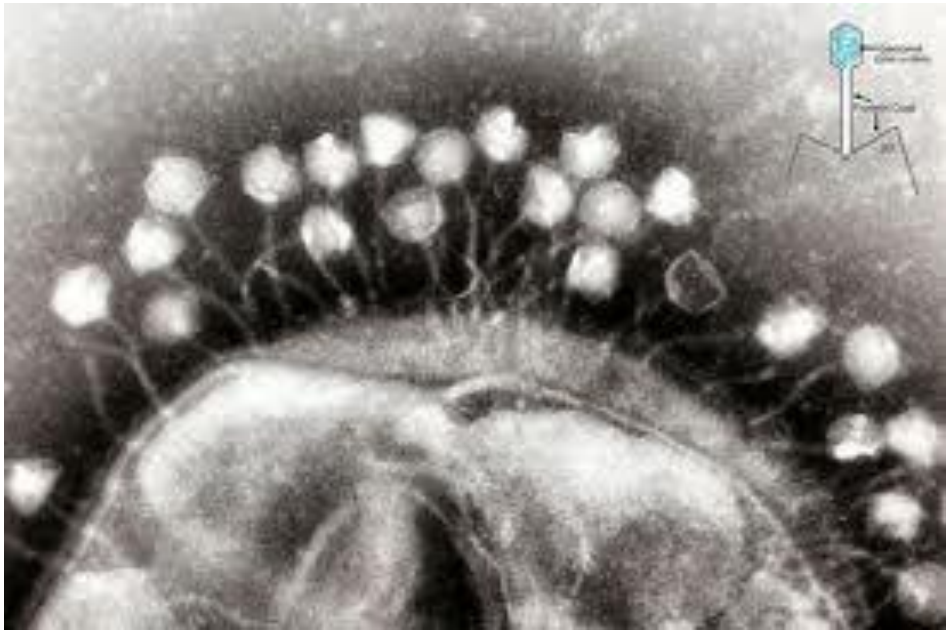
Most can be seen only with an electron microscope.







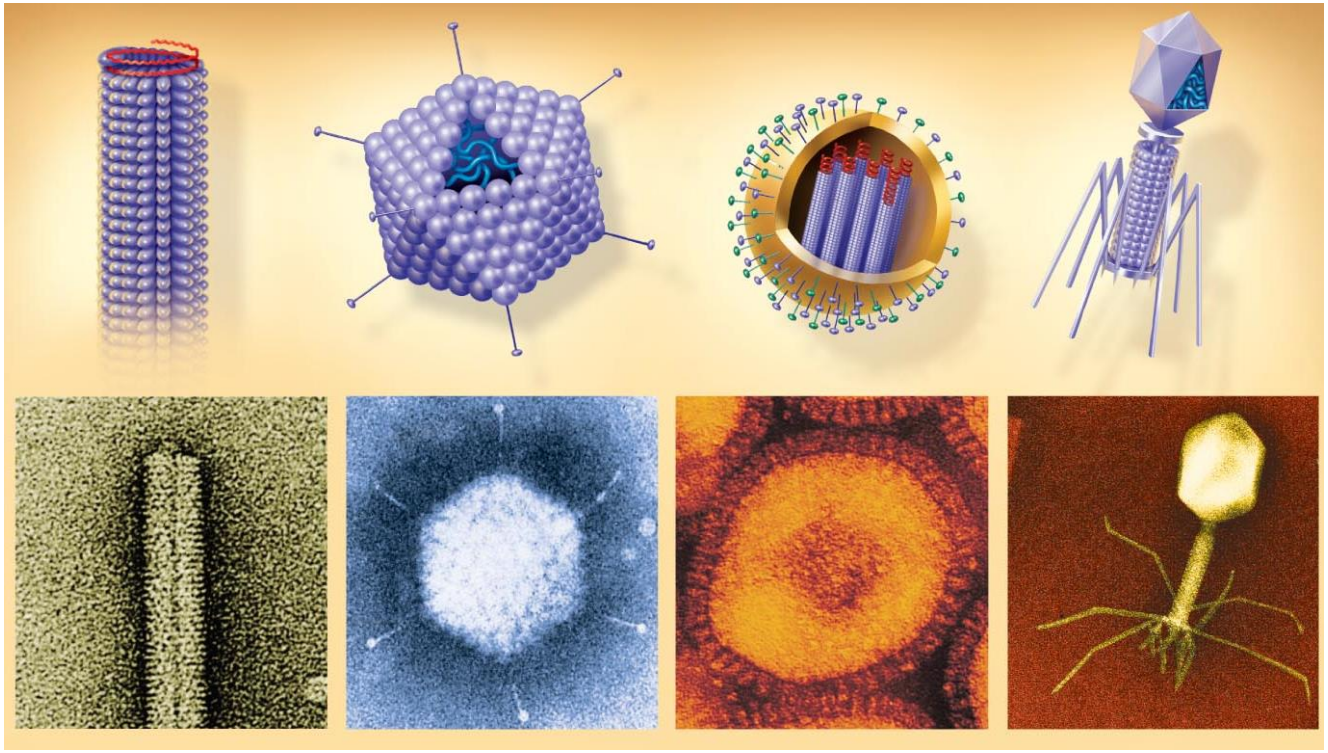
A virus is active only when inside a living cell.



When removed from a living cell, it ceases all activities, but retains its ability to infect the cell.

They may be crystallized and stored indefinitely,

but even after longs periods of time, they retain their ability to infect a living cell.



Viruses vary widely in terms of size and structure, but they all have one thing in common:

They enter living cells and use the machinery of the cell to produce more viruses.

Characteristics

✓ Viruses are NON-CELLULAR.

