But Why: A Podcast for Curious Kids

Where do constellations come from?

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Jane 00:20
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. One of my favorite things to do on a summer night is to go outside after dark and look up at the night sky. In Vermont, especially in rural areas like where I live, we don't have a lot of light pollution, and I can see so many stars. Well, as long as the moon isn't shining super bright. Right now, for this episode, we're going to go stargazing, and it doesn't matter if you're listening on a bright sunny day, sitting in a car or a classroom, or lying on your bed. It doesn't matter if you live in a city and you do have a lot of light pollution and you have trouble seeing as many stars, and it doesn't even matter if you're in the northern hemisphere because we're going to go to the southern hemisphere too. We're going to stargaze in this episode with the help of a very special place called a planetarium. I went to the Museum of Science in Boston to do some middle of the day stargazing, but if you want to wait and take this episode outside with you at night, and maybe take some bug spray too, if you have a mosquito-filled yard like mine, all the better. Let's meet our celestial guide, Talia Sepersky.

Talia 01:37
So I am somebody who works in a planetarium, which is a place usually dome-shaped room where we're very good at simulating the night sky, so we can pretend that we're out on a clear, dark night looking up at constellations.

Jane 01:53
As Talia said, a planetarium is a big theater-like room. Often the seats lean back, and they make it nice and dark and cozy. Sometimes it's really cool in there as well for some reason, and images are then projected up onto that dome-shaped ceiling. Planetariums have been around for over 100 years now in some places, and they got really popular in the 1950s and 60s. Often, what's projected onto the ceiling is the movement of the planets and stars. Using special technology, the projector can often be programmed to show you the sky on any night and at almost any time, past, present, or even future.

Talia 02:32
And in our planetarium, we can also pretend to fly anywhere in the universe. And I am the person who will be there helping fly and helping to tell everybody what they're seeing because I love talking about space.

Jane 02:46
And you don't even need a pilot's license or to be an astronaut.

Talia 02:49
Not for this spaceship, no.

Jane 02:52
So it's like 240-five or three in the afternoon here, bright sunny day. But here we are inside the planetarium at the Museum of Science in Boston, and it's very dark. And up above us, there are some squiggly lines. What are we looking at?

Talia 03:09
We are actually looking at a nighttime sky. And what I have done is, those squiggly lines are the constellations. There are 88 official constellations, and these are the ones that are up over New England tonight.

Jane 03:27
All right. So tonight being August 7, the day this episode is being released. So this is what the sky would look like, maybe around bedtime or just after bedtime for a lot of the kids who are listening.

Talia 03:40
Yep, I've got it set for 9:00 right now because August is the time of the year where the sun is, you know, setting really late. So if you want to get a nice dark sky to go stargazing, you do have to stay up a little bit later, at least in the northern hemisphere.

Jane 03:55
That's right. If you're in the southern hemisphere, it's probably pretty dark, and maybe you'll fly our special vehicle over to the southern hemisphere a little bit later.

Talia 04:04
We can absolutely do that. One of the great things about being here in the planetarium is not only can I instantly go anywhere in the universe, I can instantly go anywhere on Earth.

Jane 04:13
So this doesn't look much like the sky if I was looking up at it because of these lines, and these lines are outlining constellations. One of the questions we've gotten is, "What is a constellation?"

Skyla 04:26
Hi, my name is Skyla, and I am six years old. I live in San Diego, and where do constellations come from?

Liam 04:37
Hi, my name is Liam. I'm 10 years old. I live in Stuttgrat, Germany, and my question is, why do we have constellations?

Harry 04:45
My name is Harry. I live in New York City, and my question is, how are constellations formed?

Talia 04:54

A constellation is really any pattern or shape that you're making. Out of the stars in the sky, we have, as I said, 88 official ones. But that's just from really one culture's patterns, sky patterns that they made. There's actually thousands of different sets of constellations out there because it was very, very common in ancient times for people to look up at the sky and make shapes out of the stars, and give those shapes names and tell stories about them. So a constellation really is any shape or pattern that you're making out of the stars. And I always tell kids to go outside with their adults on the next clear night and make up their own.

Jane 05:36
Yeah, I think that's fun. It's like looking at clouds and seeing shapes. You can make up your own star patterns.

Talia 05:42
Oh, absolutely! The human brain loves making shapes and patterns out of things.

Jane 05:47
And that's actually what people have done since there have been people. It's not just us here saying make up some patterns. Like that's why we have constellations because people love to do that.

Talia 05:56
Absolutely, we think astronomy may be the oldest science there is because people have been looking up at the sky and noticing things about it since ever, as far as we know.

