But Why: A Podcast for Curious Kids

Why do oranges have peels?

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Jane 00:21
This is But Why: A Podcast for Curious Kids, from Vermont Public. I'm Jane Lindholm. On this show, we take questions from curious kids just like you and we find answers. You all are so interested in so many things that we never know where your questions will take us. This time, your curiosity took us on a field trip to Florida so we could get an expert to help us with these kinds of questions.

Sage 00:45
Why do oranges have peels?

Felix 00:47
Why fruit is so juicy?

Maisie 00:50
How do seedless oranges reproduce?

Jane 00:53
I'm pretty curious about citrus fruits, too. So I headed to the southwest Florida Research and Education Center at the University of Florida to talk with a professor named Fernando Alferez. He's a citrus horticulturist, a plant guy who focuses on citrus fruits like oranges, lemons, limes and grapefruits.

Fernando Alferez 01:12
I work on citrus research, as I like to say from seed to table. And that means that I have some projects working on citrus seeds. I have projects working on small citrus trees, how they grow, how they set fruit, and then how we can improve the quality of that fruit. So when you eat that fruit is the best that you can eat.

Jane 01:39
Oranges, and orange juice in particular, is very important to the economy in Florida. And you might drink Florida orange juice with your breakfast in the morning. So having people like Professor Alferez, who can study how to make these plants grow well and produce tasty fruit, but also how to protect them from disease and invasive species, is really important work. Since Professor Alferez knows so much, we put all of your questions to him. But first we wanted to get a real basic one out of the way: what is a citrus fruit?

Fernando Alferez 02:11
A citrus fruit is a fruit that is what we call botanically an hesperidium.
That's a pretty cool word. Citrus fruits are in a group called hesperidium, which is a type of modified berry. They're related to other berries like blueberries or raspberries, but they have a tough, leathery outer rind, and an inside juicy or fleshy part that's divided into sections. Citrus fruits include oranges, mandarins, lemons, grapefruits, pomelos, and limes. Generally speaking, a fruit of any kind has one specific job:

What a fruit does is just to protect the seeds.

That's right, the job of a fruit is to protect seeds. Fruit begins as a flower. Flowers will grow on a tree or bush, bloom, get pollinated, grow bigger and then the petals wither away, but the fruit has been fertilized and is still growing. The ovary, usually the middle part of a flower, starts to enlarge. Inner pieces of the ovary called ovules will develop into seeds. Around the seeds, the ovary expands into what we think of as the fruit. And, as we said, the purpose of a fruit is to protect those seeds. As you probably already know, seeds are needed for reproduction to make the next tree or bush. Some fruit seeds make a new plant with fruit that tastes just like the parent plant it came from, but others, including apples and citrus fruits, don't. So if you spit out an orange seed and it manages to grow into a new tree, the oranges it produces won't necessarily be the exact same flavor. But citrus farmers want to make sure that every navel orange or mandarin or key lime tastes the same, because people who buy them get used to those certain flavors. So, rather than take a gamble and plant all of their trees from seeds, they usually take a branch from a tree they know the flavor of and attach it to the roots of a new young tree. The branch will fuse to that root stock. And the new branches will bear fruit that tastes just like the older tree they originally came from. That process is called grafting. Here's a question from John:

And I'm four years old, and I live in Turkey, Istanbul and my question is, why are oranges shaped like a ball?

That's a very interesting question and looks simple, but is really profound and has to do with shape in nature. Usually, different shapes in nature, they have a role; they are not random. And in the case of why they are like balls or like a sphere is because of efficiency. Let's say that a sphere gives you the least area for a given volume, okay? And that means, at the end, means less exposure. So is the way that the fruit can protect better the seeds. So that's why most of the fruit, including oranges, are like balls.

But lemons and limes aren't quite shaped like balls; they're shaped more like American footballs.

