Lesson: “Why do trees grow so tall?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

In the summer of 2006, a group of scientists were out on a hike in California and found something really surprising. They came across this tree that was absolutely enormous, way bigger than anything else they'd ever seen. And when they looked up, they were shocked. This tree soared into the sky, way higher than the others around it. It rose 380 feet into the sky. This is as tall as a 38-floor building. It turns out to be the tallest living thing in the world. This tree, a California Redwood, even was given its own name, Hyperion, after one of the Greek gods. Trees are by far the tallest living things on Earth. Adult human beings are on average about five or six feet tall. The tallest animals today are giraffes, and they're only about 20 feet tall. And even the tallest dinosaur, the brachiosaurus, was only about 56 feet tall. The Hyperion redwood tree was about seven of these dinosaurs stacked on top of each other. Most trees are not as tall as Hyperion, but they're still taller than the tallest animals. Why do trees grow so tall? Where are they going? Let me show you our first clue. I'm going to show you something scientists discovered while studying how plants grow. We planted two seeds. The seed on the left we're going to keep in the light, and the seed on the right we're going to keep in a dark box. We'll give them both water. After four days, we opened up the box covering the dark seed, and we put them back together again to compare. And we see that both seeds have sprouted. Now, that shouldn't surprise you because all the seed needs in order to sprout roots is some water. We

learned that in the last Mystery. But what will happen if we wait longer—say, two weeks? What do you think will happen to the one in the dark compared to the one in the sunlight?

EXPLORATION VIDEO 2

All plants need sunlight to survive. So, obviously, when we open the box with the one in the dark, it's going to have gotten nowhere, all shriveled up and totally dead—wait. What? The one in the dark grew taller than the one in the light. Was this a fluke, some kind of accident? Just to make sure, we repeated the experiment, and the same thing happened. The one in the dark grew taller. Here you see it on the left. The one in the light is a little bit shorter. Why would the plant in the dark have grown taller than the one in the light?

EXPLORATION VIDEO 3

Now, just in case you thought, well, maybe plants don't need light at all, I'll show you what happened to the plant in our experiment after just a few more days. The plant in the dark is now dead. It shriveled up. So, yes, plants do need sunlight to survive. Still, it's surprising that the plant in the dark grew taller than the one in the light. Why is that? Maybe if when we did this experiment we had just added a little bit of light for the plant in the dark, something will happen that will give us a clue. So, let's repeat the experiment. Okay, this time, for the seed that's going to be in the dark, let's cut a small hole in the box so that just a little bit of light gets in. Then let's check on it two weeks later. Ready? Here we are two weeks later. Look at what happened. You see this? The plant seemed to be growing towards the light. It's grown upwards, and then through the hole that we cut towards where the light was. So, it seems like the plant can detect where light is and find it. This was all a big clue to what our plant in the dark was doing. The plant in the dark got taller because it was searching for light. Growing taller was the plant's last

fight to survive. Just like a starving animal might use the last of its strength to reach out for food, this plant is reaching for sunlight. If it doesn't find the light soon, it will die, just like the one in our earlier experiment died after a few more days in the dark. Now, there's actually one more really interesting thing to notice here. The plant kept in the dark never really got green and grew any leaves. Its leaves were, at best, just these little shriveled-up things. But the one in the sunlight, instead of growing taller, it turned green and grew a couple of nice leaves. Here are some seeds again, the ones on the left grown in the dark and the ones on the right grown in the light. Now, once a plant does get light, notice what happens. You see those? The ones in the light started growing leaves. As soon as a plant detects light, it grows leaves to soak up as much light as it can. Leaves are a plant's sunlight collectors. See the sunlight shining down on these two leaves? They're soaking up the light. I'm going to show you one last video, which will help you see how badly plants want sunlight. This is a sped-up video of plants over the course of one day. Do you see the leaves moving? Why do you think the leaves are moving like this?

EXPLORATION VIDEO 4

You just saw how a plant turns its leaves so that they're facing the sun at all times while the sun is out. Leaves are a plant's sunlight collectors. Sunlight provides the warmth and energy that a plant needs to grow big. As plants get bigger, they grow more leaves to capture more sunlight. Some plants are very careful about where they grow new leaves, so that their leaves don't overlap existing leaves and cast shadows on each other. This results in all sorts of beautiful patterns, such as this plant, which lives in the mountains of South Africa. Notice how every single leaf is capturing sun. Now that's a good solution for a single plant to get the most sunlight, but what about a bunch of trees all growing near each other? As they grow, they might start to shade each other.

