**Particles in the Air – We’re Not Lichen It: A three-part program exploring the relationships with air quality, health and the environment.**

* Part I – Air Quality and You
* **Part II – Health Effects of Air Pollution**
* Part III – Lichens as Air Quality Bio-Indicators

**The following lesson plans are focused on Part II of the program – Health Effects of Air Pollution. Students will be introduced to the basic structure and function of the human respiratory system, expanded and enriched with lung dissections. Students will then explore and discuss how air pollution can affect the respiratory system. Respiratory diseases, such as asthma, allergies, chronic obstructive pulmonary disease (COPD), and lung cancer will be discussed.**

**Grade Levels:** Grades 5 and 6

**Subjects:** Science and Health

**Time Consideration:** Two 50 - 60 minute class periods, plus an optional 50 – 60 minute enrichment time for lung dissections.

**Colorado Department of Education Life Science Standards:**

* **Life Science Standard 2 (5th grade):** Human body systems have basic structures, functions and needs.
* **Life Science Standard 1 (6th grade):** Changes in environmental conditions can affect the survival of individual organisms, populations and entire species.

**Learning Objectives :** Upon completion of Part II: Health Effects of Air Pollution, students will be able to:

* Describe the structure and function of the human respiratory system, including nasal cavity, cilia, pharynx, larynx, trachea, primary bronchi, bronchioles, alveoli, lungs, pleura and diaphragm.
* Describe how air is exchanged in the body (taking in oxygen and getting rid of carbon dioxide) at the alveoli/capillary level.
* Expand upon concepts explored in Part I: Air Quality and You, and discuss how air pollution affects the lungs.
* Compare and discuss different respiratory diseases and conditions, such as allergies, asthma, chronic bronchitis and emphysema.
* Discuss how air quality and air pollution can affect the lungs and exacerbate the above respiratory conditions.

If you are interested in more detailed information about the lesson plans or Soaring Eagle Ecology Center, you may email Judy Viola at [seecatrfl@hotmail.com](mailto:seecatrfl@hotmail.com).

**Background Information:** The following resources contain excellent information for teacher preparation and review:

* **Khan Academy** free app from Apple. The free app can be downloaded onto classroom set of netbooks/computers or iPads if available. Click on **Science**, then **Healthcare and Medicine**. Click on **The Lungs**, and then **Lung** **Introduction.** Recommend previewing the following three videos: **Meet the** **Lungs, The Bronchial Tree, and The Lungs and Pulmonary System**. One or all of these videos can be used as tutorial videos for students to view before participating in the program.
* **National Jewish Health** has excellent materials and information on lungs, respiratory disease and medical conditions. Start at the following web address: [**www.nationaljewish.org/healthinfo**](http://www.nationaljewish.org/healthinfo)
* **KidsHealth.org** has good summary sheet reviewing Lungs and Respiratory System (see enclosed hard copy of summary). Go to [**http://kidshealth.org/teen/your\_body/body\_basics/lungs.html**](http://kidshealth.org/teen/your_body/body_basics/lungs.html)to print a copy.
* **American Lung Association** at [**www.lung.org**](http://www.lung.org)has information about lungs and lung disease.
* **Air Info Now** has an easy to understand animation titled **Lung Attack** that describes how lungs work and how pollution affects the lungs. Go to [**www.airinfonow.org/html/lungattack/lungplay.htm**](http://www.airinfonow.org/html/lungattack/lungplay.htm)to preview Lung Attack.
* **The Effects of Common Air Pollutants** poster (see enclosed hard copy) can be useful for teacher and student learning groups. Go to [**http://www.epa.gov/airnow/health-prof/EPA\_poster-final\_lo-res.pdf**](http://www.epa.gov/airnow/health-prof/EPA_poster-final_lo-res.pdf)to print a copy.
* **Science as Thinking** by Wendy Ward Hoffer is an excellent teacher resource for understanding and implementing inquiry instruction for grades 5 - 12.
* **Lung Dissections (Real and/or Virtual)** will follow the recommendations of the **NSTA Position Statement on the Responsible Use of Live Animals and Dissection in the Science Classroom.** Go to [**http://www.nsta.org/about/positions/animals.aspx**](http://www.nsta.org/about/positions/animals.aspx)to read the recommendations. It is important for teachers to offer students alternative activities for those who do not want to participate in real specimen dissections, such as acting as observers/recorders of lab information.
* **Proscope Mobile Handheld Microscope:** The ProScope Mobile is a wireless handheld digital microscope designed for use with iPad, iPhone and iPod touch. It has a high quality CMOS sensor and universal lens mount with 50x, 100x, 200x and 400x lenses.

