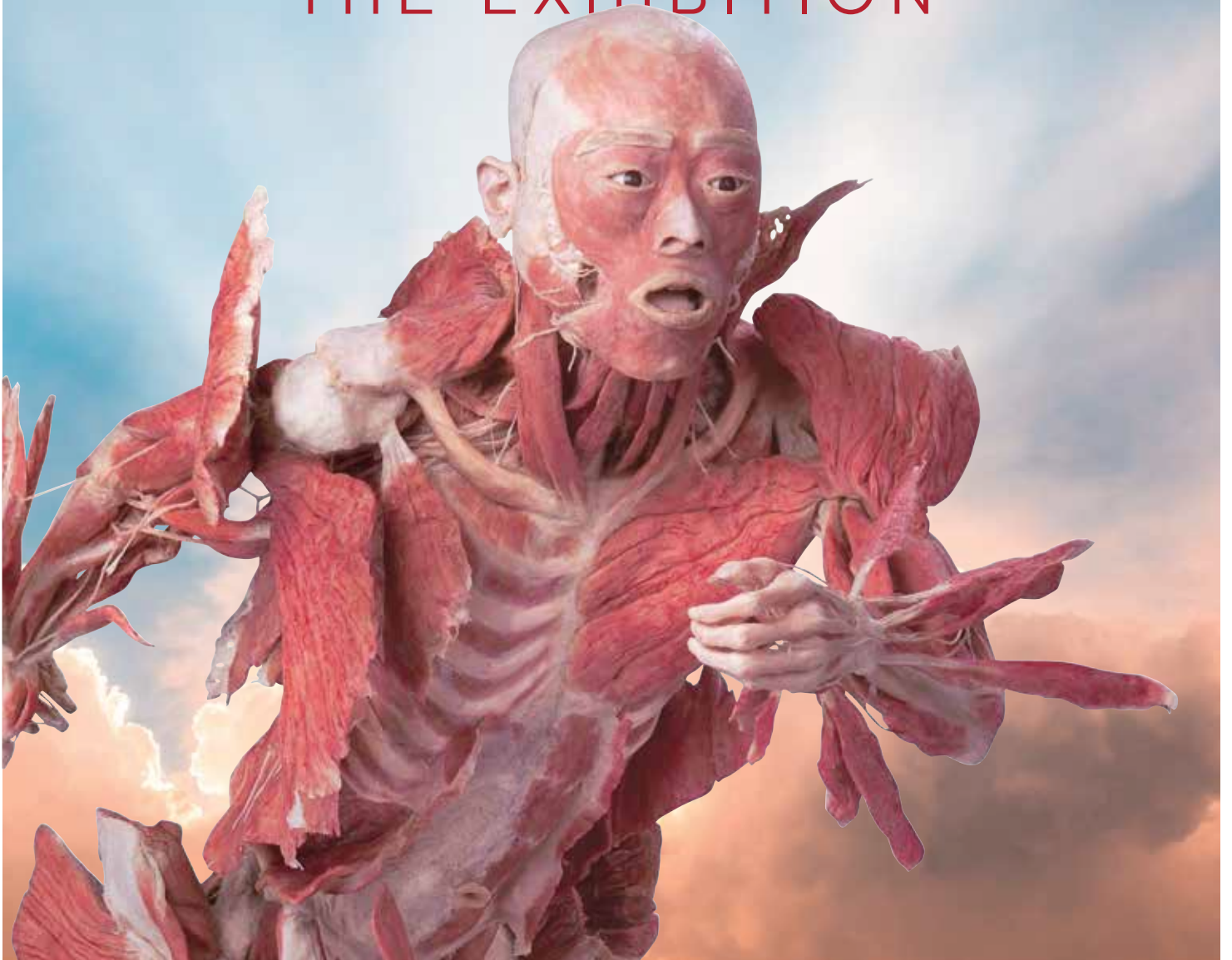


REAL BODIES

THE EXHIBITION



EDUCATOR GUIDE

REAL BODIES EDUCATOR GUIDE

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INTRODUCTION TO THE EXHIBITION

Since humans first evolved, we have been striving to understand our bodies, why we exist and where we are ultimately headed. We all want to know how we work, how blood circulates through our bodies, and how our brain tells our mouths to talk. We want to know why we experience love and fear, and why we do some of the things we do as a species. REAL BODIES challenges and deepens our understanding of these questions by exploring what defines humans both physically and emotionally.

INCLUDED IN THIS GUIDE

To engage with the Exhibition, teachers may choose from several types of activities that will best fit their students' needs and interests.

THIS GUIDE CONTAINS:

- Essential questions to ask students while touring the Exhibition
- Ten lesson plans with hands-on activities, many of which can be completed at school or while visiting the Exhibition, including:
 - Debriefing questions to help students reflect on the lessons
 - Grade level adaptations for more or less complex lessons that allow teachers to modify activities to all levels



NEXT GENERATION SCIENCE STANDARDS

The Next Generation Science Standards (NGSS) were used to structure this guide. REAL BODIES and NGSS both embrace the concepts of 21st century skills and integration. Each activity in this guide is based on NGSS Crosscutting Concepts. The NGSS outlines seven Cross Cutting Concepts present at all levels of science. Each of these concepts is clearly reflected within REAL BODIES. Below is a list of the NGSS crosscutting concepts and some questions to ponder as you go through the exhibition.

NGSS CROSS CUTTING CONCEPTS

1. PATTERNS

- As you interact with the Exhibition, do you notice any trends? Are there any concepts that repeat themselves over and over again?
- What are some characteristics that all body systems have? Why?

2. CAUSE AND EFFECT: MECHANISM AND EXPLANATION

- What happens when one body system stops working properly? How does that affect the other systems?
- How is the body like a machine?

3. SCALE, PROPORTION, AND QUANTITY

- What's the relationship between the size of a body system or organ system and its function?
- Do organs grow in proportion to the size of a person?

4. SYSTEMS AND SYSTEM MODELS

- Are any of the specimens a complete model of a human? Why or why not? What is missing?
- How do the specimens show how the body systems interact?
- Are there any body systems that are not represented?

5. ENERGY AND MATTER: FLOWS, CYCLES, AND CONSERVATION

- How does energy flow through the specimens?
- How do the various body systems conserve energy?

6. STRUCTURE AND FUNCTION

- What are some of the unique features of the specimens? Are they "normal" specimens or are they pointing out some irregularity?
- How does the function of a body system or organ influence its shape?

7. STABILITY AND CHANGE

- How does behavior influence body systems?
- How do changes in one part of the body affect function in another?

THE EXHIBITION

There are ten main areas in REAL BODIES. This guide provides instructors with essential questions to ask students at each area and a lesson that explores and expands on the ideas presented. The ten areas and the corresponding body system or concept explored are listed below:

- **ANATOMIST'S STUDY**
SKELETAL SYSTEM
- **BREATHE**
RESPIRATORY SYSTEM
- **HUNGER**
DIGESTIVE SYSTEM
- **RHYTHM**
CIRCULATORY SYSTEM
- **MOVE**
MUSCULAR SYSTEM
- **THINK**
NERVOUS SYSTEM
- **WHAT BECOMES OF US**
DEATH
- **LOVE**
REPRODUCTIVE SYSTEM
- **BEGINNINGS**
FETAL DEVELOPMENT
- **REPAIR**
MEDICINES & BODILY REPAIRS



ACTIVITY NAME:

Preservation and Decomposition

ESSENTIAL QUESTIONS:

- Why do materials decompose at different rates?
- What can we do to speed up or slow down the rate of decomposition?
- Are there parts of our skeleton that decompose faster than others?

OVERVIEW:

Skeletons. All humans have them and they will be the last physical part of us that remains. For centuries, humans have been trying to develop methods of preserving not only our skeletons, but also various other parts of our bodies as a way of honoring, remembering and studying those who have passed. In this lesson, students will explore why skeletons are the last part of us to decompose and will investigate methods used to preserve our bones as well as other parts of our bodies.

