Lesson: “How could you make the biggest fruit in the world?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hi, it's Doug! When I was eight years old, my dad came home from work and presented me with a little packet of these. "These are pumpkin seeds," he said. "We're going to plant one of these seeds in our garden, you and me." But these weren't just any pumpkin seeds. My dad had grown ordinary pumpkins before; I'd seen them in his garden. Now, if you didn't know this, pumpkins grow on vines like you see here. And like any plant, they need sunlight, and pumpkins need to be watered every day. So when we planted one of the seeds from the packet, we gave it water every day, just like we were supposed to. Soon, we planted it in the garden. But the pumpkin from my dad's packet of seeds grew, and it grew and it grew, eventually getting this big. This was getting crazy. I'd never seen a pumpkin like this. And I knew something about pumpkins. You see, I grew up in a town called Sycamore, Illinois. And in Sycamore, we're all a little bit crazy about pumpkins. Every year, the town has a pumpkin festival where we decorate and display pumpkins on our courthouse lawn. Our city flag even has a pumpkin on it. "Dad," I said, "We should take our giant pumpkin up to the courthouse." My dad got a big smile. "You read my mind," he said. "You see, that was my goal all along. I knew how big this pumpkin would grow." "You did?" I said. "Yep. Remember the seeds I bought?" he said. "Those weren't just ordinary pumpkin seeds, they were a special variety of pumpkin called giant pumpkins." Whoa. "Wait, there are different kinds of pumpkins?" I asked my dad. "Oh, yeah," he explained,

"just like there are different varieties of apples at a grocery store." Now, as it turned out, my dad had heard that there would be a giant pumpkin competition that year at the Sycamore Pumpkin Festival, and he thought we should give it a try. By the time it had finished growing, it was really so big that neither of us could possibly lift it up. I couldn't even fit my arms around it. We had to get some of my dad's friends to come over so that they could all lift it together and carefully load it in the back of a truck. We won that year. It weighed 200 pounds, the largest pumpkin in Sycamore for the year 1988. I was so proud. I even have a trophy from it still to this day. How did there come to be such enormous, gigantic pumpkins in the first place? As you might guess by now, if you've learned about selection, it all started with an original regular-sized pumpkin. Using the process of selection, plant growers—people who grow plants—have over time created new varieties of pumpkins, some of which are bigger and bigger. My giant pumpkin, at 200 pounds, is not the largest pumpkin ever, not even close. In the time since I grew my giant pumpkin in 1988, these days, you can buy seeds for a pumpkin variety that will grow to be 2000 pounds. That's the same weight as a baby elephant. That means that giant pumpkins are now officially the largest fruit ever. This is the first time anyone has tried to make a fruit so gargantuan. But it's definitely not the first time that plant growers have tried to make fruits bigger in general. Size is actually one of the most common traits that plant growers use selection to try to improve. But here is one of my favorite examples of people changing plants. This is a painting from about 400 years ago. Can you tell what that is? You might not even recognize it, but these are watermelons. Getting to see the old painting is almost like getting into a time machine and going back in time. It gives you a glimpse at what watermelons used to look like before we used selection to create the watermelons we grow today. Back 400 years ago, there wasn't as much of the watermelon that you could actually eat. Most of it was that white rind part, which doesn't taste very good. Watermelons today, you can eat all of the insides. It's so tasty, it's one of my

favorite plants to eat. What about other fruits and vegetables? What did these look like before selection? You might not recognize this little fruit, maybe you think it's a cherry. Nope, this is the original wild version of a fruit you know well. Let's see what it looks like today, after we've done selection on it to make it bigger. It's a peach. So the original wild peaches used to be much smaller. Or here's a vegetable you know. I doubt you can recognize it in its original wild form here, but let me show you what it looks like today, after we've done selection on it to make it bigger—it's corn. Isn't that crazy? plant growers have created different varieties of almost every fruit and vegetable you'd see in a store. There really isn't a single plant that we grow that is anything like the original, natural version of that plant. We've changed all of them through the process of selection. So now just for fun, if you were to become a plant grower, and you could use selection to create a giant variety of any plant, which one would you choose to make bigger?

