

But Why: A Podcast for Curious Kids

How Is Chocolate Made?

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[Jane] This is *But Why: A Podcast for Curious Kids* from Vermont Public Radio. I'm Jane Lindholm.

Each episode we take questions from you and find interesting people to help answer them.

If you want us to find you an answer, have an adult help you record your question on a smartphone and send it to question@butwhykids.org.

Don't forget to tell us your first name, where you live, and how old you are. This is our 22nd episode and we've gotten questions from kids in 35 states and 13 countries. We're based in Vermont, but we love that your questions come from everywhere.

And this week we traveled to two different places to bring you some interesting facts about two different, but similar foods. One is a food that kids tend to like. And the other is a food that adults seem to love but kids usually hate. Here's a hint about that one.

That's the sound of coffee grinding. Do you like coffee? I bet some of your parents or teachers do. But if you've ever tried it and thought, yuck, that stuff is bitter, you're not alone. Coffee comes from a seed called a bean. And those beans are roasted and ground up and then water is filtered through the powder to make a drink. We'll tell you more about that later. But did you know that chocolate also comes from a bean? A lot of kids like chocolate.

[Samarah] My name is Samarah. I am eight years old and from Johnson, Vermont My question is how is chocolate made?

[Ayala] Hi Samarah. That's a wonderful question! We eat chocolate all the time and we know so little about it.

[Jane] We thought it would be fun to go to an actual chocolate maker to get an answer for Samarah.

[Ayala] Hi, my name is Ayala Ben-Chaim and I work at Taza Chocolate factory. We are a bean-to-bar chocolate maker in Somerville, Massachusetts.

[Jane] When she says “bean to bar” Ayala means a chocolate maker that takes raw cocoa beans and turns them into chocolate. Some places get chocolate that's already made and they just add stuff to it.

[Ayala] So chocolate actually comes from cocoa beans, which are no bean at all. They are seeds of the cocoa tree. Now farmers take cocoa beans or seeds and they plant them in the ground. And over about five years the farmers water and nurture these cocoa beans so that they grow into these large cocoa trees and this is actually called the *Theobroma cacao* tree, it's the scientific name for this tree. And “*Theobroma*” is a Greek word that means “food of the gods” which I think is totally appropriate maybe.

[Jane] But you can't grow chocolate just anywhere.

[Ayala] Cocoa or cacao grows between the Tropic of Cancer and the Tropic of Capricorn, at 20 degrees north and 20 degrees south of the equator. And these lines take you all around the globe. And this is exactly where cacao trees grow: Ivory Coast, top producer, Ghana and Indonesia are also top producers. Taza Chocolate sources, or buys, cocoa beans from farmers in the Dominican Republic, Haiti, Belize, and Bolivia. These farmers plant cocoa seeds in the ground. These seeds, over about five years will grow into this tree, the trees, that *Theobroma cacao* tree and in about five years the cocoa tree is also going to produce fruit. This fruit is the cocoa pod. Cocoa pods are really funny to look at. They look a little bit like a gourd growing off of the tree or like a lumpy, tiny American football. The cocoa pods grow in a really interesting way. They grow off of the branches of the tree like apples, for example, but they also grow right off of the trunk of the tree. So they can grow anywhere from the ground almost to the very top reaching branches of the tree. The cocoa pod is going to be chopped down using a big machete by farmers or it can be twisted right off of the tree.

Immediately after that, farmers are going to use machetes, big knives, to chop into the cacao pod or cocoa pod. And the first thing that we see is this white pulp that surrounds the cocoa beans. This pulp is called in some Spanish speaking countries “Baba.” Baba is a Spanish word that means saliva, spit, drool.

It is kind of gross to think about, but this baba, it's called that because the pulp is really slimy and you can actually eat the slimy fruit straight from the cacao pod. It takes a little bit tart sometimes, it can taste a little sweeter depending on how ripe the fruit is. So these are dried cacao pods so you couldn't hear, if these were fresh these cocoa beans or seeds would be held in place by the pulp, by the baba.

But as chocolate makers we want to save this baba, this pulp, for the next step of the process which is fermentation.

[Jane] Fermentation is a neat process that's used to make a lot of foods: sourdough bread, some pickles, sauerkraut, kimchi, even yogurt. Ayala is going to explain more for us.

