Station 1: Who's More Closely Related?

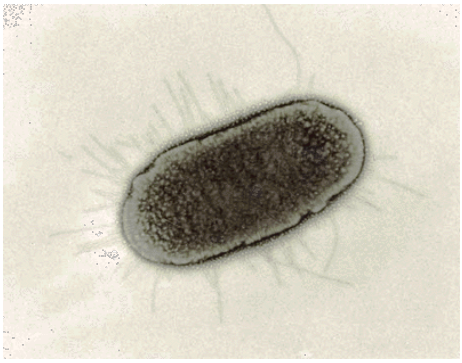
Organisms that have greater similarities to each other are more closely related than those which share only a few characteristics. In this activity, we will look at pictures of various organisms and put them into groups based on how they look, and attempt to figure out which organisms are more closely related.

For this activity, you will need:
• 20 different photograph cut-outs.

Procedure:
1. Lay out all 20 photograph cut-outs on the table so that you can see all of them.
2. Pick one organism and find other organisms that seem most similar to it. Put the photographs in this first group together, clearly separated from the other photographs.
3. Write down the names of these organisms in the row for group 1 of the table A below. Names are found at the bottom of each photograph.
4. Write down what features are shared by the organisms you have put in group 1 in the table A. Be as detailed as possible in listing out all the reasons for why you have put these organisms in the same group.
5. Continue making more groups and filling up the table until you have put all 20 organisms into a group. You do not need to fill up all the rows provided in the table.

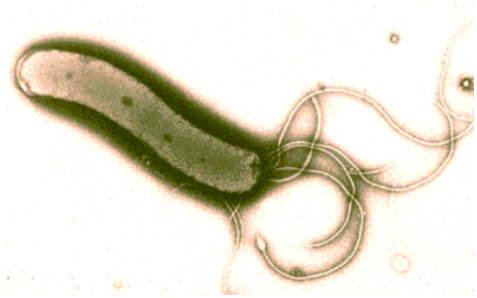
Group number	Group members (names of organisms)	Shared features
1		
2		
3		
4		
5		
6		
7		
8		

Are there any organisms that are difficult to place in one group? Which organisms are they and which groups do they seem to belong to?



Escherichia coli

Corn



Helicobacter pylori

Sequoia

Bird’s-nest fern

Shiitake

Blue crab

Enoki

Barnacle

Monarch

Tarantula

Tick

Banana slug

Clam

Chimpanzee

Snail

Long-tailed macaque

Fruit bat

Peregrine

Hummingbird

Station 2: Cladogram

A cladogram is a branching, treelike diagram in which the endpoints of the branches represent individual species of organisms. It is used to illustrate relationships and to show points at which various species are presumed to have diverged from common ancestral forms.

Procedure: Use the cladogram attached to answer the questions below:

1. What does all life stem from according to this picture?

_____

2. What major group came before animals?

_____

3. What group are mammals from?

_____

4. Which came first the chicken or the egg?

_____

5. What is the first amniote (group of vertebrates that have a thin membrane forming a closed sac around an embryo or fetus)?

_____

6. Which animals are considered vertebrates (group of animals with a backbone or skeleton)?

_____

7. What organisms are non-flowering plants closely related to?

_____

8. What organisms are insects closely related to?

_____

Station 3: Building a cladogram

Procedure: Fill in the following table. Mark an X if the species has the trait and O if they do not

	Jaws	Lungs	Amniotic sac: bag with fluid in which fetus developes	Fur/hair	No tail	Bipedal: using only two legs for walking
Lizard						
Gorilla						
Salamander						
Lamprey (jawless fish)						
Tiger						
Shark						
Human						

1. Draw a cladogram with all species and derived character traits.

2. After which animals did mammary glands develop?

3. What animal does not have jaws?

4. Which animals have lungs?

5. Which animals are probably predators?

Station 4: Russian man volunteers for first human head transplant

Procedure: Read the article below. Then discuss and answer the questions that follow at the end of the article.

By **ASHLEY WELCH CBS NEWS** *August 29, 2016, 6:47 PM*

While severing someone's head and attaching it to another person's body sounds like something straight out of a science fiction or horror movie, some real-life scientists say they are planning to do just that – as early as next year.

Italian neuroscientist Dr. Sergio Canavero made headlines last year when he announced his plans to perform the first human head transplant in 2017. Since then, he's recruited Chinese surgeon Dr. Xiaoping Ren to work with him, and now has found a volunteer patient for the procedure: a Russian man named Valery Spiridonov.