EXPLORATION VIDEO 2

Selection doesn't just have to be for plants that we eat. We can use selection to change any plant to be something we want more. Consider plants we enjoy just for their beauty, like cut flowers, the kind you might buy for one of your parents on a special day. These are roses, one of the flowers most admired for their beauty. Now in the wild, the original, natural rose looks like this. So basic. It's so simple. Can you see what we've changed about the rose? Count the number of petals, and you'll see what's so different. The wild, natural rose only has five petals. But thanks to the process of selection, roses today look like this. They have dozens of petals. If you pick and count all the petals, there's as many as 45 petals on a modern rose. Now how did plant growers do that? Well, the process of selection is possible because of two important facts. Take these pumpkins, for example. They all came from the same parent pumpkin. But no two

individual babies of a parent have exactly the same traits. The only reason someone was ever able to make a variety of giant pumpkin was because no two pumpkin brothers and sisters are exactly the same. You can see here one of them is different. There's always at least one pumpkin that's slightly bigger than all its sibling pumpkins, and so that's how they were eventually able to make a giant pumpkin variety. And with our rose example, the same fact is true. Wild roses almost always have five petals, but occasionally there's a rose that has fewer than five petals, like a four-petaled rose. And there's sometimes a rose born that has more than five petals, like a six-petaled rose. So we can summarize this fact by saying no two individuals are exactly alike. There are always small differences. That's the first fact to remember about selection. The second fact is that babies usually get most of the traits of their parents. In science, we say that they inherit the traits of their parents. So with that slightly bigger pumpkin, if you planted any of its seeds, most of the new pumpkins that grew from its seeds would also be slightly big, just like their parent pumpkin. These new pumpkins inherited their parent's larger size. Or with our rose example, if we go out and look for only those roses that have six petals instead of five, and we make sure to create new rose seeds from just those six-petaled parents, then the babies will tend to have six petals too. And now we can start the process all over again. Because remember the first fact. No two individual babies are exactly alike. Most of them will have six petals, but now some of them might grow up and have seven petals. So that's where the idea of selection comes in. It's plant growers who carefully watch for little changes in traits, like number of rose petals, and then only select those roses whose traits they want. After years of doing this over and over, growers have managed to get roses that had eight petals, and then nine petals, and then 10 petals, and so on, eventually reaching the 45-petaled roses of today that are sold in flower shops. You can really see how using the process of selection we've managed to change natural wild plants into the new varieties of bigger, better plants that we use

for food and beauty. There's really not a single natural plant in our stores. All of them have been changed by the process of selection, where we've made them bigger or tastier or more beautiful. We can use selection to improve any trait that a plant has. So now stop and think for a moment. If selection can be used to improve any trait of a plant, not just its size, what's a trait you might change about your favorite fruit?

EXPLORATION VIDEO 3

Because plant growers can use selection to change any trait of a plant, it means we've created a lot of different varieties of fruits and vegetables. Not only are there the round, orange pumpkins that you're probably used to, but plant growers have also created, as you saw, a giant variety of pumpkin. But that's not all. If you ever visit a pumpkin patch, look for some of the strange varieties that have been created too. Like this white ghost pumpkin. Or blue pumpkins. Or striped pumpkins. Weird warty pumpkins. Or even this crazy multicolored pumpkin. In total, plant growers have created over 100 different varieties of pumpkins. Plant growers can make the varieties of a plant look so different from each other that it's sometimes hard to believe they're still the same basic thing. These are all still pumpkins. All pumpkins started out from the same original wild pumpkin, which is thought to have come from the country of Mexico long ago. When you look more closely at any two pumpkin varieties, even though they might be very different in one or two traits, like color or shape or size, they've kept all their other original traits. So if they came from the same original wild fruit, they'll still have lots of traits in common. For example, when we cut them in half, you can see their insides are still similar. There's a thick outer skin and a hollow center that's filled with lots of seeds. And look at the plants themselves. Whether it's a classic orange pumpkin on the left or a ghost pumpkin, their leaves all still look very much the same. And their flowers do too, as you can see in these side-by-side