Jane 06:09
And maybe even some animals too. My dog will look up and find the moon, so I wonder if some animals look at the sky and see stars. And we know some animals navigate with celestial navigation using the magnetic field of the Earth and using things like weather patterns and sky patterns to actually migrate. So we're not even the only creatures out there looking up at the stars.

Talia 06:32
No, one of my favorite stories is apparently dung beetles track their movements against the Milky Way, and I know they've done experiments where they've actually released birds inside of planetariums and seen the birds orient themselves based on what star patterns they had projected on the ceiling.

Jane 06:49
No way, really.

Talia 06:50
Yeah, so there seems to be bird species as well who, at least at some level, are using sky patterns as a navigational tool.

Jane 06:59
Wow, and even within a planetarium, so not even just outside, but they're actually looking at the patterns when they're not even real stars.

Talia 07:08
They don't know they're not real.

Jane 07:11
So I'm looking straight up right now at one constellation that's kind of you know kind of like shaped like a house, I guess, a traditional house that you might draw when you're a little kid, and then coming out from the house is what looks like a claw, and it looks like a crab. Tell us about that constellation.

Talia 07:30
So that's actually an interesting one because that historically was one constellation, and it has since been split up into three because it's so big. So that house shape in the middle is ophichus, the serpent-bearer, and the lines that are coming off of either side, that's the snake that the serpent bearer is holding, and the side that looks like a claw, that is the the snake's head, so that one is serpens caput, which means serpent's head, and then the other side is the tail.

Jane 08:02
Wow, that's so cool! And next to it, it looks like the serpent is almost-it's-it's reaching towards a kite, or you might think of it like a stingray.

Talia 08:13
Yes, I love that stingray. That one is actually a a part of what we call the Summer Triangle. It's three constellations that you can see, pretty much from anywhere in the northern hemisphere, and you know there's a chunk of the southern hemisphere that might be able to see it as well. And it's really three bright stars in the summertime sky, and each of those three stars is in a different constellation, and one of those constellations is that stingray-looking one-that is Aquila the Eagle.

Jane 08:44
Aquila the Eagle. Where do people come up with these names and the stories that go along with them? Because you said we're looking at kind of one culture's interpretation of the sky.

Talia 08:52
Yes. So these names I'm giving you and these shapes I've got up on our planetarium dome, these represent those official constellations, which are mostly the ones that were made up by the ancient Greeks and ancient Romans. That is the set that's been sort of accepted to be the one set that everybody can use as a reference point. But they're certainly not the only ones who were doing this.

Jane 09:16
Tell us about the one that's very clearly shaped like a W.

Talia 09:19
Ah, the W. That one is actually supposed to be a queen on her throne. That is the constellation Cassiopeia, the queen. Frankly, right now it looks like a W. At different times of the night and at different points in the year, it looks like an M or an E or the number three.

Jane 09:38
Right. So, Talia, I mean, it's kind of a stretch to get some of the animals and images that we're supposed to be seeing. And I can remember as a kid being told about the constellations, and one of them, for example, Orion, who I could always find Orion's belt. That was a series of stars that was easy for me to find, but then I would look up and be like, you gotta be kidding me that you see a whole guy hunting in this star pattern. I couldn't find it. Somebody would need to draw on the sky for me to see what they're talking about.

Talia 10:12
Yeah, there's a lot of constellations that you really got to scratch your head and wonder what they were thinking. I always tell people, well, you gotta you know also remember that back in the day, you know, imagine you're in ancient Greek or in ancient Rome, and you're looking up. It's the middle of the night. You don't have anything else to do. There's no television. You can't, you know, play on your Switch. You're just looking up at the stars, and sometimes their imaginations seem to be really far out there.

Jane 10:39
I want to ask you more about the constellations, but we should probably back up because we have other questions that might help us understand a little bit more about the night sky and what we're looking at when we look up at the stars.

Johannes 10:51
My name is Johannes. I'm four years old. I live in San Francisco. How many stars are now?

Bobby 11:01
My name's Bobby. I live in Houston, Texas. I'm five and a half years old, and I wanna know how many stars are there.

Oscar 11:10
Hi, my name is Oscar, and I am five, and I live in Hong Kong. How many stars are there in the whole universe?

Luke 11:21
My name is Luke. I live in Chester, Connecticut, and I'm five years old. My question is: How many stars are there in the universe?

Talia 11:33
We have no idea, but it is a very, very, very, very, very big number. So, just to give you an idea, you know, our sun is a star. It is one of the stars in the Milky Way galaxy. The Milky Way galaxy contains a few 100 billion stars, and it is only one of about 2 trillion galaxies that we know about. And some of those are bigger than the Milky Way, and some of them are smaller. But you start to see that there's there's a lot of really big numbers out there, and we can't really put a hard number on how many stars there are. One analogy I've heard used a lot is that there are more stars in the universe than there are grains of sand on all the beaches in all the world, but the answer is very, very large.

