

Nephology with Dr. Rachel Storer

Ologies Podcast

February 5, 2020

Oh Heeeyyy, it's that lady who's both a stranger and also your internet Dad, Alie Ward. Back with a light and fluffy episode of *Ologies*. Okay, this is a big one! It has been looming overhead since the first time I encountered a list of possible ologies. This was over a decade ago, and I remember seeing nephology and thinking immediately like, "Who *does* that? Who *is* one?" And it was on my mind like a puffy thought bubble over my head so much that if you listen to the ending theme music, you will hear: [*clip of theme music: "... meteorology... olfactology... nephology...*]

So, of course you know I'm pumped *as hell* to get my head into the clouds for this. But first, per usual, thank you to everyone on Patreon supporting the show and to everyone sporting *Ologies* gear from OlogiesMerch.com. And if you want to contribute - for zero dollars - you can just make sure you're subscribed. Just do that. You can text, like, three friends. Tell them, "Hey, listen to this dumb show." You can rate it on Apple Podcasts, you can leave a review - which keeps it among the NPR beasts at the top of the charts - and also you know I read 'em all, 'cause I'm a creep. And this week, thank you to Asla0219 for this one. They said:

This podcast is insanely interesting even when the topic is something I don't typically have an interest in. Super smart people making super complicated information much more accessible. Hopefully these nerds will rule the world because they clearly have their shit together more than I do.

I doubt that, Asla0219. You left a review; clearly you've got it together, and I appreciate it. Okay, *nephology* is the study of *cloouuds*! This is very much a real word. It can mean a scientist of clouds or just someone who likes to gaze up and look at the clouds, and would hug a cloud if they could, and is like, "Clouds are tight." Now *neph* comes from the Greek for cloud - straight up - but it is not to be confused with the objects of *nephrology*, which has an 'r' in it. That means the kidneys, your pee organs, which we will explore another time, I promise.

Okay, so this ologist, this nephologist, I happened upon on Twitter, and I found out she was based in L.A. - a million DJ horns - and there's a pretty tiny number of professional cloud scientists in the world. She says that conferences are like family reunions. And she was like, "Hit me up for that cloud chat anytime." I was thrilled, I was nervous. She came over to my house just this past week; just this past Friday! This is a lightning fast turnaround, folks. We sat on my couch with my sleeping indoor racoon, Gremmy, just inches away, and we looked out at the atmosphere while we discussed: what *is* a cloud?; what are they called and why?; are chemtrails real?; what ancient weather adages can we actually rely on?; should you chase storms?; diamond rain; and clouds shaped like everything under the sun; along with which emojis are the most annoying? With atmospheric scientist, professional cloud looker-atter and nephologist Dr. Rachel Storer.

[*intro music*]

Alie Ward: Do you know that you are a nephologist?

Dr. Rachel Storer: I didn't until you said that word. [*both laugh*]

Alie: I was gonna ask if people call you a *Nephrologist* a lot, but they don't even call you a Nephrologist.

Rachel: No, nobody calls me that. Some of my friends call me a cloud doctor, which I use that one for some of my social media and stuff. I just think that sounds neat

Alie: *Calling Dr. Cloud*. How long have you been studying clouds? When did this start?

Rachel: Oh gosh. Well, I've kind of always loved storms. I grew up in Pennsylvania and we'd get great thunderstorms in the summer and stuff like that. My mom and I would sit out on the porch and stick our feet out in the rain, count between the thunder and the lightning and everything. So I've always been fascinated by it, I remember. But when I was... I was probably 12 or something like that when *Twister* came out.

Alie: Oooooohhhh *Twister*! I saw that in the theaters!

[clip from *Twister*, Dr. Harding: "Cow." Dr. Melissa Reeves: "I gotta go Julia, we got cows!"]

Rachel: Yeah - so I think a lot of people in my field around my age, that was one of those, "Oh my gosh, this movie is amazing!" And then right around that time TLC used to have all these specials about tornadoes, and tornado chasing, and all this stuff, and was like "What!? This could be my job? To study storms!?" So my undergrad was in meteorology and then I did atmospheric science for grad school and have been doing that ever since.

Alie: Oh my gosh!

Aside: Okay, so how much of a cloud badass is Rachel? Well, she is an author on papers such as: [as if over an intercom] "Effects of Convective Microphysics Parameterization on Large Scale Cloud Hydrological Cycle and Radiative Budget in Tropical and Mid-latitude Convective Regions."

And she got her Bachelor's in Meteorology from Penn State, which is a big weather school, and did a summer project about aerosols. "What the hell is an aerosol?" you're asking? Well, I asked Google for us, and it's a teeeny tiny thing that floats in the air or some other gas. It can be a solid or a liquid like dust, or water, or pollutants, or geyser mist, or snot droplets: which, by the way, the latter are called bioaerosols. So if someone sneezes on you and apologized, just say, "(aero)sol good, man" Just kidding - that's disgusting. Please cover your mouth, no offense.

Now, she got a degree in meteorology, but there are lots of topics under the meteorology *umbrella*, if you will (I'm sorry). She ended up getting her Master's and PhD in Atmospheric Science in Colorado. And part of that was just a really lucky link between that summer project she did.

Rachel: And so when I went to Colorado State for grad school, it turned out the woman who I was working with, she was doing research into how aerosols effect storms.

Alie: There ya go.

Rachel: Yeah!

Alie: Living in L.A., we get like four clouds a year. How do you feel about that?

Rachel: It's really sad. I've gotten to the point where I can get really psyched by drizzle.

Alie: Your standards just go lower.

Rachel: Yeah, you gotta take what you can get.

Aside: Just side note for context: L.A. does not have a lot of clouds.

Alie: Let's get to the nitty-gritty: what the fuck is a cloud? What is it!? It's water in the air...

Rachel: Yes. It is *a lot* of water in the air! So, if you look at a regular cloud... I'm probably gonna get the numbers wrong, but it literally can be, like, a ton of water in a cloud. But the droplets are just so small, and they can just hang out there in the air, and the light reflects off of them, and there's enough of them that we just see it as white, or gray, or whatever.

Alie: So you're looking at a cloud and you're like, "It's puffy, it's light, it's in the air," and it's just an absolute shit ton of water above your head. And the reason it's a cloud and not a puddle is... I don't know.

Rachel: Well, all of the droplets are really small. Literally like tens of microns across, is a cloud droplet. And so it's just so light, it has so little mass that just the little bits of air moving up and around are enough to keep it in place. So it's not until the drop gets big enough, until it forms a rain droplet that it's heavy enough to fall on its own.