**Lesson 1 - Health Effects of Air Pollution:** This lesson focuses on the structure and function of the human respiratory system. Although the lesson can stand alone, it is intended to follow **Part I – Air Quality and You** – of the three-part program**: Particles in the Air – We’re Not Lichen It.**

**Grade Levels:** Grades 5 and 6; can be expanded through Grades 7 and 8

**Subjects:** Science and Health

**Class Time:** 50 – 60 minutes

**Prep Time:** Approximately 20 – 30 minutes

**Materials:** The following materials are recommended for each student learning group:

* Respiratory System worksheet (see attached worksheet)
* Laminated poster of The Respiratory System for each group. Recommend poster published by Anatomical Chart Company.
* If available, physical model of lung for student reference
* Recommend one netbook/computer or iPad per group with Khan Academy free app downloaded

**Recommended Student Preparation:** In order to maximize learning time during class, it is recommended that students preview the videos selected by teacher – Meet the Lungs, The Bronchial Tree, and/or The Lungs and Pulmonary System from the Khan Academy (see information in Background Information).

**Student Learning Targets:** Student learning targets for today’s lesson:

* I can identify and label parts of the respiratory system.
* I can clearly state the main job/purpose of the respiratory system.
* I can explain the beginning process of gas exchange that occurs at the alveoli/capillary level.

**Lesson Plan:** Students will be working in cooperative learning groups with each group having access to the above materials. Inquiry-based instruction will be emphasized with time for teacher to confer with students in small groups.

* Introduce lesson with the following questions **(10 minutes**):
* What is the main job of the respiratory/pulmonary system?
* Does the respiratory system work with other systems in the body? How?
* Why is it important to know the different parts of the respiratory system?
* Using prior knowledge from previewing tutorial videos (Khan Academy) and information from respiratory system poster, students will research and complete respiratory worksheets **(25 – 30 minutes).**
* While students are working in groups (above), there will be a planned catch and release around gas exchange (oxygen and carbon dioxide) at alveoli/capillary level.
* Student learning groups share results with whole class **(10 – 15 minutes).**
* Students will have time to self-reflect in writing on three learning targets **(5 minutes).**

**Assessment:** There will be ongoing, informal student assessment while teacher confers with students. Students will complete respiratory worksheet on the structure and function of the respiratory system. The worksheets will be handed in at the end of the session.

**Lesson 2 – Health Effects of Air Pollution:** This optional dissection lab focuses on the structure and function of the respiratory system with a hands-on dissection activity using sheep or pig lungs.

**Grade Levels:** Grades 5 and 6; can be expanded through Grades 7 and 8

**Subjects:** Science and Health

**Lab Time:** 50 -60 minutes

**Prep Time**: Approximately15 – 20 minutes, plus additional time for purchasing and prepping sheep/pig lungs

**Materials:** The following materials are recommended for each student lab group:

* Lung Dissection worksheets (see attached dissection worksheet)
* Laminated poster of The Respiratory System for reference.
* Dissection kit (teacher may choose to remove scalpels)
* Nitrile disposal gloves (do not use Latex gloves), pair gloves for each student
* Eye safety goggles, one pair for each student
* Dissection trays
* Sheep or pig lungs
* Hand sanitizer and first aid kit available

**Recommended Student Preparation:** This dissection lab expands on Lesson 1 (structure and function of human respiratory system). The dissection lab is optional and can be omitted if there is not enough time.

