

Building Pulmo Park: A Constructivist Activity

Activity 2A

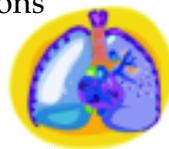
Activity Objectives:

Using a flash animation and simple materials, students will be able to:

- * Observe critical attributes of inhalation and exhalation.
- * Record observations about a flash animation called *The Anatomy of Breathing*.
- * Explore critical principles of the respiratory system through lab investigation.
- * Identify and describe the functions of the respiratory system.
- * Review and analyze flash animation again to update graphic organizer with revised observations and inferences.
- * Relate structure to function in the respiratory system.

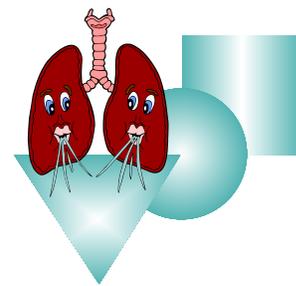
Activity Description:

Building Pulmo Park: A Constructivist Activity is a lab experience that allows students to discover critical principles of the respiratory system. Students will make observations and inferences about the structure and function of the respiratory system from watching a flash animation of *The Anatomy of Breathing* (available online at the following URL: <http://teachhealthk-12.uthscsa.edu/curriculum/pulmonary/pulmonary-breathsimulation.html>) and record them in a graphic organizer called *Pulmo Park Blue Print*. This activity is meant to be exploratory and then progress into a more insightful discussion with the teacher. Students will then apply what they learn by taking a “deeper” look into the functions of the respiratory system through a lab investigation called *Under Construction*. During the lab, the groups of students will complete a *Pulmo Park Builder’s Log* and use it to help match each lab experience to specific lung functions. Student lab investigations will support students as they create and manipulate a working model of the lungs called *Project: Build It!* Students will be encouraged to observe the flash animation as often as needed to achieve greater understanding of how the lungs work.



Activity Background:

On the Teacher Enrichment Initiatives Webpage, a flash animation called *The Anatomy of Breathing* can be found. (<http://teachhealthk-12.uthscsa.edu/curriculum/pulmonary/pulmonary-breathsimulation.html>). The animation allows students to see the process of air entering and exiting the respiratory system. An Explanation of the Flash Animation is provided for teacher use only, as students need to make observations and inferences on their own – they will be surprised to find that they



Activity Overview



LESSON 2
ACTIVITY 2A

Pulmo-Park

can figure out how they breathe by watching and thinking about what they see. The explanation will review some of the functions of the respiratory system that students should discover as they make inferences about what they observe in the animation and will provide the teacher with additional important points for discussion.

Activity Materials:

Part I.

1. Flash animation of the respiratory system (<http://teachhealthk-12.uthscsa.edu/curriculum/pulmonary/pulmonary-breathsimulation.html>).
2. *Teacher* Background Information (Flash Animation Explanation).
3. 1 Class set *Student Information Pages*.
4. 1 Copy *Student Data Page* for each student.

Part II.

1. *Teacher* Background Information (Summary of Lab Activities, Answer Key, Facilitating Suggestions for Debate).
2. 1 Class set *Student Information Pages*.
3. 1 Copy *Student Data Page* for each student .
4. Lab supplies as listed for lab investigations: *(These supplies can be placed into plastic baskets by station in order to make it quick to set up and take down the stations.)*

A. Blue Print: There is O₂ Here! (per group)

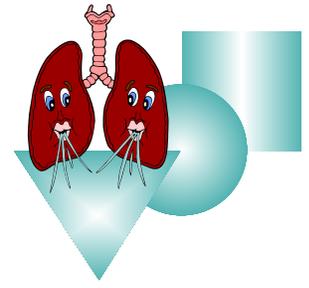
- 200 ml green craft sand or glitter to represent Nitrogen (N₂) molecules
- 50 ml red craft sand or glitter to represent Oxygen (O₂) molecules
- 10 ml white craft sand or glitter to represent Argon (Ar) atoms
- 10 ml blue craft sand or glitter to represent Carbon Dioxide (CO₂) molecules
- 2 clear plastic cups or 150 ml glass beaker
 - 150 ml glass beaker or vial labeled *Air Inhaled*
 - 150 ml glass beaker or vial labeled *Air Exhaled*
- Graduated cylinder

B. Blue Print: Dust removal! (per group)

- 3 Index cards
- Single hole paper punch
- Clear cellophane tape
- Stereoscope or magnifying glass (per station)

C. Blue Print: Everything is Expanding and Contracting! (per station)

- 1- 20 oz. soda bottle
- 2 20 cm circumference balloons
- Scissors
- Tape and/or rubber band



Activity Overview Continued



LESSON 2
ACTIVITY 2A

Pulmo-Park

D. Blue Print: Just enough pressure! (per station)

- 1- 100 ml syringe (without needle)
- 1 Mini marshmallow or small marshmallow bunny (per group)

E. Blue Print: Exchange it! (per group)

- 2 beakers
- 100 ml water
- 100 ml carbonated water
- 25 ml of Bromo Blue (for each beaker of water) (note MSDS sheet)
- goggles/gloves
- stir rod
- Colored Pencils

F. Blue Print: Model of Diffusion! (Start one set up at the beginning of class and note the time started so students can observe throughout the class)

- 2 250 ml beakers
- 2 thin snack-sized Zip-Loc® Baggies
- 1 bottle tincture of iodine
- 10 grams Cornstarch (per group at this station)
- Triple Beam Balance
- Glass stirring rods or plastic spoons
- Paper towels