Alie: So there is a tipping point, obviously, in clouds where there's enough water vapor that condenses where the droplets can't be buoyed by the air underneath it?

Rachel: Yeah, sort of. Eventually, there's just enough water and the more water there is in the cloud, the more the water's going to bump against other water droplets, and they start to stick together, and water vapor will condense directly onto water droplets, and they'll grow as long as it's moist enough. Then eventually the drops will get big enough that they'll fall.

Alie: Okay, so let's talk about shapes of clouds.

Rachel: The sort of two main types are stratus and cumulus, and the difference there is that cumulus clouds are convective, which means that they form because there's air that's warmer than its surroundings and it bubbles up. Like, you would have bubbles in boiling water, you have air that bubbles up and that's why they tend to be poofy and bumpy on the top. [*The skies always have little fluffy clouds*] And if you're going to have storms, those are convective clouds. Or you'll just get the little... one of my friends calls them *The Simpsons* clouds.

Alie: Yes, I was gonna ask about that. [*laughs*] It's funny, if I ever see a really puffy cumulus cloud, I instantly think of [*sings The Simpsons intro music*]. So, those are the puffy, fluffy cotton candy clouds, are the cumulus. And then there's the stratus.

Rachel: Yeah, so *stratus*... literally the word stratum means layer. So stratus clouds are generally layered, which means that they're sort of forming from a larger area that's rising a lot more slowly.

So, like over the ocean where things are generally, sort of, similar everywhere, then you tend to get strato-cumulus over the ocean. Or if it's a really rainy, drizzly day, a lot of times that will be a front coming through that's larger and so there's a big air mass that's just moving slowly up, and you get these flat layered clouds.

Alie: Oh, so it's like a pancake is a stratus cloud and a cumulus is a muffin.

Rachel: Yes! [giggles]

Alie: Okay, I'll take it. And then I guess, maybe, would a strato-cumulus be like a waffle?

Rachel: [laughs] Sure, why not?

Alie: [laughs] So hungry. Okay, what are some other types of clouds? What is a pyroclastic or a lenticular? What are all these terms?

Rachel: Pyrocumulus clouds are really cool, and also terrifying, and kinda sad because they're what happens when you have fire – *pyro*, right? So pyrocumulus is basically when you get so much heat from the fire that it forces convection on its own.

Aside: P.S.: Why should anyone care about the meaning of convection when it's not being used to describe an oven that's making me cookies? Well 'convection' just means a circular current, or gas, or liquid is less dense and it rises, and then the cooler stuff is more dense and it falls. This happens in weather patterns a bunch because the surface of the Earth is warm, so it heats air. That air rises and then the cooler air above it falls - that gets heated by the Earth, that rises et cetera, et cetera. Which, let's be honest, is almost as cool as cookies. That's pretty interesting.

Now, pyrocumulus, or flammagenitus, clouds have terrible names but they look like fluffy-puffy, billowy-pillowy steam clouds. [*"I'm talking steamy!"*]

Rachel: And so you get these really strong, really crazy cauliflowery, convectiony clouds that form. I've seen them here over the mountains sometimes, occasionally when we've gotten bad fires. And right now if you look at satellite imagery over Australia, you can see pyro-cumulus clouds.

Alie: Oh my god. And then what about a lenticular cloud, what's that?

Rachel: Lenticular clouds are awesome! We don't get them a lot around here. Sometimes if you drive a little bit farther east towards the mountains you can see them. But a lenticular cloud is a wave cloud, so it forms when air is forced over a mountain. If the atmosphere in general is kind of stable, then when air goes up it'll sort of go back down again, and it'll go up and down in this large wave. In the parts where it goes up, a cloud will form, if conditions are right. People call them 'UFO clouds', a lot of time they have this UFO shape to them 'cause they just form in the little top part of this wave.

So you get all these really cool... and sometimes they build up on top of each other. When I lived in Colorado we used to get the most amazing lenticular clouds. If you ever look at pictures of Mount Rainier in Washington, sometimes they'll form on top of the mountain and you'll get this really cool, layered... It's hard to describe with just words.

Alie: Ooh, I'm gonna look it up!

Aside: Y'all, are you sitting? Have you *seen* a lenticular cloud? They look like sky pancakes, or UFO's, or stacks of Hanukkah gelt. The word *lenticular* comes from 'lens shaped', like a bulging disc of a lens. Also, the word *lens* - are you even capable of dealing with this right now? I don't think you are - it comes from the Latin for *lentil*. So these giant,

disc-like clouds are like big lentil pillows. And I'll be honest, I think I just crossed the line to wanting to join the Cloud Appreciation Society, which is a real thing.

And side note: they published a book called *Cloud Spotting*, which is just a bunch of cool cloud photos and descriptions. So if you too have ever stopped to snap a photo of a cloud, there's a place for us on this Earth.

Alie: How many cloud pictures do you have on your phone?

Rachel: Oh so many! *[laughs]*

Alie: When you're driving have you ever pulled over to take pictures of weather?

Rachel: I've been storm chasing, which is a whole different story in terms of driving, and pulling over, and looking at weather.

Alie: Wait, when did you go storm chasing?!

Rachel: Oooh, when I lived in Colorado.

Alie: What does that involve?!

Rachel: Chasing storms. *[laughs]*

Alie: I know! But how do you know if it's going to be safe to do so? Are you... you're running, obviously, toward it, not away from, right?

Rachel: Toward it, yeah. Ideally you place yourself in the right positions that it will go just past you so that you can watch it.

Alie: And does that involve lightning, and thunder, and rain?

Rachel: Oh yeah, everything. Ideally, tornadoes, but it's hard to find a tornado.

Alie: "Ideally, tornadoes" - that sentence is not said often, I'm sure.

Rachel: Well, you know we're sort of a special breed.

Alie: Other people who study clouds, what are you guys doing when you're studying clouds? What does it mean to be a cloud doctor?

Rachel: My research specifically, like I said, is on storms: cumulonimbus, deep convective clouds, however you want to name them. And I look at a lot of basic things about: how much water is moving around in the storm, within the main updraft of the storm, and then out of the top into the anvil clouds, and trying to understand how the environment impacts that. So, if it's warmer or moister in certain layers of the atmosphere, how does that feed back on to the storm behaves.

Alie: Now, does that help people understand just general meteorology and weather prediction?