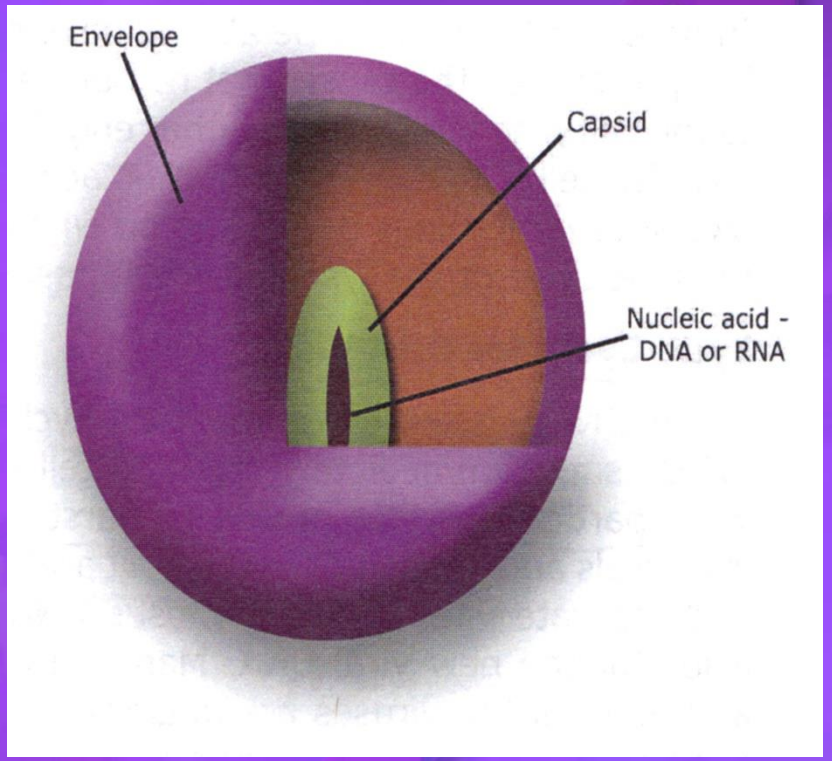
✓ They are NOT made of cells and have NO cell parts.

✓ Anatomy of a Virus:

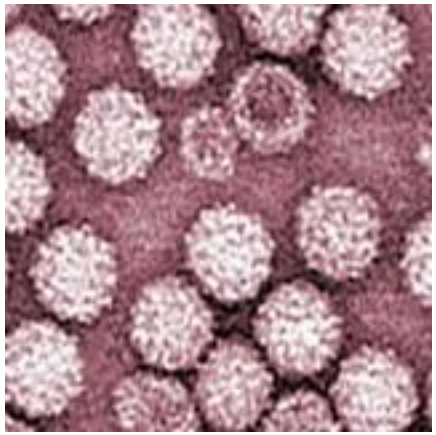
a) Envelope: Lipid bilayer derived from host membrane when virus is formed.

b) Capsid: Protein coat that protects the nucleic acid.

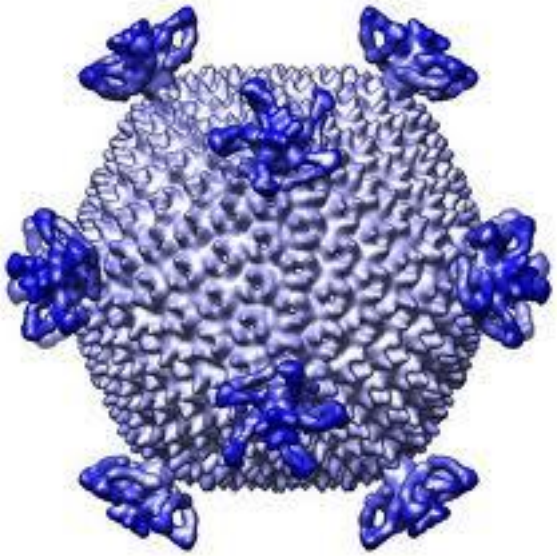
c) Have a Nucleic Acid core containing either DNA or RNA.



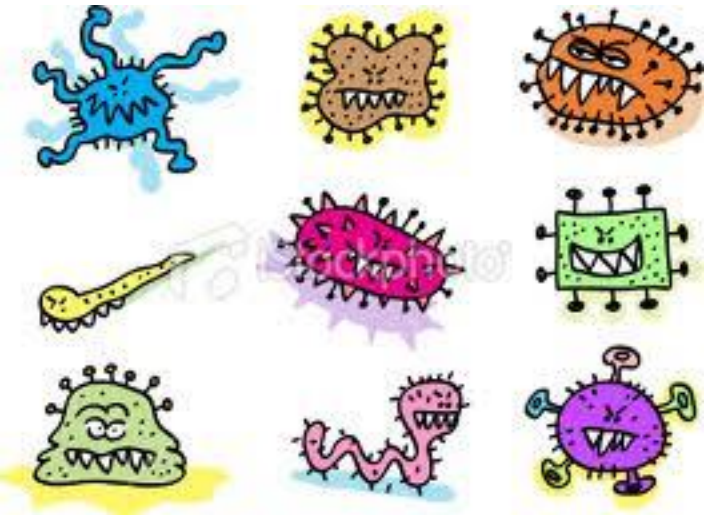
The Viral Capsid



The capsid is made of proteins that enable the virus to enter a host cell.



These capsid proteins have a particular shape that must match receptors on the surface of a host cell.



When the virus attaches to these receptors, the cell is “tricked” into letting the virus inside.

Viruses can reproduce, but only inside a living cell.

They reproduce inside a cell by getting the cell to produce viral parts instead of cell parts.

Since viruses must bind precisely to proteins on the cell surface, they are highly specific to the cells they infect.

Plant viruses can only infect plant cells.

