

**Module:** It's a Fine Balance: Exploring Respiratory Function  
**Topics:** Respiratory system, compensatory mechanisms, scientific method, asthma, lung disease

**Overview:** This lesson is designed to take place onboard the Seattle Children's Science Adventure Lab, a mobile science laboratory. In this module students learn about normal lung function and the respiratory system and the body's response to disease or malfunctions in that system. Using the same equipment as scientists and physicians, students measure the oxygen saturation level in their blood, their heart rate using a pulse oximeter and their lung capacity using a respirometer. Students then measure these same parameters after adding slight resistance to breathing to simulate the effects of asthma. Students seek to answer the question, "How does the body adjust to keep the respiratory system in balance?" The curriculum seeks to not only paint a picture of how a healthy respiratory system works, but also address health behaviors or other factors that can cause lung or respiratory diseases. Another aspect is to promote understanding and develop empathy for students with lung diseases such as asthma.

Throughout the lesson, as part of the 5E Instructional Model, Science Adventure Lab instructors and classroom teachers serve as "facilitators" and "coaches," guiding students through the inquiry process.

**Grade Levels:** This module is appropriate for students in Grades 4-8.

**Time Required:** Minimum time required to complete this module is 60 minutes.

**Lab Equipment Used:** Respirometer, pulse-oximeter, biological models of healthy and diseased lungs.

**Health Issue:** This curriculum focuses on the normal function of the respiratory system and how the body responds to restore balance when something goes wrong – such as asthma, lung disease or another malfunction.

**Objectives:**

- To understand normal lung function as part of a healthy respiratory system, and explore the body's response to malfunctions or disease in that system.
- To develop the laboratory skills and knowledge required to conduct an experiment and test hypotheses.
- To expose students to authentic equipment and tools used by scientists and physicians.
- To empower students with the confidence that they can be successful in science and encourage them to pursue careers in science and healthcare.



# Selected State and National Academic Standards

Grade Level	<b>Washington State Science Standards</b>
4-5	<ul style="list-style-type: none"> <li>EALR 2: Inquiry F - A scientific model is a simplified representation of an object, event, system, or process created to understand some aspect of the natural world. When learning from a model, it is important to realize that the model is not exactly the same as the thing being modeled.</li> </ul>
6-8	<ul style="list-style-type: none"> <li>EALR 2: Inquiry E - Models are used to represent objects, events, systems, and processes. Models can be used to test hypotheses and better understand phenomena, but they have limitations.</li> <li>EALR 4: Life Science F: Lifestyle choices and living environments can damage structures at any level of organization of the human body and can significantly harm the whole organism.</li> </ul>

Grade Level	<b>Washington State Health and Fitness Standards</b>
4-8	<ul style="list-style-type: none"> <li>EALR 2: Component 2.2: Understands stages of growth and development. Understands the structure and function of body systems.</li> </ul>

Grade Level	<b>Washington State Math Standards</b>
4	<ul style="list-style-type: none"> <li>4.5.J Make and test conjectures based on data (or information) collected from explorations and experiments.</li> </ul>
5	<ul style="list-style-type: none"> <li>5.5.C Construct and interpret line graphs.</li> <li>5.6.J Make and test conjectures based on data (or information) collected from explorations and experiments.</li> </ul>
6	<ul style="list-style-type: none"> <li>6.3.A Identify and write ratios as comparisons of part-to-part and part-to-whole relationships.</li> <li>6.6.H Make and test conjectures based on data (or information) collected from explorations and experiments.</li> </ul>
7	<ul style="list-style-type: none"> <li>7.2.A Mentally add, subtract, multiply, and divide simple fractions, decimals and percents.</li> <li>7.6.H Make and test conjectures based on data (or information) collected from explorations and experiments.</li> </ul>
8	<ul style="list-style-type: none"> <li>8.5.H Make and test conjectures based on data (or information) collected from explorations and experiments.</li> </ul>

Grade Level	<b>National Science Education Standards</b>
4	<p><b>Science Standard A (Science as Inquiry)</b> All students should develop abilities necessary to do scientific inquiry and understanding about scientific inquiry <i>Fundamental concept:</i> Employ simple equipment and tools to gather data and extend the senses.</p> <p><b>Standard C (Life Science)</b> All students should develop an understanding of the characteristics of organisms, life cycles of organisms, and organisms and environments. <i>Fundamental concept:</i> Organisms have basic needs such as air, food and water.</p> <p><b>Science Standard G (History and Nature of Science)</b> All students should develop an understanding of science as a human endeavor. <i>Fundamental concept:</i> Many people choose science as a career and devote their entire lives to studying it. Many people derive great pleasure from doing science.</p>
5-8	<p><b>Science Standard A (Science as Inquiry)</b> All students should develop abilities necessary to do scientific inquiry and understanding about scientific inquiry <i>Fundamental concept:</i> Think critically and logically to make the relationships between evidence and explanations.</p> <p><b>Standard C (Life Science)</b> All students should develop an understanding of structure and function in living systems, and regulation and behavior. <i>Fundamental concept:</i> The human organism has systems for digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection from disease. These systems interact with one another.</p> <p><b>Science Standard G (History and Nature of Science)</b> All students should develop an understanding of science as a human endeavor, the nature of science, and the history of science. <i>Fundamental concept:</i> Scientists formulate and test their explanations of nature using observation, experiments and theoretical and mathematical models.</p>

