

Epidemiology with Drs. Erin Welsh and Erin Allmann Updyke

Ologies Podcast

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Oh, heeeyllo! It's that lady that sells air plants in abalone shells at the farmers' market, Alie Ward, back with another episode of *Ologies*. In this podcast, I usually try to get you to love and appreciate things you think you do not care about, because people and subjects are crazy and beautiful with just a little bit of context. In this episode, it's time to know thine enemies, so we're gonna discuss disease. Dis-ease, the lack of ease. Shit that makes you ill. Sometimes actual shit that makes you I'll and breath that can kill a million soldiers. It's dark, it's fascinating, and I'm kinda scurrred.

But, as we learned in last week's selam... machaphor... [*struggling to pronounce*] selichamack... Mm. Selachimorphology episode about sharks [*clip from Selachimorphology episode: Chris Lowe, "Our brain is programmed to get a little squirt of happy juice [squishy splat] when we're scared."*] Okay, before we go down an infectious hole of viral wonders, let's just think some quick li'l happy thoughts first.

Thank you to all the patrons on [Patreon.com/Ologies](https://www.patreon.com/Ologies). You guys kick in a dollar or more a month to submit questions, and honestly, you guys just keep the show running. It wouldn't run without you! So thank you. And thank you to everyone who has rated, or reviewed, or subscribed. You guys are keeping *Ologies* one of iTunes' top-rated science shows that says bad words. It's a distinction that probably dismays my parents – Hi Nancy, Hi Larry – but not enough science podcasts go there: the embarrassing places, the gross places, the profane places.

Thank you for all the kind reviews! As you guys know, I'm just a touch creepy and I read them because I think it's so nice that you leave them. And to prove it, I shout one out each episode as a thank you. This week RedandBlack13 says:

Bees? Bees! My friend recommended this to me, and I was like, "Um, okay, you just listened to a podcast episode all about bees and you said it was good? I mean, okay, I will trust your judgement, and maybe try this, and listen to one, that maybe isn't about bees?" So I did, and now I've listened to seven episodes in less than seven days and I refer to myself as 'not much of a podcast listener,' and that's the level of binge-listen I'm at. Highly recommend, so fun, so informative, you might even take notes, and it'll be amazing.

Thank you everyone who reviews, and subscribes, and rates, and takes a risk of telling your friends about this weird show.

Okay, disease. Dissssseeease! First off, the word epidemiology comes from – what else? The Greek! It's cobbled from *epi* meaning 'upon', and *dêmos* meaning 'people', so it's something that is 'upon the people'. The Centers for Disease Control and Prevention says that an epidemiologist can study everything from infectious diseases, to natural disasters, terrorism, non-infectious diseases, environmental exposures, and also injuries. So, if it is upon the people, epidemiologists are there, they're on the scene, they've got a clipboard, a notebook, maybe a hazmat suit, and they're just figuring that shit out before a cold turns into Armageddon.

This episode has been months in the making, and it's an *Ologies* first: it's two guests! And they already have their own damn podcast. It's so exciting! I was aware of both of them from the world wide web – I'm proud to say they're mutuals – and their show, *This Podcast Will Kill You*, is just killing it. It was number one on the science charts earlier this year, and at the time they were making it, they were also just casually both getting their PhDs, which is quite a feat. I can barely

make this podcast and have clean socks. They're based in Illinois, and we met up at the hub of just everything cool, the Field Museum. Also, special shout out to Kate Golembiewski, a.k.a. ScienceKate.com, who works at the Field Museum, for being so kind and hooking us up with a quiet room to record this in, a place where we could talk about open sores privately.

So we settled in, just one *Ologies* podcaster and two *This Podcast Will Kill You* hosts. We scrappily shared two mics between the three of us, and we talked about plagues, and ticks, and cholera, and flus, and pandemic capitalism, and Ebola, and hand washing, and smallpox, and SARS, and fieldwork, and dissertations, and some surprising thoughts on the culture of academia. So please be very prepared to become huge, giant fans of epidemiologists Dr. Erin Welsh and Dr. Erin Allmann Updyke.

Alie Ward: So, now... which one of you is Erin?

Dr. Erin Allmann Updyke: That's a great question!

Aside: Oh god, I might as well be wearing Oakleys on a lanyard and some crocs, that was such a dad joke question. But yes, both are named Erin.

Erin A: So I'm Erin Allmann Updyke.

Dr. Erin Welsh: And I'm Erin Welsh.

Aside: Dr. Welsh has long straight dark hair; she was wearing a smart black tank top. Dr. Allmann Updyke is tall, she was wearing a blue jumpsuit, and she has curly hair. And although I did not see their brains, I can describe them, and they are amazing.

Alie: Epidemiologists, both of you! And doctors?

Erin A: Yeah!

Alie: Officially??

Erin A: Officially.

Alie: Like, fresh doctors.

Erin A: Fresh doc.

Alie: When did you get your PhDs?

Erin A: I literally deposited on Monday. [*Alie gasps*] It's Friday, so five days ago is when it's official-official.

Alie: Oh my god! And then, Erin?

Erin W: I defended a few weeks ago and I'm still waiting to deposit.

Aside: I was like, "Huh, whut?" but Dr. Allmann Updyke explained that you present all your research and findings to this PhD approval panel, which I like to imagine consists of Heidi Klum, Simon Cowell, that guy from Maroon Five, and maybe Sporty Spice. Then afterward they can say, "Go make a few tweaks, dawgg," and then you "deposit" it back to them.

Erin W: The deposit is when it's, like, all stamped, official, done.

Erin A: It's like the library has to check your margins and they're like, "Please remove this space," and you're like, "For real? Okay, I'll do that."

Alie: What did you do when you deposit? Do you put it into a drop box and then do you moonwalk away in joy?

Erin A: I wish it was that. That sounds like such a more satisfying experience. I literally emailed a PDF in, and then they sent it back, and they're like, "One of your titles has a hyphen in the table of contents and not on your page, so you need to delete that." And I was like, okay. So I did that and I sent it back and then they're like, "Congratulations!"

Alie: Oh my god!

Aside: Both Erins have PhDs reflective of a certain specific epidemic. Dr. Allmann Updyke's PhD is in Entomology, which is bugs, because she studied Chagas disease, which is contracted from tiny little parasites carried by the kissing bug, which is also oddly known as an assassin bug and is like... kissing or having a hit out on me? It's like, pick a personal brand, those are very different activities. Also, our buddy Darwin, a.k.a. the father of evolutionary biology theories, is said to have had Chagas disease.

Speaking of evolution, Dr. Welsh just got her PhD in Ecology, Evolution, and Conservation Biology, and she was studying tick-borne diseases in Panama. Both have a master's in epidemiology and they studied epidemics for their PhDs. They have a podcast all about epidemiology, but they both were not sure if they should call themselves epidemiologists. They were just demurring, as many humble brainiacs often do. I was not having that.

Alie: You have a Master's in Epidemiology, but you're not an epidemiologist?!!

Erin A: It's really hard to call yourself things sometimes when you're like, "Oh, well everyone else is..."

Alie: No, I call bullshit on that. You're an epidemiologist. So says I. [*all laugh*] Now when did you guys realize that you were fascinated with diseases, and also, briefly, how'd you meet?

Erin A: Oh, that's fun! I know exactly when I started getting into disease. I was into biology, but I wanted to be a shark biologist. That was what I was going to school to study, aquatic biology. And at the marine science institute at UCSB where I went, they were having this party for the 100th or 50th anniversary or something. And there was this professor there who everyone loved; shout out to Armand Kuris. He taught three classes, and I asked him at this party, where wine was involved, I was like, "Of your three classes, which one is the best one?" And he got very, very serious. The wine was gone, and he was like, "Listen, this is not an exaggeration. Ten percent of my students' lives are changed by my parasitology class."