Human viruses can only infect human cells.

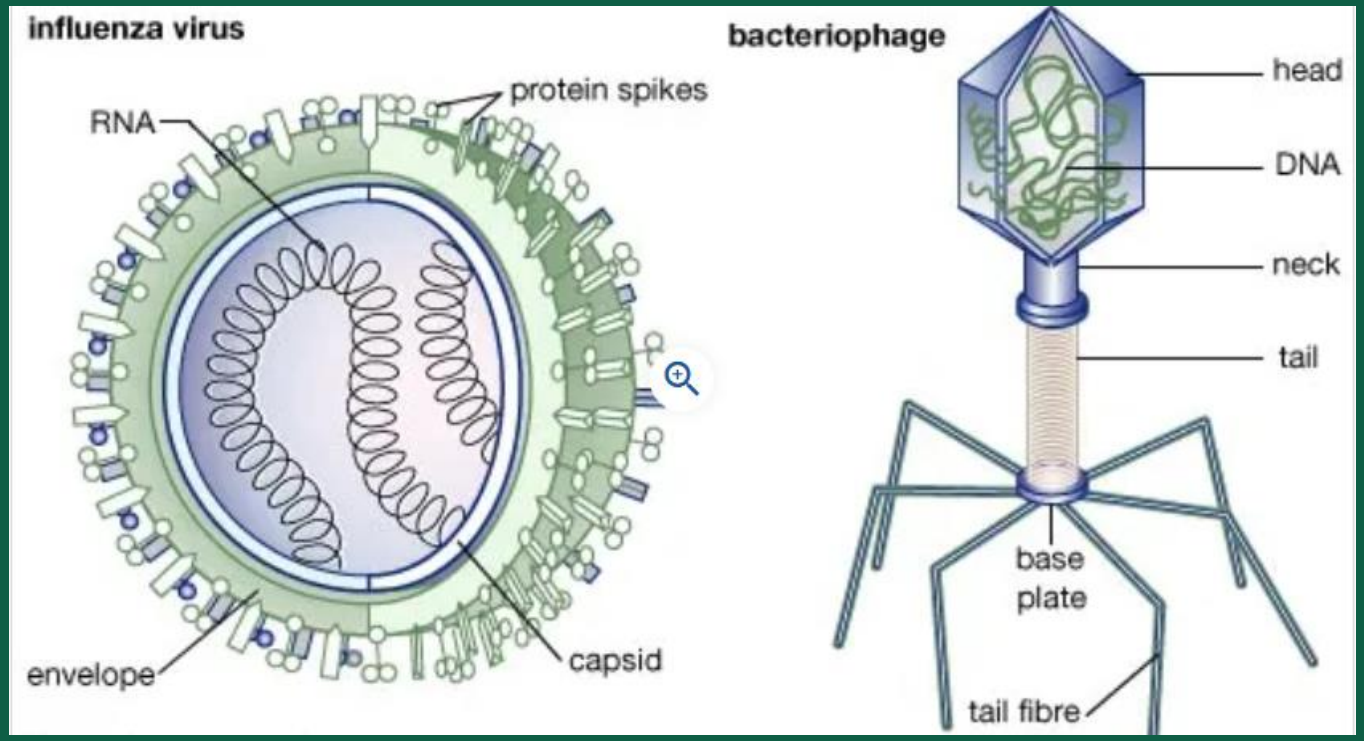
Virus-free Cells are RARE

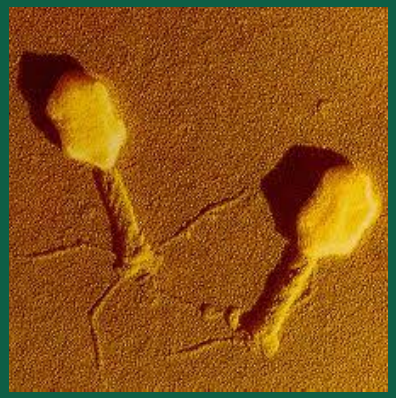
Viruses of eukaryotes are usually tissue specific.

Example:

Human cold viruses infect only the cells lining the upper respiratory system, ignoring all other tissues.

Bacteriophages



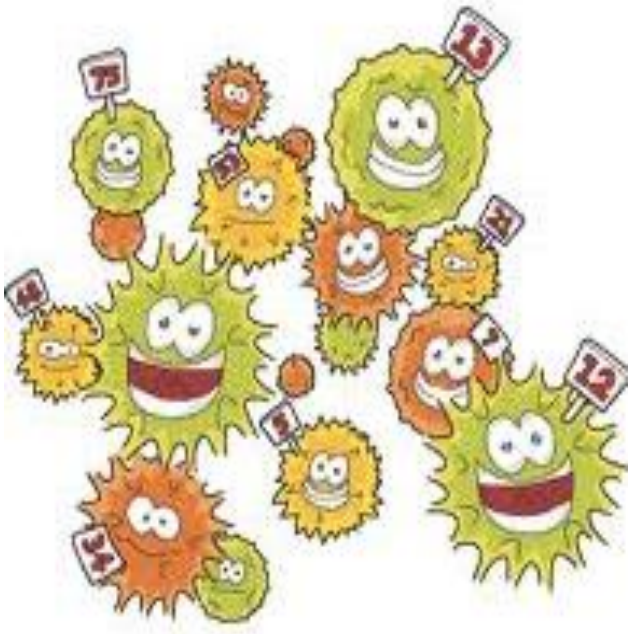


Bacteriophages are viruses that infect only certain types of bacteria.

VIRUSES – ARE THEY LIVING OR NONLIVING?