comparisons. So even though they're varieties of pumpkin, you can see all this evidence of the fact that they were long ago made from the same original pumpkin. This might come as a surprise, but if you've ever eaten squash before, well, have a look at squash when we cut it open. Does that look familiar? And here's the leaves of a squash plant. If you don't remember, here's the leaves of a pumpkin plant. Here's the flower of a squash plant. Compare it with the flower of a pumpkin plant. That's the surprise for you. Squash isn't really its own thing. By seeing its similarities with pumpkins, I can let you in on a little secret. Squash is just one of the one hundred pumpkin varieties. It, too, was created from that same original wild pumpkin that's thought to have come from Mexico so long ago. So pumpkins and squashes are just two different varieties of the same fruit. Just like how a Red Delicious apple and a Granny Smith apple are both apples. It's just more surprising with squashes and pumpkins, since we call them by such different names. But we could have called squash anything, really. Like long pumpkin, or maybe a better name for it would have been nose pumpkin. Whatever you call these, they're both varieties of the same fruit. In fact, everything you see in this picture, are all varieties of pumpkins. Isn't that crazy? There are such different colors and shapes, but inside they all look similar. So what do you think? Are there any other plants in our lives that turn out to be varieties of the same thing? You know, two fruits that seem different from each other, but actually came from the same original wild plant? There are a few more surprises. See if you can figure them out in today's activity.

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to play a game called Odd One Out. First, I'll show you the outside of three different fruits, like you see in the example here. You'll take a guess about which two you think are related. Then I'll show you the inside of those same fruits, plus I'll show you a

little picture of their leaves and their flowers. Once you've seen these clues, you'll get to take a second guess about which two you think are related. The two that are alike are varieties of the same fruit. The one that's different isn't related; it's the odd one out. After you do a few rounds of this game, then you're going to play a matching card game. But I'll give you more details on that later. Are you ready? I'll show you what to do, step by step.

ACTIVITY STEP 1

Get a handout. That's all you need to get started. You'll get more supplies later. When you're done with this step, press the arrow on the right.

ACTIVITY STEP 2

Find a partner, someone to share your ideas with as you play the game.

ACTIVITY STEP 3

Which two fruits are related to each other? Think about what you know about these fruits. Then, answer number one on your worksheet.

ACTIVITY STEP 4

Now look at the fruits' insides, leaves, and flowers. Answer number two and number three. Then talk to your partner. Do you and your partner agree on which two are related? You're looking for the two with the most traits in common.

ACTIVITY STEP 5

Discuss as a group.

ACTIVITY STEP 6

This one is harder. You probably don't know much about the dosakai, a fruit that's used in Indian cooking. Use the traits you can see to guess. Which two fruits are related to each other? Answer number one on your worksheet.

ACTIVITY STEP 7

Look at the fruits' insides, leaves, and flowers. Answer number two and number three. Then talk to your partner.

ACTIVITY STEP 8

Discuss as a group.

ACTIVITY STEP 9

Which two fruits are related to each other? Answer number one on your worksheet.

ACTIVITY STEP 10

Look at the fruits' insides, leaves, and flowers. Answer number two and number three. Then, talk to your partner.

ACTIVITY STEP 11

Discuss as a group.

ACTIVITY STEP 12

Now that you've practiced, you and your partner can figure out what familiar fruits are related to each other. Get these supplies.

ACTIVITY STEP 13

Cut on the dotted lines to make a set of cards.

ACTIVITY STEP 14

Sort your cards into five groups by comparing their leaves, flowers, and insides. Work with your partner. You and your partner may not agree on everything. You'll have to convince your partner using evidence.

ACTIVITY STEP 15

Discuss as a group.