Jane 12:22
So, if everybody who's listening now started counting and didn't stop counting for the rest of our lives, we probably still all together wouldn't have counted the number of stars there are out there.

Talia 12:34
I don't think so. I think it would take one person to do the Milky Way alone their entire life if they were, if they devoted their entire life to counting one star per second, in just the Milky Way, it would take, and they, and they lived a nice long life. It would take their whole life, and that's one person. And then you've got the other 2 trillion galaxies to worry about.

Jane 12:56
Yeah, and then we can't even stop for snacks.

Talia 12:58
No, you can't stop. You just got to do nothing but count stars.

Cam 13:02
Hi, my name is Cam. I'm six and a half years old. I live in Ambler, Pennsylvania. What are stars made out of?

Talia 13:11
So stars are made out of pretty basic gasses, actually. If you've ever looked at a periodic table, maybe you have them in your classrooms, or if you've ever heard of things like hydrogen or helium, it's the same thing that's making up stars. Stars are mostly made out of hydrogen and helium, and what happens is there are these enormous clouds of these gasses out in space, and something, can be many things, will start that gas cloud to collapsing down on itself, sort of squishing all the gas together, and it will form a big clump of gas. And that clump will get bigger and bigger and bigger, and as it does, it will also get hotter and hotter and hotter in its insides. And then once it gets hot enough, it's actually going to start smashing those atoms together, and this is something we do on Earth. It's called nuclear fusion. It is a way we can generate energy, or a way we hope to generate energy at least on Earth efficiently someday. And stars are doing it. And basically, when you smash hydrogen atoms together hard enough, they release a ton of energy, and that's what makes a star a star. It is this giant ball of these roiling gasses that is smashing atoms together and generating a bunch of energy in the form of heat and in the form of light, and that is why the sun is so warm, and it's why the stars shine so brightly.

Spencer 14:43
Hi But Why? My name is Spencer. I'm 10 years old. I live in Sioux City, California. My question is: Why are the stars in the sky?

Ezra 14:54
My name is Ezra. I'm five years old. I live in Georgia, why why are there so many stars in the sky?

Zoe 15:05

Hi, my name is Zoe. I'm seven years old, and I'm from Sydney, Australia. My question is, why is there stars in the sky?

Talia 15:19
Well, a big thing is, you know, the the reason those big gas clouds start collapsing down in the first place, it's gravity. Frequently, if you have a question about why something's happening out in space, the answer is going to be gravity. It's it plays a huge role in how things operate out in space. So you have gravity causing these gas clouds to collapse down, and they would just keep collapsing down further and further and further, but when they start making heat inside themselves, when they start to heat up, that starts to push outward. So you have gas, the gravity pulling everything inward, and this pressure from heat inside pushing everything outward. And kind of when it comes to a balance, that's where you're going to get a star, so our sun you can think of as being a constant war between these two forces. The gravity of all the mass, all the stuff that's inside the sun wants to pull everything in towards its center, but it's also making all that heat and light that we enjoy here on Earth, and that's sort of trying to push everything outward. Now these two forces are in balance, so we have a nice healthy star. Eventually, stars do reach a point where they start to run out of fuel, and one of those forces wins. But we've got another 5 billion years or so before that happens with the sun. The sun's going to be a healthy star for a very long time.

Jane 16:40
Do we see it happening? Can we see it with our own eyes when that happens to other stars?

Talia 16:46
Well, sort of. You can't when it's not something that's happening all the time. But there are stars you can look out at, and for instance, one of them is in the constellation Orion. There is another one in the constellation Scorpius, which is up in the sky tonight, doesn't matter actually which hemisphere you're in. You can see it from the northern hemisphere or the southern hemisphere, and it's the heart of the Scorpion is a red star named Antares, which is it's so red that the name Antares roughly means not Mars. Just to make...

Jane 17:20
Because Mars is also called the red planet.

Talia 17:22
Yes. So Mars also looks red in the sky, and the star Antares also looks red because this is a really large star that is much farther along in its life than the sun is, and it is approaching the end of its life.

Jane 17:36
And we're already sort of seeing into that process.

Talia 17:39
Yes. So it's at the the reason it looks red in the sky is because it is approaching this sort of end stage, this end game in its life, and it's starting to fuse different types of gasses in its core, and it's really heating its core up, so it's actually making the star swell up into a giant, and that makes it also turn red,

and eventually it's not going to be able to keep that up anymore. And that's when the gravity's going to kick in, and that's when that star is going to explode in a supernova, which is something that only the biggest stars do. But Antares is very large.

Jane 18:17
Are we going to be alive to see that?