CROSS CUTTING CONCEPT:

Stability and Change

MATERIALS LIST

- | | | |
|--|---|--|
| <input type="checkbox"/> Anatomist's Study Handout | <input type="checkbox"/> Plastic containers | <input type="checkbox"/> Vegetable oil |
| <input type="checkbox"/> Apple core or other natural fruit or vegetable food scrap | <input type="checkbox"/> Natural outdoor dirt
<i>(do not use store-bought soil as it may not contain the appropriate bacteria)</i> | <input type="checkbox"/> White vinegar |
| <input type="checkbox"/> Chicken bone | | <input type="checkbox"/> Water |

PROCEDURE

1. Ask students why dead bodies buried in the ground leave only a skeleton behind. Ask students if they have heard the term "decomposition" and ask what it means.
2. Talk to students about how everything breaks down over time and how different types of materials and the environmental conditions of the decomposition process cause this breakdown to occur at different rates.
3. Show students images of decomposed, preserved and mummified bodies (human or animal, depending upon maturity level), and ask why they think these bodies do not completely decompose. Ask students: "Under what conditions would bones break down more quickly?"

(CONTINUED ON PAGE 7)



PROCEDURE | (CONTINUED FROM PAGE 6)

4. Tell students that the same general principles that cause bones, flesh and organs to decay also cause fruits and vegetables to decompose. Today, they are going to design an experiment to determine how environmental conditions affect the rate of decay of organic materials. Then, they will design an experiment to try to preserve their specimen for the rest of the school year.
5. Put students into groups of three or four and pass out the Anatomist's Study Handout and have students follow the directions. Each group should also get three apple cores and three chicken bones. Each group should identify the three conditions in which they are going to place their apple cores and chicken bones (water, dry dirt, wet dirt, air only, oil only, etc.).
6. Have students sketch their apple cores and chicken bones, being sure to measure and record width, height and mass. Then, place the cores and bones in the three environments they chose.
7. If you have access to a camera, take photos of the apple cores and bones before students bury them. You can use these pictures as a comparison when the experiment is done.
8. Wait four to eight weeks (the longer you wait, the better the results you will get) and have students collect what is remaining of their apple cores and bones.
9. Students should again sketch what is remaining of their cores and bones and compare these drawings with their originals.

Extension - Open Inquiry

10. After this experiment is over and you have debriefed, give each group another apple core and chicken bone. Have each group design a new experiment where they use the most optimal conditions to preserve their specimens. Have students set up their experiment and let it sit for the rest of the year. At the end of the year, have each group uncover their apple core and chicken bone to compare their results.

DEBRIEF

-  Ask students to share their results and discuss under which condition the apple core and chicken bone broke down the most and under which condition they broke down the least.
-  Ask students to talk about how this experiment might explain why some bones are preserved for hundreds of years while others decompose quickly.

GRADE LEVEL ADAPTATIONS

MORE CHALLENGING

- a. Do not use the handout and give students more control over how they design the experiment.
- b. Add more options for possible environmental conditions.

LESS CHALLENGING

Do the entire experiment as a class. Keep the apple core and chicken bone in the front of the class during the entire four to eight weeks of the experiment to keep interest high.



NAME : _____



- ☞ Why does your flesh decompose before your bones?
- ☞ Why are bones sometimes preserved for centuries while other times they break down?

In this experiment, you will use apple cores to represent human flesh and chicken bones to represent human bones. You will place them in three different environments to see under what conditions they do and do not decompose.

DIRECTIONS:

As a group, choose from the list below which conditions you want to try on your apple core and chicken bone.

TYPES OF ENVIRONMENTS TO PLACE YOUR APPLE CORES AND CHICKEN BONES

(circle the 3 you choose):

- 1. In water
- 2. In dry dirt
- 3. In wet dirt
- 4. In an open container
- 5. In a sealed container
- 6. In oil
- 7. In vinegar

- Sketch your apple cores and chicken bones in the space provided. Be as detailed as possible and use labels. Measure the length, width and mass of each.
- Using the plastic containers, place your apple cores and chicken bones under the conditions you choose.
- Wait several weeks until your teacher tells you to unearth the apple cores and chicken bones.
- Sketch what the cores and bones look like now, and compare to your original sketches.
- Discuss your results with the class.

(CONTINUED ON PAGE 9)

ACTIVITY NAME:

What Affects Breathing Rates?

ESSENTIAL QUESTIONS:

- What is the relationship between our breathing rate and our emotional state?
- What's the connection between breathing rate and concentration?

OVERVIEW

Ever since humans developed consciousness, we have been aware of the relationship between breathing and life. We take our first breath when we are born and our last when we pass. Breathing is not just a physical process that keeps us alive - it's so much more. We take deep breaths to keep us calm. We breathe more heavily when we need energy. Athletes use breathing to control their heart rate and they are often able to speed it up or slow it down, depending on their needs. In this activity, students will conduct a brief test to try to identify a connection between breathing rate and concentration.

CROSS CUTTING CONCEPT:

Cause and Effect: Mechanism and Explanation

MATERIALS LIST

- Breathe Worksheet

PROCEDURE

1. Ask students why we breathe. Ask students what the purpose of breathing could be beyond simply obtaining oxygen.
2. Ask students to identify times when they are conscious of their breathing (when running, doing yoga, trying to calm down, etc.) and list their ideas on the board.
3. Discuss with students how breathing is connected to everything we do. Explain that it doesn't just provide us with oxygen, it also impacts our emotions and concentration.
4. Tell students that they are going to conduct a mini experiment to try to determine the relationship between breathing rate and concentration.
5. Pass out the Breathe Worksheet and tell students that they are going to do two word searches. They will do the first word search after breathing very slowly and deeply, and they will do the second after doing jumping jacks.
6. Ask students to predict if they will do better on the word search after breathing heavily or after breathing slowly.
7. As an entire class, take five to ten long, deep breaths together. Be sure all students are taking these deep breaths, then give them 45 seconds to try to find as many words as they can in the word search.

(CONTINUED ON PAGE 11)

PROCEDURE | (CONTINUED FROM PAGE 10)

8. Have each student record how many words they found on the board.
9. Have students stand and do jumping jacks for one minute. Be sure all students are active as the goal is to get everyone's breathing rate up.
10. Have students do the second word search for 45 seconds and record how many words they found on the board.
11. Have students take the class average of both tests and graph the results.
12. As a group, discuss the results. Be sure to discuss if there were or were not differences in the two tests, and determine if this experiment was designed well enough to actually test for the relationship between breathing rate and concentration (answer: it was not).
13. Tell students that they are now going to design their own experiments to better test the relationship between breathing rate and concentration.
14. Have students identify the independent and dependent variables they will test and have them answer the rest of the questions about their experiment on the worksheet. Some suggestions for how to test concentration: shooting a basketball, playing a memory game, etc.
15. Give students a week to complete their experiments outside of class.
16. Have students present their findings.

DEBRIEF

- ✍ After all the presentations, ask students if they noticed any trends in the data. Were the results always the same or did they fluctuate? Ask students if they think their results were accurate or if there was a flaw in their experimental design. (Were they seeing real results or was the experiment improperly designed or tested?)
- ✍ Ask students to compare how they measured concentration differently in different experiments.
- ✍ Ask students to design the "perfect" experiment to test for the relationship between breathing rate and concentration. Ask students: "If time, money and resources were not an issue, how would you set up the experiment?"

GRADE LEVEL ADAPTATIONS

MORE CHALLENGING

Set higher demands on the experiments the students design. Require more subjects and make sure the dependent variable is quantitative. Have students conduct a data analysis of their results.

LESS CHALLENGING

Design the second experiment as a class. Have each group of students independently collect data then discuss as a class, share data and collectively draw conclusions.



NAME : _____

DATE : _____

DIRECTIONS:

1. Listen to your teacher guide you through ten long and deep breaths.

After the breaths, take 45 seconds to locate the words from this list in the word search below.