Alie: Ten percent!

Erin A: Ten percent! And I was like, "Okay, well I guess I better take it." I thought he was joking, but he wasn't joking and I literally... I think it was the second lecture, which was on schistosomiasis and he calls it "the hook." He's like, "This is the one that changes people's lives," and I kid you not, it changed my life. I was like, "Oh, *this* is what I have to study." And I went to his office almost in tears where I was like, "It's my senior year and I'm about to graduate and I don't know what to do with my life!" And he's like, "You'll be fine." And that's how it happened.

Alie: Now, schistosomiasis, not hookworms, right? But it is a hooky worm.

Erin A: Right, not hookworm, it is the hooky worm lecture.

Alie: And now Erin, when did you know diseases were for you?

Erin W: I actually kind of came at it from a slightly different perspective. When I started university, undergrad, I was majoring in nursing and I thought, “Okay, I really am interested in sort of this health aspect and the concept that every day it’s something new and it’s really exciting.” You can go anywhere; you can see all these different things. And so it was sort of like this way to sate my curiosity, and I did about a year and a half of that until I had to take – as part of the nursing curriculum – a class in microbiology. It was at 8am, Monday, Wednesday, and Friday. Brutal, right? But something was different about this particular class.

8am classes... I slept through an exam that was at 10am. [*Alie and Erin A. laugh*] I was not an early bird. It was embarrassing. So 8am, to actually have to get up, and get out of bed, and go to this class, at the beginning I was like, “Oh god, I can’t do this.” But then I was like, “I don’t want to miss it, actually.” I found myself wanting to be there every single morning and it was the only class, I think, maybe in my entire undergrad that I didn’t skip once. So during that semester I said “Okay, this is actually what I need to be doing.” Then I switched into biology. I joined a microbiology lab looking at plague, and then I kind of transitioned into epidemiology, and then ended up doing disease ecology.

Alie: That is the most casual use of the word plague I have ever... [*Erins laugh*] You just dropped that so smooth. “I was just studying plague and...” And now, how did you guys meet?

Erin W: Well, so I’m from Kentucky originally and we both go to the University of Illinois, and I started in the PhD program in 2012, and then the next year I got an email from my advisor saying, “Okay, we have a few new students joining the lab, and one of them is basically you times two. Her name is Erin. She has a master’s in epidemiology, and she’ll be joining the lab.”

Aside: Meanwhile, Dr. Allmann Updyke, newcomer to the lab, was nervous to meet Dr. Welsh because she’d done all this cool work in Panama and seemed like a badass. But one blessed summer afternoon on a Friday...

Erin A: ... and I peeked my head around the corner of the office. And I was like, “Hi, are you Erin? Because I’m Erin?” [*to Erin W.*] You were the best human ever, you were like, [*excited high-pitch*] “Yeah! Hi!” And then she forced me to come to happy hour that same night, and we’ve been soulmates ever since.

Alie: Aw, oh my god, double-Erin epidemiologists! [*Erins laugh*] When did you decide, “We need to take this to the podcast level?”

Erin A: September of last year. My friend hosts a barbecue every year called a Larbeque – his name is Laurence. I forced Erin to come with me last year, and we were sitting around... It’s mostly my partner’s friends, so I was like, “We’ll come to eat delicious food and hang out,” and Erin and I were being very antisocial and we sat in a corner of the yard the whole time.

Aside: Chatting about parasites and ignoring all the other living humans, they said those fateful words, [*clip of “Here Comes the Bride” played on an organ*] now akin to platonic marriage vows, “We should have a podcast.” And the next thing you know they were dreaming up themed drinks, aka Quarantinis, to match their epidemic episodes.

Erin A: We came up with the idea of Quarantinis that exact moment, and started coming up with a list of names, many of which we've actually used.

Alie: Your Quarantinis are so clutch.

Erin A: They're really fun. They're really a nice addition.

Alie: You're so funny and passionate about this, that *of course* you're the right people to be schooling the Earth on plagues. You make influenza so accessible. And I really appreciate that. Do you have a favorite Quarantini that you've made?

Erin A: Oooo... yes. My favorite is actually the first one, which was the H1Drink1. It is technically just a Corpse Reviver#2. That's the official name for it. It was super delicious. What's your fav?

Erin W: I think I really enjoyed that one. And then what was in the Harmadillo? Oh, I also have to put a plug in for Rice Water Stool, which sounds horrific but tastes delicious.

Alie: Hmm! Rice Water Stool. Is that a cholera...?

Erin W: Yes.

Alie: I remember that episode also. Thank you for taking me back. [*Erin W. laughs*] What is it about diseases and epidemics that you really love? And what is your goal? What's your mission? Do you want to make people more afraid of diseases or less afraid?

Erin A: That's a good question. The thing I love about diseases – and it sucks that you can't say things like "I love disease," because people get offended – but I am really interested by the complexities of disease. That's why we both sort of ended up studying disease ecology because it's looking at disease from a very wide angle and understanding all of the intricate details between the host, and the pathogen, and the environment, and vectors, and multiple hosts, and complicated lifecycles. And so that's what really hooked me about diseases, these diseases that are very complex and difficult to understand and therefore difficult to treat and deal with.

Alie: Especially when they go through so many hosts and they've got to go through this snail to get to this frog, to get to this pelican, who shits on a fisherman, who makes out with a seal. [*Erin A. laughs*] And then the next thing you know, a whole village is dead.

Erin A: Exactly, right. It's so interesting that an organism could evolve a lifecycle like that. Like, "How did you get there? How did you come up with that? How did that happen?" That's what really fascinates me about disease. So I think that our goal is more to just get people thinking about how interesting diseases are. Definitely not to scare them more, but I think that's the end result sometimes.

Erin W: I think part of the goal for me is mostly to inform. And so part of it is, if learning about how widespread and unchecked malaria is scares you, that's a good thing because it should scare you. Malaria and other neglected tropical diseases are huge issues. And so I think that it's more about bringing awareness to these problems that still exist and that most people don't really think about it on a day-to-day basis because we're not confronted with it because we have vaccines, we have easy access to healthcare... well, questionable.

Alie: LOLz!

Erin W: We do have the potential for access to healthcare, whereas other countries lack that completely. And so the driving force behind my interest in a lot of this, in disease or in

disease ecology, is putting it all in context. When I have taken history classes, it all seemed so segmented, like bullet pointed. “Then this war happened, and then this invention happened,” instead of putting it all into the perspective of, “Okay, but what else was going on at the time?” And so when I was in this lab working on plague, the first thing I did was I ran out and bought a book on the Black Death and I was shocked to learn the extent to which it impacted humanity. And still there are echoes of it today.

So, understanding how this thing that we think about... We think about these things in little cells, like we put disease over there, we put history over there, we put biology over here, and they don't really all interact together. So I think putting these things in context is where it really became fascinating for me.

Alie: How much of your work, and your research, and your science communication deals with domestic epidemics versus global ones, where we haven't quite implemented solutions that we may have implemented in the first world?

Aside: Dr. Welsh says...

Erin W: My research is on tick-borne disease and climate change and this all takes place in Panama. So I basically was trying to understand where ticks are, which ticks are infected, and why they are where they are, when they are, and then throwing the pathogen into that. “Let's predict how tick-borne disease will change in the future; we just have to understand what drives it currently.” We talk about how a domestic outbreak, or a small little outbreak of disease can turn into an epidemic, can turn into a pandemic.