Spiridonov suffers from Werdnig-Hoffmann Disease, a rare and often fatal genetic disorder that breaks down muscles and kills nerve cells in the brain and spinal cord that help the body move. Spiridonov is confined to a wheelchair; his limbs are shriveled and his movements essentially limited to feeding himself, typing, and controlling his wheelchair with a joystick.

In its September issue, The Atlantic profiles Spiridonov and the two scientists who hope to perform the experimental – and highly controversial – procedure.

"Removing all the sick parts but the head would do a great job in my case," Spiridonov told the magazine. "I couldn't see any other way to treat myself."

Many scientists have spoken out against Canavero and Ren's plans, accusing them of promoting junk science and creating false hopes. One critic went so far as to say the scientists should be charged with murder if the patient dies, a very likely outcome.

REUTERS/MAXIM ZMEYEV

Valery Spiridonov, a man who has volunteered to be the first person to undergo a head transplant, attends a news conference in Vladimir, Russia, June 25, 2015. The 30-year-old Russian has a degenerative muscle condition known as Werdnig-Hoffman. Italian neurosurgeon Dr. Sergio Canavero believes he could perform a head transplant with a 90 percent chance of success, but many experts are doubtful.

Canavero has published detailed plans for the procedure, which has been successfully tested in mice, in several papers published in the journal Surgical Neurology International.

First, like with other organ transplants, he and his team would need a suitable donor. This procedure would require a body from a young brain-dead male patient.

Once permission from the family is granted, the surgeons would set the body up for surgical decapitation.

At the same time, Spiridonov would be brought in and another surgical team would cool his body to 50 degrees Fahrenheit. This would delay tissue death in the brain for about an hour, meaning the surgeons would need to work quickly.

Using a transparent diamond blade, they would then remove both patients' heads from their bodies, ultimately severing their spinal cords at the same time.

A custom-made crane would be used to shift Spiridonov's head – hanging by Velcro straps – onto the donor body's neck. The two ends of the spinal cord would then be fused together with a chemical called polyethylene glycol, or PEG, which has been shown to promote regrowth of cells that make up the spinal cord.

The muscles and blood supply from the donor body would then be joined with Spiridonov's head, and he would be kept in a coma for three to four weeks to prevent movement as he healed. Implanted electrodes would be used to stimulate the spinal cord to strengthen new nerve connections.

Canavero has said the transplant – which would require 80 surgeons and cost tens of millions of dollars if approved – would have a "90 percent plus" chance of success.

Yet many in the scientific community strongly disagree.

"It is both rotten scientifically and lousy ethically," Arthur Caplan, the head of medical ethics at NYU Langone Medical Center, wrote in an article for Forbes last year.

Dr. Jerry Silver, a neuroscientist at Case Western Reserve whose work on repairing spinal cord injuries was cited by Canavero, told CBS News in 2013 that the proposed transplant is "bad science. This should never happen."

"Just to do the experiments is unethical," he added.

Even in the unlikely event that the surgery worked, it raises further, uncharted ethical concerns.

For example, Canavero is presuming that transplanting Spiridonov's head and brain onto another body would automatically transplant his whole self with his mind,

personality, and consciousness. But it's not that simple, as Anto Cartolovni and Antonio Spagnolo, two Italian bioethicists, pointed out in a letter to Surgical Neurology International after Canavero's paper was published last year.

"Despite his [Canavero's] vision, modern cognitive science shows that our cognition is an embodied cognition, in which the body is a real part in the formation of human self," they write. "Therefore, the person will encounter huge difficulties to incorporate the new body in its already existing body schema and body image that would have strong implications on human identity."

Furthermore, if Spiridonov were to reproduce with his new body, his children would not have his genetic makeup but that of the donor's. What kind of rights, then, might the donor's family have to the offspring?

Finally, Cartolovni and Spagnolo argue that because of the uncertainty of the operation, such a procedure would take away vital donor organs that could have been used for someone else who needed a heart or a liver transplant to save their lives.

If approved, the procedure would likely take place in China or another country outside of Europe or the United States, The Atlantic reports, as it would not be approved in the Western world.