MOUTH • LUNGS • DIAPHRAGM • PHARYNX • BRONCHI

F	V	K	K	K	X	U	V	D	U	B	O	C	H	L
Z	D	I	Z	T	D	C	I	X	N	G	K	G	T	P
R	I	E	G	P	I	A	V	R	L	S	G	Y	U	G
T	X	H	T	R	P	C	E	Z	Z	O	C	R	O	U
S	E	K	C	H	X	N	Y	R	A	H	P	E	M	X
L	X	X	R	N	P	D	T	V	Q	A	Q	V	Y	L
N	S	A	Q	M	O	K	O	C	G	W	E	M	P	L
W	G	L	Z	U	M	R	Y	R	H	Q	S	Z	X	H
M	K	C	F	M	N	W	B	V	I	H	X	V	H	X
B	S	R	V	C	K	N	S	K	R	L	G	I	O	Y
I	M	J	C	S	N	I	Q	A	W	F	M	D	S	K
G	I	Y	G	L	F	M	M	W	U	G	Z	E	T	B
S	T	N	W	J	W	K	U	E	Y	A	Z	W	J	I
D	U	D	S	H	U	G	P	C	A	Q	J	G	R	Q
L	P	C	R	L	H	E	K	K	U	N	W	Q	N	J

2. Record the number of words you found on the board.

3. Listen to your teacher guide you through one minute of jumping jacks.

4. After the jumping jacks, take 45 seconds to locate the words from this list in the word search below.

RESPIRATION • LARYNX • DIAPHRAGM • THROAT • TRACHEA

V	W	G	C	H	K	Z	Y	W	N	K	O	K	W	O
V	W	B	S	N	J	X	L	Y	U	E	M	L	I	K
H	T	Q	D	M	J	Y	W	E	I	F	A	E	I	T
J	M	H	S	E	G	G	S	G	G	Z	E	R	F	Z
T	H	R	O	A	T	A	I	I	I	X	H	D	Q	O
Y	C	T	Q	R	C	Z	R	X	U	T	C	R	Q	V
X	V	T	F	S	K	A	N	H	Q	X	A	S	R	J
C	F	H	F	N	K	Y	M	J	P	B	R	A	F	V
J	J	P	T	K	R	X	F	K	C	A	T	H	G	A
N	O	I	T	A	R	I	P	S	E	R	I	E	J	D
E	Q	R	L	J	E	Y	B	N	Z	W	M	D	T	B
L	G	E	W	C	K	V	D	D	G	Q	S	M	K	Y
Q	N	X	U	K	M	L	A	J	T	F	F	R	Q	R
A	C	F	S	T	K	S	C	I	Y	U	A	C	F	L
B	K	B	R	I	C	W	X	T	H	A	M	X	M	W

(CONTINUED ON PAGE 13)

5. Record the number of words you found on the board.
6. Average of each of your classmates' tests and make a bar graph of the findings below:



QUESTIONS:

1. What were the results of the two tests?

2. What observations did you make about the tests?

3. What suggestions do you have for improvements on this experiment?

DESIGN YOUR OWN EXPERIMENT:

- Independent Variable (how you control breathing rate) _____
- Dependent Variable (how you measure concentration) _____
- How many people will take part in your test? _____
- What other factors do you need to consider when designing your experiment?

ACTIVITY NAME:

Crazy Eating Habits

ESSENTIAL QUESTIONS:

- What is the relationship between eating habits and other animal behaviors?
- What are some strategies animals use to fight their hunger?

OVERVIEW

Imagine a species of animal that travels hundreds of miles to gather with family around a single bird carcass in order to eat and celebrate together. Or, imagine a species that forces cream down a duck's throat before killing and eating it. Those are just a couple of weird human eating behaviors, but we're not alone in our odd eating habits. There are plenty of other animals that also have their own quirky food habits. In this activity, students will explore the strange eating habits of several species to try to identify which behavior belongs to which animal. Using clues and deductive reasoning skills, students will try to match the animal with its eating behavior.

CROSS CUTTING CONCEPT:

Structure and Function

MATERIALS LIST

- Hunger Worksheet
- Animal Images Handout

PROCEDURE

1. Ask students to share one of their families' eating rituals. Do they give thanks before eating? Do they eat separately or in a group? Discuss how we all have different eating routines.
2. Ask students to discuss some different animal eating habits. Do animals eat in groups or by themselves? Do they eat their food right away or do they store it? Do they eat the same thing the same way every day? Discuss the students' ideas.
3. Tell students that they are going to learn about the eating habits of various animals and explain that they will have to use their reasoning skills to determine which animals have which types of eating habit.
4. Pass out the Hunger Worksheet.
5. As a class, read the descriptions of the four animals and have the students make predictions about what type of animal is being described.
6. Put students in groups and have them answer the next five questions on the Hunger Worksheet and revise their predictions if necessary.

(CONTINUED ON PAGE 15)

PROCEDURE | (CONTINUED FROM PAGE 14)

7. Have the groups share their answers with the class, then pass out the Animal Images Handout and have the groups determine which animal goes with which description.
8. Go over the answers as a class:
 - Animal 1 - Burying Beetle
 - Animal 2 - Red Squirrel
 - Animal 3 - Leaf Cutter Ant
 - Animal 4 - Lion

DEBRIEF

- 📎 As a class, discuss the follow-up questions on the Hunger Worksheet.
 - a. What was the most surprising animal eating habit? Why?
 - b. Did the clues help you revise your prediction?
 - c. Did discussing with your group help you to make a better prediction? Why or why not?
 - d. What other information would have been helpful when making your predictions?
- 📎 Talk with the class about the scientific method and ask students to explain how this activity modeled the method.

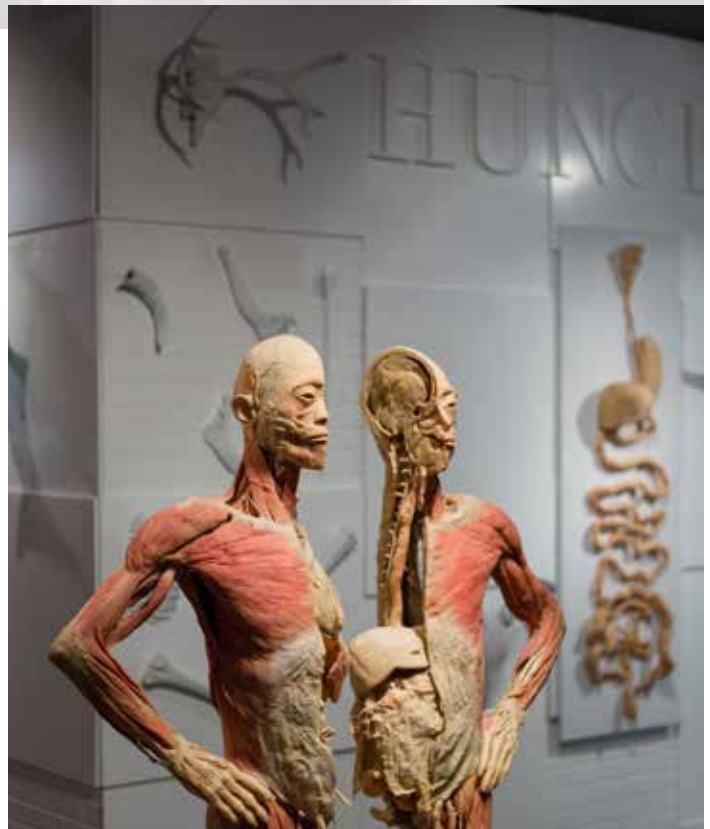
GRADE LEVEL ADAPTATIONS

MORE ADVANCED

Complete the lesson as described above, but instead of passing out the Animal Images Handout, have the students do research on their own to find the exact animals described.

LESS ADVANCED

Work on one animal at a time. Allow groups to answer the questions on their own, but have them only focus on one at a time. After revising their predictions about each type of animal, determine the correct answers as a class.



NAME : _____

DATE : _____

DIRECTIONS:

1. Read the descriptions of the animal eating habits in the chart below. Look for clues about what type of animal each column describes.
2. Make a prediction of what type of animal you think each describes and explain why you think this.
3. In groups, answer the other questions from the chart.
4. Revise your prediction based on any new information you receive after discussing ideas with your group.
5. Your teacher will pass out images of the animals. As a group, try to match the images with the appropriate descriptions.
6. Check your answers with the teacher and answer the follow-up questions below.

	ANIMAL 1	ANIMAL 2	ANIMAL 3	ANIMAL 4
DESCRIPTION of Eating Habit	This animal takes a rodent and covers it with oral secretions to slow down the decaying process. It then digs a hole, lines it with the rodent's hairs and buries the rodent. The animal then puts its nest next to this grave so when its young are born they can eat the rodent.	This animal has a neat trick for getting a sweet snack in the winter. It bites into the side of a maple tree, deep enough to cause the maple syrup to drip. The animal returns later and licks the maple residue off the tree for a jolt of sweet energy.	These are the first animals known to cultivate their own food. They bring leaves back to their home, then poop and spit on them to stimulate fungus growth on the leaves. They then use this fungus to feed their young.	This animal's family follows a clear order when feeding. Eating first is the alpha male, then the females, and then the young ones. However, when food is abundant, they will all eat together and will even allow other species of animals –like hyenas–to join them.
PREDICTION In each box, write the type of animal you think fits the description (dog, insect, bird, elephant, etc.)				