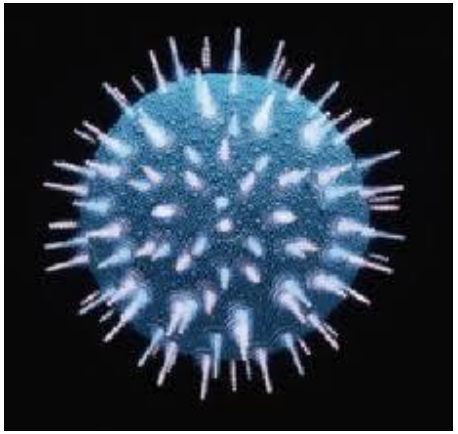
Living Characteristics of Viruses:

1. They can reproduce--but only inside a living cell.
2. They can mutate or change.
3. They have DNA or RNA. Their genome may consist of only four genes, or up to a hundred genes.



VIRUSES – ARE THEY LIVING OR NONLIVING?

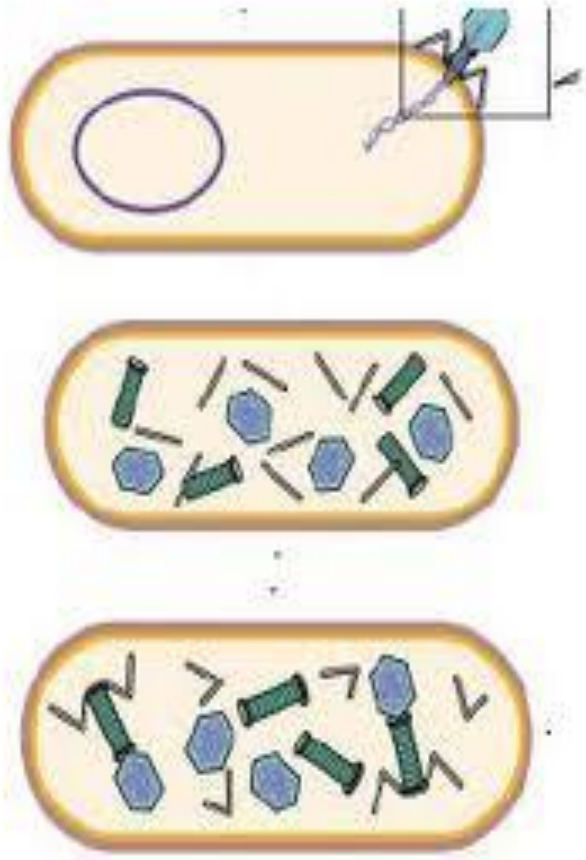
NON-living Characteristics of Viruses:



1. They are non-cellular.
2. They have no metabolism. They have no food or energy requirements.

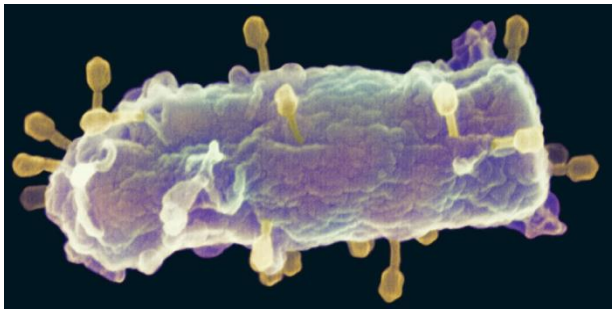
3. They can be crystallized and dehydrated and stored indefinitely. They come to "life" only when injected inside a living cell.

Viral Reproduction : How Do They Do It?



1. Since viruses have no enzymes and no cell parts, they force the host cell to: start making viral parts.
2. A viral infection begins when:

   the genetic material (DNA or RNA) of a virus makes its way into a host cell.
3. Once inside, the virus hijacks the cell, reprogramming the cell.



4. The viral genome takes over the host cell and makes the host cell start producing viral parts.

5. The host cell will begin to make copies of the viral DNA and producing the protein capsids_.

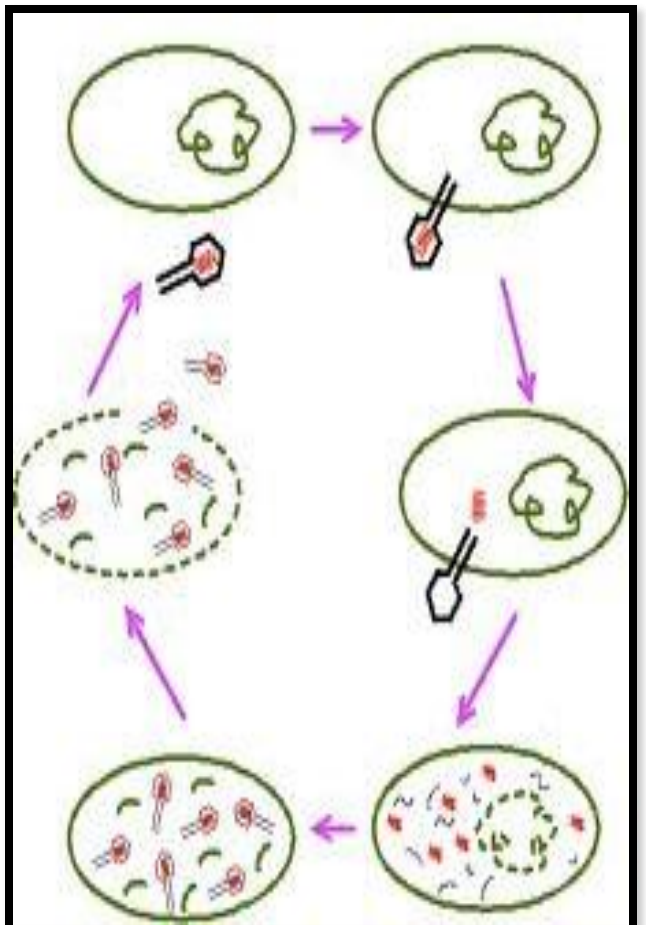
6. The host cell assembles the parts into viruses.