[Ayala] Fermentation is so important in chocolate making. And this is one of the most surprising things about chocolate making, I think. In the fermentation of cocoa bean we're going to put all these big batches of these wet with pulp cocoa beans into a wooden box. And in this wooden box we stir this whole mix around and there's yeast in the atmosphere. It's everywhere but we can't see it because it's microscopic. So it's there, and there, and there we just can't see it. And this yeast actually likes to eat the sugar and we have a lot of sugar in these big wooden boxes because of the baba that pulp. And the yeast come, they eat this sugar and they fart out CO₂, carbon dioxide, which is exactly what you and I breathe out.

Now in this fermentation it's the yeast is at play the sugars are at play. There's also bacteria and what all of this is doing is it's cooking the cocoa beans making a really nicely flavored cocoa bean, and also a good looking cocoa beans or something that looks a little bit more like the brown chocolate.

Now after fermenting the cocoa beans for about a week we want to dry the cocoa beans. Those seeds will be spread out into one thin sheet of seeds and they're left out on these wooden planks to dry for about a week. I think of it kind of like a vacation under the sun.

So here we've got a big pile of cocoa beans.

They look, I would say, like an almond, maybe a little smaller and they're dark deep brown. After we're done fermenting and drying the cocoa seeds on the farm we're ready to then ship the cocoa beans to wherever they're actually going to be made into chocolate. And the first thing that we want to do with these cocoa beans is almost like a continuation of that drying that we left off with on the farms. We're going to roast the cocoa beans.

This is our roasting and winnowing room here. We have a big roaster. That's about -- it can hold 400 pounds of cocoa beans in this roaster -- and it's about twice my height, about 10 feet tall.

These are the big bags of cocoa beans.

The big sacks of plastic, or burlap sacks and they are filled with about 150 pounds of cocoa beans per sack. We roast the cocoa beans at 200 degrees Fahrenheit for about an hour. And in that time we get this really nice toasted flavor to the cocoa beans. It

starts to smell a little chocolatey in the air. And we also start to separate the thin outer shell that surrounds the inner part of the cocoa.

So this is the soft sound of a cocoa bean shell.

Our next step is actually to separate the cocoa shell from the inner part of the cocoa bean, called the nib. So we do this by winnowing the cocoa beans. Our winnowing machine is made up of a big bean crusher. That crushes the cocoa beans and splits them up into these tiny fragments of shell and nibs inside. Then we introduce a gust of wind that blows these tiny fragments and disperses them throughout the winnowing machine based on their weight. The lightest part of the cocoa bean is the shell. The shell is going to be blown to the back of the machine. And we use a tiny vacuum to suck the shells right out of the winnowing machines, so that we're left with just the nibs, the gold to the chocolate makers and we're ready to grind them down into chocolate.

These are the nibs. They are a little bit nutty, they're pretty dry. They're a little bitter because it's just cocoa beans broken into pieces, no sweetener yet. Then we bring the cocoa nibs down to grind them.

So what we do at Taza Chocolate is we use a traditional Mexican milling-style using a *molino* or mill, in Spanish to grind the cocoa beans down. Back in the day, makers of chocolate would use a *metate* and the *metate* is made out of stone. This is a granite stone and it kind of looks like a large stone plate with a stone rod and we pretty much put the cocoa beans on the stone plate and then we use the rod to grind it down.

And over time those cocoa nibs or the cocoa beans, they'll be turned into a cocoa liquor. That's what we call it.

And this cocoa liquor is smooth and chocolatey. If you can imagine a chocolate waterfall, it looks a little bit like that. It looks beautiful. It smells chocolatey and delicious. And yet it is not very tasty because we're missing a really important ingredient in chocolate: that is sugar or the sweetener.

Downstairs in our factory we use *molinos*, those are the traditional Mexican mills, they use two stones and we use the same type of stone, Oaxaca granite stones, and one of the stones will be stuck in place while the second stone is going to be very, very close but not exactly touching and it's going to be spinning super quickly. It would make your head spin if you were to watch it.

And in between the two stones, in that very small space, we feed the nibs and that's how we grind those nibs down into the chocolate liquor.

This is where we add the sugar, you can see sugar crystals along the bar here, into the molten chocolate liquor.

This is kind of cool. We use our chocolate plumbing system so these vertical and horizontal metal pipes, that are going to suck up the chocolate and carry chocolate from one place to the next. All of the pipes are insulated with a hot running water so that the chocolate within remains molten. And it also helps to move the chocolate from one point to the next.