Rachel: Yeah, it's sort of the basic fundamental stuff that I'm into, which for me, I just love to answer the questions about it. Ideally, if I learn something worthwhile then it could help make models better for prediction, or for climate models, or whatever.

Alie: Do you trust forecasts?

Rachel: Yeah. Our forecasts are actually really good, out to a few days. There's specific ways people score them and they've gotten better over the years. If you look at 20 years ago, a

four-day forecast now is as good as a three-day forecast was then - we've gotten even better as we've gotten better models, more compute power and things like that.

Alie: You mentioned nimbus and anvil clouds. What are those?

Rachel: So, *nimbus* means rain.

Alie: Oh, it does!?

Rachel: Yeah.

Alie: I never knew that. Okay, wow. That's amazing.

Rachel: So cumulonimbus is like a thunderstorm, basically. [*"That's a fancy name!"*] And then anvil clouds... The top of the troposphere is called the tropopause, and then above that is the stratosphere, and that layer of that transition is really stable, so air that goes up can't really go farther than that. So when you have a storm cloud that goes up, it goes to the tropopause and then the air doesn't have anywhere to go. The clouds don't have anywhere to go and so they spread out. And they're called anvil clouds because if you look at the shape of them where they sort of peek out and point out, they sort of look like an anvil.

Aside: I looked 'em up, and these thunderstorms do in fact look like anvils! And their full name is 'cumulonimbus incus'. The *cumulo* means 'heaped', so there're like a bunch of heaps of whipped cream, and the *nimbus* means 'rain storm', and *incus* in Latin just means 'anvil'.

So when this rising air hits the tropopause... that's the boundary between the lowest level of our atmosphere and the next level, stratosphere. So, the cloud hits that and is like, "Oww - shit! Shoot! That's a ceiling! Okay, I'm just gonna casually fan out, I'm gonna act normal. Hopefully nobody noticed."

It doesn't even know how cool it is!

Alie: How does a cloud even form?

Rachel: The basics that you need are moisture and something for the moisture to condense onto and you need rising motion. If you have air that's rising for some reason, like for a convective cloud it's because you have warm air that gets buoyant - it's warmer than the air around it - or if you have air that's moving over a front, or over a mountain, then when the air moves up, as air goes up the pressure goes down and therefore the air gets colder. That's ideal gas law sort of stuff.

Aside: The ideal gas law is an equation, and it's $PV=nRT$

P is the Pressure of the gas times the Volume taken up by the gas, and those multiplied equal its Temperature times the gas constant [R] times the Number of moles of the gas. What's my point? My point is a professional nephologist does all kinds of computer modeling, and physics, and stuff on a white board, and doesn't just get to stare at the sky and say, "That's a chill fucking cloud, man."

Alie: It's funny that something so beautiful that we see every day is so complicated, you know what I mean?

Rachel: And that's part of what I love about it. I'm like, "Okay, dewpoint, saturation, vapor pressure..." You don't want to hear these things.

Alie: Those are great points!

Rachel: So you've heard of the dewpoint. The dew point is the temperature at which water would condense given the amount of moisture that's currently in the air. So the higher the dewpoint, the more humid it is. So as you raise air, it gets cooler and eventually it'll get to where it equals the dew point of that bit of air that's rising. So at that point condensation can happen.

Alie: Oohhhhh, okay!

Aside: Quick recap: the dewpoint is the temperature that water would start to condense, and a 50° dewpoint is pretty comfy, but a 70° dew point is just getting into swamp bottom territory. Living in L.A., this dew point info was new to me. I had not the foggiest idea.

Alie: And when does something become a cloud if it's foggy? Is fog a cloud?

Rachel: Fog is a cloud. Fog is just a cloud that's touching the ground. That's literally all it is.

Alie: How far does it have to go before it's a cloud? Just above your head? Is that philosophical or meteorological question?

Rachel: I think it's one of those fuzzy things because if you fly through a cloud when are you in the cloud and when are you not in the cloud? There's all these little water droplets, and at some point it's enough that you can see it. But if you look at it with a LIDAR, there's a lot more that you can't see because it's just too small, or too sparse, or whatever. So a what point is it a cloud verses not a cloud? It's not like there's weird, hard boundaries.

Alie: Right!

Rachel: So touching the ground verses not... there's wiggle room. *[laughs]*

Alie: Okay! What is it like for you when you're flying, and you fly through clouds, and you burst through, and you're like, "Ta-daaaa!" Is that always more fun for you? Are you always on the window seat?

Rachel: I like the window seat a lot. I try to plan it depending on what time my flight is. *[laughs]* If I'm flying in the middle of the day, I'm going to try for the window seat for sure, if I'm flying over the middle of the country, so I can see some storms. Otherwise I'll do the aisle, because I like to pee a lot. *[both laugh]*

Alie: You're like, "I'm well hydrated so if it's a nighttime thing..." Why do clouds cause so much turbulence?

Rachel: Because where there's clouds it means that there's a lot of air moving around. It's sort of a chicken and egg thing, because you're going to have more clouds where there's air going up. But also clouds themselves, because there's evaporation and condensation happening, it's like you're going over little waves in the ocean almost, where if you are in a pocket of air that that goes down pretty quickly, then the plane will get forced down a little bit.

Alie: Have you ever seen people during minor turbulence freaking out and you want to just be like, "Yo, I'm a cloud doctor." "Is there a cloud doctor on this plane?" You're like, "I am, and it's gonna be fine."

Rachel: I am careful about whether I tell people what I do or not sometimes, on the plane.

Alie: Really? How come? What kind of questions do strangers ask you the most?

Rachel: Oh, well I get ridiculous conspiracy theory things. People are all about chemtrails. [*spacey voice: "There's something I believe in, calmly, in chemtrails. I've seen them. I know they're real. I've seen chemtrails."*]

Alie: Let's break it down. I was going to ask you about that. I mean, chemtrails are definitely chemicals that are being spread by the government to make us stupid, right?

Rachel: Yeah. They read our minds, and yeah, they make us docile. [*clip from the X-Files theme song*]

Alie: Oh cool, that's what I thought. No.
What people do think that, about when they see contrails from jets, right?

Rachel: [*slightly strained*] Mm-hmm. Yep. You can go down a rabbit hole of YouTube videos where people will post, like, any picture of a cloud that looks at all weird and they'll be like, "See, it's proof." [*clip from YouTube: "And that's a chemtrail." Long pause. "Wow."*]

Alie: Do you look for faces in clouds or is that something that you abandoned as a child? Do you still look for shapes in clouds?