Talia 18:19
Probably not. This is going to happen sometime in like the next 100,000 years or so, which is a very short time in the period of a star, like in the lifetime of a star, but not so much the lifetime of a person.

Jane 18:29
All right, fine. Well, I won't get hopeful then that I'm going to see it. So you mentioned that Antares looks red, and some of the questions we've gotten are about the colors of stars.

Eliza 18:40
I'm Eliza. I'm from Missouri, and I'm seven years old. And my question is, why are stars white?

Willow 18:53
My name is Willow, and I'm four and a half years old, and I live from British Columbia, Coldstream. And my question is why are stars white?

Reed 19:05
My name is Reed. I'm six years old. I live in Exeter, California, and my question is why are some stars blue and some stars red?

Talia 19:19
Excellent question. It's all about the temperature of the surface of the star. So, you know, here on Earth we usually use red to mean hot and blue to mean cold. But it's kind of the opposite when you're talking about stars. The redder stars have cooler surfaces. Now, you know, I say cooler. You can go up and give it a hug. We're still talking several 1000 degrees, but the reason Antares is red is because those outer layers have puffed up so far away from its super hot core that they've cooled off and they've turned red. The blue stars; those are the in blue and white. We tend to say stars are blue or white when they're at this stage. They're the biggest and the hottest. They're they're big stars right in the prime of life. Antares was probably a blue star before it began to enter this end stage of its life. So we do have several of these blue stars visible in the summertime sky. In fact, if you're looking up at your summertime sky from the northern hemisphere, one of the brightest stars you can see is the star Vega, and Vega is a sort of a bluish white color because it's a young hot star.

Jane 20:33
If we're looking up right now here in the planetarium, can you orient me and show me where it would be and what constellation it might be a part of.

Talia 20:40

Absolutely. It's part of the constellation Lyra the lyre, which means it's a it's like a harp. Although I gotta say this is one of the constellations that really doesn't look very much like what it is supposed to be. And right now we're looking at about 9:00 on August 7, and it's almost straight up. It's very close to. It's part of the summer triangle. It's what that I was talking about before, those three bright stars that appear in the summertime sky. Vega is the brightest of the three, and at 9:00 on August 7, it is almost straight up.

Jane 21:14
Is it the one that looks like it's part of a fish?

Talia 21:16
It does look like it's part of a fish. Yep, that's it.

Jane 21:19
Yeah, it looks like a fish to me. I'm not seeing a harp.

Talia 21:21
No.

Jane 21:22
After the break, more secrets of the night sky, like why do stars twinkle and how do you navigate using the stars if you're lost? Stay with us.

Jane 21:34
This is But Why. I'm Jane Lindholm. Today, I'm with planetarium educator Talia Sepersky at the Museum of Science in Boston. We're learning all about stars and how they make up these imagined shapes called constellations, as well as how stars form. And to do it, we're looking at a projection of the night sky in Boston, Massachusetts, which is in the northeastern part of the United States, on August 7, which is the day this episode comes out.

Triti 22:01
Hi, my name is Triti, and I'm seven years old, and I'm from India. My question is, why do stars twinkle?

Amelia 22:11
Hi, my name is Amelia, and I'm eight years old, and I live in New Jersey. Why do stars twinkle?

Oddaya 22:19
This is Oddaya from Israel. I have a question. Why do the stars twinkle?

Josie 22:26
Hi, my name is Josie. I'm six years old. I'm from Shingle Springs, California. How do stars sparkle?

Esther 22:36
My name is Esther. I'm from Warsaw, Poland. I am five years old. Why do stars twinkle?

Talia 22:48
Ah, the fun part of that is they're not actually twinkling. You know, twinkle, twinkle, little star, the the classic song. They're not twinkling. Our atmosphere is making it look like they are. So when starlight reaches your eye, so you can see the star when the light from the star gets all the way through space and reaches your eye. But the last step before it reaches your eyes, it's got to get through Earth's atmosphere, the air around us, and that can actually change the light a little bit. For one thing, especially in the summer when it's really really hot, air moves a lot when it's really really hot, and it can make the starlight that's coming through the atmosphere look like it's wiggling, and we see that as a twinkle. So when we're actually seeing you know stars twinkle twinkle little star, the star is not doing that. It's Earth. It's the air around us playing tricks on our eyes.

Jane 23:46
But I can remember as a kid being told, if you see something that's not twinkling, it's a planet, and if you see something that is twinkling, it's probably a star. So what's the deal with that, or is that just wrong?

Talia 23:57
Nope, that is a pretty good rule. The it has to do with the fact that starlight is coming from something so far away from us that even though a star is actually a huge, enormous object, it's so far away from us that it essentially looks like a dot. We call that a point source, but the point is that it it looks like it's coming from a single spot, whereas those things that don't look like they're twinkling look like stars that aren't twinkling. Those are planets in our own solar system, and they're not nearly as big as the stars, but they're so much closer to us that they're more like little circles than single points, and that actually affects the way the light comes through Earth's atmosphere, and it's why planets, unless it's a really hot day and the atmosphere is really dancing around, planets are not going to appear to twinkle the way that stars do.