Here at Taza Chocolate, we do a second and final phase of grinding. We use the *molin*os again to grind those, that now sweetened chocolate down even more. In this stage, we will sometimes add some of the other ingredients. You can make a chili spicy chocolate, you can make a coffee flavored chocolate, you can make a fruity chocolate, you can go crazy with your chocolate-making choices.

Now at this point some chocolate makers are going to “conch” the chocolate. It's a method of raising the temperatures of your chocolate and this is going to melt everything down. It melts the sugar granules down, so you get this really smooth chocolate. At Taza Chocolate we don't “conch: the chocolate.

We go straight to what all chocolate makers do and that's called “tempering” the chocolate. Tempering is so important. It's increasing and decreasing the temperature of the chocolate, between 87 degrees and 89 degrees Fahrenheit. And it's only 2 degrees difference but it makes some really, really big changes to your chocolate. Important things happen here.

First of all in tempering the chocolate we are going to get a nice, glossy finish to your chocolate. Also in tempering your chocolate you get a really nice, brittle chocolate bars so when you go to break apart a chocolate bar, to share, or not share, it doesn't crumble in your hands and it doesn't become flexible. It just has a nice, crisp break to it.

[Jane] After tempering they pour the chocolate into molds and cool them down. They wrap them up and ship them off to folks like you. Then you unwrap the chocolate at home.

So there you have it, Samarah. That's how chocolate is made. Did you think it was going to be that complicated? It sounds like quite a process.

We also have another question from Arden.

[Arden] Why chocolate does melt but not oatmeal? And I'm six and a half from Philadelphia.

[Jane] Arden wants to know why chocolate melts but something like oatmeal doesn't?.

[Ayala] Hi, Arden. That's a great question. Chocolate melts because if you remember, chocolate comes from cocoa beans and those cocoa beans are cocoa seeds are made

up of about half and half cocoa powder and cocoa butter. Cocoa butter is a fat. And like most fats, like all fats, cocoa butter melts. And one thing about cocoa butter is that it melts at about 92 degrees Fahrenheit. And I don't think I'm the only one in saying that chocolate has definitely melted in my hand as well as my mouth, but that's because our body temperatures are warmer than the temperature at which chocolate melts, and that's all because of the cocoa butter.

Some chocolate makers will add extra fat in the form of cocoa butter or other fats and that makes chocolate melt at an even lower temperature and even quicker.

[Jane] Melting is the transition from a solid to a liquid, so since chocolate has all that fat in it and the fat starts out as a liquid it can become a liquid again if it gets warm. But oatmeal is not liquid so it wouldn't melt. Here's another question it's from Tallulah. She's four and lives in Vermont.

[Tallulah] Why is it not healthy to eat chocolate, like a lot?

[Ayala] Hi, Tallulah. As the expression goes, "everything in moderation." That's very true for chocolate too. There are a couple things that make chocolate hard to eat in big quantities. That is because chocolate has the fat in it so that makes it not the best thing for our health, in some cases. Chocolate is often made with sugar which is not good in large quantities. And chocolate also gives us this big burst of energy. That's partly because of the sugar in chocolate. Chocolate also has a little bit of caffeine and a lot more theobromine. Theobromine is a chemical that stimulates you. It gives you this nice big burst of energy which sometimes we don't want too much of that, right? Especially if we're going to bed, for example. So a little bit of chocolate is totally good and there are also many good things about chocolate. Chocolate has flavonoids which are good for your health. They have these anti-oxidant properties. Chocolate also has iron and copper in healthy amounts. Chocolate, and this is my favorite thing about chocolate, we know that chocolate can help raise your serotonin levels and serotonin is a chemical in your body and your brain that makes you feel happy.

So if you get this good boost of positive energy after eating chocolate it may be because of the serotonin lifters in chocolate. A little bit of chocolate is definitely good for you. Of course some people may not find that chocolate is their thing and that works too. But if you like chocolate then a little bit is pretty good.

[Jane] So there you go, Tallulah, a little bit of chocolate is fine for humans. But that brings us to another question.

[Elan] My name is Elan and I am five years old. I am from Lyme, New Hampshire. And my question is why can't dogs eat chocolate?

[Jane] The theobromine that I mentioned at the beginning of the episode along with caffeine that's in chocolate is OK for humans, but not OK for dogs. Their bodies can't process those chemicals the way humans can, so it actually poisons the dogs if they eat too much. That's why we have to be very careful to not let dogs eat chocolate.