Rachel: I don't really go out of my way to. I mean, if I see it, I'll take note of it or whatever. But I tend to just sort of stare agog at them, just like, "Oh, it's so pretty." [*laughs*]

Aside: So we sat on my couch, staring at the sky, which was hazy with stripy things in it. They were probably stratus? Or cumulus? Right?

Alie: What are these today? These are stratus?

Rachel: Those are cirrus.

Alie: What the fuck is a cirrus?? [*laughs*]

Rachel: Cirrus is really high up, basically. There's three, kind of, levels that we think about in terms of the heights of the clouds. The higher up ones are cirrus, the middle ones are altos, so we have altostratus or whatever. And then the low ones are just, like, the stratus, or cumulus, or things like that.

Alie: So you can tack on a prefix to tell you where in the sky it is?

Rachel: Yeah. If you look at the actual... There's a Cloud Appreciation Society that has... there's all sorts of different... yeah. The names get ridiculous in terms of how specific it gets for different kinds of clouds. I cannot keep track.

Aside: Okay, so lemme pause for a minute just to tell you that she is not kidding. If you have ever stared into the mirror loathing yourself for not knowing what different cloud names mean, call your therapist and tell them you're healed. 'Cause guess what? You are not alone. Cloud names? [*takes a long pause and inhales deeply*] They're numerous. And they're long. And they're confusing. Like, not even a rare professional nephologist can grasp them all. But I'm here to lead us through the haze.

First off, let's all pour a little fog juice on the ground for the late Luke Howard. He was a 19th century botanist turned meteorologist who conceived of this system of cloud nomenclature. The dude loved clouds, and he published this opus, *The Essay on the*

Modification of Clouds, in 1803. And in it, he was like, “Hey, clouds? Clouds are not just water vapor in the sky, blown willy-nilly by the winds, all right? Clouds come from the Earth's temperature and all kinds of factors. We need to come correct and have a naming system for them. Have a little respect for clouds!”

So he turned to Latin roots, and hence, high clouds are cirrus, and that means ‘curl’ or ‘hair’. They're waaayyy up there, and they're pretty chilly. They're made of super cold water vapor or even ice crystals. And the middle clouds are alto, which means ‘high’. And low clouds are stratus, meaning ‘layer’. Now, why is alto in the middle? I don't know. Why does Starbucks call a small a tall? Beats me, dudes. And actually, you know what, I swear looking at this cloud naming is less complicated than a Starbucks order.

And just like a latte, you can customize. So, the Howard method – remember, he's the granddaddy of clouds – has a bunch of sub-sub-categories, like cumulus, which means ‘heapy, whipped cream clouds.’ Stratus can mean ‘low’ or ‘sheetlike’, either one, whatever. Nimbostratus, for example, is a low raincloud. Before you know it, stratocumulus stratiformis translucidus undulatus is as familiar and soothing as a triple venti sugar-free oat milk caramel macchiato. You're like, “I get it.”

Also, shoutout to the Kelvin-Helmholtz clouds, which look super oceanic, like cartoons of the sea. They look exactly like the Billabong logo, I swear. But it's not sponsored by Billabong. Let's just debunk that right now. Now, what other myths are floating around out there?

Rachel: One thing that I get picky about is that the bottom of clouds is generally pretty flat. So if you look at a field of cumulus clouds – we call them fair weather cumulus, just the nice little puffy *Simpsons* clouds – they generally will have a pretty flat base and they're all at the same height. And so when people draw clouds and they're all poofy at the bottom too, I'm just like, [*disappointed*] “Oh.”

Alie: You're like, “You don't get it. You don't get it.”

Aside: By the by, after we stopped recording, Rachel mentioned that she has a cloud tattoo on her left shoulder blade, and she said the design was really important and she had to work with the artist to make sure that the cloud was flat on the bottom. As a nephologist, that was very critical.

And also, the morning we recorded this, her husband Eric had texted her a good luck GIF of a cloud. And in his text, she showed me that he apologized for its shape, which was puffy on the bottom. He's like, “Listen, I know this is an insult to clouds, but the sentiment is there.”

Also, as a graduate of that prominent meteorology program at Penn State, what else peeves her?

Rachel: I get pretty irked when people do the whole, “Oh, you get paid to be wrong half the time,” that sort of thing. That's one of those that sticks in your craw, 'cause you're like, “Oh, you don't even know. We do so well.” It's, like, confirmation bias that you remember the one time that they screw up, but really we do pretty well. You generally know whether you should bring an umbrella or not, you know? It's hard. It's really hard.

Alie: That is really hard! To see something so far down the horizon and to say, “Hey, we saved your butt on those rainy days.”

Rachel: Yeah.

Alie: I have so many Patreon questions. Are you ready?

Rachel: Yeah, sure.

Aside: Okay, she is ready. But first, before your Patreon questions, each week we make a donation to a cause of the Ologist's choosing. And this week, given the chat about pyrocumulus clouds and the wildfires in Australia, Rachel chose the World Wildlife Fund's charity Australian Wildlife and Nature Recovery Fund, which supports veterinarians who are treating injured wildlife, and provides food and water to critters in impacted regions. They use koala detection dogs to help rescue them and to find other threatened species, and they get supplies to triage sites. So thank you, Rachel, for picking that. And that donation is made possible by sponsors of the show, which you may hear about now.

[Ad Break]

Okay, back to your cloud questions.

Alie: Kathryn asks: Why are they so fuckin' cool? Molly Rupp says: Word for word the question I was going to ask lol. So yeah, clouds. Why are they so cool?

Rachel: I mean, they just are, right? I couldn't put it better myself. Clouds are fucking cool. [Alie laughs] And that's the great thing: no matter what, I can just look outside and be like, “That's just really cool.”

Alie: It's cool. It's like wallpaper for the sky.

Rachel: Right?

Alie: You know what I mean?

Rachel: And it's different every day.

Alie: All the time.

Rachel: It's beautiful.

Alie: And sometimes it rains on us, in a great way. Aki wants to know: Why are clouds white?

Rachel: Yeah, I sorta got this a little bit earlier. Because you have a lot of droplets all in the same place and the light bounces off of them and gets scattered, it gets scattered in all of the different directions, and so that looks to our eyes like white, basically.

Alie: Huh! Kayla Simpson wants to know: How do “hole punch” clouds form?

Rachel: Ooh, okay. So, this is interesting.

