

## Category V Life Science Examples

### Encouraging students to explain their ideas

#### Food for Plants

In *Food for Plants*, a middle school unit that targets the key idea that "plants use the energy from light to make sugars from carbon dioxide and water" (American Association for the Advancement of Science, 1993), students are presented with a seed and a log and are asked to discuss in small groups how a seed grows into a huge tree (*Teacher's Guide*, p. 7). Then, *each* student is asked to write his or her own ideas about how a seed grows into a tree (express ideas), draw a sketch that shows how they think this happens (represent ideas), and how their idea is different from someone else's in their group (clarify ideas) (*Student Book*, pp. 6-7). The writing activity is followed by a whole-class discussion.

The *Teacher's Guide* includes descriptions of common student responses and suggestions to help the teacher provide explicit feedback to students, including advice on how students can develop their ideas further (*Teacher's Guide*, p. 8).

### **ACTIVITY THREE: THE SEED AND THE LOG**

**Materials:**

- One large-sized tree log or branch for each group
- A seed of that same tree type for each group (pine works well because the seeds are especially small and pine trees are quite common in many communities)
- Paper towels for clean up
- (Optional) Large photographs of that tree type or a smaller picture for each group to look at

**A Possible Teacher Narrative:**

**FRAME:**

Read or talk about ideas in paragraph 1, p. 5.

“Each group will receive seed and a log. Your group’s job is to examine the seed and the log and to come up with your ideas about how this tiny seed can change into a huge tree. Scientists use the word HYPOTHESES for the ideas that we are not sure about yet. These hypotheses are ideas that we need to examine more closely to see if they are true. So what are your ideas, your hypotheses, about how a seed grows into a huge tree? Where does all the material that makes up a tall tree come from? As a group, try to come up with as many different ideas as you can.”

**ACTIVITY:**

Allow about 10-15 minutes for students to talk.

“Now you have three tasks to complete by yourself to help you reflect on the ideas that you have discussed. First write down your ideas about how a tiny seed can become a tree.

“Next draw a sketch that shows how you think this happens.

“Finally write how your idea is different from someone else in your group.”

**REFLECT:**

“How many different hypotheses did we come up with? Let’s hear some of them.”

### ACTIVITY THREE: THE SEED AND THE LOG

There are lots of possible questions about plants that we could explore together. Some of you wondered about how trees get so big. How do they get their food to grow so big? How can a tiny pine tree seed grow into a huge tree with a large trunk and many branches? How does it grow those rings? Trees must use food to grow like that. But how does the tree get its food?

#### Seeds and Tree Trunks

Look at some tree seeds and at a piece of a tree trunk. How does such a tiny seed grow into a huge tree with a trunk and branches and needles (or leaves) and many roots?

What are YOUR ideas (or hypotheses) about how a TINY seed can change into a HUGE tree? Where does all the stuff in the tree trunk come from?

Talk with your partner or group about your ideas. Listen to their ideas.

1. Then write down your ideas about how a tiny seed can become a huge tree:

---

---

---

---

---

---

---

2. Draw a picture showing your ideas about how a tiny seed can become a huge tree:

3. Tell how your ideas are different from someone else in your group?

---

---

---

---

---

---

---

## THE SEED AND THE LOG

### **Common Student Responses and Suggested Teacher Actions:**

•*Some students will have difficulty getting beyond, “the seed grows.”*

Students need support and encouragement to go beyond the descriptive level (the seed grows into a tree) to the explanatory level (how does a seed grow into a tree?).

Once someone in the group generates an idea, this will often stimulate other ideas.

The teacher can also help by encouraging students to “use your scientific imagination. Imagine you are shrunk down like the kids in Honey I shrunk the kids and you could get inside of that seed. What is going on inside the seed that enables it to grow into a tree?”

The teacher can ask questions like: Clearly there is a lot more stuff (matter) in the log than in the seed. So where did all that stuff come from?

•*Some students will become fascinated with the rings and focus their discussion on how the rings are made. They will make reference to the idea that the tree grows a new ring each year and that you can tell how old a tree is by counting its rings. However, they do not usually have many explanations of how a new ring is created each year.*

•*Very few students will think about unseen processes going on inside the seed or the tree trunk. A few students may wonder about what is going on inside the seed and how water and light helps it grow. However, the typical pattern of thought is that the seed soaks up the water and the sun that the tree needs to grow. They do not usually think about food being stored in the seed or about the embryo inside the seed.*

### **Additional Teacher Resources**

*Private Universe Teacher Workshop Video #2: Lessons Pulled from Thin Air.*  
Available from the Annenberg/CPB Math and Science Collection.

This video shows teachers and students wrestling with the seed and the log problem. Where does all this matter come from? Student misconceptions are explored, and content issues for teachers to consider are addressed. In particular, there is a focus on how the source of the matter that the log is made of comes primarily from carbon dioxide in the air. In contrast, the student in the video is convinced that the material in the log comes primarily from the soil.