

# It's No Fun Being on Restriction: Obstructed Airways Activity 5A

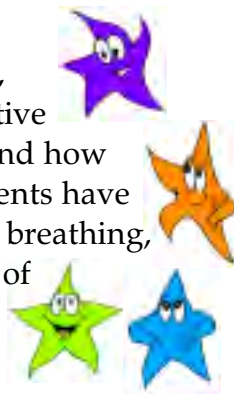
## Objectives:

*Students will be able to:*

- ◆ Compare normal breathing to obstructed breathing
- ◆ Develop an awareness of the impact obstructed airways can have on daily functioning
- ◆ Identify variables in an experiment
- ◆ Collect, analyze and graph data

## Activity Description:

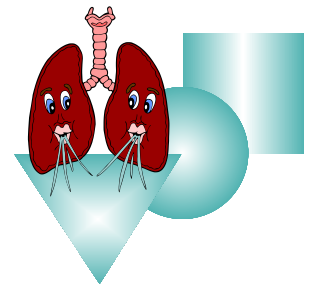
By breathing through straws to simulate a lung disorder, students will experience what it feels like to have restrictive and/or obstructive lung disease and will observe first hand how such a disease can affect normal functioning. Once students have experienced how it feels to have obstructed or restricted breathing, they will conduct an experiment to determine the effect of restricted breathing on their ability to perform a simple cognitive test.



## Activity Background:

There are four basic processes involved in respiration. The first process is breathing or *ventilation*. The second is the exchange of carbon dioxide and oxygen in the alveoli of the lungs. The third process is circulation of blood between the lungs and the body tissues. The last process is the carbon dioxide and oxygen exchange that occurs between the blood and body tissues.

Normal *ventilation* (breathing) is the mechanical movement of air in and out of the lungs, without an obstruction. When we *inhale*, the intercostal muscles contract, expanding the rib cage. Further increasing the size of the rib cage, the diaphragm contracts and pulls downward. The effect of these muscle movements is that the thorax (chest cavity) expands and the increase in volume lowers the air pressure inside. The lowered air pressure around the lungs causes outside air to be pulled into the lungs. When we *exhale*, the intercostal muscles relax, decreasing the size of the rib cage. Further decreasing the size of the rib cage, the diaphragm relaxes and moves upwards. The net effect of these movements is that the thorax (rib cage) decreases in volume which causes an increase in air pressure inside the chest cavity. The increased air pressure pushes on the lungs, forcing air to the outside. When we inhale, air moves through the respiratory system (See *Figure 1 Human Respiratory System* on next page) by entering through the nose or mouth, traveling through the trachea, which branches into the bronchi.



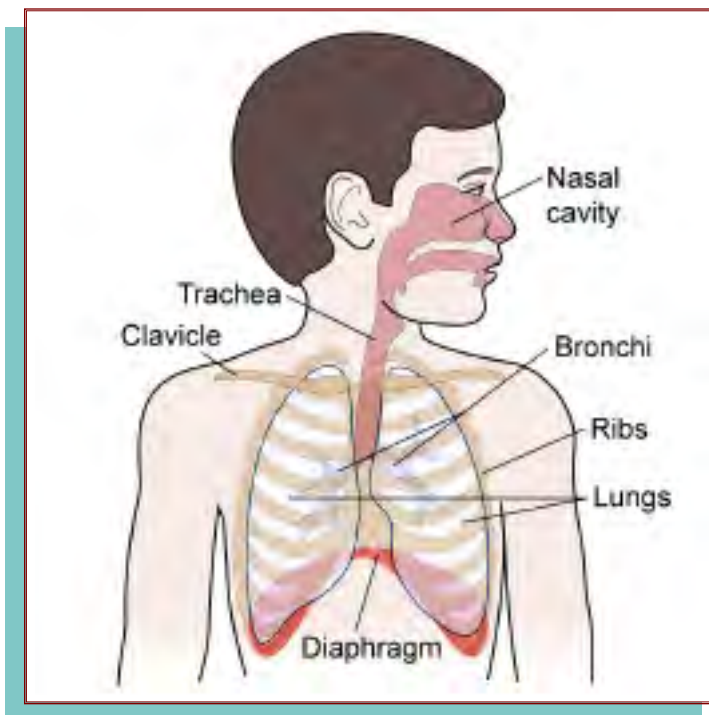
# Activity Overview



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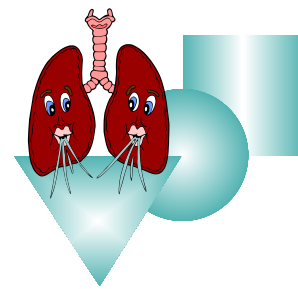
Air travels through the bronchi into smaller branches called bronchial tubes. Air continues through the bronchial tubes and into the smaller branches called bronchioles. After leaving the bronchioles, air moves into tiny sacs called alveoli. During exhalation, air moves in the opposite path through the respiratory system.