Aside: Okay, so I have never seen a hole punch cloud, or a fallstreak hole punch cloud, or a cloud canal, or a cavum, or a skypunch. Call 'em what you want, but I looked it up, and it's like there's just this big gaping bite taken from the middle of a cloud. And if you had had moonshine for dinner, I can certainly see why you would think this was an alien spaceship, as many people have done. So what causes them?

Rachel: Between 0° C and -40° C, all three phases of water can exist. You can have liquid, you can have vapor, and you can have solid. There's this diagram that shows where the dewpoint of water is, and there's a similar one for ice, where at a certain temperature then ice would form. But in those in-between regions, it's actually easier to form ice than it is to form liquid. So if you have both of them in the same place, then a lot of times the liquid will evaporate and the air, the water vapor, will be more drawn towards the ice.

And so in a whole punch cloud, something happens that sort of disturbs the cloud. You get something that can form ice. Like, maybe a plane will go through and you'll get the right kind of particle that ice can form on. And so then a little bit of ice will form and it'll sort of like, [*makes a "shloop" sound effect*]. And a bunch of the water will go towards the ice and then you won't be able to really see it, because that part, there's not much of it there and it's pretty thin. And so you get almost this little hole in the cloud.

Alie: Oh my god, that's nuts. I'm gonna ask, how do you feel about the term 'cloud computing'?

Rachel: You know, I don't have strong opinions on it, but I do get a lot of followers on Twitter from various cloud computing resources and whatever.

Alie: I guess those people would be... technophologists. Do you think so?

Rachel: I don't know.

Alie: Yeah, I think they'd be a technophologists. First time question asker Navarro wants to know: In places like Brooklyn (big up!) it's overcast almost every day, only in the winter. No visible sun, just a silvery white haze blanketing the entire sky. I actually got curious and Googled it the other day. Turns out the explanation is nephological in nature. So can you please explain? And Jacq Poirier and Kourtney Ryan also have those questions about why is it cloudy in the winter.

Rachel: Yeah. I'm from Pennsylvania originally and so I know the gray skies of winter. It's a depressing time of year. [*clip from The Office, Michael Scott: "Seasonal affective disorder!"*] A lot of it is just the kind of clouds that tend to form. So, a lot of the stratus clouds, like I said, form when the atmosphere is stable. And so you get these sort of blankety... the stratus clouds. And in the winter, generally the type of weather that happens tends to be that type of weather. And we don't get a lot of sun, you know, the Earth's tilt is such that we're not getting a lot of sun that time of year, so the ground's not heating up a lot. You don't get a lot of convective clouds or anything like that and so a lot of the stuff is just stratus-y overcast sort of stuff.

Alie: I'm from San Francisco and I just call that sunscreen. Myself, a foggy day? Ah, soup weather!

Aside: JK, JK, the Skin Cancer Foundation says that up to 80% of the sun's UV rays can pass right through clouds, so sunscreen? Just wants to be friends. It's here to help. Use it.

Alie: So many people, I'm going to say their names quickly, including Emily Maloney, juliebear, Dave Insanity, Heather Densmore, Kitti Halverson, Chase Penix, Camille Young, Emmanuel Sanchez, and first-time question askers Julia Tolbert, Belinda Kuo, and Libby Mehle asked, essentially, in Libby's words: [*imitating a standup comedian*] What's the deal with seeding clouds?

Rachel: Yeah. So, in order to form a cloud droplet, you need something for it to condense onto. Like I said, we usually call these things aerosols. They're little solid or liquid particles that come from different reactions in the atmosphere, or sometimes it's dust or whatever. So cloud seeding, they do it in... some places do it for research. There's a couple places that do it sort of operationally. I'm trying to think... I think somewhere in Canada they do it. And I think in Israel they do it sometimes over the mountains. But basically if you put a bunch of particles into the cloud, these little aerosols or whatever, I don't remember what they use for it, some sort of salt, probably.

Alie: I was going to say Febreze, but, okay.

Rachel: *[laughs]* Something, yeah, something.

Alie: Something, okay.

Aside: They actually can use calcium chloride, or dry ice, or silver iodide or propane, or even tiny particles of sodium chloride, a.k.a. table salt. They bust those into the sky to change the weather. Like, we went through a spacetime portal into the future. But actually, cloud seeding and weather modification has been going on for, like, 50 years at least.

Rachel: And you're sort of changing the makeup of that cloud. If there's not enough of those particles and you put some in the atmosphere, you're triggering cloud formation if you want it to rain more there maybe. Or sometimes what happens is if you are sort of slowing down the rain process, then you can make it rain maybe further downstream. *[clip from Magic Mike: "Can you make it rain, ladies? Can you make it rain?"]*

Alie: And Emmanuel Sanchez wanted to know: Was that happening at the Beijing Olympics with their weather modification?

Rachel: So far as I understand, that's what happened, that they did some sort of cloud seeding to try and rain out some of the pollution, yeah. I don't know the details on it though.

Alie: Whoo!

Aside: Okay, so I looked this up, and apparently China's all about cloud seeding, and they shoot rockets of silver iodide into the sky and then sometimes, hot gossip, it rains over another country, and then everybody fights about whose rain it is. Like, is it seeders' keepers? I don't know, I'm not a cloud litigator. *[Law & Order "dun dun" sound effect]*

Alie: Is that ethical, to cloud seed, as a cloud doctor? How do you feel about it?

Rachel: Yeah, I mean it's not really harmful. You know, what you're putting in the atmosphere is just, like I said, some sort of salt or whatever, that kind of thing that's up there anyway. It's not something that can really be done to any sort of large, scary scale or anything like that. It's not easy to do and it's not easy to do well. The places where it is done is really small-scale places where they understand that environment really well.

Alie: Julia Tolbert, also first-time question asker, wants to know: Do clouds have a smell?

Rachel: *[chuckles]* Do clouds have a smell? I've never noticed a smell. I mean, rain has a smell, right? Because you get that, it's called petrichor, the smell of rain, which is really... I think

it's something in the dirt that gets stirred up when it gets wet or something like that, yeah. I hope clouds don't have a smell. It's mostly just water.

Alie: Okay. A lot of people of course want to know about climate change. Emily Elayne LaBorde, nikuya wooton – who's a first time question asker – Hayley Everson – first time question asker also – SarahDez, and J, juliebear, Schmitty Thompson, and Janou, they all want to know, in Hayley's words: Will climate change affect the clouds we see and will certain types of clouds become less common or even go extinct?