Discuss the article and answer the questions below:

1. Which body parts do you think can and can't be transplanted? Which parts are you not sure about?

2. If a person receives a body part, such as a heart, from someone else, that person is still considered living. If Valery Spiridonov head transplant is a success, would you still consider him to be living? **Explain.**

Station 5: Classifying life

Procedure: Visit the website:
http://www.pbs.org/wgbh/nova/nature/classifying-life.html

1. What phrase is given on this website to help you remember the classification categories?

2. Click the link for "Classifying Life" and then classify each organism and complete the chart below:

Category	**Bear**	**Orchid**	**Sea Cucumber**
Kingdom			
Phylum			
Class			
Order			
Family			
Genus			
Species			

Station 6: Characteristics of life

Procedure: Analyze and discuss the pictures shown. What characteristics of life are being shown?

Group 1: _____

Group 2: _____

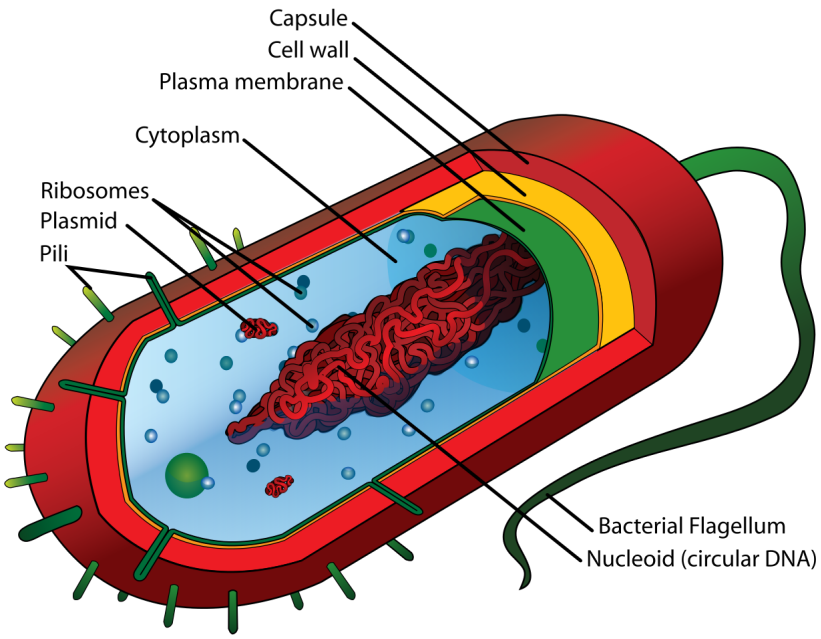
Group 3: _____

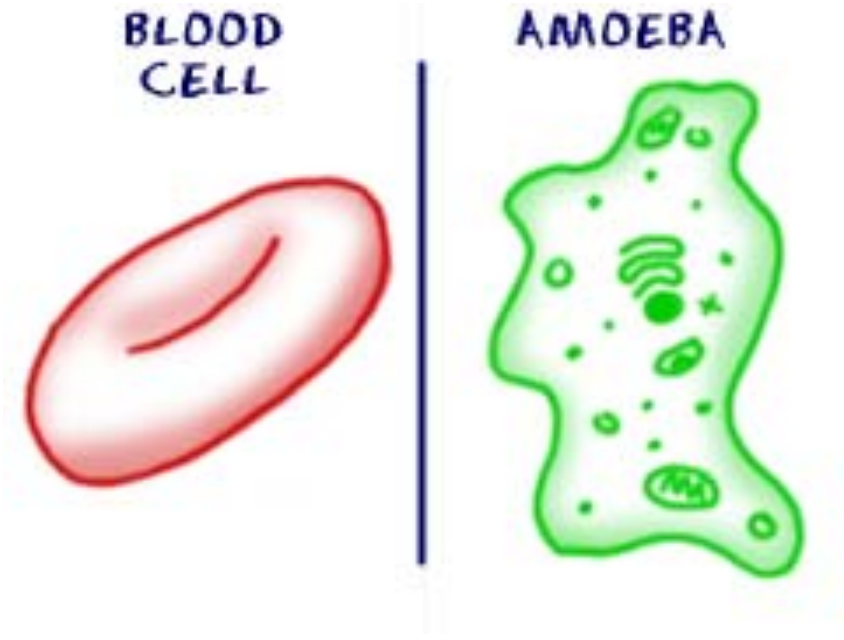
Group 4: _____

Group 5: _____

Group 6: _____

Group 1

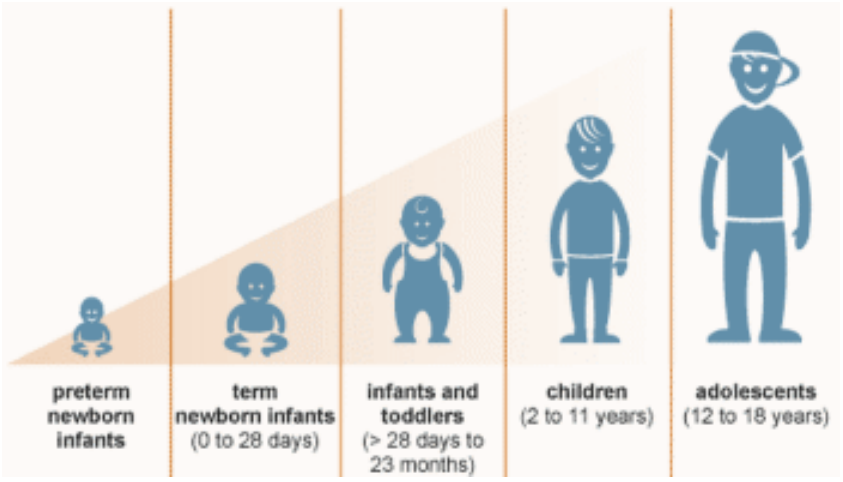

Capsule
Cell wall
Plasma membrane
Cytoplasm
Ribosomes
Plasmid
Pili
Bacterial Flagellum
Nucleoid (circular DNA)


BLOOD CELL
AMOEBA

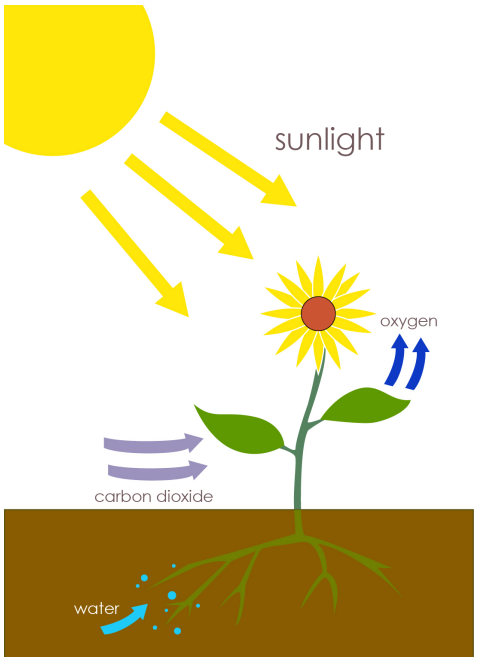
Group 2

Group 3

Group 4


preterm newborn infants
term newborn infants (0 to 28 days)
infants and toddlers (> 28 days to 23 months)
children (2 to 11 years)
adolescents (12 to 18 years)

Group 5



Group 6

Station 7: Characteristics of life

Procedure: Review the list on the last page of the packet and identify which of the statements show each characteristic of life.

Characteristic of Life?	Statement:
	The cell uses sugar and oxygen to make water, carbon dioxide and ENERGY through the process of cellular respiration.
	Multicellular living things are usually made up of cells, tissues, organs, organ systems.
	Faster running fox are more common in a population because they are able to escape predators.
	The stomach, large intestine, small intestine, etc make up an organ system.
	A cladogram shows that species have a common ancestor.
	Rabbits make more offspring sexually.
	Organisms have different traits now because of adaptations.
	Plants are autotrophic (make their own food).
	There are different species that have similar structures. These structures are called homologous.
	Making offspring sexually provides more variation.
	An organism increases in size through the process of cell division.
	Sugar is broken down in the mitochondria for energy.
	Muscle is an example of tissue.
	Roses make more offspring either sexually or asexually.

Station 8: Dichotomous key

Procedure: Use the dichotomous key to identify these organisms. Write the correct scientific name on the answer key.