(CONTINUED ON PAGE 17)

	ANIMAL 1	ANIMAL 2	ANIMAL 3	ANIMAL 4
Does it seem like the animal eats meat, fruits and vegetables, or both?				
Does the animal eat alone or in a group?				
Based on the food it eats, how big do you think the animal is?				
What other clues did you notice in the description? <i>(more than one offspring, climate in which the animal lives, etc.)</i>				
REVISE YOUR PREDICTION. With your group's help, and based on any new information, has your prediction changed?				
Correct Answers				

(CONTINUED ON PAGE 18)

FOLLOW-UP QUESTIONS:

1. What was the most surprising eating habit for an animal? Why?

[Blank response area]

2. Did the clues help you revise your prediction?

[Blank response area]

3. Did discussing with your group help you make a better prediction? Why or why not?

[Blank response area]

4. What other information would have been helpful when making your predictions?

[Blank response area]

LIST OF ANIMALS:



Leaf Cutter Ants
Image credit: leandroarthropodsclub28 via Flickr



Red Squirrel
Image credit: herbivoreswildanimalbestblog.blogspot.com/2016/05/eating-habits-of-wild-animals.html



Burying Beetle
Image credit: kebman via Flickr



Lion
Image credit Daniel Waters via Flickr

ACTIVITY NAME:

Mapping the Circulatory System

ESSENTIAL QUESTIONS:

- What is the role of the circulatory system?
- Why and how does blood move around the body?
- Why do we have both veins and arteries?

OVERVIEW

The circulatory system plays a vital and unique role in our bodies. This system carries oxygen and carbon dioxide throughout our bodies, supplies our organs and tissues with needed nutrients, and carries white blood cells to infected areas in order to fight disease. It covers our entire body and connects each of our organs and body systems. In this activity, students learn about the core components of the circulatory system and discover how blood travels through the body. The goal of this activity is for students to gain the foundational knowledge they need to be able to go into a deeper study of the circulatory system and other body systems.

CROSS CUTTING CONCEPT:

Systems and System Models

MATERIALS LIST

- Sticky notes
- Giant roll of paper -
big enough to trace the students' entire bodies
- Circulatory Handout
- Art supplies



(CONTINUED ON PAGE 20)

PROCEDURE | (CONTINUED FROM PAGE 19)

1. Ask students if they have heard of the circulatory system and ask them to explain what they know about it.
2. Ask students to describe the role of the heart in the body, and ask them if they know the difference between a vein and an artery.
3. Discuss with students that our circulatory system is a closed system, meaning that there is no beginning or end. Instead, the blood circulates around the system over and over again.
4. Tell students that, to better understand the journey of blood, they are going to trace their own bodies on a sheet of paper, then draw and label the parts of their circulatory systems. First, they need to learn about the key components of the system.
5. Pass out sticky notes and go over the following terms, then have the students write the definitions on the sticky notes.
 - a. Heart - the muscle that pumps blood through the body
 - b. Vein - carries deoxygenated blood to the heart
 - c. Artery - carries oxygenated blood to the tissues
 - d. Capillaries in the lungs - tiny, thin-walled blood vessels that allow gases and nutrients to pass into the blood
 - e. Capillaries in the body - tiny, thin-walled blood vessels that allow the exchange of gases and nutrients between the blood and the cells of the body
 - f. Pulmonary artery - one of two arteries (branches of the pulmonary trunk) that carry deoxygenated blood from the heart to the lungs
 - g. Atrium - upper chamber of the heart that receives and holds the blood traveling to the ventricle
 - h. Ventricle - a chamber of the heart that receives blood from an atrium and pumps it to the arteries
 - i. Aorta - the large trunk artery that carries blood from the left ventricle of the heart to branch arteries
 - j. Vena cava - receives blood from the head, arms and chest, and empties into the right atrium of the heart
 - k. Lungs - The circulatory system of the lungs is the portion of the cardiovascular system in which deoxygenated blood is pumped away from the heart, via the pulmonary artery, to the lungs, and returned, oxygenated, to the heart via the pulmonary vein.
6. Put students into groups of two and have them trace each other on the large sheets of paper.
7. Pass out the Circulatory Handout and have students draw the arteries, veins and heart on their bodies just like the image.
8. Students should color the veins red and the arteries blue.
9. Have students place the sticky notes in the appropriate places on the body.

(CONTINUED ON PAGE 21)

PROCEDURE | (CONTINUED FROM PAGE 20)

10. Tell students that they are now going to write a story from the perspective of a blood cell. The story will be about how the blood cell travels throughout their entire body. Each student is going to start and stop their story in different places around the body. Remind students that the circulatory system is a loop and there is no beginning or end.
11. Have students spin a coin on their drawing. Wherever the coin lands is where their story begins. For example, if a student's coin lands on the pulmonary artery, the story will begin and end there, and might start like the following:

I'm a tiny blood cell who has just left the heart. I'm about to make a turn and go into the lungs where, with the help of the capillaries, I'll become oxygenated. Then I will continue to travel around the entire body supplying important nutrients to the body's organs and tissues. After leaving the lungs I'll head down the....

12. After students have written their stories, have them share with the class or with their partners.
13. Display the drawings and stories around the room.

DEBRIEF

- 📎 Ask students what new things they learned about the circulatory system in this activity. What other information do they want to know?
- 📎 Ask students to discuss how they think the circulatory system works with other body systems. Are they separate? Do they depend on one another or does one drive the other?

GRADE LEVEL ADAPTATIONS

MORE ADVANCED

Have students include all the parts of the circulatory system listed on the image on the Handout. Also have students add other key body parts like kidneys, brain, stomach, etc. to help give more context to how things work together inside the body.

LESS ADVANCED

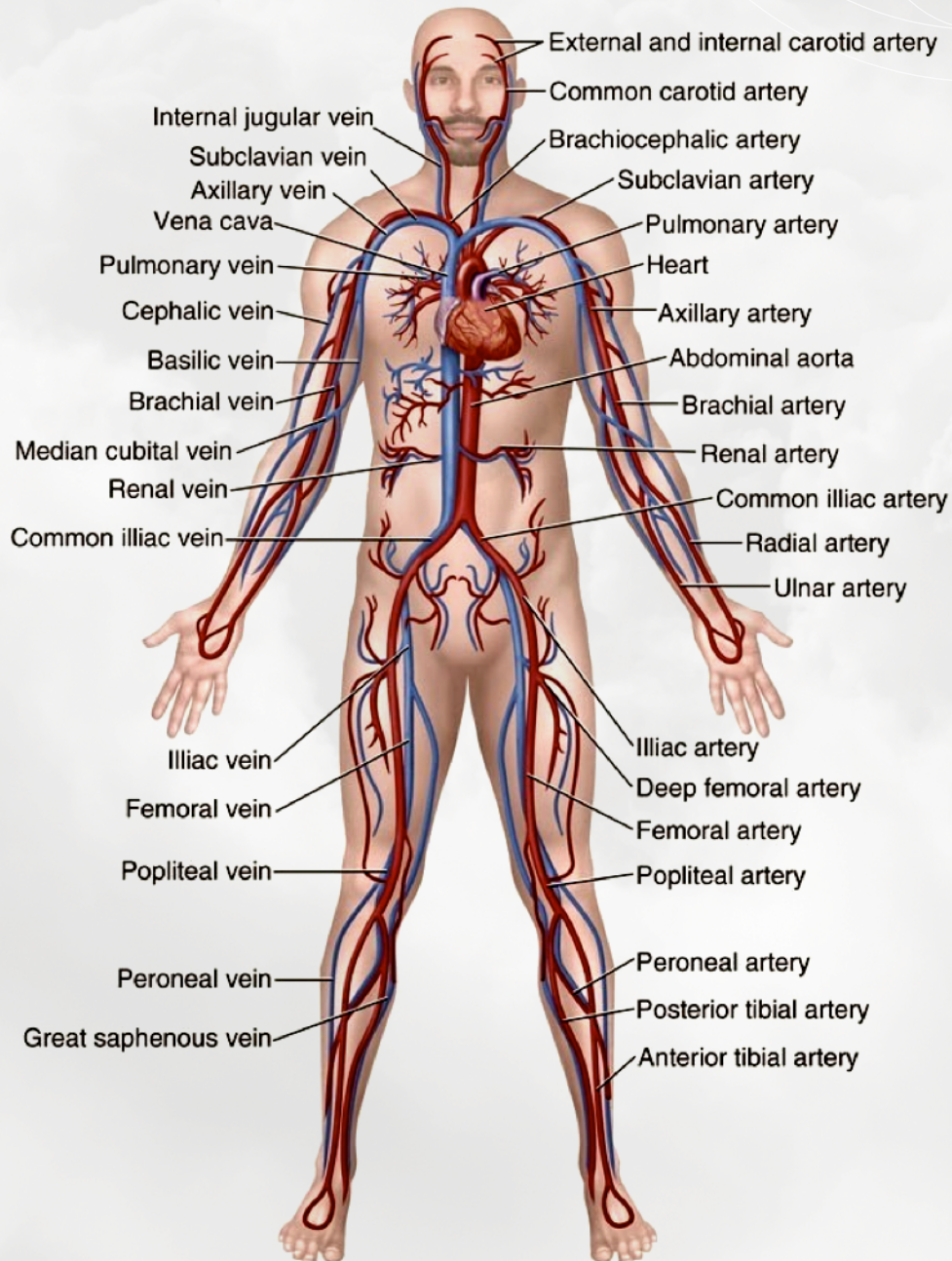
Have the entire class develop the first story as a group to model what their own stories will sound like. This will allow students to both get an example and to also contribute their own ideas. Then have students create their own stories in groups of two.