**Figure 1 Human Respiratory System**

It is in the tiny alveoli that gas exchange occurs; oxygen is moved from the air into the blood and carbon dioxide is moved out of the blood into the air. During this gas exchange, oxygen and carbon dioxide diffuse through the walls of the alveoli. These walls are only one cell thick and are very moist with water. The gasses (carbon dioxide and oxygen) dissolve in the water and are then able to pass through the alveoli walls.

If a person has an obstructive lung disorder or a restrictive lung disorder then major breathing problems can result. Obstructive lung disorders occur when airflow is blocked and restrictive lung disorders occur when lung volume is reduced. Examples of *obstructive lung disorders* are asthma, bronchitis, or cystic fibrosis. Asthma is the narrowing of the airways; bronchitis is inflammation of the airways and cystic fibrosis is a genetic disease that clogs the airways by an over-production of mucus. An example of a *restrictive lung disorder* would be emphysema. Emphysema is caused mainly by smoking or other environmental particulates that damage the alveoli sacs, causing them to lose their elasticity. Because breathing is an involuntary action controlled by the brain, we do not have to think about it and are free to concentrate on other tasks. As demonstrated during this activity, when our attention becomes focused on breathing, it is difficult to accomplish even the most simple task.



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## Activity Materials:

- Small diameter plastic drinking straws such as coffee stirrers or cocktail straws (enough for each student to have one straw)
- 1 nose clip (Can use swimmer's nose clips such as Aqua Explorers series-model E1950 or disposable nose clips available from Medical supply companies)
- Stopwatch
- Paper Towels
- 1 copy of *Student Answer Page*

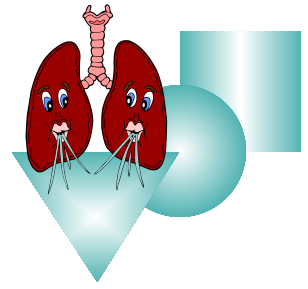
## Activity Instructions:



**BE SURE TO ADVISE STUDENTS WITH ASTHMA OR OTHER RESPIRATORY PROBLEMS TO SKIP THIS ACTIVITY – THEY CAN WATCH THEIR CLASSMATES AND LEARN FROM THE ACTIVITY!**

### I. Simulating an Obstructive or Restrictive Lung Disease

1. First, pass out a paper towel, nose clip and straw to each student.
2. Instruct students to put the nose clips on and place the straws in their mouths, breathing through their mouths until the simulation begins.
3. Explain to students that once the simulation begins, they will breathe *only* through the straw.
4. Have students breathe through the straws for 1 minute. After 1 minute passes, have students place their straws on sheets of paper towel on their desks. Ask students how it felt to breathe through the straws. Point out that they were able to breathe normally after one minute, but someone with a restrictive or obstructive lung disease would not have that option.
5. Now ask students to stand by their desks with nose clips in place. Once again, they will place the straw in their mouth and breathe through the straw for 1 minute, but this time they will run *in place* at the same time. After 1 minute passes, have students sit down and put the straws on paper towels placed on their desks. Ask students how it felt to breathe through the straw while running. Point out that people with restrictive or obstructive lung disease must breathe that way all the time and it seriously affects their daily activities. Ask students why it was more difficult to breathe through the straw while running in place than while sitting still.
6. Have students complete the *Venn Diagram* included with the *Student Data Page*, comparing and contrasting *Restricted Breathing* with *Unrestricted Breathing*. They may add to their Venn Diagram after they complete the investigation that follows.



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## II. Experimental Investigation

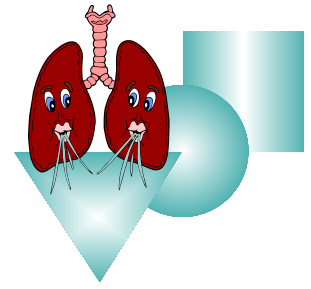
1. Now that students have experienced what it is like to breathe with obstructed or restricted airways, they will conduct an investigation to see how this type of disease might affect their performance on a simple cognitive test.
2. **Explain** that you will read a list of words at the rate of 1 word per second while students close their eyes and breathe normally (nose clips and straws should be on the paper towels on the desks). They will then have 5 minutes to write down as many words as they remember from the list that was read to them.
3. **Explain** that in the second part of the experiment, students will again place the nose clips and straws back in place and will breathe through the straws. They will close their eyes and listen to a second list of words, which you will read at the rate of 1 word per second. After removing the nose clips and straws, students will have 5 minutes to write down all the words they remember from the list of words that was read to them.
4. After you have **explained** the procedure to students, ask them to make an hypothesis reflecting how restricted or obstructed breathing might affect their ability to perform a simple cognitive test (remember a list of words). Students will write the hypothesis on their **Student Data Page**.
5. Ask students to identify the *independent* and *dependent* variables in this experiment and write them on the **Student Data Page**. [The *independent* variable in the experiment is type of breathing (restricted or unrestricted) and the *dependent* variable is the number of words recalled.]
6. Now you are ready to begin the experiment. Ask students to close their eyes and breathe normally. Read the **Unrestricted Breathing Word List** that follows at the rate of 1 word per second. When all the words have been read, have students open their eyes and give them 5 minutes to write as many words from the list as they can recall. They should write the words on their **Student Data Page** in the word box entitled **Unrestricted Breathing Words Recalled**.