Georgia 24:52
Hi, my name is Georgia. I'm four years old. I live in Toronto, Canada. Why do we see stars at night?

Jane 25:00
Why do we only see the stars at night? We can see the moon during the day sometimes.

Talia 25:04
We can, and the reason we can see the moon during the day is because it's also quite close to us. It is less than 250,000 miles away, which I know sounds like a huge distance, but that is right next door when it comes to things in space. These stars that you see at night-they are up during the day. They're all still shining. They don't switch off during the day, but they are really, really, really far away from us. And the sun, even though it's a lot of these stars that you see at night, are bigger than the sun. But the sun is so close to us; it's only 93 million miles away, which yes is a short distance when you're talking about distance to a star. It's like a giant spotlight shining right in your face. Now, if you've got a humongous spotlight right in your face, you might be able to see something that's right next to you, like the moon, but you're not going to be able to see anything else, and so we really can't see these other

stars because our sun is just so bright in our daytime sky. That's why we only see them when the sun's not in the sky.

Jane 26:11
Will you tell us about another constellation before we move on to some other questions? Maybe one of your favorites.

Talia 26:16
Absolutely, actually, one of my favorites is the third corner of the summer triangle. So we talked about Aquila the Eagle, which has the the star Altair in it, and we talked about Lyra the Lyre, which has the really bright star Vega in it. The last corner of the triangle is the constellation Cygnus the Swan, which I like because it is actually one of the few constellations that looks like what it is supposed to be. It looks like a swan in flight. It's got a long body and a long neck, and then it's got the wings spread out to either side. And then behind the wings is its little tail, and that tail star is Deneb. And the eye star, the one that's in the middle of the triangle. The eye of the swan is Alberio, and those two stars are both really interesting. Alberio, if you ever get a chance to look at it through binoculars or a telescope, is actually two stars, and they are very different colors. They're two stars that are very different colors. One of them's very very blue, and one of them's much redder. And then Deneb, the tail of the swan-that is one of the most distant stars you can see with your eyes. It doesn't look super big and bright, but it's actually really huge, really, really, really ridiculously huge, and really, really, really ridiculously bright. It's just also really, really far away.

Jane 27:42
Why do you like that one? Just because it looks like a swan, or because of some other reason?

Talia 27:47
I mean, for that one, it's because I like that it actually looks like what it is supposed to be. I also always love if you look at the constellations of the Summer Triangle, Cygnus and Aquila, the Swan and the eagle-they look like they're flying at each other-and I always ask guests in the planetarium who they think is going to win if there's a fight between the swan and the eagle. And everybody always picks eagle, and I say that means everybody is severely underestimating how mean swans are.

Jane 28:15
Yes, totally. So, what we're looking at right now-the whole time we've been talking, all of these stars have been in the same place. But if we were lying down in a field watching the stars, we might not notice at first. But over time, we might see that they have kind of changed position in the sky from where we were looking at them in the past.

Lucy 28:38
My name is Lucy. I live in Oakland, California, and I am eight years old. My question is: How do stars stay in space, and do they look like dots, or do they look like the shape of a star?

Noa 28:52
Why do the moon and stars look like if they're following us, but they're really just staying in one spot?

Jane 29:02
Do stars move, or are they staying in one place and we're moving, or what's happening?

Talia 29:08
Well, there's sort of two answers to that question. If you're talking about over the course of like a night, you do see the stars appear to move across the sky, and that's not because the stars are moving. That's because Earth is moving. Earth is spinning or rotating. It takes about 24 hours for Earth to rotate completely once. That's why we have a 24-hour-long day, and because of that, that's why the sun appears to rise in the east and set in the west. It's same with these stars; they're going to appear to move across the sky, and that is all down to the way Earth is spinning. Now that said, the stars do move. They are all moving through space. They're all moving through the Milky Way galaxy. They're just moving on really long timescales. It's not something you're going to notice from night to night, or year to year, or even lifetime to lifetime. But if you look over the course of a few thousand years, you definitely see the stars appear, some of the stars appear to start to change their position compared to the other stars. So the constellations of say somebody who was living 10,000 years ago aren't going to be exactly the same as the constellations you're going to see today because the stars will have moved a little bit, but again, that's not what's happening on a day-to-day basis. That movement is not actually the stars. That's us.

Jane 30:29
So it didn't. I mean, not they're not moving enough though that the serpent really looked like a serpent, and now it doesn't.