1a. organism with two or four functional legs.....go to 2

1b. organism without two or four legs..... go to 3

2a. organism without wings..... *Canis familiaris*

2b. organism with wings..... *Passer domesticus*

3a. organism is unicellular..... go to 4

3b. organism is multicellular..... go to 5

4a. organism has cilia and swims freely in water ..... *Balantidium sp.*

4b. organism does not have cilia and is anchored to a substrate.....*Stentor sp.*

5a. organism is heterotrophic.....go to 6

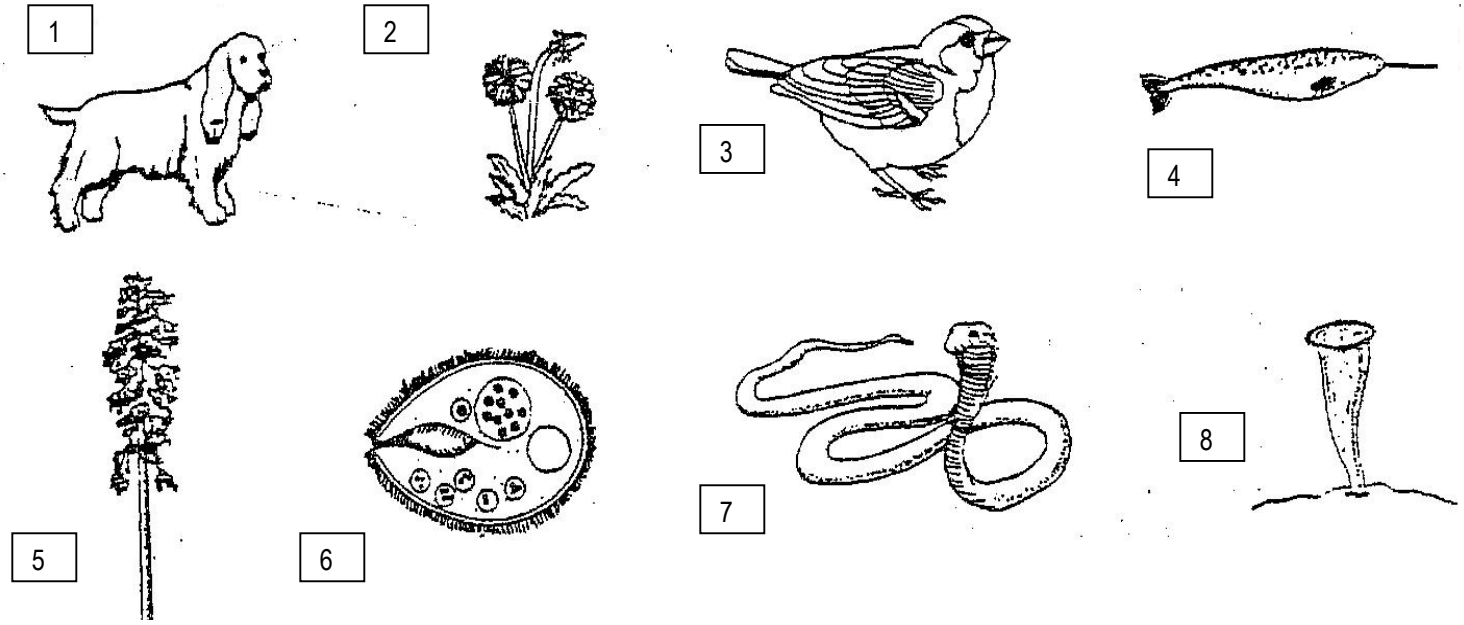
5b. organism is autotrophic.....go to 7

6a. organism lives in oceans.....*Monodon monoceros*

6b. organism lives on land.....*Ophiophagus Hannah*

7a. organism is tall with a thick trunk..... *Pinus ponderosa*

7b. organism is short with thin stems..... *Taraxicum officinale*



Station 9: Animal Classification Game

Procedure: Visit the website:
http://www.pbslearningmedia.org/asset/lsps07_int_animalclass/

1. Click the link for "Animal Classes" to help you identify each animal group by its description.

_____ Cold-blooded invertebrates that have 3 body segments and 3 pairs of legs.

_____ Warm-blooded vertebrates that have hair or fur, give birth to live young, and nurse their young with milk.

_____ Warm-blooded vertebrates that have feathers and wings as well as lay eggs.

_____ Cold-blooded vertebrates that have scales, dry skin, and usually lay eggs.

_____ Cold-blooded vertebrates that have moist, smooth skin, live on land and water, and have webbed feet.

2. Click the link for "Classification Games" and try each one. Record your scores below.

African Savannah - Score = _____ North American Forest - Score = _____