NAME : _____

DATE : _____

Circulatory System



Source: http://human-diagrams.blogspot.com/2014/01/circulatory-system-diagram.html#.V_fO8dwrJhE

ACTIVITY NAME:

What is Strength?

ESSENTIAL QUESTIONS:

- What is strength?
- What are the best ways to represent strength?
- Other than physical, what are some other types of strength?

OVERVIEW

In this activity, students are challenged to think about what the term “strength” means. In REAL BODIES, students were able to closely examine the detail in a human muscle, and they were also presented with the various ways strength has been interpreted throughout history. Most cultures have varying interpretations of what it means to be strong. In this activity, students will explore the idea of strength and will create an advertisement to convey what strength means to them.

CROSS CUTTING CONCEPT:

Structure and Function

MATERIALS LIST

- Move Worksheet
- Art supplies
- Internet and research materials

PROCEDURE

1. After visiting REAL BODIES, ask students to reflect on what they saw in the Move gallery. Discuss muscles and what muscles do.
2. Ask students to define strength and write their answers on the board. Be sure to ask students about emotional and mental strength, as well as physical strength.
3. Once all the various definitions are on the board, ask the group to come up with one definition that encompasses all the definitions. It will be nearly impossible to come up with the perfect definition, so, after a few tries on the board, tell students that, instead of coming up with a definition, they are going to create a poster that visually represents what strength is.

(CONTINUED ON PAGE 24)



PROCEDURE | (CONTINUED FROM PAGE 23)

4. Before students get started on their posters, ask them to name a few symbols for the following:
 - a. Love - e.g. hearts, kisses
 - b. Freedom - e.g. American flag, bald eagle
 - c. Peace - e.g. dove, hand making peace sign
5. Tell students that they are going to try to create this kind of symbol for strength. The requirements are:
 - a. Make a poster showing up to three symbols that represent strength
 - b. Add labels or slogans to describe or enhance the meaning of the images
 - c. Develop a 30-second presentation explaining why they think their image best represents strength
6. Put students in groups and pass out the Strength Handout. Help groups work through the handout, allowing the students to create their own images, print images from the internet or cut images out of magazines.
7. Have students present their posters to the class.

DEBRIEF

- 📎 Ask students to discuss the other students' posters.
Which of the posters resonated with them most? Why?
- 📎 Ask students to think about the commercials they see on television.
What images do corporations use to convey the values of their company?

GRADE LEVEL ADAPTATIONS

MORE ADVANCED

Have students select an item that is intended to be strong (super glue, trucks, rope, etc.) and ask them to create an advertisement for that item.

LESS ADVANCED

After discussing the significance and meaning of symbols in general, have the entire class list symbols that represent strength. This will help the students generate more ideas for when they go into their groups to create their own symbol posters.



NAME : _____

DIRECTIONS:

1. As a group, fill in the 'Images' table below to help clarify your thinking about what strength means. When you are done, sketch some ideas in the bottom row of the table.
2. Make your poster.
3. As a group, fill in the 'Presentation' table below to organize your presentation.

IMAGES	
List ten words that come to mind when you hear the word "strong."	What are some animals that are strong?
What are some products or items that are strong?	List people (family and celebrities) who are strong.
What color comes to mind when you think of the word "strong?"	What images come to mind when you hear the words "NOT strong?"
What other ideas do you have about being strong?	What did you learn about being strong in REAL BODIES?
Sketch the images that best represent strength.	

NAME : _____

PRESENTATION

Explain why you chose the image(s) you did.

Explain why you chose the colors you did.

What is an interesting way to present your ideas to the class?

Write what you are going to say during your presentation.

ACTIVITY NAME:

Short-Term Memory

ESSENTIAL QUESTIONS:

- Is there a difference between your brain and your mind?
- What are some strategies to increase your memory?

OVERVIEW

Perhaps what makes humans most unique is our brain and our ability to reason and remember. However, we still know relatively little about how our brains work. In this activity, students work on developing new strategies to help improve short-term memory. The goal is for students to develop and test several new ways to improve their short-term memory.

CROSS CUTTING CONCEPT:

Patterns

MATERIALS LIST

- Tools for memory quiz:
e.g. deck of cards, dictionary, or telephone book

PROCEDURE

1. Divide students into small groups. Explain that they will be testing the short-term memories of students in other groups and analyzing the strategies individual students use to improve their ability to memorize.
2. Ask each group to use the materials selected for the memory exercise to create a ten-question quiz that will test their fellow students' short-term memory skills. Suggest a series of items such as playing cards, numbers, words or simple facts. Make it clear that the quizzes should be challenging, yet not so difficult that students will not be able to score well.
3. When the quizzes have been created, invite each group to give its quiz to two or three other groups and record the results.
4. When the testing is complete, bring the students who scored the highest on each quiz to the front of the room to be interviewed by the class about their memorization strategies. Encourage each high scorer to explain any techniques the others might also be able to use as memory aids. During the interviews, students may come up with other possible strategies for short-term memory improvement.
5. After the interviews, have students take a different group's quiz to try the memorization techniques discussed.

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PROCEDURE | (CONTINUED FROM PAGE 27)

6. Finally, lead a class discussion about which memorization techniques were the most effective for students, why they were effective, whether they might be useful to others, and how these strategies will help them to learn in general.
7. As a follow-up, ask students to write down the memorization techniques they think will prove most useful to them in the future.

DEBRIEF

- 📎 Modern medical technology allows us to see which parts of the brain are working as we do different activities. Ask students how they think this technology can help scientists research the brain. How can it help people with brain damage or disease?
- 📎 Ask students to make a list of all the activities they do that use the cerebellum and ask which daily activities we “memorize” so well that we can perform them on “autopilot.” Ask students why it is important for us to be able to do these things easily and without thinking.
- 📎 Ask students why they think 25% of our brain is devoted to vision and processing the things we see. How would our lives be different if the same percentage of our brainpower was devoted to hearing, touch, smell or taste?

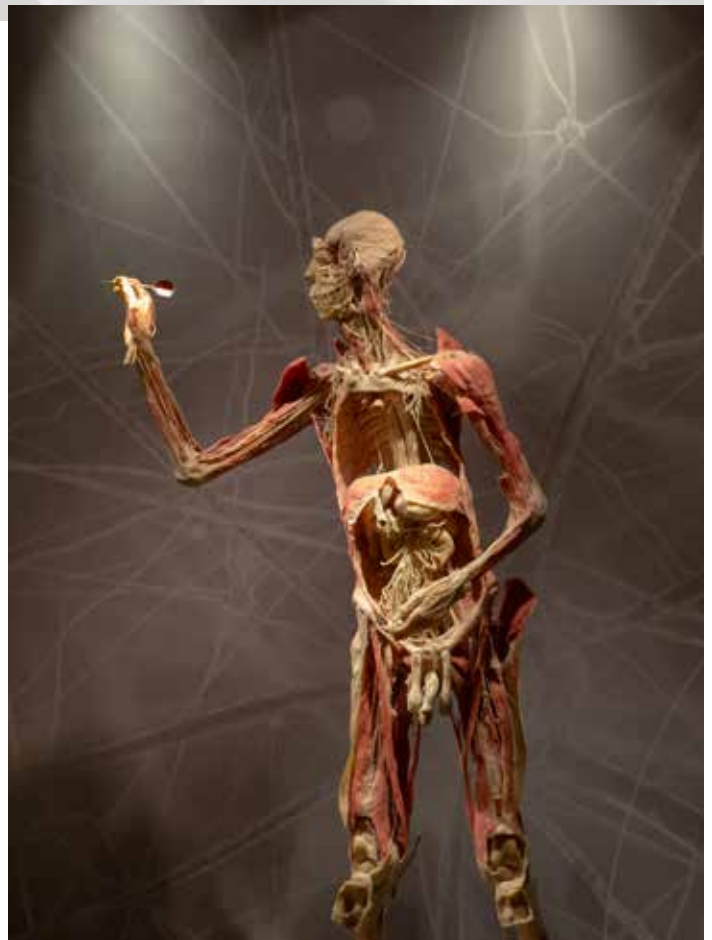
GRADE LEVEL ADAPTATIONS

MORE ADVANCED

Have students research and write brief reports about formal short-term memory experiments that have been conducted by scientists. Have each student write a paragraph evaluating the results and analyzing the significance of the activity in which they just participated.