Talia 30:36
Oh no, that's just down to those ancient Greeks having a really active imagination.

Max 30:40
Hi, my name is Max, and I'm eight years old. I live in Flint, Michigan, USA, and my question is: Why is the North Star always facing north?

Talia 30:51
That is an excellent question, and it's a-it's actually has nothing to do with the star itself. So the North Star, or what we now call the North Star, Polaris, is its official name. It has to do with where the star is in space. So, if you've ever seen maybe a globe of the Earth in your classroom, and there's a stick that runs right through the center of the Earth, we call that the axis. If our real Earth had a stick running through it, and that stick came out of the North Pole, it would be pointing at Polaris, so Polaris itself isn't a particularly remarkable star. It's not very bright, it's not particularly interesting looking. It's just a normal star, but it sits almost directly over Earth's north pole, and that means that when Earth is spinning and all of these other stars are appearing to move, the North Star, Polaris, really just isn't moving. It's kind of like if you spun in a circle, everything around you would appear to be moving. But if you looked straight up, the spot on the ceiling above you would appear to hold still. So Polaris is just sitting in a particularly useful spot. And the funny thing is, if you want to go crazy, if you go wait long enough, the North Star isn't going to be the North Star.

Jane 32:07
Because of that star movement you talked about?

Talia 32:10
Nope, this one's down to Earth again. Earth actually wobbles like a top over the course of about 26,000 years. It wobbles in a complete circle. So again, this is a very long, slow process. But remember, I was talking about the star Vega in the constellation Lyra earlier, 13,000 years ago, Vega was the North Star, and it will be again in another 13,000 years. So right now, we have a nice bright star sitting pretty much right over to the North Pole. That's not going to stay the case. So it's actually kind of cool that we are living in a point in Earth's wobble where we have a North Star.

Jane 32:51
Well, you talk about where these stars are and and how we sort of think of them in the night sky. And if you know the North Star, then you know where North is. But we got a question from Hannah, who says,

Hannah 33:04
How do you navigate the stars when you get lost?

Talia 33:07
So a big one is being able to tell which way is north. So that's always a good thing to be able to find the North Star. That will at least tell you which direction you're facing. And then I believe I've never personally had to navigate by the stars, You can also, if you know what stars are rising when at different times of the year, and they used to have very, you know, sailors, for instance, used to have very detailed charts saying what rose when at different times of the year. That can actually help you figure out your longitude, how far east or west you are. If you've got really precise clocks and really precise charts, knowing say if you're in, you know exactly when a star appears to rise in the east on this day in London, and then you know what time of day it appeared to you wherever you are? If you have a really accurate clock, you can then use that to figure out how far east or west of London you are. It's pretty complicated, and I'm really glad we invented the GPS.

Jane 34:14
I guess also if you let's say you took a long nap and you woke up and you were like, "Have I been asleep for three months or seven months, if you knew where you were and you saw what was rising when, you could be able to tell maybe what even what day or what month it is.

Talia 34:29
Yes, for instance, I always know that we're approaching the beginning of spring because the constellation Leo starts appearing in the east when the sun sets. Leo is only in that spot in the sky at that time of day in like late February when it's starting to be towards springtime, and that's always exciting for me because I'm always ready for winter to be over. I should say it's springtime in the northern hemisphere, not for the southern hemisphere. And similarly, you know, I can tell how far. We are into summer by how high the summer triangle is when the sun sets. You know it's not precise. I can't be like, oh, it's it's 6:03 p.m. but I can tell roughly what time of year it is from that.

Jane 35:12
So, Talia, you don't even have a calendar at home. Probably, you just navigate by the stars, the stars to see. Oh, I know what day it is today. I have to go to work early because I saw when the stars rose last night.

Talia 35:22
I can't do that. But there were ancient cultures that I think could do that. They tracked the stars so precisely, and there's even you know ancient architecture, ancient monuments built around these very precise appearances of specific things in the sky at specific times of the year, they were truly great astronomers.

Jane 35:46
Yeah, that's kind of amazing to think about how how precise they could get it on a certain day to have the sunlight stream through, you know, kind of a frame of stone or something like that.

Talia 35:58
Absolutely, and there I know there are things that are built around you know the the time that the Pleiades rise on a specific day. The Pleiades is a little star cluster that we see in like the winter time sky here in the north, and there are things built around when that appears at specific on specific dates and or the orientation of the Milky Way relative to different things on different dates, like people tracked this stuff very, very precisely, considering they didn't have any telescopes or any tools like that to work with.

Jane 36:29
The Pleiades is one of my favorite constellations. I love going out in the winter and seeing it, and to me, it looks kind of like a kite.

Talia 36:36
I mean, I always see it look like a little, little, little, little dipper, personally.