Alie: And let's address that. Run me through what is an epidemic versus a pandemic.

Erin A: Yeah, great question. An epidemic is essentially just an outbreak of a disease that is outside what is normal for that community. So if you had even a few cases of plague in the US, that might be an epidemic because plague doesn't happen very commonly in the US.

Aside: I just gotta break in here because, to the gratefully uninitiated, like.... Wh... Eh... What is plague?? I thought maybe it was just a catchall term for some bad shit that kills people, but plague is an actual disease caused by a specific bacterium, *Yersinia pestis*. Pestis? A little bit on the nose, but okay. Plague is transmitted through fleas that live on rodents and there are three styles, if you will.

There's septicemic, which infects your blood through a flea bite and is 100% fatal if left untreated. Just, boom: You're out. Then there's bubonic plague, which was responsible for the pandemic in the 1300s known as the Black Death, or just, The Plague. I think it's all in inflection here. You can't really call The Black Death 'the plague', I think it's more like, Thee Plague, like how Chandler on *Friends* would say it.

The Black Death was responsible for up to 200 million deaths in just over four years. This bubonic plague, FYI, is when the bacteria enter the body through a flea bite and infect lymph nodes, and it causes them to swell or maybe burst. These are called bubos, which sounds so cute, like a term of endearment for your grandma, but they're actually swollen lumpy nodes of infected plague that can kill you and others.

But wait, there's more! The third type of plague – pneumonic plague – also can involve bubos but includes lung infection. So, what I'm trying to say, next time you're having a bad day and there's not enough ice in your cold brew, or maybe your new jeans stained a whole load of towels indigo, just think, “Well fuck. At least I don't have plague.”

Epidemiologists also suggest not handling dead animals in areas where plague is common, and for some of us that warning may be well-needed. I've handled a dead thing here and there, thankfully not in plague-torn areas. I'm just going to give a shout out to *Grease*, the 1978 musical, which issued this warning about duplicitous, leather-clad John Travoltas being vectors of widespread suffering: [*clip from Grease: Frenchie, "Men are rats. Listen to me. They're fleas on rats. Worse than that, they're amoebas on fleas on rats!"*] Amoebas... bacterias... You're close enough.

Erin A: In Madagascar there is a cyclical cycle of plague and so a few cases is normal, but last year when we were recording, last fall, there was a huge outbreak. There was an epidemic. When you have disease happening in a population that's larger than the norm, that's an epidemic. And then a pandemic just means an epidemic that's gone global. Usually it means global, but it could even just mean it has spread to many different countries. So a pandemic is just an epidemic that's spread globally.

Alie: How do epidemiologists feel about people saying like, "Snapchat addiction is an epidemic." How do you feel about it being misapplied?

Erin A: That's a good question. I mean, I kind of roll my eyes at it. We call everything an epidemic these days and it's like, "Okay, yeah, people are using Snapchat more than they did 10 years ago because *it didn't exist*. Chill." Eye-rolly, yeah.

Alie: Don't steal the thunder of an epidemic because when I need to talk about ticks on your butt, like, I need this word to mean something. I do have a question about... I have so many millions of questions, oh my god. Run me through the different types of epidemics, like what is a virus, versus a bacterium, versus a parasite, versus... Are there fungal epidemics? What flavors are there?

Erin A: There's a bunch of different flavors just based on what the pathogen is. A pathogen is a microorganism that causes disease. So you can have viruses, you can have bacteria, you could certainly have fungal infections. Fungal infections are less common because generally our immune system is better equipped at dealing with them. So you're usually most susceptible to fungal infections if you're already immunocompromised. Then you also can have parasitic infections, and usually people distinguish between parasites and pathogens, meaning pathogens are microscopic and parasites are larger. Is that right?

Erin W: For the most part, I mean I've also heard people say a protozoan is a parasite.

Aside: Let's say you are on a date and suddenly you realize, "Wow, it would really impress this person to know some information about protozoa." Well, I'm here to help! A protozoa is a single-celled organism that has a nucleus. Bacteria are also single-celled, but they don't have a nucleus. No, I did not know this. Yes, I just had to google it. You are welcome. I hope this leads to scintillating conversation, and maybe smooches... provided nobody has the plague.

Alie: I was going to say, do they have to have a mouth and a butt to be fully... But even single-celled organisms have that sometimes. So, it really depends maybe on who you're asking?

Erin A: Yeah.

Alie: And can you run me through what exactly is a virus?

Erin A: A virus is a... You can't even really call it an organism, right?

Alie: Is it an alien? Is it a tiny space alien?

Erin A: It's not an alien because they were definitely here before us.

Erin W: It's just genetic material.

Erin A: Yeah, it's genetic material, usually DNA or RNA, surrounded by a protein coat, and that's pretty much it. It's just genetic material in a sack of protein and it can't replicate on its own. So that's why people don't call it a living thing because it has to infect something else for it to actually make more of itself.

Alie: Oh my god!

Erin A: There are some giant viruses that they've discovered recently that – I don't know about any of those – the ones that live in the Arctic and stuff that are massively huge compared to other viruses, in that they have a way larger genomes than most viruses. They're huge. They're are larger than some bacteria in actual physical size.

Alie: And a virus essentially, from what I remember, is like a hexagon or something-shaped pod with weird legs like a claw machine that you would get a stuffed animal out of at Chuck E. Cheese. And it just comes and sticks its weird virus dick in you and then it just puts its DNA in you. Is that... Am I a doctor now?

Erin A: You're pretty much... I'm going to give you an honorary PhD.

Alie: Thank you.

Erin A: What you're thinking of specifically is a type of bacteriophage. I think it's called T7.

Aside: I was totally thinking of a bacteriophage, which is a virus that preys on bacteria. Its name, bacteriophage, literally means "I eat bacteria" and apparently, they're known informally just as phages. Like, "Please, please, my father is Bacteriophage, call me Phage."

Erin A: It has a name, that specific one. One time my roommate drew it in henna on her arm and I was like, "We should all get that tattooed. It's so beautiful." So that's a bacteriophage. That's a specific type of virus that infects bacteria. But not all viruses look like that. They can be little squiggles. The virus that causes Ebola is actually this little squiggly guy, that if you just were looking at it without any context you might think it's some kind of spirochete bacteria or something, if you don't have a size scale. It's just this little squiggly guy. You can have viruses that are just, sort of, balls. Influenza virus is like a ball with spikes coming out of it.

Alie: Oh yes, I feel like I've seen that on herbal remedies for flus.

Erin A: [laughs] Yeah. There's a lot of different shapes and all of those shapes are just basically the protein coat. So whatever protein structure it makes, that's what will determine what the virus looks like. Then it injects its little penis probe. It's just pushing its genetic material into whatever cell it's infecting.

Alie: Like, "Can you not??" You know what I mean? "Do you mind???"

Erin A: It's so rude. Like, "Did you ask permission?? I don't think so."

Alie: Do you guys feel like there is a certain kind of vector or pathogen that is the worst news? Which of the types of pathogens are you like, "Ooooh no"?

Erin W: Influenza.

Alie: Yeah? Whyyy?? Let's talk about this. This was your first episode on *This Podcast Will Kill You*. You're like, "We are going to start with a big one!" And also, the questions I got from

the Patreon patrons are like, “1918, let’s talk about it, *this* influenza, *this* outbreak.” So let’s get into some flu, because it seems like you have the flu, you’re out for a couple days, you missed some emails, you eat some soup, you’re fine. But really it’s going to kill us all.