7. The reproductive cycle ends with:

   the exit of hundreds or thousands of viruses from the infected host cell.

8. This often destroys the host cell.

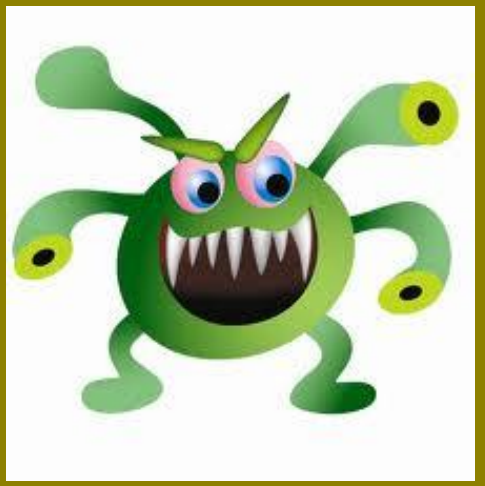
Each of these viral progeny has the capacity to infect neighboring cells thereby spreading the infection.



The Two Reproductive Possibilities:

1. Once a virus is inside a host cell, two different processes may occur.
2. Some viruses replicate themselves immediately, killing the host cell.
3. Other viruses replicate themselves in a way that does not destroy the host cell.

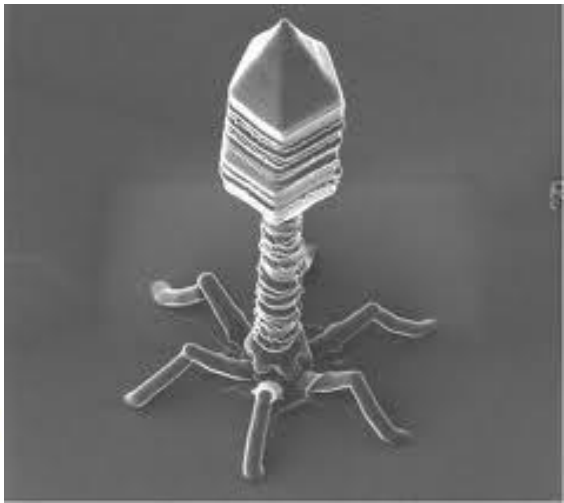
4. These two processes are
   a) The Lytic Cycle
   b) The Lysogenic Cycle



The Lytic Cycle

In a lytic infection, a virus enters a cell, makes copies of itself, and causes the cell to burst.

Bacteriophage T4 is an example of a virus that causes a lytic infection.



The Lytic Cycle
(5 Steps)

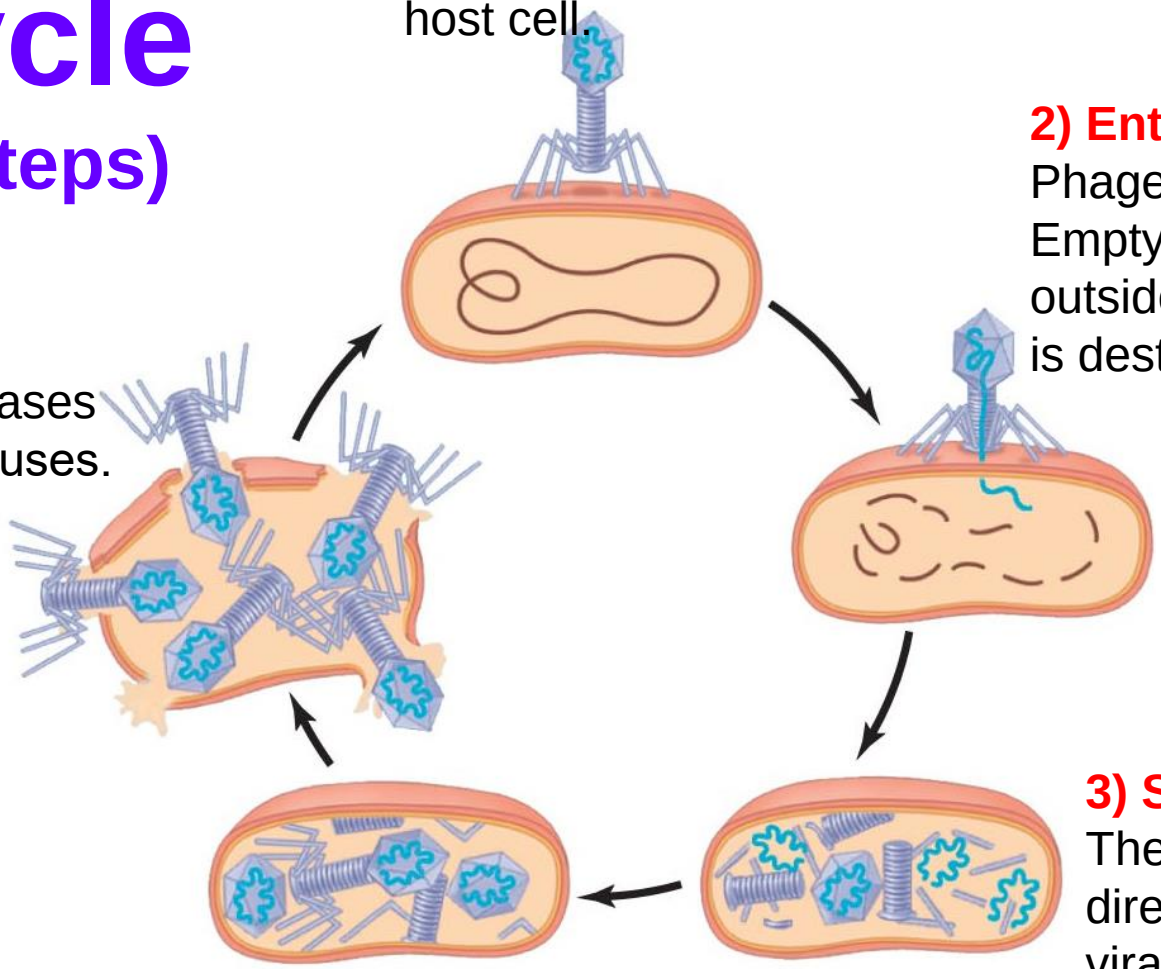
1) Attachment.
Tail fibers are used to attach to receptor sites on the surface of the host cell.