LESS ADVANCED

Create one quiz and have all students take it. Have the students share their memory strategies as a class.



ACTIVITY NAME:

Living, Non-living or Dead

ESSENTIAL QUESTIONS:

- How do you know if something is or was once alive?
- What changes in an organism when it dies?

OVERVIEW

Students often have difficulty characterizing things as living, non-living or dead. For example, they tend to describe anything that moves as alive. They also may not yet understand the cycle of life (birth, growth, death), and therefore classify anything that has died as non-living. In science, the word “living” is used to describe anything that is or has ever been alive (dog, flower, seed, road kill, and log); “non-living” is used to describe anything that is not now nor has ever been alive (rock, mountain, glass, and wristwatch). Over time, students will begin to understand that all living things grow, breathe, reproduce, excrete, respond to stimuli, and have similar basic needs like nourishment. Older students may even realize that all living things are made up of cells. In this activity, students will classify several objects as living, non-living or dead.

CROSS CUTTING CONCEPT:

Patterns

MATERIALS LIST

- ❑ A variety of everyday objects: *e.g. rocks, seeds, mold, flowers, candle, water, apple, etc.*
- ❑ Living, Non-Living or Dead Worksheet

PROCEDURE

1. Ask students to define what it means to be alive.
2. Ask students to list characteristics that all living things have. Write down their ideas on the board. Don't try to organize the ideas, just list them all. Some common answers are: it needs air and breathes, it moves, it poops.
3. Pass out the Living, Non-Living or Dead Worksheet. Have students choose ten of the characteristics of living things from the board and write those in the Worksheet's "Characteristic" column. Students will be observing these characteristics.
4. Set up ten stations around the room with your everyday objects. Pick objects that are easily identified and may cause students to leap to conclusions. Items like seashells and corks make students pause before deciding whether they are living, non-living or dead. Dead bugs, twigs and seeds are great examples of easily identifiable objects for this exercise.
5. Have groups spend about five minutes at each station labeling their objects as living, non-living or dead.
6. Have groups return to their seats and complete the worksheet.
7. Have a class discussion about how to classify the objects.


(CONTINUED ON PAGE 30)






PROCEDURE | (CONTINUED FROM PAGE 29)

8. Create a list of the “official” characteristics of the living things listed on the board.

- Has cells
- Grows
- Can reproduce
- Responds to the environment
- Metabolizes (*changes food into a form that can be used by the body*)
- Maintains homeostasis (*The body’s ability to maintain equilibrium within itself, even when faced with external changes, e.g. regulating body temperature to 98.6 degrees Fahrenheit*)
- Made of organic molecules (*proteins, lipids, carbohydrates, and nucleic acids*)

DEBRIEF

 Ask students:

-  What characteristics did all of the living things in this activity have in common?
-  Do any of the non-living things possess some of the same characteristics as the living things? Which ones?
-  How were the living things different from the non-living things?
-  Are all things that have the ability to move “alive?” Defend your opinions by referring to the results of your characteristics activity.
-  What are some non-living things that move?

GRADE LEVEL ADAPTATIONS

MORE ADVANCED

Have students teach this lesson to another class. The students should choose the objects that they thought were the most challenging to label as living, non-living or dead, then brainstorm new objects that they think would be good additions to the activity.

LESS ADVANCED

Label the first four or five objects as living, non-living or dead as a group. Allow the students to explore and label the remaining five or six objects on their own.



DEBRIEF

- ✎ What characteristics did all of the living things in this activity have in common?
- ✎ Do any of the non-living things possess some of the same characteristics as the living things? Which ones?
- ✎ How were the living things different from the non-living things?
- ✎ Are all things that have the ability to move “alive?” Defend your opinions by referring to the results of your characteristics activity.
- ✎ What are some non-living things that move?:

WHAT IS THE “OFFICIAL” LIST OF THE CHARACTERISTICS OF LIVING THINGS?



ACTIVITY NAME:

Sexual Strategies

ESSENTIAL QUESTIONS:

- Why do different animals exhibit different strategies for reproducing?
- Why do some organisms produce many offspring that require very little parental care, while other organisms produce very few offspring yet devote huge amounts of time and resources to them?
- Is love a genetic response or an emotional one? Is there a difference?

OVERVIEW

Courtship—it's one of the fundamental behaviors of humans and is one of the driving forces behind reproduction. Human courtship is one of the earliest behaviors that students will witness. From watching movies to observing their parents to interacting with friends, students are exposed to a huge spectrum of ways humans try to court one another. However, courtship is not just a human behavior. In this activity, students will play a dating game to learn the courting rituals for a variety of animals.

CROSS CUTTING CONCEPT:

Structure and Function

MATERIALS LIST

- Courtship Cards
- Dating Game Worksheet

PROCEDURE

1. Ask students: What does courtship mean? Ask students to discuss behaviors they have seen people do to court a mate. Some ideas include bringing gifts of flowers or candy, dressing nicely or wearing perfume. Challenge students to be creative and to think about how they have seen courting on TV and in movies.
2. Ask students to discuss the difference between sexual (generally two organisms sharing genetic material) and asexual (one organism) reproduction. Be sure to ask for the possible advantages of both.
3. Tell students that they are going to learn about the courting rituals of several animals by participating in a dating game where a female Bowerbird will ask several males a series of questions and then choose the mate that suits them best. One of the males is another Bowerbird and the other two are different species. Based on the male contestants' responses, the audience will decide which one is the male Bowerbird.
4. Ask one student to volunteer to be the female and three other students to volunteer to be the males. Actual gender of the students does not matter, but each should play their chosen role.
5. Pass out the Courtship Cards to the volunteers and the Dating Game Worksheet to the rest of the class.

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Have the males sit in front of the class and have the teacher interview the female (you can also have a student play the role of interviewer).

TO BE READ ALOUD BY THE HOST:

“Greetings everyone and welcome to the Dating Game! The goal of the game is to match this female with the best mate and YOU as the audience get to choose!

Our first female contestant is a Bowerbird. Isn’t she beautiful?

Here’s how the game is going to work. The female Bowerbird will ask the males 4 questions. The males will then read their responses. You in the audience will take notes on your worksheet and then, as a group, determine who the best mate is for the Bowerbird. You will know what TYPES of animals the male contestants are but you will not know which contestant is which animal. You will have to use your deductive skills to figure out who is the best match for the Bowerbird.

So, Miss Bowerbird, please introduce yourself and read your first question.”

6. Have the female Bowerbird read one question at a time to each of the three males and make sure the class is taking notes on their answers.
7. After the final question has been read, have the group vote for the male contestant the Bowerbird should choose.
8. Read the descriptions of the three male animals and reveal who was representing what animal.

DEBRIEF

- 📎 Ask students to discuss the mating rituals they just learned. Did they know about those rituals before this activity? Why do they think these animals evolved to court in this way?
- 📎 Ask the students how they made their choice regarding which animal was best suited for the Bowerbird without knowing any background information about the animals.