**Student Learning Targets**: Student learning targets for today’s lab:

* I can describe the color and texture (feel) of the sheep/pig lungs.
* I can find the different parts of the animal’s respiratory system, including larynx, trachea, primary bronchi, bronchioles and alveoli.
* I will predict if a small piece of sheep/pig lung can float or sink in water and explain why my prediction was accurate or inaccurate.

**Lesson Plan:** Students will be working in pairs with each group having access to the above materials. If it is too expensive to purchase sheep/pig lungs for each dissecting group, teacher could demonstrate dissection for whole class; however, a hands-on, inquiry-based lab would enhance student learning.

* Introduce lesson by emphasizing safety guidelines for dissecting lab, as well as respect for specimen being dissected **(5 minutes).**
* Using the dissection worksheets, students will make prediction about whether a small piece of lung will sink or float in water and their reasons why **(5 minutes).**
* Teacher will guide students through the dissection and worksheet **(30 -35 minutes).**
* Technology Enrichment Activity: If available, teacher and students can use the Proscope Mobile (see Background Information) and iPads to magnify structures of the respiratory system using 50x to 400x lenses. Great for viewing trachea’s hyaline cartilage rings and alveoli **(10 minutes)**.
* Students will have time to self-reflect in writing on three learning targets **(5 minutes).**

**Assessment:** There will be ongoing, informal student assessment while teacher confers with students. Students will complete lung dissection worksheets that will be handed in at the end of the lab.

**Lesson 3 – Health Effects of Air Pollution:** This lesson builds on information and learning from previous lessons from Part I: Air Quality and You, and Part II: Health Effects of Air Pollution (structure and function of the respiratory system).

**Grade Levels:** Grades 5 and 6, can be expanded through Grades 7 and 8

**Subjects:** Science and Health

**Class Time:** 50 – 60 minutes, may need additional 30 – 40 minutes for poster completion and presentation

**Prep Time:** Approximately 15 to 20 minutes

**Materials:** The following materials are recommended for each student learning group:

* Rubric for Respiratory Disease and Air Pollution Poster Project (see attached rubric).
* Laminated poster of Diseases of the Lung for each group. Recommended poster published by Anatomical Chart Company.
* Effects of Common Air Pollutants poster that includes Air Quality Index (AQI) information first presented in Part I: Air Quality and You (see Background Information).
* If available, netbook/laptop for each group to use for research on respiratory disease.
* Brochures/pamphlets/information sheets on specific respiratory diseases, such as allergies, asthma, chronic bronchitis, emphysema, lung cancer, pneumonia, flu.
* Materials needed to create posters, such as poster paper, markers, etc.

**Recommended Student Preparation:** In order to maximize learning time during class, it is recommended that students preview **Lung Attack**, a short animated video highlighting how air pollution affects the lungs (see web address in Background Information).

**Student Learning Targets:** Student learning targets for today’s lesson:

* I can explain how pollutants in the air can affect the lungs and respiratory medical conditions.
* I can describe the relationship between the AQI numbers and the risks for people with and without respiratory disease.

**Lesson Plan:** Students will be working in cooperative learning groups with each group having access to the above materials. Inquiry-based instruction will be emphasized with time for teacher to confer with students in small groups.

* With students having already previewed **Lung Attack**, teacher will introduce lesson with the following question **(10 minutes):**
* Why is air quality critical (important) for people’s health?
* Each group will select a specific respiratory disease/condition and create a poster to describe the respiratory condition and illustrate how air quality can affect people’s lungs and lung disease. A rubric for the project will be given to each group **(30 -40 minutes).**
* While students are working in small groups, teacher will confer with the students.
* Quick sharing of finished group posters **(10 minutes)**. If more time is needed, this lesson may be expanded (especially for group poster presentations).

**Assessment:** There will be ongoing, informal student assessment while teacher confers with students. The poster/project rubric will be used as a planning guide for students, as well as an assessment tool.

**Attached Files for Part II: Health Effects of Air Pollution**

**For Lesson 1:**

1. Respiratory System Worksheet

**For Lesson 2:**

1. Lung Dissection Lab Activity

**For Lesson 3:**

1. Rubric for Respiratory Disease and Air Pollution Poster Project