Erin W: It could.

Alie: Okay.

Erin W: I think the thing about the flu is that we don’t really have any very effective treatment for when you actually do get flu, so if you have a really bad case of flu, it’s pretty much just like, “Okay, let’s keep you hydrated, let’s monitor you, and you have a pretty good chance of surviving.” But the scary thing is that, like the 1918 flu, something like that could happen again. And there were a lot of things that went wrong, or went right depending on your perspective. [*Alie and the Erins laugh*]

Alie: Flu’s publicist is like, “This was a success!”

Erin W: Planets are aligning. [*Alie and the Erins laugh*]

Erin A: I love to imagine that their little PR team after the epidemic they’re like, “Guys, this was great. Let’s do it just like this every year!”

Alie: “What a get!”

Erin W: “1973... Whoops, failed.” So yeah, something like that could happen again, where everything happens where you have a lot of people gathering together, which we kind of do all the time now in a much larger degree than we did in 1918. We have global travel... I guess the recombination with animals, mammal hosts, the bird hosts, and then the viruses inside, just sort of intermingling.

Alie: And can you give you the briefest of rundowns on that 1918 flu? Just tell me what were we dealing with here?

Erin W: We were dealing with a flu that started out possibly in Kansas, possibly in France. We don’t really know what happened.

Alie: Same thing.

Erin W: Same thing, I mean, more or less. A couple of soldiers who were on leave probably picked it up, went back to an army base where there’s a ton of young, otherwise healthy dudes sleeping in a giant tent, right? All breathing each other’s spit, all pooping in holes. This allowed for the virus to just sort of boom, boom, boom, boom. And somehow people started just, sort of, dropping like flies. People were getting really sick and they were not recovering, which was unusual for the flu because these were young men, really healthy.

And so, specifically about that strain was that it caused something called a cytokine storm. Basically, your immune system went into overdrive and your whole body essentially just shut down. And I think the most common way that you died was that your lungs sort of filled up with fluid and... that was the end.

Alie: Oooh no!

Erin W: Once it got into these army camps, of course, people who were maybe exposed to someone a few days before, got into a bus, were shipped maybe to Philadelphia, and boom! another outbreak there. And then if someone else went to England, boom! another outbreak there. And it sort of followed this hop, skip, and jump across the globe.

The reason that a lot of people call it the Spanish Flu, or used to call it the Spanish Flu, was because Spain was one of the only countries that was not censoring its news reports. And so to keep morale up around in the US or in England, they were like, “Oh no, we’re not going to tell everyone how many hundreds of thousands of people are dying. We’re just going to pretend like it’s no big deal.”

Erin A: And Spain was like, real talk.

Erin W: Right. Like, “Guys? Everyone’s dying. What’s going on, are we the only ones?”

Alie: Oh my god, Spain is like that person at the party who likes to call it like, “Your boyfriend sucks,” and you’re like, “Oh noooo, you’re right!” So how many people were lost to that?

Erin W: I can’t remember, was it 50 million? [*Alie gasps*]

Erin A: That’s right.

Alie: 15, or 50?

Erin W: 50.

Alie: Oh my god!

Erin W: Can I fact check that?

Erin A: She’s gonna google it.

Aside: So, the flu of 1918 infected 500 million people, 10-20% of whom died. On the low end, that’s an estimated 50 million lives lost, maybe up to 100 million. Brutal statistics, nothing to sneeze at. Which, in writing that, made me wonder if the term “nothing to sneeze at” was born of epidemiology but it turns out, no. In the 1600s – get this – sneezing became the cool thing to do because people thought it cleared the brain, and then sneezing at will became a way to throw shade at others. So, the idiom “nothing to sneeze at” was just invented by snobs, which are maybe even worse than viruses. Because viruses are just trying to make a living and replicate themselves off of your healthy tissues.

Alie: So, influenza is really what should be on our watch list.

Erin A: Yeah. Biologically, some of the reasons that I would say most epidemiologists are probably most afraid of influenza is because, one – like Erin mentioned already – the rate of recombination is really high.

Alie: What does that mean?

Erin A: Influenza can infect a lot of different organisms. It’s not specific to humans. It can infect birds, it can infect pigs, it can infect dogs, whatever. And when it infects an organism, if you get two strains that infect the same organism – say a pig gets two different versions of flu in it at the same time – the pieces of the influenza genome can kind of break apart and reassemble [*Alie gasps*] in such a way that makes a brand new virus.

Alie: Oh, that’s sneaky.

Erin A: Yeah. And so it means that it mutates rapidly enough that it can do those big shifts. Those are called antigenic shift, which are big changes, and can make it really hard for your immune system to identify it and fight it off. It also is an RNA virus, which means its genome is made of RNA...

Aside: PS: what is RNA again? Okay, I didn't know, so RNA is like DNA, but instead of that double helix structure, it's a single helix, kind of like a springy curl. DNA stores genetic information and RNA acts as a messenger between the DNA and ribosomes to make protein. It's like DNA's wingwoman [*"Hey girl, heeey..."*] but maybe she gets a little sloppy drunk sometimes. [*"I mean, helluurrr!"*]

Erin A: ...which means it doesn't have a fact-checking mechanism, so it makes more mistakes and sometimes those mistakes mean it does something better, like it replicates faster, or it's more virulent, meaning it makes you sicker, or things like that. So, the fact that it changes so rapidly is something that makes it difficult to combat and that's why we have a new flu shot every year, because it's always a slightly different strain. And the other thing is that it's spread by respiratory droplets, so it's unlike something like Ebola, which you have to have close personal contact with bodily fluids to actually get the infection. In this room, if I breathe, I can get you infected.

Alie: Oy vey.

Erin A: Yeah. So those are the kind of components that make what we call a disease of pandemic potential.

Alie: Is it a DPP or no?

Erin A: Let's call it DPP.

Alie: So you got yourself a li'l DPP.

Aside: [*as if through a megaphone*] Disease of Pandemic Potential.

Alie: I always think about exponential growth curves in populations. How you look at deer populations, human populations, it's like, boop de boop de boop... then sharp increase, exponential growth, and then there's always something that picks you off. Either it's famine because there's a lack of resources because the population can't be sustained, or it's close quarters, overpopulation causes a quick drop. If you look at human populations, I feel like we're due for that.

Erin A: People say that, yeah, for sure.

Alie: In terms of epidemiology, do you look at populations and say, "Oh no, there's so many of you that you're going to spread things quickly"?

Erin A: So globalization has definitely led to things having the potential to become pandemics much more easily than in the past. It was 2003 when SARS was a thing. Everyone was like, "That's going to be it. This is it. This is our next pandemic. Everyone gear up."

Alie: Can I just say, one of my best friends' name is Sarah and we've called her Sars as a nickname since we were 12. And so she's in my phone as Sars, she's been in my phone since before 2003 as Sars, and I can't change it, but anyway... I'm sorry Sars. I know you're listening, Sars, and I'm sorry.

Erin A: As long as it's not in all caps, it should be fine.

Alie: Okay, good. No, it's not. Okay. We're fine.

Erin A: You're fine. Don't worry about it.

Alie: Contextually, totally in the clear.

Erin A: With something like that, that was a disease that made people really sick. It was transmitted by respiratory droplets, and at first we didn't know at all what it was. So the fact that we have globalization, and people living in close quarters, and cities where people are living right on top of each other, it definitely makes it a lot easier for certain diseases to spread. It doesn't, I think, necessarily mean that there's going to be something that kills the entire human population, but it's possible.