Rachel: Ooh, okay. So it's a really complicated question that we don't really know the answer to, but the short answer is yes, it will change things. As it gets warmer, it can shift climate patterns around and so places that maybe weren't warm enough for there to be a lot of convective clouds might get more of those, or it can shift where the main storm track regions happen. And then there's also, over the oceans, there's these large stratocumulus layers and there's a lot of open questions as to how those will change. There wouldn't be a cloud that would go extinct. That would make me very sad. *[Alie laughs]* But it's more about small shifts. And the important thing there is how that affects the radiation, because there's all these feedbacks with warming and how it affects the precipitation. Those are the more important questions for what we actually want to understand.

Alie: Yeah. Are we going to get drier as we get warmer?

Rachel: It depends on where you are. One of the things that gets thrown a lot is this “rich get richer” idea, where the places that are moist will get moister and the places that are dry will get drier, which is unfortunate, right? Like, if you live in a place, that's prone to flooding, you don't want more of that. And if you live in California, you don't want more drought. There's a lot of indications that that might be the way things are going.

Alie: So we gotta stock up on moisturizer in LA.

Rachel: Yeah, for sure.

Alie: Oof.

Rachel: Yeah.

Alie: I know that this is probably a question you get a lot. It's a super stupid question, which is why I'm asking it. The difference between weather and climate.

Rachel: Yeah.

Alie: Do you have to explain that a lot?

Rachel: It's a first step a lot of the time, because a lot of times when people have doubts about climate change, a lot of it is they have all this distrust of the models that we use. Or people will just be like, “Oh, it's cold. Where's that global warming?” So there's a lot of really cool analogies for it that I try to remember. One of the obvious ones is that the climate is the clothes that are in your closet and the weather is the clothes that you wear.

Alie: *[laughs delightedly]* That's a great way to get people to understand the difference. You kind of addressed this, but Laika Rountree, first time question asker, Mike, first time question asker, and Bryce and also Ivan want to know: Is it true (in Bryce's words) that clouds often weigh millions of pounds?

Rachel: Yeah. [*Alie softly screech-gasps*] A million sounds like a lot. I don't know, I'd have to do the math, but definitely thousands. "Ton" has definitely been thrown around, you know, those random facts that you hear and stuff like that.

Alie: Gracie Zecha wants to know: What is your favorite cloud formation and why?

Rachel: Ooh, okay. My favorite clouds are mammatus clouds.

Alie: [*high-pitched distortion*] What? Okay.

Rachel: So mammatus clouds, they can form in other ways, but usually they form on the underside of anvils. So the anvil is this big cloud that comes out from a thunderstorm, and mammatus clouds happen almost opposite the way that cumulus clouds do, where you get little pockets of air that comes down. And so it looks really bumpy and it looks like this really cool formation. [*clip from Dumb and Dumber, Lloyd Christmas: "There's a trip down mammary lane."*]

Mammatus, the word, I mean ya sort of get where the root of that comes from, right? 'Cause you get this little, like, bulbousy things. And they're just really, really cool looking and they're associated with storms so you see them after a storm passes. And especially if it's evening time, the light shines on them, they can look really, really cool. They're my favorite, yeah.

Alie: And they're boob clouds.

Rachel: They're boob clouds.

Alie: Nice. Erin Ryan wants to know: What would it actually feel like to fall through a cloud?

Rachel: It would just feel like falling, but you'd be kind of moist.

Alie: You'd be like, "Ah, ouch." It would be like ouch. Elizabeth Gonye wants to know: Why do cumulonimbus clouds appear to us as such crazy colors like yellow and green and purple?

Rachel: It depends on sort of what's in them and how the light is scattering. The darker that a cloud is, usually the more stuff is in it because it's blocking the light above it. If it's really dark overhead, there's more moisture in that cloud, right? If it rains, the clouds overhead are usually really dark gray. Sometimes a cumulonimbus cloud will tend to look greenish, and often that means that there's hail in it.

Alie: What?!

Rachel: Because the hail is really big and it just scatters light in a different way. And so a lot of times if there's hail in the cloud it'll have this sort of greenish tinge to it. If you get clouds on the horizon at all, you get all sorts of different color effects because of the angle of the light and the way that it scatters and stuff.

Alie: Katherine Finney wants to know: I once heard from a meteorologist friend that it's possible for clouds to have over 100% humidity. Is that true? How can that be true?

Rachel: It is actually.

Alie: What?!

Rachel: Yeah, it's kinda funny. Because if you have, like, a blob of air... When we think about clouds, we sort of hypothesize this parcel of air, which is, I don't know, if you think about a

balloon without the balloon on it, just sort of the blob of air. And it has a certain amount of water in it and it has a certain temperature. There's, like, this equilibrium that happens when you have exactly the same amount of water at the dewpoint temperature. But, like, nothing happens instantaneously, and so you can get, like, a couple of percent over 100% relative humidity.

Alie: Wow! That's nuts. Okay, so that's not a lie. That's not flimflam.

Aside: This, by the way, is called supersaturation, in case you ever meet a meteorologist and need to impress them in a pinch. Also, I may as well mention that sky writing involves smoking oil, like paraffin, to write words, and it's usually done around 3,000 feet up. To leave a sky message for your sweetie, it'll set you back around three grand. Now, the fancier dot matrix font sky writing is actually called 'sky typing', and that one lasts longer because it's about three times the altitude, but it's going to cost you like 15 Gs.

At one point, the most commonly written letters in the sky... I wanted to look this up, I was like, "They must be marriage proposals, right? No. They said, LSMFT. OoOoOhh, what is the secret message? It just means, "Lucky Strike Means Fine Tobacco." Mmm, sky cancer. Somehow, less sunny and romantic than I was expecting.

Alie: Anna Thompson wants to know: What's up with sunshowers, the event when it's raining but it's sunny above you? What's up with that?

Rachel: *[laughs]* Yes. Again, things don't happen instantaneously, right? So if you have rain that formed from a cloud, it can be falling, the cloud itself might dissipate in the time that it takes for that rain to fall on you. Or you could have just a little cloud that's, like, moving quickly and you get some rain that falls. Yeah, it can happen.

Alie: Just be-boppin' by. Elyzah Gaston wants to know: How much truth is there in the saying, "Red sails at night, sailor's delight. Red sails in the morn', sailors be warned"? Ever heard that?

Rachel: Yeah. Red skies at night, sailor's delight... There is actually some truth to it, and it has to do with the kind of clouds that you get. If you have an approaching weather system versus something that's just passed, where you'll see cirrus clouds and the way the light scatters off of them and stuff like that.

