

Within the Cell

Scene: The Tiniest Food Factories

Setting: After classes have ended, Aviv, Jalen, and Xio are in front of their school, trying to decide what to do this afternoon.

Aviv: Hey, do you want to go visit the world's tiniest solar-powered food factory?

Jalen: Now? Where?

Aviv: Sure.... it's right behind the library.

Xio: What? In the school garden? Since when is there a factory there?

Aviv: Let's go check it out. Farmer Raquel may still be there with the Green Team.

Narrator: The friends walk to the garden. The gardening teacher, Farmer Raquel, is nearby, collecting fallen leaves for the compost pile.

Xio: OK, I give up. Where is your tiny solar-powered food factory?

Aviv: Right here, and here, and here. All around us. Millions—maybe billions—of them!

Jalen: Yeah, right. Are you in some alternate reality, dude? I don't see anything.

Aviv: Just because you can't see them, doesn't mean that they're not there. They're so small, they're microscopic. What we need is a microscope and a... uh... specimen.

Jalen: Raquel, we need help! Aviv's talking about spacemen.

Xio: Sheesh, Jalen. Aviv said SPEHS-uh-mun. Specimen. A sample. But of what?

Aviv: [grabbing a small onion from the basket held by Raquel, who came over to see what was happening] How about this? We can use onion skin.

Xio: Oh, I get it! You're talking about plants! I never thought of plants like that, but you're right—plants are literally solar energy plants, solar energy factories.

Jalen: That's confusing! Plants are...energy plants? Huh?

Aviv: Well, actually, I don't mean the whole plant. The real factories are the millions of cells that make up each plant. Each cell is a tiny machine that takes in air, water, and sunlight and turns it into fuel.

Jalen: Fuel? Do you mean biodiesel?

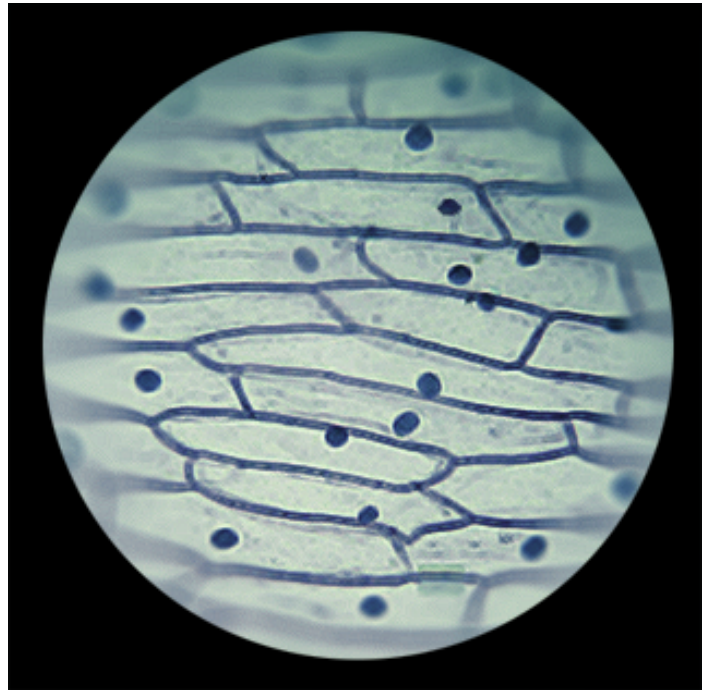
Aviv: No, not that kind of fuel. Fuel like food. Plants have been doing this as long as they've been around. Is that about right Farmer Raquel?

Raquel: Absolutely! Plants make their own food and energy. Their cells power themselves, using energy from

the sun—solar power. So a plant cell really is a tiny solar-powered food factory. Humans have never invented any kind of nanomachine as cool as the cell, the basic unit of all life. Here, let's take that onion into the shed to take a closer look.

Narrator: Farmer Raquel helps the three friends mount a thin piece of onion skin onto a slide and then look at it through the microscope.

Raquel: Look closely. What do you see?



