

## FID May 18th-May 29th Biology: Review of Classification

In class this year, we talked about some ways scientists can **classify**, or sort, information. For example, we classified organisms as **prokaryotic** (no membrane bound organelles or nucleus) or **eukaryotic** (have membrane bound organelles, including a nucleus). We also classified things as **biotic** (living) or **abiotic** (nonliving). Biotic factors include animals, plants, fungi, bacteria, and protists. Abiotic factors are not living, such as oxygen level or water.

Activity 1: Consider how you would classify the following items as biotic or abiotic (an example of each has been done for you):

- |            |             |                |            |
|------------|-------------|----------------|------------|
| 1.Air      | 2.Virus     | 3.Spider Plant | 4.Minerals |
| 5.Potato   | 6.Elephant  | 7.E.Coli       | 8.Rocks    |
| 9.Mushroom | 10.Salinity | 11.Temperature | 12.soil    |

Biotic (living)	Abiotic( Nonliving)	Not Sure
-Dog	-Water	-soil: can have both living and nonliving components

**BONUS FOR ADAPTED WORK:** Activity 2: Have your family members help you collect **6 random items** (challenge yourself and try to make them as different as possible!). Next, analyze your items for similarities to try to figure out how you could classify them into two categories. **Label your categories and sort your items below:**

For example: shoe, sock, DVD, pencil, plate, candy- Category 1: bedroom, Category 2: Livingroom

Category 1:	Category 2:

1.Why did you choose these categories?

2.If you had more categories do you think you could have organized your items better? Why or why not?

## Classification of Organisms: Why Does It Matter?

Approximately 1.78 million species have been identified in the last 250 years, and scientists estimate that there may actually be from 5 to 10 million species on Earth.

Classification of all of these organisms is helpful in a variety of ways:

1. It helps us identify living organisms more quickly
2. It organizes organisms by their features, helping us explore their similarities and differences.
3. It demonstrates how complex organisms evolve from simpler organisms.
4. It is essential to understand the inter-relationships among the different groups of organisms.

## One Way to Classify Organism: CLADOGRAMS

### Background Information:

A **cladogram** is a diagram that shows evolutionary relationships among groups. It is based on **phylogeny**, which is the study of evolutionary relationships. In the past, biologists would group organisms based solely on their physical appearance. Today, with the advances in genetics and biochemistry, biologists can look more closely at individuals to discover their pattern of evolution and group them accordingly. This strategy is called EVOLUTIONARY CLASSIFICATION. Cladistics is a form of analysis that looks at features of organisms that are considered "innovations" or newer features that serve some kind of purpose. These characteristics appear in later organisms but not earlier ones and are called derived characters.

**Directions:** Use the word bank to identify the descriptions by writing the correct term on the line.

Cladogram

Phylogeny

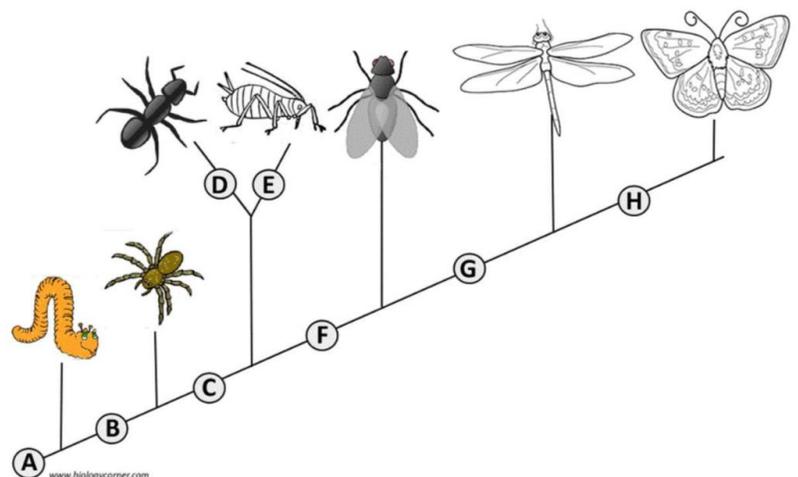
Derived characters

- \_\_\_\_\_ 1. Characteristics that appear in recent parts of a lineage but not in its older members
- \_\_\_\_\_ 2. A diagram of the evolutionary relationships among organisms.
- \_\_\_\_\_ 3. The study of evolutionary relationships among organisms.

### PART I - Analyze the Cladogram

Examine the sample cladogram below. Each letter on the diagram points to a derived character, something different (or newer) than what was seen in previous groups. Once a new characteristic appears on the bottom everything after it will have it too. For questions 1- 8, match each letter on the cladogram to its character.

1. \_\_\_\_ Wings
2. \_\_\_\_ 6 Legs
3. A Segmented Body
4. \_\_\_\_ Double set of wings
5. \_\_\_\_ Cerci (pair of appendages at rear end)
6. D Crushing/pinching mouthparts
7. \_\_\_\_ Legs
8. \_\_\_\_ Curly Antennae



9. Give a reason why letters “D” and “E” are not located on the bottom line with all the other letters.

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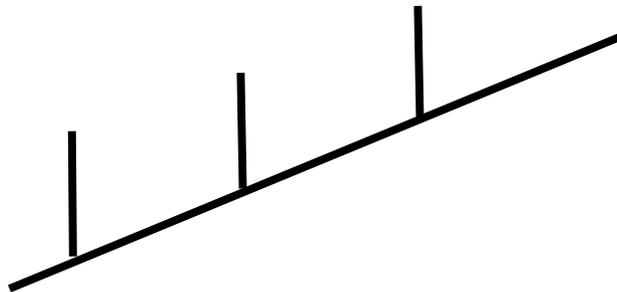
**PART II - Create Your Own Cladogram**

To make a cladogram, you must first look at the animals you are studying and establish characteristics that they share and ones that are unique to each group.