Jane 36:40
Yeah, I can see that too. Speaking of the dipper:

Dane 36:42
My name is Dane and I live in Spokane, Washington. How does the Big Dipper appear?

Jane 36:53
How does the Big Dipper appear?

Talia 36:56
Oh, I always think it looks like a pot that has a bent handle. So there are seven stars in the dipper, and four of them make up the pot, and then three of them make up the handle. And the handle has a bend in it; it has kind of an arc in it. So I, you know, I've heard people call it a big spoon or things like that. I think it looks like a cooking pot with a bent handle.

Jane 37:20
What's the difference between the Big Dipper and the Little Dipper?

Talia 37:23
Oh, many things. The Big Dipper, first of all, is made of much brighter stars. So if you're looking, you see it, and you're not sure if it's the Big or the Little Dipper, it's the Big Dipper. It's much, much brighter than the Little Dipper, and their handles actually curve in different ways. So the Big Dipper has a handle that curves up, and the Little Dipper kind of has a handle that curves down.

Jane 37:46
So, here on August 7 in the planetarium, as we are looking at the sky tonight again, this is the Northern Hemisphere summertime, and we're looking from the perspective of New England. But some of the Northern Hemisphere stars are going to be seen in a lot of different places in the Northern Hemisphere. This is may look fairly similar if you're in the Northern Hemisphere. How would you advise us to start stargazing? Because as you told us, there are so many stars in the sky; it can feel a little intimidating or overwhelming to know how to start thinking about stargazing at night.

Talia 38:22
I like to find one or two patterns that I can find fairly reliably, and then use them to sort of learn the sky around them, and then you can use those the the sky around them as markers for figuring out you know what's beyond that. So, for instance, the Big Dipper is a good one because the Big Dipper you can use to find like if you follow the direction that the handle arcs and you keep going, you can find the constellation Bootes directly under the Big, well, the Big Dipper is part of the constellation Ursa Major. Directly under the bear is Leo the lion. The bear is standing on the lion's back.

Jane 39:04
And Ursa means bear. So Ursa Major is Big Bear.

Talia 39:07
Yes. So Ursa Major, Big Bear, and Leo is the lion. So the way they're positioned in the sky, it looks like Ursa Major, the bear, is standing on the lion's back. And you know, for instance, if you can find, if you can use the handle of the dipper to find Bootes, the herdsman. I use Bootes to find the Northern Crown, which is right next to it. So I can use the Dipper to find one thing, and then use that thing to find another thing. So some good markers to use. Like I said, the Big Dipper is a good one. If it's summertime, I like to use the summer triangle. If it's winter time, I like to use the constellation Orion, especially his belt. His belt is very handy for pointing at things. So that's my advice. Find one or two, two or three patterns that you can find pretty reliably, and then use them to learn the sky immediately around them, and then you can use the things immediately around them to find even more things, and you'll gradually learn the whole sky.

Jane 40:13
And if you live in a big city where there's a lot of tall, lit up buildings and car traffic and streetlights, that doesn't mean you can't see any stars. Talia says when the planets are in the visible part of the sky,

you'll likely be able to see them because they are very bright. And while you might not be able to see entire constellations, you could still spot a few really bright stars within those constellations. Plus, many cities have museums or universities with either planetariums or telescopes or both, and you might be able to visit one. Okay, but what if you live in the southern hemisphere, in a place like Australia or Chile or Botswana, and you have been patiently listening to all this talk about the summer sky in the northern hemisphere? It's true, the sky looks really different depending on where you are, and the southern and northern hemispheres have particularly different constellations and celestial seasons. Well, we haven't forgotten about you. I asked Talia to take us to see the night sky in the southern hemisphere on August 7.

Talia 41:16
Absolutely. Let me go. Let me bring us to Australia. Why not?

Jane 41:20
Woo! This is a very fast flight.

Talia 41:22
Yes, we are now in Australia. We are looking at, and because the sun is setting earlier, we are now looking at the sky the way it would look at about 7:00 and we've got a lot of constellations I'm not that familiar with because I'm not as familiar with the southern sky.

Jane 41:39
But some of them are similar. I'm seeing some of the same constellations.

Talia 41:43
Yep, I can still see Aquila, the eagle. I can see Lyra the lyre, and I can also see some really cool constellations like the Southern Cross that I don't ever get to see in Boston because I live too far north. Oh, and nice and high. I should point out, right almost directly overhead from Australia at 7:00 on August 7 is Scorpius, the scorpion with that bright red star Antares at his heart.

Jane 42:09
And that kind of to me looks like a J, like a wonky J.

Talia 42:12
Absolutely, a J. It's supposed to be the curl of the Scorpion's tail, but I know, for instance, if there are any fans of the film Moana listening to this, there were Pacific Island cultures that referred to it as Maui's fishhook, for instance.