EXPLORATION VIDEO 5

In a forest, the trees are all growing as tall as they can. The taller a tree grows, the more sunlight it can get and the less chance that another tree will cover it in shadow. That's why trees grow so tall and put most of their leaves up at the top. They want the sunlight. Next time you're in a forest, notice how few patches of sunlight there are peaking through the tops of the trees. It's actually really dark on the floor of a dense forest. We call the top part of the forest the canopy. Think of it as the roof of the forest. Up above you in the canopy, each tree has grown branches and put leaves wherever there is a spot of sunlight. That's why it's so dark. The trees have worked hard to grab almost every bit of sunlight, creating one big zone of darkness on the forest floor. So, in summary, plants need sunlight to survive. They'll search for it after sprouting. And when they find it, they grow leaves to collect the sunlight. They arrange and even move their leaves to collect as much sunlight as possible, and then they'll use whatever chances they get to hog all the light they can from their neighbors, like trees, which grow as tall as they can.

EXPLORATION VIDEO 6

It's important to understand that plants need light. But don't forget that plants also reach underground with their roots, into a world of darkness, where you can't see what they're up to. Here at Mystery Science Labs, we made a Root Viewer that lets you see into the secret root world. So, what's been happening over the last week in that secret world? This is the Root Viewer that we made. It was five seeds placed on a wet paper towel, with the Viewer placed on end, just like you see here. Let's get a closer look. Here's what one of the seeds looked like on day one, the day we made our Root Viewer. And now, here's day two. The root had started to grow. By day three, the root had grown even longer. And notice, you can also see lots of those

fuzzy threads. Do you remember what they're called? Root hairs. They're the part of the root that actually soaks up the mineral-rich water from the dirt. Now, check this out. Let's back up again to day two. I want to show you something. So, this is a close-up of the seed on day two. Do you notice anything surprising? When you look closely, you can see that this seed had been pointing upward. See how the root started to come out of the top? But then, the root curved around and grew downward where it needs to be if it's going to find water. Isn't that weird? It's as if the root knew which way was down. We wondered, what would the root do if we now turned it so that it was no longer growing downwards? Can a root really sense which way is downwards? So, in order to figure this out, we took the Root Viewer, which all this time had been pointed in this direction, and we turned it on its side so that now the Root Viewer is pointing this direction. Now each root, which had been growing downwards, is pointing sideways. If the roots really can sense which way is down, what do you think will happen now? Let's wait one day and see. You ready? Day four. Whoa. You see that? The roots figured out which way it was down again. They started growing downward. So, plant roots really can sense which way is down. And you can change the direction they're growing by turning them as they grow.

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to make one of these: a Grass Head! You'll use what you learned about plants to make your Grass Head's hair grow in the direction you want it to grow. Like, do you want the grass hair to grow straight up, like this? Or do you want it to grow pointing swept back, like this? You'll get to choose. But first, you need to make a Grass Head and give it about a week or two to grow. So I'll walk you through the process now, step by step.

ACTIVITY STEP 1

Get your starting supplies. You'll get more supplies later. When you're done with this step, click the arrow on the right.

ACTIVITY STEP 2

Fold one edge of a paper towel up two inches. Then, fold it into a strip, like this.

ACTIVITY STEP 3

Roll the strip around a popsicle stick. Then, put a rubber band around it, like this.

ACTIVITY STEP 4

Use the other paper towel to cover the roll, like this. And then put a rubber band around it, like this.

ACTIVITY STEP 5

Now it's time to draw a face. You choose what it looks like. I'm going to draw a silly face.

ACTIVITY STEP 6

Get your final supplies. You'll share the water and seeds with other students.

ACTIVITY STEP 7

Okay, dip the head into water. And before taking it out, let it drip in the cup for a bit. Then, keep it over your plate to catch any more drips.

ACTIVITY STEP 8

Dip the wet head into the seeds. Make sure seeds are stuck on everywhere you want hair to grow. Work over your plate to catch any falling seeds.

ACTIVITY STEP 9

The next step is a tricky one. Work with the person next to you.

ACTIVITY STEP 10

Watch this whole step before you touch anything. You'll open the sock likeness and have your partner put in the head, just like this. Then you'll add a rubber band. Now, you may have to adjust some seeds that were knocked out of place, like this.

ACTIVITY STEP 11

In a minute, you'll have a choice to make. While your Grass Head is growing, it can be in one of these three positions. It can be lying on its back, standing up, or lying face-down.

ACTIVITY STEP 12

Make some predictions as a class. Which way do you think your Grass Head's hair will grow if it's lying on its back, standing up, or lying face-down?

ACTIVITY STEP 13

Choose a position for your Grass Head. Then, fill in the top of your worksheet.

ACTIVITY STEP 14

If you want your Grass Head to stand, put it in a cup. To have it lie down, put it on a plate.

ACTIVITY STEP 15

Now your teacher will add water and put them in a sunny window. Make sure they stay wet throughout the week. It will take one to two weeks for the grass to grow. Good luck!