Thanks to Taza Chocolate and Ayala Ben-Chaim for showing us around and teaching us how chocolate is made.

So now you know how chocolate's made, what about coffee? Coffee might seem very different. For one thing it's gross. Well, at least it seems gross to a lot of kids. Many adults drink coffee without any sugar or milk and it can taste really bitter. So why do so many adults love it and what is it in the first place? Turns out it's a lot like chocolate. It comes from the seed of a plant and it gets ground up and roasted. For a little more detail, we traveled to Deer Isle, Maine to learn from someone who spends her days making coffee.

[Megan] My name is Megan and we are on a little island off the coast of Maine at 44 North Coffee and you are in our roasting shop, where we roast beans and bag and then ship them all over the country.

Coffee actually comes from a fruit that looks a lot like a cherry. It has a skin and then it has a fruit or mucilage component and then the very center or the pit, also the seed, is what is a coffee bean. So when coffee is picked from trees, usually by hand, usually at high altitudes around the world and around the equator, it is gathered and then it is washed and de-pulped, so the skin and the fruit come off the bean. And then dried out in the sun on these huge flat beds either on concrete, or wood, or tarps, and there it's dried and it loses a lot of moisture kind of shrinks like a raisin and then it's bagged up and it's shipped all over the world.

We get coffee that is delivered at our door on a pallet and each pallet is about 130 to 150 pounds. Pretty heavy. And then when you open up the bag there are these little green beans. They vary in color from turquoise to pea soup. These are green beans from Ethiopia, from the Yirgacheffe region.

And then we weigh them out and we put them in our roaster and that's when the real magic happens, that's when the color changes and the whole roasting process creates the coffee that we drink.

And once the coffee has roasted it expands in shape and also in flavor. It usually takes them between 12 and 16 minutes to roast coffee and the temperature varies from 150 degrees to 455 degrees. So it's a huge span. And then when you dump it out we have roasted coffee. When you roast coffee it's interesting, because it actually it smells a lot like baking bread. There's very much like this kind of bready, toasty smell. So when

people drive by they often think that we're a bakery because all they can smell is toasted bread.

OK, here we're going to grind up a cup of coffee. There's a lot of different ways you can drink coffee.

I think the very first time that I had coffee. I was in Honduras I was 10 years old and it was Christmas and everyone around me was drinking coffee and I never had a cup of coffee before and they had this big pile of cake on the table and the only thing to drink was coffee.

So I think I put a lot of cream and a lot of sugar in the coffee and I drank it. I thought it tasted horrible. It was pretty horrible but it was a memorable cup of coffee, my first cup of coffee. It's true coffee taste weird. I often think it smells a lot better than it tastes even now even though I love it. But it's more the effect of coffee. It gives you energy. The caffeine in coffee is that component that allows people to drink it and wake up and go do their day.

Sometimes I think people might drink coffee because they think it's what they're supposed to do. I think they're the culture of the coffee pot and now that you wake up and have a cup of coffee and you go out to the diner and you have a cup of coffee, might be what you will do. But I also think that there is a ritual around it.

I personally know that this. That is what I do every morning, whether I mean to or not, I get up and I put on the hot water and I grind the beans and I make that pot of coffee and that's something I do every single morning and that's my routine and it's become probably one of the most enjoyable parts of my day.

Coffee plays a huge role in culture and how people come together and how they find a place to, over a hot cup of coffee, create community and conversation. The coffee house has definitely been a fixture in the society and communities all over the world for a very long time and has a very strong role and influence in productivity and in enlightened community activity.

[Jane] Well, in that case, let's have a cup of coffee.

[Megan] Let's do it.

It tastes good, it tastes really good.

[Jane] That was Meghan Wood. She co-owns 44 North Coffee in Deer Isle, Maine with her partner Jessica Rafferty. Does that make you want to have a cup of coffee? Maybe start with a decaf. Kids have enough energy already. You don't need caffeine but maybe

that at least helps you understand why adults like both the taste and the ritual of drinking coffee.

That's it for this week. As always if you have a question for us you can send it to questions@butwhykids.org. We will try to get an answer for you. *But Why* is produced by me Jane Lindholm, along with Melody Bodette at Vermont Public Radio. Our theme music is by Luke Reynolds. We'll be back in two weeks answering this question:

[Devika] Why are all of the world split up like countries, states, cities, counties and more?

[Jane] Until then, stay curious!