Aside: This adage is attributed to everyone from Shakespeare to Jesus, literally. The logic behind it is, to quote the Library of Congress:

When we see a red sky at night, this means that the setting sun is sending its light through a high concentration of dust particles, and this usually indicates a high pressure and stable air coming in from the west. Basically, good weather will follow. And a red sunrise can mean that good weather has passed. And if it's deep fiery red there may be a lot of water in the atmosphere.

So, red skies in the morning, gather your goulashes. Which means: if you live in LA, you can start cancelling your plans. We don't do rain.

Alie: A bunch of people, including first time question asker Grace Baden, ask about acid rain. Yo, can we talk about acid rain? Grace says: What is up with that and should we expect more occurrences of acid rain to continue as we continue to fuck up our atmosphere?

Rachel: Yeah, water carries with it the stuff that in it up in the sky. If there's a lot of carbon dioxide in the sky... or a lot sulfate forms sulfuric acid. Whatever's in the atmosphere that can form an acid will raise the acidity of the rain as it falls. It's pretty gross and harmful. And yes, if we keep sticking stuff up in the atmosphere, that's a thing that happens.

Aside: Acid rain was on American minds more in the 1980s before the Clean Air Act of 1990. But that didn't totally curb sulfur dioxide emissions. And some countries' environmental regulations haven't caught up since then, so acid rain – just like acid washed jeans – remains a global threat.

Alie: Logan K wants to know: Is a sundog a type of cloud?

Rachel: No, a sundog is... There has to be a cloud for sundog to happen, but what happens is it's usually a cloud that you can't see. It's usually a really thin ice cloud. Then if the sun is at a particular angle, the scattering of the sun off of that ice cloud will make that really cool bright spot.

Alie: Oh, I don't think I've ever seen a sundog.

Aside: I Google image searched them, and sun dogs are like ice halos that make these glittery, shiny spots on the horizon, kind of flanking the sun like a couple of Beyoncé dancers. Now, also, as long as I was looking up sundogs, I was like, what about cloud cats? Boy freakin' howdy, there are a lot of cat-shaped clouds on the internet. Some of 'em, of questionable authenticity. There's a lot of heart-shaped clouds, too, and some real deal dinosaur-shaped clouds, and dong-shaped formations, according to a whole round-up of them in the British newspaper *The Sun*. Sky dinos, sundogs, cat clouds... as long as we're talking cats and dogs, side note: raining cats and dogs may have come from the Greek phrase *cata doxa* which means 'beyond previous experience'. A li'l trivia for you! Speaking of which:

Alie: Lauren Quebral wants to know: How heavy does a cloud need to be before it rains?

Rachel: It's not necessarily about the heaviness of the cloud, it's sort of about the heaviness of the drops. There has to be enough water so that rain can form. A rain droplet has to be a certain size before it's big enough, heavy enough, to fall through the air. Ballpark, a raindrop is like, I don't know, a millimeter or something like that.

Alie: Okay, [*impressed*] whoo!

Aside: Also, after we stopped recording, Rachel mentioned that the raindrop emoji is on her shit list too, because raindrops flatten out when they're falling, and they make the shape of like, a boob implant, or a whoopee cushion, or I guess... a lentil. So now we know that boob implants and whoopee cushions are lenticular. What a great big beautiful world we live in.

Alie: John Worster said: I've seen clouds that have tornadoes in them and they have a greenish tint. I live in Nebraska. Is that the hail?

Rachel: That's the hail, yeah. [*male voice with a strong country accent saying, "What the hell," in such a way that its sound like "what the hail."*]

Alie: Pandora II says that: My son Shea, who's nine and is a first-time asker, wants to know, why are clouds never square?

Rachel: Oh, that's neat. [*laughs*] I like that. Kids ask the best questions. Because, I would say, probably because of turbulence, and air is always moving around and stuff like that. Plus, there's all this, sort of, chaotic stuff that happens on the small scale in clouds where just because you have sort of similar conditions right here, they won't be exactly the same ten feet away. So maybe you'll get a little bit more cloud here than you get there and it's all kind of uneven.

Alie: But they're flat on the bottom?

Rachel: They are pretty flat in the bottom.

Alie: Megan Leonard - [*high pitched and squeaky*] first-time question asker - wants to know: Can clouds carry parasites or harmful pathogens like giardia?

Rachel: [*surprised*] Ooh...

Alie: "Can clouds get beaver fever?" is also a thing Megan would like to know.

Rachel: [*laughs*] Beaver fever? I don't know what that is. That sounds inappropriate. [*both have a good laugh*]

I have no idea if clouds can... presumably they... I mean, I know they can have bacteria. Bacteria is something that can actually be a cloud condensation nuclei if it's the right shape.

Alie: [*impressed*] Ree really? So it *could* rain Giardia down on you, maybe.

Rachel: Maybe. I hope not!

Aside: I just googled, 'can it rain Giardia,' and I found out that there *can* be algae, and fungus, and bacteria - all kinds of things in clouds. And between that and the chemtrail research, Google is probably pretty worried about me.

Alie: Have you ever heard about those storms of lizards and frogs that rain down?

Rachel: Yeah... [*laughs*]

Alie: [*whispers*] It's fucking crazy. *That'll* turn a cloud green.

Aside: If you're like, "Lizard rain, Dad? You're on the drugs." I swear I am not. Please listen to the Thermophysiology episode if you have not - it's with the wonderful Dr. Shane Campbell-Staton - for more on clouds of cold-blooded critters.

Alie: Ethan Badr has a great question. He wants to know: If different clouds had personalities, what would they be?

Rachel: Oh my gosh. [*laughs*] Wow. Um, stratus clouds would be sort of gloomy.

Alie: [*laughs*] Like emo?

Rachel: Yeah, I'm picturing Sadness on *Inside Out*, sort of, "meh." Then, cumulus clouds would be pretty happy I think, right? They're pretty friendly, like, just chill. Cumulonimbus clouds would probably have a short temper, make the thunder.

Alie: What would lenticular clouds be, like, your weird aunt?

Rachel: *[laughs]* Yeah, maybe.

Alie: I feel like a pyrocumulus would be not someone I'd want to mess with, necessarily.

Rachel: Yeah, no, probably not.

Alie: First-timer Paulina Tarr wants to know: Why do clouds look like they're moving really fast sometimes?

Rachel: They *are* moving really fast sometimes!

Alie: Really? How fast?

Rachel: You tend to get – you know how there is a jet stream that jets like to fly in? The air in there can move like 50 knots or something like that. Just zooms through. And if you look up and there's clouds at different layers, it's cool because you can see them moving at different speeds.