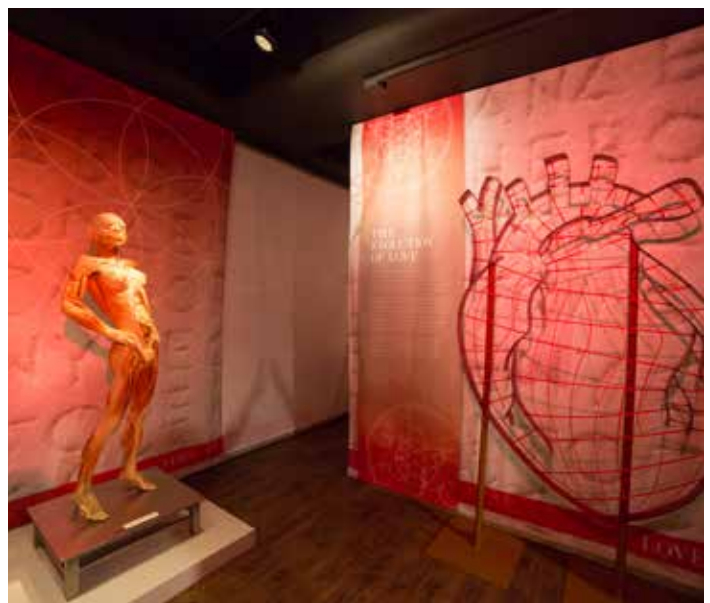
GRADE LEVEL ADAPTATIONS

MORE ADVANCED

After completing this first round of the dating game, have groups research animal behaviors and develop their own contestants, questions and answers for another round.

LESS ADVANCED

Give students information about the animals before the game begins. They will be better equipped to draw upon prior knowledge to make their choice for the best mate.



FEMALE

Introduction:

"I'm a pretty typical bird. I like to make my own choices, but overall I'm pretty ordinary."

QUESTIONS TO READ:

QUESTION #1

"Where would you like to live?"

QUESTION #2

"When we get married, how many offspring would you like to have next year?"

QUESTION #3

"How long is your ideal relationship?"

QUESTION #4

"What would you do to convince me to marry you?"



MALE RESPONSES

NURSERY WEB SPIDER

QUESTION #1	I can live pretty much anywhere.
QUESTION #2	It depends, but I'd like at least a thousand.
QUESTION #3	I'm not sure. I have not had the chance to mate yet - and none of the friends I know who have mated are around anymore.
QUESTION #4	I would wrap a special treat for you in the finest silk.

MALE RESPONSES

ADELIE PENGUINS

QUESTION #1	I only like living along the coast and prefer the cold.
QUESTION #2	Just one. And I will do my best to care for it while you look for food.
QUESTION #3	I will love you forever but I'm ok with you dating other people.
QUESTION #4	I would present you with lovely and rare special rocks.

MALE RESPONSES

BOWERBIRDS

QUESTION #1	I like to live below the equator.
QUESTION #2	Between one and three. It's really up to you.
QUESTION #3	I would love it if we could re-connect every year, but I know I have to keep proving my worth to do that.
QUESTION #4	I would dance for you, of course!



NAME : _____

DIRECTIONS:

As you listen to the male contestants read their answers, take notes on this sheet. When they are done, you will need to determine who will make the best mate for the female.

Below are the species of the contestants in random order:



	CONTESTANT 1	CONTESTANT 2	CONTESTANT 3
QUESTION #1			
QUESTION #2			
QUESTION #3			
QUESTION #4			

QUESTIONS:

- Using your general understanding of spiders, penguins and birds, which animal do you think is represented by which contestant?
- Which of the contestants would be the best mate for the female? Why?

Image Sources:

Spider: https://en.wikipedia.org/wiki/Nursery_web_spider

Penguin: <http://worthlesstrivia.blogspot.com/2011/07/pictures-of-adelie-penguin-free-adelie.html>

Bird: http://all-free-download.com/free-photos/australia_satin_bower_bird_bird_221260.html

ACTIVITY NAME:

Mother and Fetus

ESSENTIAL QUESTIONS:

- How does a human fetus develop?
- How does a woman's body change to support the development of a fetus?
- How do the fetus' body and its mother's body work in unison?

OVERVIEW

We often marvel at the miracle of birth and don't think too much about the amazing period from fertilization to birth. For 40 weeks, a human embryo develops into a fetus then into a baby at an incredible rate. The development of the fetus is fascinating, but what makes it even more amazing is seeing how the mother's body changes during this time to support the baby and prepare for birth. In this activity, groups of students will research different stages of human gestation and present their findings to the class.

CROSS CUTTING CONCEPT:

Systems and System Models

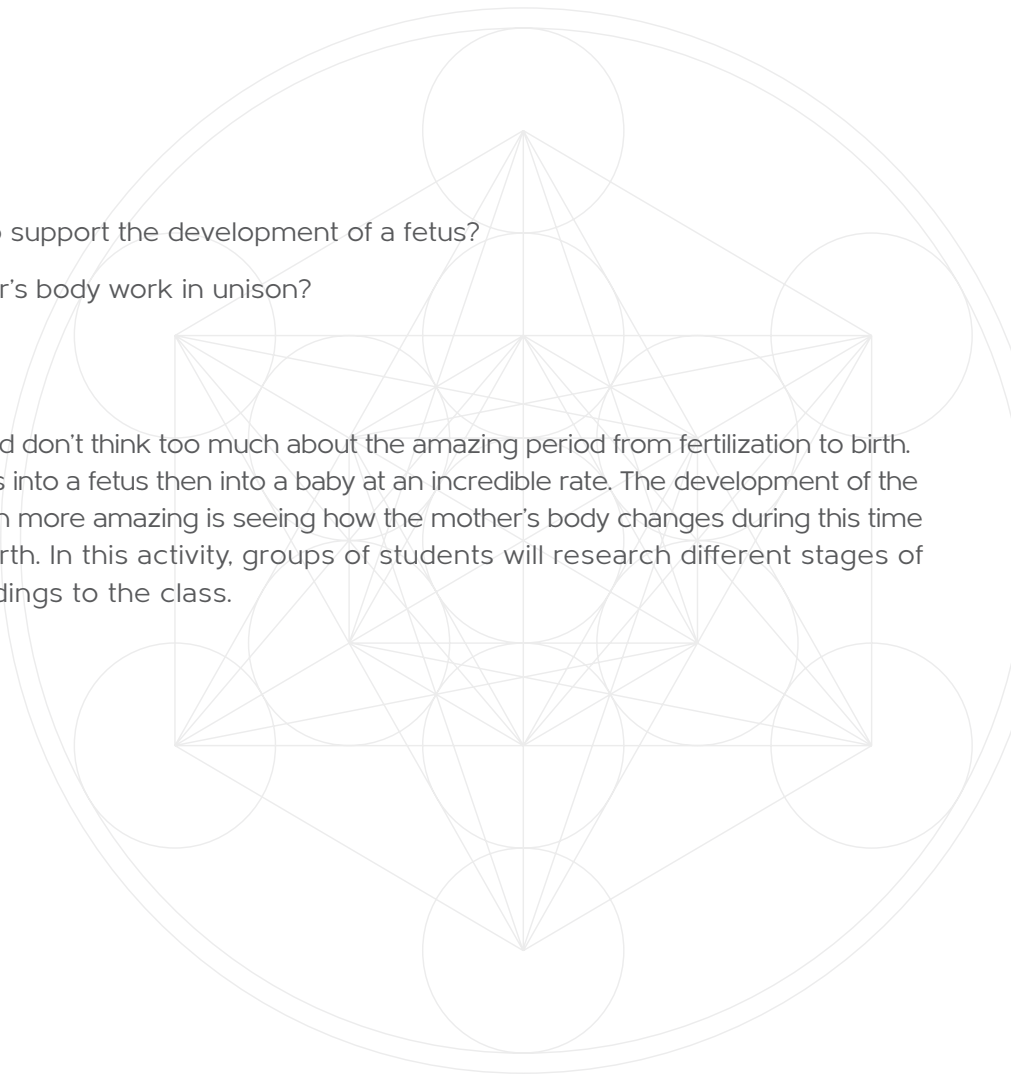
MATERIALS LIST

- Beginnings Worksheet
- Internet and research materials
- Art supplies

PROCEDURE

1. Ask students what they know about how a baby develops. Ask them to try to describe the phases of development. Ask students if they have heard the words "fetus" and "embryo" before and ask if they know what the difference is between the two.
2. Tell students that humans go through a 40-week gestational period. This is the amount of time it takes for a human baby to develop.
3. Divide your students into small groups. Explain that each group will be responsible for researching and presenting their findings regarding one particular segment of the 40-week human gestational period.
4. To determine the number of weeks for each segment, divide the 40 weeks of gestation by the number of groups your class has formed. Give the segments consecutive numbers (Segment 1, Segment 2, etc.), and assign each group one segment of the human gestational process.

