



Another Perplexing Pair...



Dear Teachers,

Thanks for your feedback. We're glad you're reading and thinking about the email. We want to take a moment to comment on a question about relevance. Although it might not seem that all the email content is directly related to what you are teaching, it *is* what the fourth and eight grade students are expected to know on the state exams. Even if you don't teach at one of these grade levels, you are helping prepare the students for the tests. Knowing what your students will be expected to do will help you guide them; you can see how your science units fit into the big picture.

In last week's email we looked at **breathing** and **gas exchange**. This week we will examine another concept that is often confused with breathing: **respiration**. In everyday language, **breathing and respiration** can be synonymous. When we enter the academic area of science, however, terms become more distinctive.

To review, last week we defined **breathing** as the active, mechanical process some animals use to draw in oxygen rich-air and to push out carbon dioxide-rich air. This is accomplished through the *respiratory system*, which consists of such structures as the lungs, the trachea, and the diaphragm. Clear so far? Ok, now it becomes complicated.

What is respiration? In science, **respiration** refers to the process where chemical energy is converted to other forms of energy (e.g., heat and motion energy in humans). This occurs in cells of *organisms* (living things).

Respiration is the same for most organisms: it's a slow form of burning. Think about what happens when carbon contained in substances such as wood, candle wax, or paper burns... It combines with oxygen, releasing energy (light, sound, heat, motion). Respiration is the same process: oxygen and high energy compounds containing carbon combine, releasing heat and motion energy (needed to carry on life functions).

Most organisms *require* oxygen for respiration, but oxygen is not *obtained* through respiration. (See last week's email for specifics about obtaining oxygen.) Only some animals have respiratory systems and, therefore, breathe, but *all organisms* respire.

What does respiration look like? For respiration to occur in cells, gas exchange has to take place

Oxygen has to get in, and carbon dioxide has to get out. How does this happen? Think of a candle burning in a jar. If you cap the jar, no oxygen can get in and the candle will stop burning. Cells that respire, therefore, have to allow passage; they have cell walls that allow oxygen in and carbon dioxide out.

What do students know about respiration?

Here are some ideas that may help you determine what your students understand about respiration. You may want to modify the activities depending on your class.

- In the early grades, the focus should be on energy. Questions can include:
 - ***What are activities that living things do that need energy?*** (This discussion should include both plants and animals. Children often hear about humans and energy; they need to relate it to all living things.) Correct responses may include: growing, developing, moving, eating (animals), making food (plants), getting rid of waste, playing, and working. Try to encourage responses that cover a variety of organisms
 - ***How do living things get the energy they need for these activities?*** Based on the Elementary Core Curriculum, it's enough for young students to understand that organisms need air and nutrients to live and thrive.
- In later grades, respiration can become the specific focus. Possible questions can be based on the background information provided in this email:
 - ***What is the process of respiration?***
 - ***How can we distinguish between the respiratory system and respiration?***

Why do I care about respiration?

Even if you don't find the topic utterly fascinating in its own right, it is important to the NYS Core Curricula.

- Intermediate Level Science Core Curriculum, Grades 5-8
 - *Standard 4, Major Understanding 1.1b*
 - The way in which cells function is similar in all living things. Cells grow and divide, producing more cells. Cells take in nutrients, which they use to provide energy for the work that cells do and to make the materials that a cell or an organisms needs.
 - *Standard 4, Major Understanding 1.2d*
 - During respiration, cells use oxygen to release the energy stored in food. The respiratory system supplies oxygen and removes carbon dioxide (gas exchange). [Note: The performance indicator 1.2 specifically refers to human systems.]

These understandings develop from concepts introduced in earlier grades:

- Elementary Level Science Core Curriculum, Grades K-4
 - *Standard 4, Major Understanding 1.1a*
 - Animals need air, water, and food in order to live and thrive.
 - *Standard 4, Major Understanding 1.1b*
 - Plants require air, water, nutrients, and light in order to live and thrive.

As we have seen in these email messages so far, science is *full of concepts* that are different from how those words are used in everyday conversation. Do you have any questions about such concepts? Any comments or questions about this topic? Any ideas for future email topics? Contact us!