Yeah, that's right, well, there is some variation there.
Jane 05:42
A ball shape means there's less overall area on the outside of the fruit that can get punctured by an animal or exposed to challenging weather conditions. And inside the protection of the peel, that shape provides a lot of room for juice and pulp to protect the seeds. You know how when you peel open an orange, it has sections, and then you can just pull those sections apart and eat them one by one without all the juice spilling out? Kevin has a question about that.

Kevin 06:09
I come from Maui, and I'm nine years old. And my question is how are oranges pre-sliced?

Jane 06:17
What role do the segments play and why have they developed?

Fernando Alferez 06:21
Yes. And actually you can see between, let's say, in general, between 10 and 15 segments per per fruit, depending on the on the variety, and every segment will have typically one or more seeds. And why this is organizing that way? There is not a clear answer. But one theory that is easy to understand: it facilitates seed dispersal. So if you have your seeds divided in segments, probably easier for for those seeds to be dispersed by different animals. So all the seeds will be will be dispersed in different places. Okay, that's what I have read about it. Now, I would like to know if an animal is able to eat only one segment and leave the risk for other animals. I would not be able to do that.

Jane 07:28
No, I don't think humans are very good at that. We may be able to divide the segments and if we have to, we'll share with a friend or a sibling. But yes, I don't think an animal biting into it is likely to leave some segments. But if seed dispersal or the way the tree has developed to make sure its seeds get spread, is by having animals eat those seeds, which a lot of plants use that as a method of seed dispersal, why do they have such a tough peel? Humans don't usually eat the peels of oranges, although we can eat the peels of some citrus fruits, but we usually don't. They're kind of bitter and they're tough. So why have such a tough peel if the fruit is supposed to be eaten by an animal?

Jed 08:13
My name is Jed from three years old, and I live from [unclear] and why do apples have skins that you do eat and why do bananas and oranges have skin and peels that you don't eat?

Sage 08:40
My name is Sage. I am seven and I live in Madison, Alabama. Why do oranges have peels?

Eva 08:48
Hi, my name is Eva. I am four years old. I live in Illinois. Why is there peels on an orange?

Fernando Alferez 09:00
Yeah, well that's again, for protection. And that's for protection when when the fruit is growing, and the seeds are developing. At some point when when the fruit gets into into maturation, peels are not that
tough. They are more soft, and animals can actually access without any problem. And that comes at the end of the maturation, that the fruit can also drop from the tree and is accessible to animals.

Jane  09:38
I didn't realize that, that the skin of citrus fruits becomes less tough as the fruit matures. So it's really good at protecting the fruit as it grows and ripens and then once the fruit is ripe and it's time for an animal to eat it, or for the fruit to fall to the ground and go into the dirt, then the skin or peel becomes less tough.

Ellis  09:57
My name is Ellis. if I'm almost four years old. And I want to know why fruit is so juicy.

Felix  10:04
Why is fruit so juicy?

Jane  10:13
Ellis and Felix both want to know about why fruits have juice, and citrus fruits are full of juice!

Fernando Alferez  10:20
This is to make them appealing to animals and also consider the fruit as what we call a sink, a sink organ in the plant. So it it accumulates sugars. So it accumulates the juice and because of the sugars, it makes it desirable for the animals as well.

Jane  10:42
So some of the sugar that the plant creates during photosynthesis gets stored in the juice vesicles within the fruit itself. And that's pretty appealing to animals who want to eat those fruits. And then the animals will poop out the seeds in various places, not just right where the original parent tree is. And that's one of the ways trees have evolved to get seeds to new spots. Okay, but what about seedless fruit?

Maisie  11:07
My name is Maisie. I'm from Valley Spring. I'm seven years old. How do seedless oranges reproduce?

Arlo  11:14
Hi, my name is Arlo and I am eight years old and I live in Charlotte, North Carolina. How do they get the seeds out of seedless fruit, like watermelons and seedless clementines, if they have to be planted from a seed?