Alie: How much do you guys wash your hands?

Erin A: Oh, not enough. This is horrible [*Alie laughs*] because I'm legitimately going to become a doctor. So I've been washing my... [*laughter*] I know, right? Sorry, patients! I do wash my hands a lot more now that I'm doing doctor-y clinic things and I'm always pumping that hand sanitizer. But before the clinical things, I don't know...

Alie: You weren't obsessive about it?

Erin A: No!

Erin W: I've never been obsessive about it, which is bad maybe. But I also... Every time I would be in the field in Panama, and I'd be setting out camera traps or something, and I would have just climbed through mud and trees, and my hands would be filthy, I'd be like, "Well, I guess I forgot any soap again and I'm going to have to eat this sandwich." And I would just sing to myself, like [*DJ record skipping*] "Microbiommomomome..."

Alie: Two questions about that. Number one, when will Purell stop working and do we go live in bunkers at that point? And number two, there are certain theories of too much sanitation screws you up, it sets you up for allergies. What is it called?

Erin A: The hygiene hypothesis.

Alie: Yes, the hygiene hypothesis. So where's the in-between there?

Erin A: I like to think – because this is how I live my life – that the in-between is, if you're picking up your dog's poop, yeah, you should wash your hands after.

Alie: Good idea.

Erin A: But if you're just hanging out on the beach and you're in the sand, whatever dude! There's some microbes! If you're camping, you probably don't have soap. It's fine!

Alie: It's fine.

Erin W: Oh, but you might have giardia. [*Alie and the Erins laugh*]

Erin A: You have a water filter. That's what's important, right?

Erin W: I think it's just managing reasonable risks. It's like, well, when I take public transportation, I know that people are coughing all over poles and certain times I might... in the winter I'm a little more paranoid. Like, "Okay, time to wash my hands now. I just went and taught this class," *definitely* gonna wash my hands after hearing, you know, 1,300 kids cough all over the place. But yeah, we're also not saying "don't wash your hands."

Alie: Right, but even as epidemiologists, you haven't reached compulsive levels of like, "Oh my gosh!" You haven't reached a state of paranoia.

Erin W: I think also washing your hands, it's a very conscious act. You're saying, "Okay my hands are going to be clean now," but we touch our faces so much throughout the day when our

hands are not clean that we don't think about it. You can definitely infect yourself with dirty hands in the eyes. And the number of ways that we can get sick is not just because we clean our hands. If we're on the bus, and I'm holding onto the railing, and then I go home and wash my hands, that doesn't matter if someone coughed directly into my mouth when we're on the bus.

Alie: *[laughs]* Lucky you!

Aside: Coughing directly into a stranger's mouth is how I flirt on the bus. Okay so influenza's definitely on their shitlist and this is a poorly phrased question to ask because it kills people, but...

Alie: Do either of you have, like, a favorite disease or any stories of triumph where you're like, "Wow, this could have really wiped us out, but we figured this shit out."?

Erin W: I feel like... I mean, one of the stories that brings me great joy is the smallpox.

Erin A: *[laughing]* Just her eyes when she says, "It brings me great joy."

Aside: To be clear it's not smallpox that brings her great joy, it's the eradication. Please do refrain from getting it twisted.

Alie: Something to celebrate for sure! What was smallpox and how did we get rid of it?

Erin W: Smallpox was a virus, a pox virus, and we got rid of it through vaccination. *[snapping in approval]* The smallpox vaccine was the first vaccine developed, and it was developed in a very unethical way. *[Steve Urkel, "Did I do thaaaat?"]* So, this guy named Edward Jenner basically grabbed a village boy, James... I can't remember his last name, dang it!

Aside: James Phipps, in case anyone's taking notes.

Erin W: Edward Jenner had noticed that milkmaids would get this version of a pox that was very mild and then they would never get any sort of smallpox.

Aside: Since the CDC announced the global eradication of smallpox in 1980, *[DJ airhorn]* it's no wonder that most of us have no idea what this sometimes fatal, oft-called 'Speckled Monster' looks like. I thought maybe, it looked like zits or something? Well, I just googled it and y'all, it's horrific. Imagine raised, weeping pustules clustered together like rush hour subway-style. Like your whole body is the texture of an oozing, painful, infectious Nestle Crunch bar. Whole lot of no thank ya.

Erin W: And you know, there's always this romantic idea of like, "Oh, a milkmaid's skin is so pure and clean and smooth." And it's because they never got smallpox because they were exposing themselves to cowpox. *[cowbell ringing and cow mooing]*

Aside: So, cowpox on the other hand, rarely fatal. It looks like some sores, usually on the hands and arms, but they resemble bullet hole Halloween makeup. Seriously, I just looked it up. I may put a side by side on Instagram or Twitter, because it's identical. And for some backstory, Dr. Jenner was this young science-loving orphan, who was taken in by some families, and in his teens, he became an apprentice to a surgeon. Because back then, I dunno, being a teen was like, middle-aged, or something? It was like, "13? Sure, you can cut some people open, you're like, over the hill."

Now there are two theories: either Jenner had heard reports from other local doctors that farmers who'd had cowpox never got smallpox, or there's another, kind of more beloved, story, that as a lad, Dr. Jenner overheard a milkmaid bragging, saying, "I shall never have

smallpox for I have had cowpox. So I shall never be ugly.” So essentially, her milkface brought all the boys to the yard. Hehe. Heehee. [*low pitch dad-joke groan*]

Erin W: And so he thought, “Okay, what happens if we inject or if we expose somebody intentionally to cowpox?” So he just chose, you know, a boy who had no ability to say, “No, I don’t think this is going to be great for me.”

Alie: Oh no, I wonder what that boy’s deal was!

Aside: I had to look into this, and I was thinking maybe James Phipps, this tiny, eight-year old human guinea pig, was the neighborhood rascalion. Maybe he was just a wicked, bratty boy that Jenner pulled aside and stuck with a virus out of spite, like poisoning Dennis the Menace. But no, little British Jimmy Phipps was simply nearby and available. He was the son of a poor, landless laborer who tended the Jenner’s garden. So the doctor was like, [*fancy old-timey British accent*] “Ah... Do pardon me, man who clips the roses, might I borrow your fine young lad? I’m just going to put a disease on him. Brilliant. Cheers.”

Erin W: Then he gave this poor James Phipps cowpox and this boy recovered. And so then Edward Jenner was like, “Okay, that was pretty good. That’s a good sign, but that’s not enough. Let’s expose him to smallpox.” So, then he took smallpox from someone who was infected and basically tried to give it to him, and it was a success.

Aside: And because it came from cowpox, or *vacca* for cow, Dr. Jenner called it a vaccination. He never really tried to profit off of his vaccines, which in 2018 I find very impressive, but he was eventually awarded money from the government for his contributions to science and, like, saving humanity. And little James Phipps lived quite a long life, I am happy to report. Dr. Edward Jenner gave him, his wife, and his two children a free lease on a cottage, which later went on to become the Edward Jenner Museum.

I also found out in researching this that on the property there’s a small, thatched hut known as the Temple of Vaccinia. It was originally built to be Dr. Jenner’s mancave for writing, or just chilling, or I dunno what. I don’t know if they just smoked opium casually in it. But he actually ended up using it as a place where he would administer vaccinations, for free, to the poor. And while reading these follow up facts, I totally cried on my keyboard.

Erin W: Vaccination has always been a controversial issue. At the beginning people were like, “Absolutely not! You’re going to turn us into cows. This is horrible! What’s wrong with you? This is unnatural.”