1. For the animals in the table below, indicate which animals have the characteristics by marking an “X” in each box if an organism has that trait.
2. Based on that chart, create a cladogram with the animals in the correct order.
3. Label the animal names at the top of the cladogram branches and label the derived characters at the bottom of the cladogram, like the sample above.

	Cells	Backbone	Legs	Fur
Bacteria				
Shark				
Frog				
Cat				

DRAWING OF YOUR CLADOGRAM



4. According to your cladogram, which two species are more closely related (circle answer):

Sharks and Frogs OR Cats and Bacteria

Cite evidence to support your answer: \_\_\_\_\_

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5. According to your cladogram, what species are **Cats** most closely related to? \_\_\_\_\_

Cite evidence to support your answer: \_\_\_\_\_

\_\_\_\_\_

**Summary:** Which **3** types of information can be obtained from a cladogram? (circle them):

- How organisms are related to each other
- The likely order of evolution for the included species
- Who the parents of the included species are
- The derived characters shared by the included species

### How Classification Helps Control Disease Outbreaks

Did you know that classification can help to control disease outbreaks? Classification of disease-causing bacteria and viruses allows scientists to build **phylogenetic trees** that show evolutionary relationships between them, providing insights into how to combat them. Viruses and bacteria can be placed on a phylogenetic tree based on their genetic sequences, allowing us to identify its origins and close relatives. This helps scientists discover where a disease originated, how/where it may spread, and how to fight it.

### What Can Phylogenetic Tree Tell Us About COVID-19?

In the family tree of viruses (seen on left), COVID-19 fits on the branch occupied by other coronaviruses.

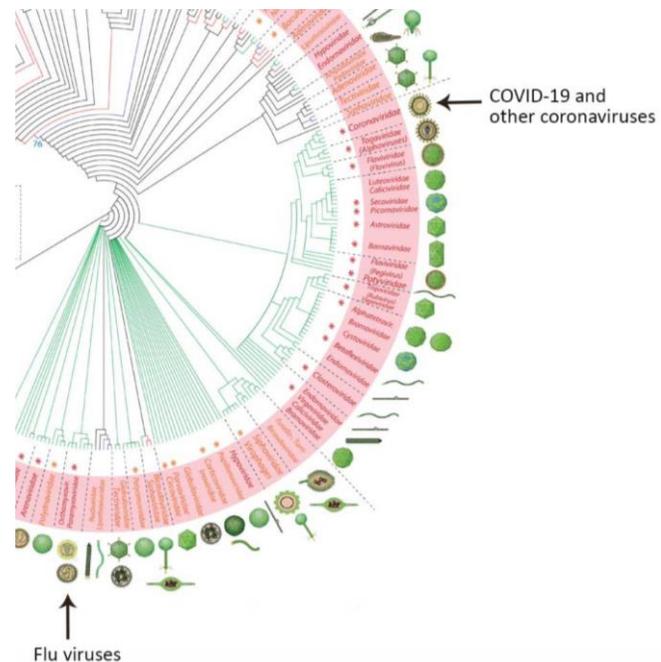
Notice that coronaviruses are only distantly related to flu viruses, though the range of symptoms they cause is similar.

Because they are not closely related, we wouldn't expect the proteins on the surface of COVID-19 to have much similarity with those of flu virus particles.

**Vaccines** protect us from disease by teaching our immune systems to recognize and fight pathogens based on their surface proteins. This means that flu vaccines are designed to target different surface proteins and simply won't work against the new pandemic coronavirus, however similar the symptoms might seem.

Nevertheless, keeping up to date on your flu shot is especially important during the current pandemic because people who get sick with the flu add even more burden to our stressed healthcare systems.

**Question 1:** What does this phylogenetic tree tell us about the relationship between COVID-19 and flu viruses?



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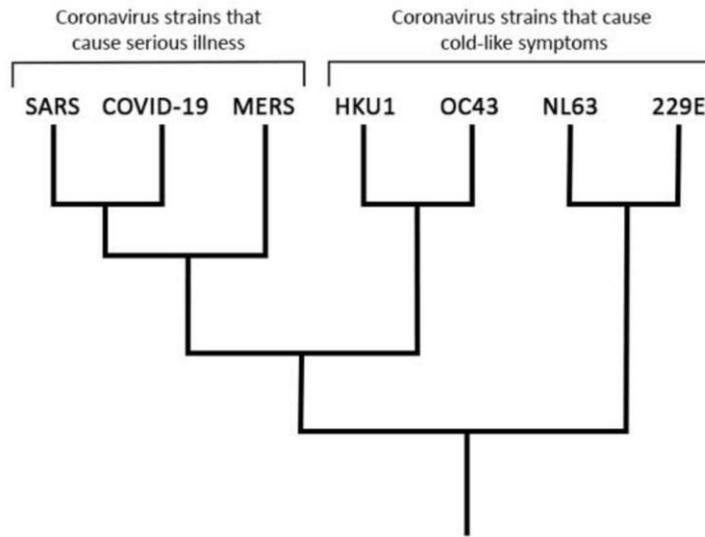
**Question 2:** Why is the flu vaccine not effective against COVID-19?

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**A Phylogenetic Tree of COVID-19 and Its Close Relatives**

Examine the phylogenetic tree of COVID-19 and its coronavirus relatives below:



**Question 1:** Is COVID-19 more closely related to SARS or HKU1? \_\_\_\_\_

Explain how you know: \_\_\_\_\_

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**Question 2:** Scientists have worked on developing vaccines for SARS and MERS. Do you think this research could help scientists develop a vaccine for COVID-19? Explain your reasoning.

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