Alie: *[amazed squeal]* Aaahhh! So you can track one and it's just floatin' right over you, just like a *berbye*.

Mellissa Croce wants to know - first-time question asker: What do we know about clouds on other planets, if anything? Are there different types of clouds on those planets?

Rachel: Yeah! So the, neat thing about clouds on other planets is that a lot of them aren't water clouds, which is sort of mind boggling to think about. Because the temperatures are so much colder, for instance, that you can get methane clouds and stuff like that. So that's pretty neat.

Aside: Okay, I checked into this and NASA JPL researchers have calculated that, in the methane-stormy regions of Saturn, it could rain up to *2.2 million* pounds of diamonds annually. You have a crush on Saturn now, don't you? If you like it, you're gonna have to *[corny chuckle]* put a ring on it. *[sing-songy]* Riiiiings. Okay...

Alie: You know what's funny about that is, when I picture it raining diamonds, I picture cut gemstones and not just rocks for some reason. *[laughs]*

Rachel: *[laughs]* I picture that too! There's an episode of *Doctor Who*, I think, where there's something like that, some sort of diamond planet.

Alie: Like they're already cut and polished like a diamond emoji.

Rachel: I picture the same thing.

Alie: And you're like, *[as if being pelted by diamonds]* "Ow! Ow!"

What do you think is the crappiest thing about clouds? What do you hate, or what do you hate about studying them, or what is your least favorite cloud? What about clouds is on your shit list?

Rachel: Wow, I don't know. I just love clouds! But yeah, being a scientist is frustrating sometimes. I mean, there are days when all you're doing is googling error messages for some code, or when you have to write papers or proposals, and you're spending all this time writing, which is one of those things that I never really enjoyed doing and nobody really told me was such a huge part of the job until it was too late to change my mind. *[laughs]*

Alie: So people picture you just on a grassy hill staring up at the sky with maybe a casual notepad next to you, but really you're at a computer.

Rachel: Yeah, I'm at a computer constantly. I use computer models to do my work, so I make fake clouds in the computer. They're less pretty than the real ones.

Alie: What do you love the most about clouds or your work? Or about being a nephologist, which you now know you are?

Rachel: I just love that on a day when my work is making me grumpy I can go outside and look at the sky and be like, "Oh right! That's the thing that I'm studying, this cool thing!" I get to work with other people who get excited about it, too. The few days of the year that we do get a storm come through, there's a couple of us that are like - the weather weenies in the group - that'll be outside huddled, like, "Oh my gosh, there's actual weather!"

Alie: I know! And then the greatest thing about LA is that when it does rain here, it's like a holiday.

Rachel: Yeah! It's magical! *[laughs]*

Alie: People don't go to work, *[laughs]* everyone cancels their plans. It's just like, "Well, it's raining." And everyone's like, "Oh, I know, well, I'll be staying home." Which is so thrilling. Any advice to anyone who wants to become a nephologist?

Rachel: Ooh, one of the biggest things in meteorology that I think maybe people don't know is how much math it is. If you want to study meteorology, you should probably bone up on your math skills. It's a lot of math, and physics, and stuff like that.

Alie: Okay, cool! Well, I would say that you were a ray of sunshine, but you're really - I feel like that's an insult in your work, so you're just a very dense and deep, dark, stormy cloud -

Rachel: *[laughs heartily]*

Alie: - and I mean that as a compliment.

Rachel: Okay. *[laughs]*

Alie: That's the best kind of cloud, right?

Rachel: Yes, I love them.

So, as always, meet smart people, and then invite them into your home if you feel like it to ask them stupid questions.

To follow Dr. Storer, she's on Twitter as [@cloudsinmybeer](#). We're [@ologies](#) on Twitter, come be friends with us on that. And on Instagram, we're [@ologies](#). You can tag your merch photos

#ologiesmerch and we repost you on Mondays. Thanks to Shannon Feltus and Boni Dutch for handling that. They host the comedy podcast *You Are That* and you should take a listen.

Thank you to Erin Talbert, for adminning the Ologies [Facebook group](#). Thank you to Emily White and all of the Ologies transcribers out there for making episodes accessible for free. Those and bleeped episodes for kids are up at [AlieWard.com/Ologies-Extras](#) (there's a link in the show notes). And if you ever need a pro transcriptionist, email hireemilywhite@gmail.com, she is wonderful.

Thank you, Jarrett Sleeper, for the assistant editing and some research help this week. And as always, the happy cumulus in the shape of a mustache, Steven Ray Morris who hosts the kitty-themed *Purrrrcast* and the dino-themed *See Jurassic Right* podcasts, for lead editing. Could not do it without you. Nick Thorburn wrote and performed the theme song.

Now, if you listen 'til the end of the episode, you know I tell you a secret, and this week – okay, so once I had this big meeting. I was really nervous about it. And for fun, I had a time I was talking to a good friend who was like, “Lemme draw you a tarot card from the deck sitting next to me. I’ll see what advice I should give you.” Kind of like in a “let’s see what your fortune cookie says.” And the card was a sword, and I don’t know *dick* about tarot, but she was like, “Oh! That kinda means like action, and courage, and power,” and I was like, “That’s tight, those are good meeting vibes.”

So before the meeting, to remember to feel strong and courageous, I straight-up took a sharpie and I drew a sword on my stomach, and it was fun going into a meeting knowing I had a giant, sloppy, asymmetrical, poorly-drawn sword on my belly, under my shirt, and [*whispers*] nobody else knew. But now you know.

So, go ahead, write crazy shit on your body before a meeting, but don’t do it before a date because if it goes well that could be really weird. Unless you’re seeing an ex, and you don’t want to get back together. Then maybe you could write “Hey, if you can read this, this was a mistake,” which would probably kill the mood pretty quickly. So, hot tip there.

But, yeah, it’s your body, graffiti it up for the day! Also sometimes it’s fun to write happy birthday on your butt, and then hang out with a friend all day and then moon them, like, “Surprise!” Just make sure that the ink is non-toxic. Just, your ol’ Dad, looking at for you.

Berbye.

[*outro music*]

[*clip of Bob Ross: “Right up in here we’ll make a happy little cloud. Use just the corner of the brush. You can just put as many layers of clouds in your world as you want, but do one layer at a time.”*]

Transcribed by

Mickey McG.

Hannah Dent

The lady in the allergy shot clinic STILL working on that same ding dang crochet project six months later, Katlyn Catron.

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