WRAP-UP VIDEO

So, did you figure out which fruits or vegetables in your life have the same wild parents? Hopefully, you noticed these five groups. My favorite surprise from this is that even though oranges taste and look so different from lemons, which taste and look so different from

grapefruits, when you look at them more carefully, suddenly you see lots of similar traits between them. Like when you cut them open, you can see, hey, wait a second, they all have fruit divided into sections, like this. They also have a thick skin that can be peeled off by hand. You notice that here? And when we look at the other parts of these plants, we see even more in common. Like, look at their leaves. You can hardly even tell them apart. Or their flowers, they all look so similar. We can include limes in this group too. Limes have the same traits as oranges, lemons, and grapefruits. So these four fruits—oranges, lemons, grapefruits, and limes—they're not even really different fruits. They're all just different varieties of the same fruit. Think of it this way. An orange is to a lemon as a Red Delicious apple is to a Granny Smith apple. Now that's crazy because Granny Smith apples and Red Delicious apples, at least you knew they're varieties of apple. They even have apple in their names. So then, what fruit are oranges, lemons, limes, and grapefruits varieties of then? Well, in the forests of Southeast Asia grows a wild fruit that looks like this. It smells like a lemon, and it has similar flowers and leaves to a lemon. We call this a citrone, or citrus fruit. Even if you've never seen one of these, you've probably heard that word before, citrus. Scientists think that oranges, lemons, limes, and grapefruits are just different varieties of some kind of original citrus fruit, which is probably something like a citrone. So you'll sometimes hear all of these called the citrus fruits. That's why that name might be familiar. I think what's so surprising about the citrus varieties, unlike the apple varieties, is that we've used selection to make them all so different in color, in taste, in shape. I mean think about just taste, right? Oranges are sweet. Lemons and limes, they're sour. And grapefruits, they're kind of bitter. And yet, they're all varieties of a single fruit: the citrus fruit. So, once again, we see how by discovering some knowledge about how living things inherit their traits, we can use the process of selection to create new and different varieties of plants from what's originally found in the wild. So far, we've just been talking about citrus fruit that you

can find in your grocery store, but have we ever made other varieties of citrus, ones maybe you haven't heard of? Like have you ever made a giant citrus the way we made a giant pumpkin? Well, as far as I know, no one's made any giant citrus yet, but I do want to tell you about one last example because it might be the weirdest fruit I've ever seen. I was walking around in a park in Southern California when I saw this. Do you see that thing? Right there, growing on the tree? I couldn't believe this was real. I was like, what? It's what I would expect a fruit to look like on some alien planet. What is this thing? Well, if I cut it open, it looks like this. That does not look familiar at all to me. Just looking at this picture, you might say something like well, Doug, that might just be its own kind of fruit. I don't think this is a variety of one of the other fruits. But if you think that, you'd be wrong. And that's because what you really need is you need to be able to smell this thing. Wow, does it smell strong. It has to be the most intense citrus smell I've ever smelled in my life. It's like the smell of 1,000 lemons. That's right. This is a variety of citrus fruit. It's a fruit from Japan that's called Buddha's hand partly because it looks like a bunch of fingers. Now, if it's a citrus variety, then why doesn't it have all those sections inside like other citrus fruits? Well, look at the inside of a citrone. Remember, that wild citrus fruit? It has sections too, but notice how it also has a really thick peel or skin? With a Buddha's hand fruit, instead of selecting it to have more fruit, plant growers actually selected it to have more peel. There's no fruit part at all to it, so you don't really eat Buddha's hand. Instead, people like to use it for its smell. They'll scrape little bits of it off and put it in their tea or soup, just for its nice strong citrus smell. If you're lucky, sometimes, occasionally, you might be able to find a Buddha's hand citrus fruit in the grocery store. Next time your parents go to the grocery store, or if they ever go to a farmer's market, ask if you can come along. Spend some time hanging out in the fruit and vegetable section and see what incredible varieties of things you can find. One day, if you

become a great plant grower or a plant scientist, you could make some new varieties of fruits too, maybe even the next biggest fruit in the world. Stay curious, and see you next Mystery!