(CONTINUED ON PAGE 40)



PROCEDURE | (CONTINUED FROM PAGE 39)

5. Pass out a Beginnings Worksheet to each group.
6. Ask each group to use the research materials you have provided, plus source materials from the library and the Internet, to research the changes that both mother and fetus undergo during the gestational period the group has been assigned. (Some examples of these changes include: By the end of the 12th week of gestation, the fetus has developed all of its organs and major body structures. During the final three months of pregnancy, a woman's growing uterus takes up a huge amount of space, her spine curves with the extra weight, her abdominal organs and lungs are pushed out of place, and her heart works harder and grows larger.) Have students print images from the internet or cut images out of magazines for use in their group's presentation.
7. When each group's research is complete, have students use their group worksheets to create a verbal description and a visual presentation showing the group's findings and detailing the changes that occur in both fetus and mother during the group's gestational period.
8. When the students' work is complete, compile the presentations into an illustrated timeline of fetal development, and have each group present their findings to the class.

DEBRIEF

- ✍ Ask students to compare the changes in the mother to the changes in the fetus as it develops. Do they see any relationship?
- ✍ Ask students to compare human fetal development to other animals. How do they think they are similar or different? For example, a dog's gestation period is only about two months and the mother often gives birth to multiple dogs.
- ✍ How do you think a dog's development is similar or different from the development of a human? What about a horse or a monkey?

GRADE LEVEL ADAPTATIONS

MORE ADVANCED

Instead of focusing only on human gestation, also have each group do research on the full gestational period of a different mammal.

LESS ADVANCED

Only give groups two options: the development of the embryo or the development of the fetus. Have groups compare those two stages.



NAME : _____

DIRECTIONS:

After your teacher assigns your group with a gestational segment, research the effects of that period of human gestation on the fetus and on the mother. Be sure to include images, citations and written descriptions.

GESTATION WEEKS _____ TO _____ SEGMENT _____		
FETAL DEVELOPMENT		CHANGES IN THE MOTHER
	IMAGES	
	DESCRIPTION	
	CITATION	

ACTIVITY NAME:

Treatment and Prevention

ESSENTIAL QUESTIONS:

- What are things you should do to keep your body from getting sick or injured?
- What are some safe treatments for illnesses?
- Do you know the best approach to maintaining your health?

OVERVIEW

It is often said that your health is the most important thing because, without it, nothing else really matters. In this activity, students will be introduced to a variety of medical treatments. Some of these treatments are traditional, some alternative, some are preventative, and some are focused on recovery. The goal of the lesson is for students to start thinking beyond only using treatments to cure illnesses and to look at remedies for illnesses that are more holistic.

CROSS CUTTING CONCEPT:

Systems and System Models

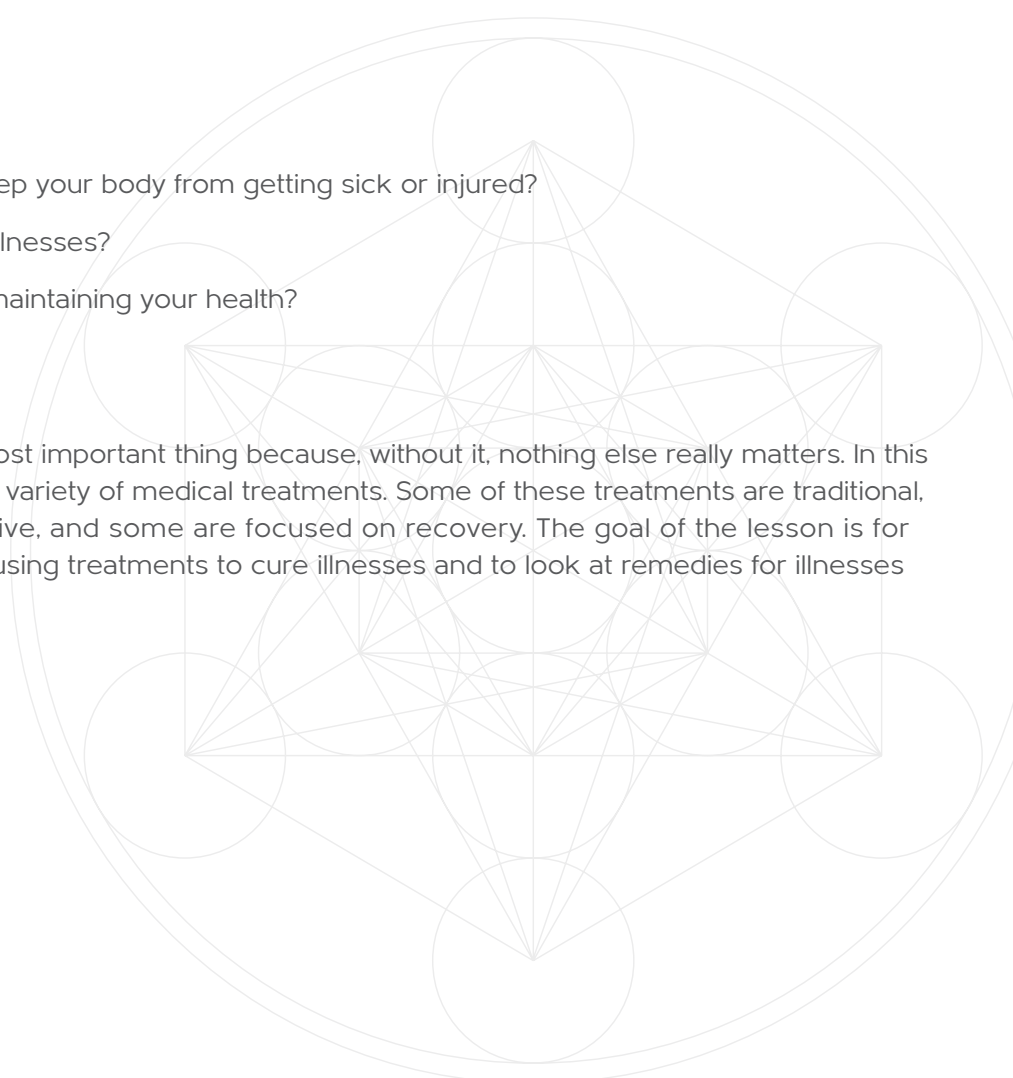
MATERIALS LIST

- Repair Worksheet
- Internet and research materials

PROCEDURE

1. Ask students what they do to make themselves feel better when they are sick. Have them share their remedies for a cold. List the ideas on the board.
2. Ask students what they do to prevent getting a cold. List the ideas on the board.
3. Draw a Venn diagram on the board with one area labeled as prevention and one labeled as treatment. Ask students to explain the difference between the two sides of the diagram.
4. As a class, put each of the terms on the board into the appropriate circle on the Venn diagram.
5. Tell students that treatment and prevention are complementary parts to our health, and that it is vital to respect and honor both if you want to remain healthy.

(CONTINUED ON PAGE 43)



PROCEDURE | (CONTINUED FROM PAGE 42)

6. Ask students to list as many other forms of treatment and prevention that come to mind, and then add some of your own to supplement the list. Some ideas include:
 - Acupuncture
 - Steroids
 - Chemotherapy
 - Massage
 - Yoga
 - Dietary supplements
 - Jogging
 - Swimming
 - Hypnosis
 - Diet
 - Meditation
 - Surgery
 - Knee replacement
 - Band-Aids
 - Helmets

7. Put students in groups and pass out the Repair Worksheet. Have students put the ideas you discussed as a class for treatment and prevention into their diagrams. If possible, allow students to search the internet to learn more about the terms they listed.

8. As a class, make a master Venn diagram. Note that there is no “correct” diagram and that many of the terms listed can be used for treatment, prevention or both.

DEBRIEF

- 📎 Ask the class if they disagree with the placement of any of the terms.
- 📎 Ask students which is more important - treatment or prevention.
- 📎 Ask students to discuss any behavior changes they might make after participating in this lesson.

GRADE LEVEL ADAPTATIONS

MORE ADVANCED

After the initial Venn diagram you make with the class about cold prevention and treatment, do not brainstorm a list of terms for the class to use. Instead, tell groups that they need to research their own terms to find at least five terms for each of the three areas of the Venn diagram.

LESS ADVANCED

Complete the big Venn diagram as a class, and explain and debrief each term as you decide together where the term belongs.



NAME : _____

DIRECTIONS:

Place the terms you discussed as a class regarding the treatment and prevention of sickness and injury into the correct area of the Venn diagram below.



FOLLOW UP QUESTIONS

Are there any terms with which you are unfamiliar? If so, which ones?
Were you surprised by the definition?

Are there any terms that you are not sure where to put? If so, which ones?