### Unrestricted Breathing Word list:



Wet, Puddle, Umbrella, Thunder, Lightning, Clouds, Showers, Drizzle, Floods, Rainbow, Flowers, Spring.

7. Ask students to put the nose clips in place on their noses and put the straws in their mouths. When you are ready to begin reading the word list, ask students to close their eyes and breathe only through their straws. At the rate of 1 word per second, read the **Restricted Breathing Word List** that follows. When you are



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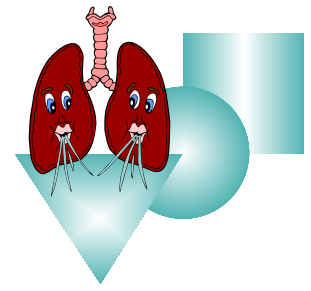
finished, ask students to open their eyes, remove the nose clips and straws and place nose clips and straws on paper towels on their desks. Give students 5 minutes to write all the words from the word list that they remember. They should write the words on their *Student Data Page*.

### Restricted Breathing Word list:



Ice, Wind, Sleet, Blizzard, Winter, Storm,  
Mittens, Icicles, Snowmen, Snowshoes,  
Freeze, Overcoat

8. Before proceeding with the lab, ask one student to take a container around the room so students can place their nose clips into the container. For sanitary reasons, instruct students **NOT TO HANDLE NOSE CLIPS USED BY OTHERS**. Put *disposable* nose clips in the trash can; collect *reusable* nose clips so they can be thoroughly cleaned in a dishwasher before reusing. Some suppliers include cleaning instructions with their reusable nose clips, be sure to review and follow their recommendations. (Note: If acquiring and/or handling the nose clips is a problem, the activity can be done by simply having students pinch their noses closed with their hands.)
9. Ask one student to take the trash can around the room so all students can place their straws and paper towels into the trash.
10. Help students process the results by collecting class data required to complete the *Student Data Page*. *It may be helpful to make a transparency of the data tables to help students place data in the correct spaces.*
11. Students may have added words to their recall lists that were not included in the original word list. For example, the word “*rain*” was left out of the first word list. Our brains tend to fill in what is perceived as “missing information” that would fit the pattern found in the other words from the list. The word “*snow*” was left out of the second word list and may be added to student recall lists for the reason just described. **Do not** mention this to students until after the experiment has been conducted. Once results are processed, it will be an interesting point of discussion to see if *restricted* breathing stress caused students to add the word to their recall list. If more students write the missing word in the *unrestricted* breathing list, it might be an indication that reduced oxygen to the brain affects the brain’s ability to recognize patterns.



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## Activity Management Suggestions:

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### Extension:

When gathering straws in various diameters, include coffee stirrers, cocktail straws, bendable straws and very large diameter straws as used in several fast-food restaurants. Have students investigate the effect of straw diameter on cognitive function.

### Activity References Used:

Farabee, M.J., (2001). The Respiratory System. Retrieved July 1, 2004, from Respiratory System Web site: <http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookRESPSYS.html>

Sherwood, (2004) Respiration. Retrieved July 1, 2004, from Lung Volumes Sherwood reading Chapter 13.

Web site: <http://csm.jmu.edu/biology/danie2jc/respiration.htm>

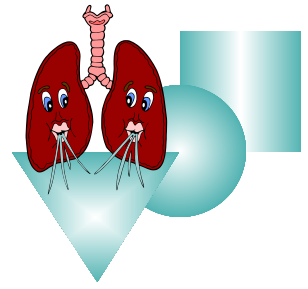
### Useful Websites:

American Lung Association [www.lungusa.org](http://www.lungusa.org)

National Heart Lung and Blood Institute <http://www.nhlbi.nih.gov/>

### UTHSCSA Faculty Advisor for this Activity:

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