2) Entry.
Phage DNA is injected. Empty capsid remains outside. Host cell DNA is destroyed.

3) Synthesis.
The host cell is directed to produce viral genomes and protein capsids.

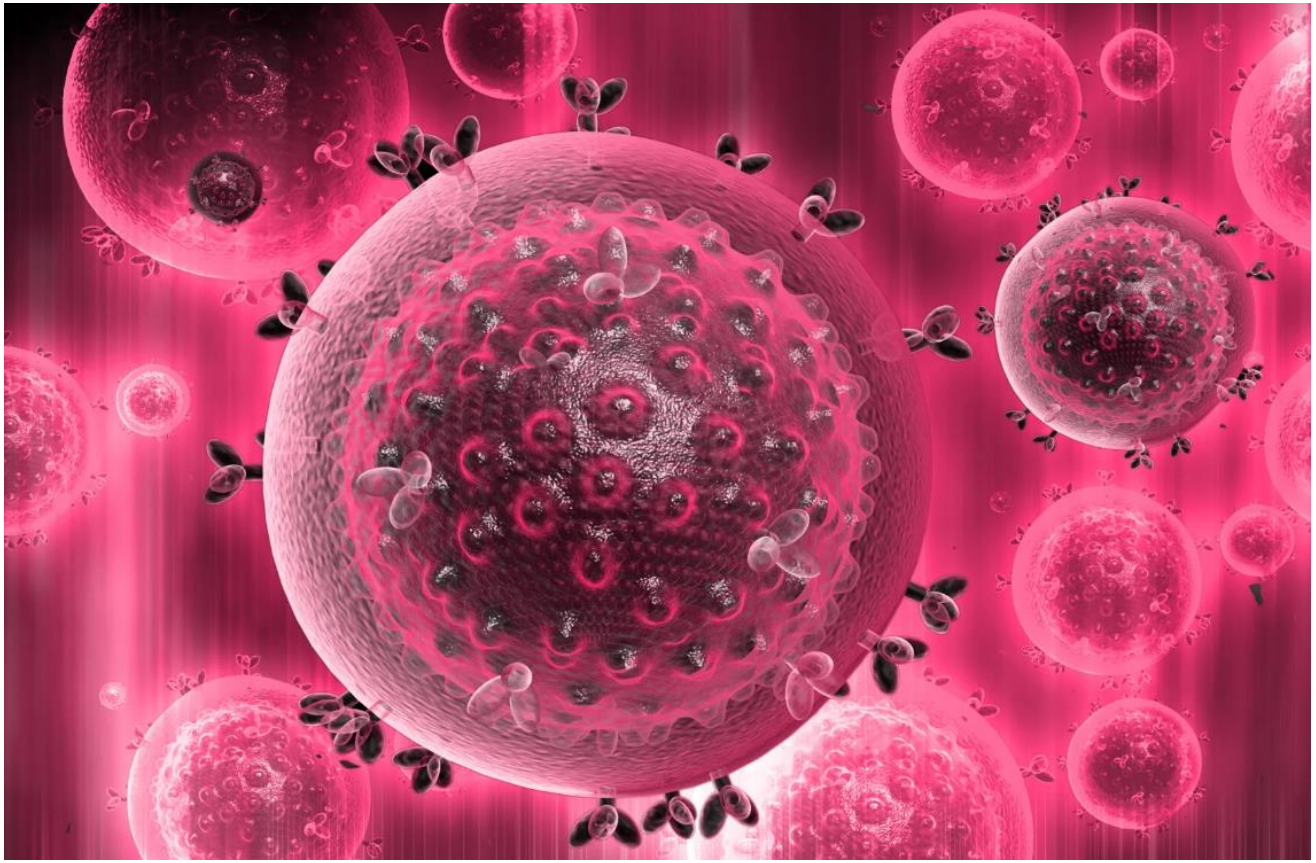
4) Assembly.
The viral DNA or RNA is assembled inside the protein coat.

5) Release.
The cell swells, bursts, and releases 100's of new viruses.