Alie: Turn us into cows by giving us cowpox??

Erin W: That’s all of the political cartoons that were anti-vaccination back then; people as cows or other animals.

Alie: Oh man, but a nice rack of udders would be kinda hot in the summer. [*laughs*]

Erin W: Milk all the time. [*laughs*]

Alie: Yeah! All... the time.

Erin W: Cheese... butter!

Alie: I can poo wherever I want! I love this. I have four stomachs. Bring it on! So, people were ethically like, “We’re not an animal. How dare you put animal things in us,” and then they continue eating milk and cheese anyway.

So, moving onto vaccine research, that must be a real big itch in your trou... I don't know what the thing... What do you say when something's... Not an itch in your trousers. That sounds disgusting.

Erin A: Ant in your pants? No? Is that not it?

Alie: Thorn in your side?

Erin A: There you go!

Alie: That's gotta be a real thorn in your side.

Erin W: It's a snake in my boot. [*Alie and the Erins laugh*] Too *Toy Story*?

Alie: A real itch in your snake! [*laughs*]. So, it's gotta be a real pain in the ole neck to come up against so much resistance to vaccines. How do you deal with that? And what's the nitty gritty there?

Erin A: I do a lot of screaming into my pillow to deal with it, which helps moderately. [*muffled scream into pillow*] But it is really problematic because you literally have children in the United States today dying from measles because they were too young to get vaccinated or they are immunocompromised so they can't get vaccinated. And some kid whose mom listens to Jenny McCarthy didn't vaccinate her kids and now there's a measles outbreak at Disneyland or whatever.

Alie: Right, which happened.

Erin A: Yeah, it happened! I mean, it continues to happen every year. It's getting worse because the more kids you have not vaccinated, the greater the risk it is. It's really frustrating and it's something that actually has been one of the best feelings about starting our podcast, when we have people email us like, "Hey, I got my flu shot for the first time ever because of you," and then we just cry tears of joy because that's kind of what it's all about.

When you look at the vaccination schedules from CDC, they do look intense and I totally understand. My niece is not even two years old and there's pictures of her after her vaccines and she's got a million band-aids and you're like, "Oh my poor baby!" So, I get it that it's a lot of vaccines, but it's very easy to ignore the fact that these diseases literally killed people for decades, for hundreds of years, before we came up with these vaccines.

And because we aren't faced with those deaths or with paralysis from polio on a daily basis anymore, it's really easy to just ignore it and say, "This is my personal right, to make a choice and to not vaccinate my children," when in reality you're putting everyone's children at risk of *death* by not doing it.

Alie: What do you think about the risks that seemed to keep people up at night? Like the risks of autism, or mercury poisoning, or setting off some kind of wildfire of an autoimmune response?

Erin A: So, the autism thing is 100% false. There's not even a millionth of a risk there. There was one paper by Andrew... We're not going to mention his name, he's not worth mentioning.

Alie: Voldemort. Got it.

Erin A: Voldemort, He Who Must Not Be Named, who wrote that paper, got fired from the Medical Society and had to retract this paper because it was completely falsified. It wasn't just that they were like, "We don't like your data," it was *completely* false. So that entire association with autism, which is one of the main things that sort of started this anti-

vaccine movement, at least in the States and also in the UK because that's where he was from, it's based on a completely false statement, a false paper that it is not real, 100%.
[“D’oh!”]

Alie: So, if you had to debunk some flimflam it would be this.

Erin A: Yeah, it's the easiest thing to debunk because it's 100% false. There are very small risks of other adverse reactions. There are certain vaccines that you should not get, that you're contraindicated to get if you have certain allergies, and that's something that you and your doctor should talk about, obviously. But all of the other risks are orders of magnitude less than the risk of dying if you get measles or something like that.

Erin W: And all of those adverse reactions, if someone cannot have a vaccine for that reason, there's something called herd immunity and so that's fine. So, the small proportion of the population that is not vaccinated, I feel like should be reserved for the people who actually cannot for health reasons. Not for personal choice, not because “Oh, I'm scared that my child will have autism,” because that is not true. Your child may develop autism or may be diagnosed with autism, but that's not because of the vaccine and that has been shown for decades now. So, I think that it's sort of debunking some of these things and I think that our podcast, in a way, is sort of doing this.

I think we have a responsibility, just as every disease ecologist, epidemiologists or science communicator has, to inform and say, “Okay, let's actually talk about what's going on here.” So, we're doing two things by saying, “Okay, the flu vaccine is actually really important even though every year there are people who go ‘Oh well it's not effective this year, so why do I even get it?’ Still get it. Just. Get. It.”

I think in talking about the ways that these diseases have impacted people in the past, It's also bringing awareness to the fact that yes, a lot of these diseases we can talk about in the past tense, but that's only because we are privileged with where we are. For so many other people who can't get a vaccine for something, think about what's going on there and be aware that this is still a huge problem.

Aside: So, there have been theories about correlations between autoimmune diseases – where your body's immune system loses its shit and attacks its own tissues – like MS, and rheumatoid arthritis, and lupus, and any possible links to vaccine use. But a lot of experts say it's just as likely, if not more, that wild infections can trigger the body's immune response in people predisposed to autoimmune diseases. So, I don't have much for you there, but as soon as I have an immunologist on, I'm gonna ask about autoimmune diseases since they run heavily in my family and I am just very selfishly curious.

Okay, let's ask more super smart, hard-hitting, and really complicated questions.

Alie: Do you guys have any favorite movies about diseases?

Erin A: *Contagion*. A thousand percent.

Alie: Oh reeeally? What is it about *Contagion* versus *Outbreak* versus so many other disease movies? Lay it on me.

Erin A: So, I haven't seen *Outbreak*, which I know, I know it's terrible.

Alie: A gasp from the other Erin! [gasp]

Erin A: I know, it's atrocious. [Alie laughs] But it doesn't matter because *Contagion* is, I know, so much better.

Aside: Okay, so between *Outbreak* and *Contagion*, two out of two epidemiologists named Erin prefer the 2011 film *Contagion*.

Alie: Which one is *Contagion*?

Erin A: *Contagion* is the one with Kate Winslet, aka my hero. [clip from *Contagion: Dr. Erin Mears, "Don't talk to anyone, don't touch anyone, stay away from other people."*] So that movie came out while I was doing my master's and I told my mom, "Oh mom, if you were wondering why I'm doing my master's and why I'm applying to MD/PhD programs, watch this movie, this is who I want to be." After the movie she was like, "Oh, Erin, that's just so great! You're going to be the one who saves the day and finds the cure!" I'm like, "Nah, bruh. I wanna be Kate Winslet [audio smeared to indiscernibility]."

Aside: Spoiler alert: Redacted, kiddos, because I care. I care!

Erin A: And she got really upset about it. But that movie, they worked with the CDC, and they worked with public health professionals, and they did such an awesome job of keeping it very true to life. I think it is the scariest movie that you can watch because it's so weirdly accurate. It's not perfect. There are science things that aren't absolutely perfect. In a class that our advisor teaches, he has the kids watch the movie and critique it, like what is true to life and what things are not true to life. So that's a fun little exercise.

Erin W: Also, it must be noted that Kate Winslet plays an epidemiologist named Erin.

Erin A: [gasp] Oh my god I forgot that! [screams]

Alie: Get out of town! She needs to meet you guys for real. We need to hook this up. Kaaate...

Erin A: Oh my gosh, I would die. Kate are you listening? Hi!

Alie: Erin, is that also your favorite? *Contagion*?