Jane  11:31
One of the things you mentioned was that the whole point of a fruit is to protect the seed, to grow and protect a seed so that that seed can grow into a new tree. But sometimes, when we buy fruits in the grocery store, they are what are called seedless fruits. And so because we don't really like to eat the seeds, they don't taste very good. They're hard to spit out. So a lot of fruits have developed that are seedless fruits you can buy, but how is that even possible? If the whole point of the fruit is to protect the
seed, and when the tree is growing, the fruit is supposed to make seeds, how in the world do we get seedless fruits?

**Fernando Alferez** 12:12
Yeah, that's a great question. And many, many of the efforts from researchers from the industry is to develop a seedless fruit. You can do that by by by breeding, by hybridization. And in some cases, even by high radiating the budwood, for instance, with gamma rays, and you can get you can get a budwood that doesn't produce seeds anymore. There are a lot of commercial varieties a that don't produce seeds because because we did that. And that's a trend since many, many years ago, because for instance, a can tell you the story of one of the of the most sought grapefruit here in Florida. It's the Duncan grapefruit. At some point it was it was really, it was really, really, really popular in the state, because the taste and the flavor, but it may have 70 seeds per per fruit. So it was impossible. So what happened was that people have decided not to do it again, or to grow it any more because that amount of seeds. So at some point it was not marketable anymore. So that's that's what happened. So the trend is to try to reduce the number of seeds. And you can do that by by by breeding mostly.

**Jane** 14:00
I don't think I would want to eat a fruit that had 70 seeds either. So farmers have found ways by selective breeding or by radiation to create trees that produce fruit with fewer seeds. By breeding, that means you select varieties that have fewer seeds and pick those plants to reproduce. And remember, most citrus trees are made by grafting, so you can use a branch from an original tree to create a new one without having to start with a seed at all.

**Elena** 14:28
Hi, Elena, and a live in Williston, Vermont. Why do lemons have seeds but limes don't?

**Fernando Alferez** 14:38
Well, there are limes that have seeds, and there are lemons that don't have seeds. So in some cases, is as I just described. I mean, we always try to to breed a fruit that is seedless or almost seedless because then is easier to market. And in the case of lemons, if you're squeezing a lemon and you get all the seeds in there, your food isn't like that. So, we always try to get rid of the seeds.

**Jane** 15:17
The limes that we most typically find in US grocery stores are Persian lines. And these limes, a cross between a key lime and a lemon, don't naturally reproduce through seeds. So the farmers who grow them use that grafting technique we've talked about to make new lime trees and the limes they produce don't have many seeds. But other types of limes do have seeds. Coming up: why are those limes so sour?
This is But Why: A Podcast for Curious Kids. I'm Jane Lindholm. We're answering your questions about oranges, lemons and limes with Professor Fernando Alferez at the University of Florida.

Kimiko 15:54
My name is Kimiko and I'm eight years old and I'm from Austin, Texas. Why does lemon taste so sour?

Hanley 16:01
Hi, my name is Hanley. I'm eight years old. And I live in Arlington, Virginia. And I want to know why are lemons sour?

Laura 16:09
My name is Laura. I'm six years old. I live in Germany. And what makes a fruit sour or sweet?

Elijah 16:17
I'm Elijah. I'm six years old. I live in Great Neck, New York. Why are lemons sour?

Jane 16:24
Lemons and limes are sour because they contain something called citric acid. That's an organic chemical that's in a lot of fruits. Citric acid is found in higher amounts in the more sour citrus like lemons and limes. We have little tastebuds, little body parts that can perceive taste, on our tongue, the roof of our mouth and the back of our throats. Those taste buds send information to nerves which then send information about what we taste to our brain and that's how we taste things as sour. Okay, now we have a question about juice from Dominic.

Dominic 16:56
I'm eight years old. I live in Farmington Hills, Michigan. I wonder how many oranges it takes to make one gallon of orange juice.

Fernando Alferez 17:08
For a gallon of juice, okay. A gallon, if I am correct, is about 128 fluid ounces. And a regular orange has about six ounces. So you do the math,

Jane 17:28
You're getting out your calculator.

Fernando Alferez 17:29
Yeah, if you do the math is it's about 21 fruit per gallon of juice.