The Lytic Cycle

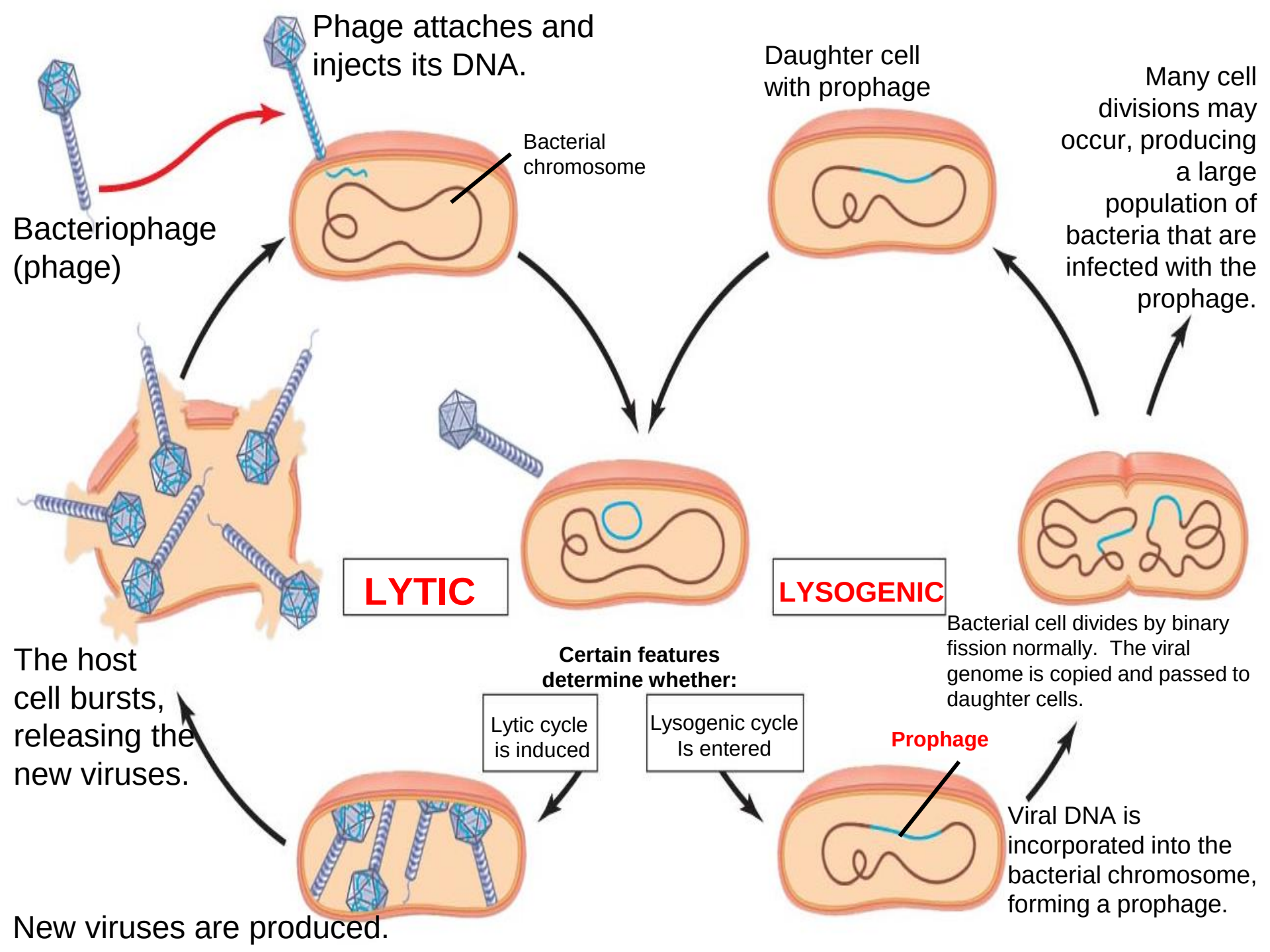
A phage that reproduces only by a lytic cycle is called a **Virulent Virus**.



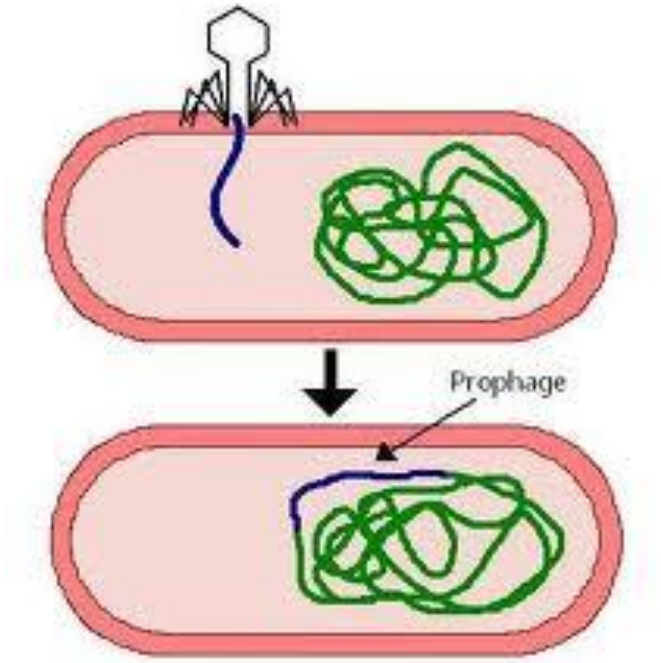
Examples of
Virulent Viruses
West Nile
Avian Flu
HIV
Ebola
SARS
Covid 19

The Lysogenic Cycle

1. In this type of viral reproduction the host cell makes copies of the viral genetic material indefinitely.
2. The virus incorporates its DNA into the DNA of the host cell. The viral DNA is then replicated along with the host cell's own DNA.
3. Lysogenic viruses do not kill the cell right away. A lysogenic virus may remain inactive for a period of time.


Phage attaches and injects its DNA.
Bacteriophage (phage)
Bacterial chromosome
Daughter cell with prophage
Many cell divisions may occur, producing a large population of bacteria that are infected with the prophage.
LYTIC
LYSOGENIC
Bacterial cell divides by binary fission normally. The viral genome is copied and passed to daughter cells.
Certain features determine whether:
Lytic cycle is induced
Lysogenic cycle Is entered
Prophage
Viral DNA is incorporated into the bacterial chromosome, forming a prophage.
The host cell bursts, releasing the new viruses.
New viruses are produced.

The Lysogenic Cycle



Prophage: The viral DNA embedded into the host cell's DNA.