Erin W: I think it is. I think it is the most unsettling and definitely, after I washed that... washed that, I'm already thinking about it. After I watched that I was washing my hands a lot more. I mean, it's really scary. It shows at the very beginning... it's not even at the beginning it's at the very end where you see how the virus that has caused this pandemic has jumped from animal to animal to human and it's so... I just got goosebumps. It's so real!

That's how it happened for SARS. I think it was a very similar series of events in terms of wildlife, to an outdoor market, to a domestic animal, to humans. And so, SARS actually had a pretty good shot at it for a while and then for various reasons it didn't become a full-fledged pandemic, thank goodness.

Alie: Was that because we controlled it or because it just died out?

Erin A: This is so fun. I get really excited about the SARS one. One of the main reasons why SARS didn't become as big of a pandemic as it could have been, and as people were afraid that it would, is because we were able to catch it early and they did a lot of really intense quarantines at airports. But the reason you could quarantine at an airport is because when you get infected with SARS, you actually begin to show symptoms before you're infectious. So, if you're coughing on a plane... like during the 2003 SARS outbreak, if you were on a plane from any of the areas where SARS had been a problem and you were coughing, they were gonna quarantine you. That worked as a quarantine method because people were not yet infectious. With something like influenza, you're infectious for several days before you show symptoms so quarantine is much less effective.

Alie: And what about Ebola?

Erin A: The reason that it became as big as it did was in part because of miscommunication between the World Health Organization, and the CDC, and people on the ground. It was in part because it made it into a larger city. Usually Ebola outbreaks happen in more rural areas because that is a disease that tends to happen as what we call 'spillover', so from animal populations spilling over into human populations.

Alie: Bats, right?

Erin A: Bats in this case, yeah. They are pretty sure in the big 2014 Ebola outbreak, they traced it back to a kid playing in a tree with a bat.

Aside: This is sad for the humans and also the bats.

Alie: Man, I hate that because bats are just getting on the up-and-up where people are like, "Don't worry about bats you guys. They're good, they're cool."

Erin A: "We should save them. They're really important..." And they are, but they are also great at diseases. So many diseases are in bats.

Alie: Why is that?

Erin A: I have no idea.

Erin W: I think part of it is because they're mammals and they can disperse long distances. Also, for a lot of bats, there's this communal living. There's a lot of bats in one population and so you have the opportunity for something to spread very rapidly.

Alie: And so, with Ebola, what's the latest on a vaccine for that? Let's knock on Ebola's door and do a little visit.

Erin A: From what I know, there is a vaccine that they tested right towards the end of that outbreak in 2014 and it is effective. So, I think now they have been using it in current outbreaks that are happening.

Alie: Okay, so we can sleep a little easier.

Erin A: Yeah, and the thing is that here in the US, there really was never a reason to not sleep easy since the way that Ebola is transmitted is through close physical contact with blood or other bodily fluids. If you're living in Chicago or LA, you're not at risk. That's not the disease that's going to become the next pandemic, mostly because of the mode of transmission.

Alie: Okay, so what is the medical community's stance on illnesses that some would argue are behavioral or lifestyle influenced, like smoking-related lung cancer, or obesity, or heart disease? Do those fall under the same epidemiological protocol in terms of response to them?

Erin A: Yeah, so I know the CDC actually classified obesity as a disease just a couple of years ago, so it's officially classified. I have personal feelings about that, but...

Alie: Yeah, because we say that certain behaviors are a choice, but I feel like we're marketed to in a way that is a pathology in and of itself. It's so hard to say it's a choice when there's billions of dollars making our brains make these choices. How free are we to make these choices? I don't think that a huge swath of the population would suddenly become obese of their own doing.

Erin A: Exactly, and that's not how this has come to pass, but it is definitely something that, more and more, the CDC and public health agencies like state public health agencies are focusing on more. It's then, therefore, very easy to ignore infectious diseases in this country because chronic illnesses and things tend to take the forefront, which makes sense because that's sort of what costs the most in terms of healthcare dollars in this country.

But yeah, I would say most public health professionals do call those things epidemics or pandemics because that's the way that they view them. I just have a lot of personal feelings about it.

Alie: Yeah, I feel like we talk about pathogens and we talk about viruses, bacteria, parasites, and "okay, that's what we're up against." But with things like heart disease, pulmonary disease from smoking, obesity, the pathogen is capitalism and you're like, "What do we do??"

Erin A: That's exactly what it is!

Erin W: Just as a little side note to bring microbes into this question of obesity and so on, is that there is a lot of recent research that suggests that the way our gut microbiome is organized might actually contribute to a lot of these things that we consider behavioral epidemics. So, I think that's a really interesting facet, that we're only beginning to grasp the enormity of, how the microbes in our gut are actually making our choices for us in some ways. There's a really interesting book called *Your Brain on Parasites*.

Aside: Full title, *This Is Your Brain on Parasites: How Tiny Creatures Manipulate Our Behavior and Shape Society*, by Kathleen McAuliffe. And call me crazy, but it seems like a good beach read.

Erin W: She deals a lot with the question of what choices are our own. In addition, chronic disease epidemiology is really difficult to get a grasp of the risk factors for because it's very easy to say, "Okay, well this person ate that, or this person smoked, or X, Y and Z." But assessing those data, going out and collecting the surveys, asking someone what they ate for lunch three days ago... I have no idea what I ate, and so in general it's very difficult data to get.

Erin A: I'm thankful that in our med school we talk a lot about this. It's also a problem of health literacy, where we have huge health disparities in this country that are a result of wealth disparities and education disparities. These result in health literacy disparities, so if they do have access to a healthcare provider, they might not actually be getting all the information they need from that, and if they do get information, it might not be in a language they can understand, or in terms they can understand, or they might not know what to do with that information. Chronic diseases in general are much more complicated in very different ways. Some of the same ways too, especially in terms of wealth, but they're complicated.

Alie: From what I understand, in med school you have like a four-hour course on nutrition. Our nutrition and our gut biome aren't necessarily super addressed in Western medicine. Then like, "Oh, we have this epidemic! Well, it's everyone's own personal fault," and you're like, "Excuse me!" If you only had four hours on infectious diseases in your entire med school, you probably wouldn't be very good at solving that.

Erin A: I am actually now remembering that as part of my biochemistry class, we had a nutrition component, but it was this online thing and I just straight up clicked because I was like, "I

don't have time for this! I'm trying to write a dissertation. I'm trying to do field work." And so yeah, there's a lot of things that I think don't get addressed as well as they could. A lot of the problems that we put on individual people sort of stem from these systemic issues that we have in the country.

Alie: Exactly! We wouldn't see such a huge spike if there weren't something systemic underneath it. It's weird that in a first-world nation that the big sweeping dangers that we're up against are so ingrained. It's not nature we're fighting against, it's money, which is so awful.

Aside: Ooooh man, we have so many Patreon questions and very limited time but... Shoot, okay, just one more.

Alie: But I do want to ask, Lyme disease, what's the deal?

Erin W: *[laughs]* Dang it! I was hoping not to get this question. I have to admit that I am not a Lyme disease expert in any way, shape, or form. I am a Panama tropical tick lady.

Alie: *[guitar music plays behind singsong]* Tropical tick laaaady...

Erin W: And there's my theme song! That being said, we've been seeing Lyme disease a lot lately in the news reports. I get forwards from family members and friends, like, "Oh, I just saw this about ticks!" And tick-borne disease is incredibly on the rise. We've seen doubling of cases over the past couple of decades. Part of that has to do with more reporting. Part of that has to do with the fact that it is actually increasing both in terms of incidents, the number of cases a year, but also in terms of geography, so where people are actually getting infected.