Jane 42:28
And you could see that in New England too, but it was much much lower in the sky when we were looking in the northern hemisphere.

Talia 42:34

Yes, so you can see all of Scorpius from New England, but his tail barely the bottom of his tail barely clears the horizon. Now we're in Australia, and the whole scorpion is right overhead.

Jane 42:46
I want to point out two other constellations before we go. One is to me what looks like a kid, maybe with no arms, kicking a soccer ball.

Talia 42:56
Is it the one that's right next to Scorpius? Yeah. So that one, I always see a teapot with that one.

Jane 43:01
See, I love that we can see different things.

Talia 43:03
That is the constellation Sagittarius, the the Archer, and that's actually the direction of the center of the Milky Way. And you can see that from New England as well. Again, it's going to be quite low, but that's the direction that the center of our galaxy is in.

Jane 43:18
And then there's another constellation. Well, actually, it's a couple of constellations, and it's above the Southern Cross, and one of them looks very much like an animal, maybe a wolf or some kind of animal with four legs and a big tail. And then there's another animal, maybe a person. I don't know, but definitely some other kind of animal kind of looks like a minotaur, and they look like they're in conflict.

Talia 43:46
Well, I can tell you that the one that looks like a minotaur that is Centaurus. So it is it's a centaur.

Jane 43:51
That's what I was thinking. Yeah.

Talia 43:52
And then the one next to it is a wolf. That is Lupus the wolf. So very good with your guesses, and Centaurus is actually the location of the star system that is closest to Earth. It is one of the two bright stars, sort of marks the front feet of the Centaur, is Alpha Centaurus, and that system has three stars in it, one of which is Proxima Centauri, which is the closest star to Earth at only 4.25 light years away.

Jane 44:24
Oh, so you practically next door?

Talia 44:26
Yes, it's right in the backyard.

Jane 44:28

Talia, is there anything else that you think would be fun for us to know as we start looking up at the sky and trying to understand what's going on up there?

Talia 44:36
Yes, if you're looking at the sky on August 7, you should come back out and look on August 12, because the Perseid meteor shower is going to be peaking that night, and there isn't going to be any bright moon to get in the way. And the great thing about a meteor shower is you don't need any special equipment to enjoy it. You just go find the darkest spot you can, make yourself comfortable, lay back, let your eyes adjust, and look for shooting stars that are actually pieces of a comet's tail that got left in Earth's path, and we're plowing into them, and they're burning up in Earth's atmosphere, and it's one of the better meteor showers of the year.

Jane 45:11
Since we're talking about shooting stars, here's one last question.

Jana 45:15
My name is Jana. I'm from Long Island, New York. I'm six years old. Are shooting stars real?

Jane 45:23
Yes, shooting stars are real, but it's so magical to watch them in real time. And if you blink, you might miss one, or you see one and your friend doesn't, or your sibling sees it and you don't. So, what is a shooting star if not magic?

Talia 45:40
Ah, it's a piece of space debris burning up in Earth's atmosphere. So.

Jane 45:43
I mean, that doesn't sound quite as cool.

Talia 45:45
I don't know. Something from space tearing itself to shreds in Earth's atmosphere sounds pretty cool to me.

Jane 45:51
Thank you so much for sharing this with us and helping us get excited about the night sky. I'm really excited to go out and start using your technique of just trying to know a couple of things, and then knowing a couple things more by using those constellations or those stars as my guide.

Talia 46:08
Oh yeah, always start small. I mean, the sky's not going anywhere. You have plenty of time to learn it, and if you want to just go out and just look up, and enjoy how beautiful the night sky is, that is also a great way to be an astronomer.

Jane 46:23

And if you have any constellations that you see in your mind's eye, will you draw us a picture of what constellation you see? Maybe your adults can help you look up which stars are in your constellation, and then you can send the shape that you see, whether it's an animal or an instrument or a toy, and send us a picture of what you've drawn. I really want to hear what you would call your constellation and what you think it looks like. Send it to questions@butwhykids.org. Thanks to Talia Sepersky, planetarium educator at the Museum of Science in Boston, for taking us on a guided tour of the night sky. That's it for today. As always, if you have a question about anything, have an adult record you asking it on a smartphone using an app like Voice Memos. Then have your adult email the file to questions@butwykids.org. Our show is produced by Sarah Baik, Melody Bodette, and me, Jane Lindholm, at Vermont Public, and distributed by PRX. Our video producer is Joey Palumbo, and our theme music is by Luke Reynolds. If you like our show, we'd love it if you and your adults would give us a thumbs up or a review on whatever platform you use to listen to us. It helps other kids and families find us, and that helps us keep going. We'll be back in two weeks with an all-new episode. Until then, stay curious.