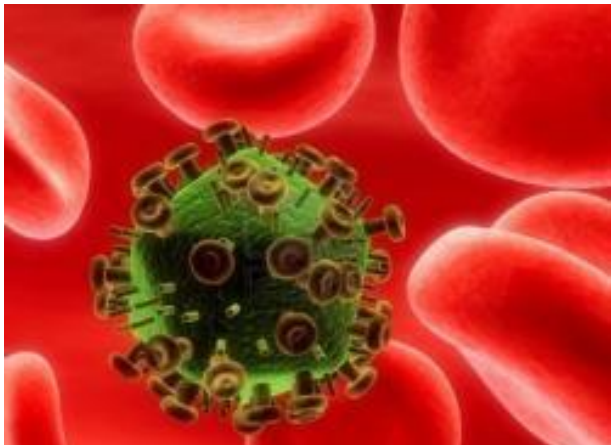
The prophage may remain part of the host for many generations before becoming active.

Eventually, certain environmental conditions (chemicals, radiation) may trigger the switchover from the lysogenic cycle to the lytic cycle.

Retroviruses

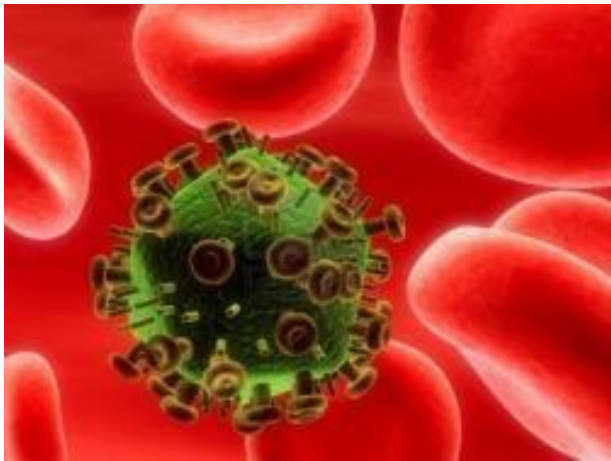
Retroviruses have RNA as their genetic information rather than DNA.

- These viruses have an enzyme called Reverse Transcriptase, which transcribes their RNA template into DNA.
- The newly made DNA then enters the cell's nucleus and integrates into the DNA of a chromosome.
- In this way, the retrovirus may remain dormant for a length of time.



Retroviruses

- It will eventually becomes active, causing the host cell to make new viruses, and causing the death of the host cell.
- Retroviruses are responsible for some types of cancer.
- The AIDS virus is a retrovirus.



Comparison of Viruses and Cells

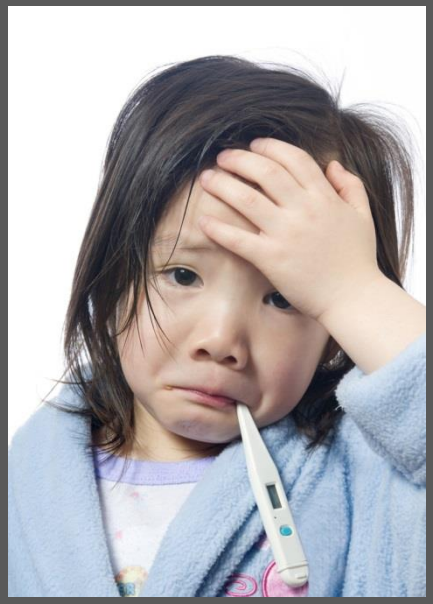
Viruses and Cells		
Characteristic	**Viruses**	**Cells**
Structure	Have DNA or RNA and a protein capsid	Cell membrane, cytoplasm, nucleus, cytoplasmic organelles
Reproduction	Only within a host cell	Reproduce independently, either sexually or asexually
Genetic Code	DNA or RNA (not both)	DNA
Growth and Development	None	Yes, in multicellular organisms
Obtain and Use Energy	No	Yes
Respond to the Environment	No	Yes
Change Over Time	Yes	Yes

Comparison of Viruses and Cells

Smallpox virus	Cells round up; inclusions appear in cytoplasm
Herpes simplex	Cells fuse to form multinucleated syncytia; nuclear inclusions (see figure 6.16)
Adenovirus	Clumping of cells; nuclear inclusions
Poliovirus	Cell lysis; no inclusions
Reovirus	Cell enlargement; vacuoles and inclusions in cytoplasm
Influenza virus	Cells round up; no inclusions
Rabies virus	No change in cell shape; cytoplasmic inclusions (Negri bodies)
Measles virus	Syncytia form (multinucleate)

Common Viral Diseases Include:

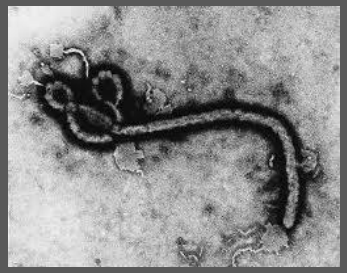
Colds



Flu

AIDS

Hepatitis



Ebola

Chicken pox

West Nile Virus

Viroids

1. They are known for their extreme simplicity and small size.
2. They are much smaller than a virus.
3. They consist of small, circular molecules of RNA, but they have no protein coat. They are tiny molecules of naked circular RNA.
4. They have only been identified in **plants**. But, they are suspected of causing some diseases in animals for which no pathogen has ever been isolated.
5. The important lesson we have learned from viroids is that a ***molecule*** can be an infectious agent and cause disease.

Prions

1. These are disease-causing particles that do not contain DNA or RNA.
2. They are tiny bits of **protein**.
3. Prions cause degenerative brain diseases such as Mad Cow Disease.
4. How can a protein, which cannot replicate itself, be a pathogen?

The leading hypothesis is that a prion is a misfolded form of a protein normally present in brain cells. When a prion enters a cell that contains the normal form of the protein, the prion converts the normal protein to the prion version.

Viroids and Prions