G. Blue Print: Branching Out.

- 1 dissecting kit
- 1 stereoscope
- 1 floweret of broccoli or cauliflower
- Petri Dish
- running water
- red dye (use dropper if needed)
- magnifying glass

H. Blue Print: Break that surface tension!

- 2 beakers filled with water (per station)
- 2 toothpicks (per group)
- Ivory dishwashing detergent (per station)
- Paper towels (per group)

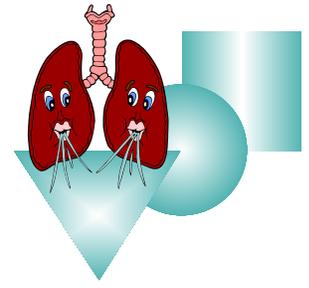
Activity Management Suggestions:

Make three copies of each station instruction – *these can be laminated for re-use.*

Organize students into groups of three.

Parts or all of this activity might be used.

Time students as they move through the station activities to keep the activity moving. (Each station should take about 7 minutes)



Activity Overview Continued



LESSON 2
ACTIVITY 2A

Pulmo-Park

Organize materials into plastic crates or tubs so stations can easily be set up and taken down.

Have students first review information they record in their graphic organizers within groups of three and then review in a large group setting. Ask them to share their *most* significant findings. Ask for any details that might have been skipped in discussion. Finally, add any detail that you, the teacher, think is important. Teacher background material is provided to help the teacher facilitate processing out of the activity.

The background piece is important to understanding the significance of each lab and helping your students tie them together to understand the function of the respiratory system. Look for the lab cues in the explanation. They will indicate the best reference for the lab.

Materials for setting up each lab are listed in the materials list. Students will rotate through the labs and decide which function of the respiratory system is best represented by the investigation and indicate this information on their lab worksheet called *Pulmo Park Builders Log*.

Using the same groups of three, rotate the students through the group stations.

When finished, allow students to have a class-wide debate on the best representation of the lab investigations.

Evaluate students on participation in debate as well as completion of the *Pulmo Park Builders Log*. Lab sheets called Under Construction review expectations of each lab and teaching strategies for conducting the debate.

To extend this project, have students revisit the flash animation and update the graphic organizer with their new findings. Findings can be applied to the creation of a model of the respiratory system called *Project: Build It!* Keep in mind that many of the materials used in the lab can be used to complete the model.

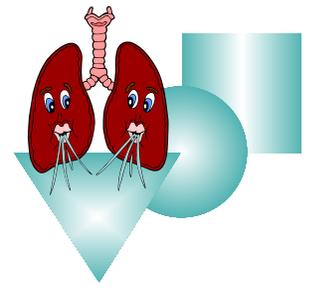
Be sure to instruct students to leave the station clean and organized for the next group.

Modifications:

Some students may need extra time to work through the stations. Students with special needs usually are very insightful during lab investigations. Make sure to encourage their participation.

Extensions:

A study of the laws that affect the respiratory system could be one way to make modification or allow extensions for students who are gifted in mathematics.



Activity Overview Continued



Examples:

For air to flow into the lungs, intrapulmonary pressure must be lower than atmospheric pressure. This follows from *Boyle's Law* in which pressure decreases as the volume (of the chest cavity) increases.

For the gas exchange in the alveoli, oxygen and carbon dioxide exchanges are dependent on the conditions set up in the alveoli. This follows from *Dalton's Law* that total pressure of a gas mixture is equal to the sum of the pressures that each gas independently exerts.

For pressure inside the alveoli as we inhale and exhale is largely based on *LaPlace's Law* and surface tension.

Activity References Used:

Coyle, Michael. Pulmonary Primer: [An Overview of the Pulmonary System](#). VivoMetrics, Inc.

Davies, Andrew. [The Respiratory System: Systems of the Body Series](#). Churchill Livingstone: New York. 2004.

Leff, Alan and Paul Schumacker. [Respiratory Physiology: Basics and Applications](#). W. B. Saunders Company: Pennsylvania. 1993.

Marieb, Elaine. (2003). Anatomy and Physiology Coloring Workbook: A complete study guide. California: Pearson Education, Inc.

Nagel, Ron. (2002). Body By Design. Volume 2: The Respiratory System. Connecticut: UXL-An Imprint of the Gale Group.

Norman, Wesley. (1999). Functions of the respiratory system. Retrieved June 14, 2006 from Georgetown University, The Anatomy Lesson: <http://mywebpages.comcast.net/wnor/thoraxopeningpage.htm>

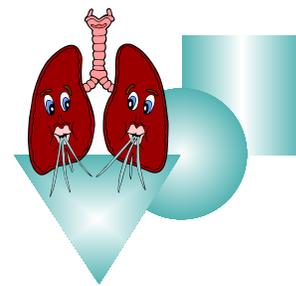
Positively Aging. (2006). Flash Animation: The Anatomy of Breathing. Posted May 2006. <http://teachhealthk-12.uthscsa.edu/studentresources/AnatomyofBreathing3.swf>

Walker, Richard. (2002). [Encyclopedia of the Human Body](#). New York, NY: DK Publishing Inc.

Excellent use of visuals in finding anatomy of the lungs: <http://www.netterimages.com>

Used to find lab ideas for stations: [Healthcommunities.com, Inc.](http://www.healthcommunities.com)

Excellent up-to-date information on the respiratory system: <http://www.nhlbi.nih.gov/> (The National Heart Lung and Blood Institute)
<http://www.lungusa.org> (American Lung Foundation)



Activity Overview Continued