Jane 17:39
That's a lot of oranges just to get our juice. But that's one of the the most important agricultural products here in Florida, too, is that Florida exports a lot of juice to everybody else.
Yes. And actually our production here in Florida is mostly focused on juice production, I would say that is about 95% of the production here in the state goes to juice.

**Alex 18:10**
My name is Alex. I'm six years old. And I live in Palo Alto, California. And my question is, why are bananas and oranges here all year long, and not pomegranates?

**Fernando Alferez 18:27**
You go to the supermarket and you have citrus fruit all the time in the year. So what they do is to have different varieties at different times in the year. So you can see, for instance, a mandarin, let's say in as early as September, and you keep seeing that mandarin, or you think is the same mandarin because the brand is the same, in October, November, December, January, but the variety is different and you don't notice. So they brand it the the same way but they are different varieties. The same happens with with oranges. You can have for instance, and I'm working in Florida so, for instance, you can have Hamlin oranges in the supermarket in October, November, December. And then all of a sudden you will have Valencia oranges and those will come in January, February. So you have a lot of different varieties during the whole during the whole year.

**Fernando Alferez 18:31**
So you're telling me that oranges are seasonal too, But why do we have them in the grocery stores all year round? And then we have certain fruits that only come at a certain time of year?

**Fernando Alferez 19:48**
Yes, that has to do with the with the number of varieties available. Pomegranates, probably they don't have that much that many varieties. This but in the case of citrus, we estimate, and there is not there is not a clear answer, there is nobody who knows exactly how many citrus fruits are there, but some estimate that is more than a thousand contain oranges, mandarins, lemons, limes, and other other specialty specialty fruit. So it's more than 1000, probably. Is a huge amount. And in some places like Spain, for instance, you can have 30 or 40 different varieties through through the year. Now, if there are typically some months like June, July, August that you don't have fruit, what happens is that we import fruit from from other areas. We are in the northern hemisphere. So we produce the fruit from September to, say, May, June. But then July, August and even early September we will import fruit from from the southern hemisphere.

**Maddie 21:18**
My name is Maddie. And I'm seven. I'm from Nampa, Idaho. And my question is, why is the fruit orange and the color orange called the same thing?

**Jane 21:33**
Why are oranges called oranges, at least in English?

**Fernando Alferez 21:37**
The word is really an ancient word. And the origin from a language that was spoken like 3000 years ago in northern India. That's the Sanskrit, that gave origin to different languages including English and
Spanish and others. And it was called naranga. Which is N A R A N G A. And that means fragrant. That means fragrant in Sanskrit.

**Jane 22:14**
Fragrant, like smells good?

**Fernando Alferez 22:16**
Yes, the Spanish word is the same, is naranja. You just change the G for a J, okay? And if you consider the word orange, it has almost the same letters. It just lost the first n, but that's how languages evolve. Now the first mention in English for an orange I think is from the 13th century. So that's the first time that the word came in in English.

**Jane 22:47**
Before traveling traders started bringing oranges to English speaking countries, there actually wasn't a word for the color orange. The word for orange in English is the word for the fruit. And once people started seeing oranges in markets and knowing what they were, that's when they started using the same word for the color. It's so amazing that a discussion about fruit can turn into a conversation about language, history and culture. Thanks so much to Fernando Alferez at the University of Florida's Southwest Florida Research and Education Center for sharing his expertise on citrus with us.

**Jane 23:23**
That's it for this episode. If you have a question about anything, have an adult record it. It's easy to do on a smartphone using an app like Voice Memos or Voice Recorder. Then email the audio file to questions@butwhykids.org. Be sure to include your first name, hometown and your age. We can't answer every question we get, but we do listen to all of them. And we're always delighted to hear what's on your mind! But Why is produced at Vermont Public and distributed by PRX. Our team includes Melody Bodette, Kianna Haskin and me, Jane Lindholm. Our theme music is by Luke Reynolds. We'll be back in two weeks with an all new episode. Until then, stay curious!