Xio: It looks like a strange brick wall.

Raquel: Each "brick" is a cell. But there are walls in there. The thick line around each plant cell is a cell wall. Just inside, too thin to see, are the cells' membranes.

Jalen: The cells have some kind of brains?

Raquel: Oh, no, not brains but membranes. A very thin boundary between the inside and outside of any cell. It's like a wall, but thinner and more wiggly.

Aviv: Oooh! I see dark dots. Looks like there's one on each cell.

Raquel: Those are the nuclei. Each dot is the nucleus of one onion skin cell. It's the closest thing the cell has to a brain. The nucleus is the control center, and it houses the cell's DNA.

Cells Teaming Up

Scene: A Team of Cells (continued)

Jalen: Thanks for showing us all this, Raquel. But Aviv: why did you drag us to the garden to tell us about cells being factories? We have cells too. Right here. Inside us. Trillions of them!

Xio: Our cells are different, though. I'm no vegetable.

Aviv: Yeah, animal cells don't use sunlight to make energy the way that plant cells do.

Raquel: That's right. Plants are self-sufficient, meaning that they can take care of all their own needs. Plus we let them take care of our needs, too! Animals (or more to the point, their cells) require energy that they get by breaking down the starches and sugars that plants make.

Jalen: So our cells don't look much like what we're seeing in this microscope, then?

Raquel: Cells of all living things have some of the same parts, and some different.

Xio: Oh right, plant cells have those little green things. Color-somethings.

Aviv: Close! I think you mean chloroplasts—they are like the solar panels in my solar-powered factory, making energy for the cell to use.

Jalen: Sounds like we're the freeloaders here. The plants do all the work, and we just eat them all up!

Raquel: Biologists use the word "consumers" instead of "freeloaders", but, yes, you have the right idea. Plants are the producers—they make food for themselves and others—the consumers— eat plants (or they eat things that eat plants.)

Xio: But we make stuff the plants need, don't we?

Raquel: Absolutely! Look at that huge tree over there: about half of its total mass is carbon. All that mass comes from the carbon dioxide in air! Plants use the carbon dioxide we and other organisms release to build their roots, shoots, fruits, and leaves.






Jalen: All this talk of fruits and vegetables is making me hungry. Can we have a cherry tomato before we catch the bus, Farmer Raquel?

Raquel: Certainly! I'm not going to get in the way of what you and your hungry cells need.

Comprehension / Discussion Questions


Respond in writing to the questions, then compare and discuss your answers with someone else.

The Merriam-Webster Dictionary defines "factory" as:
a building or set of buildings with facilities for manufacturing
the seat of some kind of production

-  What meaning do you think more closely overlaps with the way Aviv uses "factory" to define a cell?
-  Draw a simple sketch of some of the parts the students see in the cell when they put the onion specimen under the microscope.
-  What do plant cells use sunlight to do?
-  How does Raquel describe plants' use of sugars?
-  What are some differences between plant and animal cells?

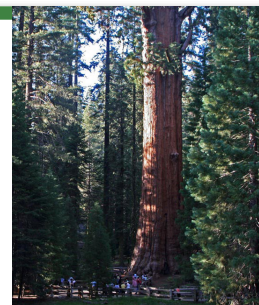
Turn and Talk

Discuss your response to this question with a partner.

-  What's the difference between consumers and producers? How is that difference reflected on a cellular level?

Misconceptions

Many people believe that trees get all they need from the soil around them. It is a common misconception: a way that people think about the world that doesn't match scientific fact.



List some ideas about cells and plants that you know are true. Then list some ideas that are false but believable: misconceptions you think your friends may have, or misconceptions you used to have. Read them in a random order to your neighbors and see if they can tell which ones you meant to be true.

Explain how the world's largest tree, the General Sherman giant sequoia, grew from a seed about 5 mm (0.25 inch) long, to a tree nearly 95 meters (311 feet) tall, a base of 103 feet (31 meters) around, weighing over 2,000 tons.