



## *Another Perplexing Pair...* **Breathing and Gas Exchange**



This week we're going to look at **breathing** and **gas exchange**; an upcoming email will deal with a related and even more perplexing pair: **breathing** and **respiration**.

When considering **breathing** and **gas exchange**, a complication arises from New York State. Although we're going to look at an elementary document, it's important for all teachers of science to know what their students tackled in earlier grades.

### **What do the New York State Standards say?**

Elementary Core Curriculum states:

Performance Indicator 1.2: Describe the life processes common to all living things.

Major Understanding

- 1.2a Living things grow, take in nutrients, breathe, reproduce, eliminate waste, and die.

Young children know about breathing; they breathe. It's easy for them to assume that everything breathes. While we try to keep concepts understandable for young students, we must be careful that we do not simplify ideas so much that they become scientifically inaccurate. We believe that the Core Curriculum was trying to make the point that all living things *need* oxygen<sup>1</sup>. To obtain oxygen, though, all organisms do not *breathe* as humans do. That's an important distinction even for young students. Let's see what scientists working with CRSEP have to say on the subject:

- Mammals (including humans), birds, frogs, alligators, and turtles are all examples of animals that breathe. These animals have cavities in their bodies into which they draw oxygen-rich air and out of which they push carbon dioxide-rich air. This is an active, mechanical process.
- Fish have no such cavity. Water flows over the gills propelled by the movement of the external structures of the gills. The gas exchange of oxygen and carbon dioxide occurs at the *surface* of cells on the *internal* surface of the gills.
- Flowering plants and insects have holes (stomata and spiracles, respectively) that lead into spaces in their bodies. Gas exchange occurs as air *diffuses* in and out of these spaces, much as air moves in and out of an open window on a calm day.

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**Breathing** is the active, mechanical process some animals use to draw in oxygen rich-air and to push out carbon dioxide-rich air.

**Activity (Formative Assessment):**

When starting to teach a life science unit, it can be worthwhile to determine your students' beliefs about life processes. The simple question, "**How do we know if something is alive?**" can be asked at any level, with varying responses considered correct. Since this is designed as formative assessment, however, we do not suggest you use this time to teach. Let students feel free to express their understandings. Record responses and refer back to them as learning occurs.

- **At the K-4 level**, it is very likely that responses will include such ideas as breathing, moving, eating, and growing. In order to ensure understanding of students' beliefs, ask students to explain their answers. For example, if a student simply states, "breathing" as a proof of life, we can't be sure if this is a reference to mammal's lungs or to the more general idea of needing oxygen. A follow-up explanation clarifies the student's thinking for the teacher.
- **At upper levels**, students might list specific life processes: growth, development, respiration, transport, regulation, excretion, synthesis, nutrition, and reproduction. Again, an explanation would help determine if the student understands the concept or just knows the vocabulary.
- To combine last week's email and this one, put the names of a few organisms on chart paper (e.g., tree, fish, dog). Ask the students to record answers to the following questions:
  1. Is it alive?
  2. Does it breathe?
  3. How do you know?

*For some topics, in some cases, short answers may be all that are needed to assess student understanding. With formative assessment, however, making assumptions from responses can lead to misinterpretations. Also, encouraging elaboration will help determine more of what students know. Even if the answer seems wrong on the surface, there might be some scientific truth behind it.*

We'd like to hear your students' responses to any of the activities in these emails. If you care to share them <mailto:crsep@schenectady.k12.ny.us> .

<sup>1</sup>With the exception of a very few anaerobic organisms.

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