Lyme disease is one of these where it is spreading, and spreading, and spreading. Part of what is driving the increase in cases is development, basically. So, by changing the structure of the forest, you're changing the animals that live in the forest and some animals are better at transmitting Lyme to ticks than other animals. If you imagine a tiny little baby tick just emerged, and it does not have Lyme when it is born. When it is born, it does not have any Lyme disease in it, even if its mother had Lyme.

Alie: And it's the size of a poppy seed.

Erin W: Yes, it's teeny tiny. Yes. I remember the CDC issued an apology for ruining poppy seed muffins.

Aside: Dude, this just absolutely won Twitter for me. A few months ago, the CDC published a photo to illustrate just how tiny nymph ticks can be, by placing a few on a poppyseed muffin with the caption, "Can you spot all 5 ticks in this photo?" plus a link to learn how to prevent tick bites. This tweet had everything: food porn, hidden twist, there was science communication outreach, a puzzle, and a link to save lives!

But nevertheless, 'Big Muffin' got in the way and as a USA Today headline woefully reported the next day, "CDC apologizes for hiding ticks on a poppyseed muffin to warn of Lyme disease threat." The CDC followed up with the tweet: "Sorry we ticked some of you off." *[Price is Right loser horns]*

Erin A: I loved that! It was amazing! It was so good!

Erin W: Oh, I would constantly, in Panama when I would come across a tick bomb of larval ticks, I would play freckle-or-tick all the time.

Alie: Wait, tick bomb?

Erin W: I should've brought pictures. Or a video actually.

Alie: Oh my god, and you do have freckles. Oh, that's a nightmare!

Erin W: So, the most ticks that I have ever counted in one sitting; over 6,800 ticks in one tick bomb. A female tick lays a clutch of eggs after she's fed and then they all hatch at once, roughly. Then they all do something called questing, which sounds very Arthurian legend, but it's just going to the end of a piece of vegetation where they wait for an unsuspecting host to walk by, and it's a writhing mass of ticks. *[Alie wails]* That's how you collect ticks, you just drag a piece of cloth through the vegetation and you count them. So, they would crawl up on the cloth onto my arms, or I would just brush up against it when I was doing camera trapping, and they'd be all over.

Alie: I'm having a full body cringe. I love bugs. I love bugs except for ticks. Ticks and roaches are like, "Sorry, no, 86'd." But from what I understand, Lyme disease... there's like 300,000 cases a year.

Aside: I just looked at a CDC map comparing the rates and distribution of Lyme from 2001 to 2016 and DUDE! It looks like someone broke a pen near Connecticut and the ink is steadily hemorrhaging into New England and the rest of the United States. And just for funsies, I'm just going to mention... If you're into conspiracy theories, you might want to look up Lyme and Plum Island Animal Disease Center, which was a government military testing facility that employed re-homed Nazi doctors to do trials on animal-borne biowarfare.

Fun fact: Plum island sits 8 miles off the coast of Old Lyme, Connecticut, where Lyme Disease was first identified. Now, am I saying this conspiracy theory is true? No. Am I telling you that it's super interesting? Yes. Am I a doctor? No. But anyway, 300,000 cases a year of Lyme Disease in the United States alone. Now Dr. Welsh – who likely does not believe in conspiracy theories – explains some other reasons why Lyme might be spreading.

Alie: That's a lot. Right?

Erin W: Yeah, that's a lot. It's one of these things where these ticks are now infected. Where the disease is present, all the ticks are infected. It's because we have this suburbia, basically, where in these areas we have deer that can still live amongst neighborhoods and stuff like that. So, that doesn't really hurt deer populations. Mice can also live amongst these neighborhoods, doesn't hurt mice populations. Mice are really, really good at infecting ticks with Lyme disease, and deer are really good at feeding ticks and making more ticks.

So, with a combination of these two things, you just have this explosive boom. When we deforest an area, we reduce the number of species around. We then get this huge increase in tick-borne disease because we have the hosts that are left that amplify the ticks and amplify the pathogen. So, that's part of what's going on in addition to just this general geographic spread. We could throw in some climate change up in there and talk about the overwintering survival of a tick. I mean, vector-borne disease is super complicated.

Alie: And what about chronic Lyme?

Erin W: Chronic Lyme is a really interesting thing. The definition... or the treatment in public health regarding chronic Lyme has really changed over the past couple of decades because it first started out as being this, "Oh, it's all in your head." Now it's becoming increasingly apparent that it's actually not in your head, and these are people, for

whatever reason, who are having some symptoms that last long beyond the active infection stage. Whether it is something where your body recognizes the Lyme bacterium and then that Lyme bacterium is very similar to a cell that you already have in your body and it elicits this huge autoimmune reaction.

Alie: Right, how much is severe autoimmune reactions to some kind of infection?

Erin A: Yeah, it's interesting and there are other vector-borne diseases that can cause weirdly long-lasting joint pains and things if you get infected with something like Chikungunya or Dengue.

Alie: Chikungunya sounds like a lunch special.

Erin A: Yeah! It's another vector-borne disease. It's transmitted by the same mosquitoes that transmit Dengue and Zika. It also invaded in the same way as Zika did. It started in the Caribbean and then sort of spread to South America and, as all these diseases do, they get press and then they fade from the public eye.

Alie: Are they fading because the disease is fading or are they fading because no one cares anymore? A little bit of both?

Erin A: A little bit of both. So, when you talked earlier about the exponential growth of populations, you see the same thing in epidemics. You have what's called an epidemic curve, where when a disease invades a susceptible population, a whole bunch of people get sick really fast, but then you hit some sort of peak. And what causes that peak is maybe there's no more susceptible people left in the population or something. Then that disease will decline and it's literally, like, a hump, like a mountain shape and that's what's called an epidemic curve.

Every single outbreak follows this exact pattern. How big the curve is or how wide it is depends on the disease. So when you have that waning phase of a disease, it's very easy to stop talking about it because people aren't getting sick anymore. Also, you get funding for a certain amount of time, so it's in the news and then the next news cycle comes around and people stop talking about it, and Chikungunya is hard to pronounce, so people don't talk about it.

Alie: It really does sound like a curry, not gonna lie. [*Erin A. laughs*]

Erin W: I also wonder how much of it too, is... Zika was huge, people were like, "Oh no, we're in the US. Can it happen here?" And then once that answer slowly became no, it became less of an interesting or press hot issue.

Alie: As soon as pregnant women started being like, "Oh, I'll go to Mexico." You know what I mean?

You guys ready for rapid fire?

Erin A: So ready.

Alie: Okay, we're going to blaze through these. You ready? Okay, Sarah Nichelle wants to know: What is the deal with the dancing plague of 1518?

Erin W: Great question. I've looked into it the tiniest bit and it seems like it's still unclear, but I really want to do that as a future episode. Stay tuned!

Alie: What happened?

Erin W: It was just... A bunch of people started dancing to the point of exhaustion. They dropped dead from dancing so much. It sounds like a *Buffy The Vampire Slayer* episode because it was!

Aside: Fact checked and yes: this epidemic was said to have inspired the dancing demon of Buffy's musical episode: "Once More, With Feeling."

Alie: Are you serious?? Now, what do they think caused this?

Erin W: I don't know. I don't remember what the different hypotheses were in the Wikipedia article that I glanced through once.

Aside: Top contenders: famine-induced psychological distress and/or possible wheat fungus. More on that in a minute.

Alie: Oh my god! It sounds like just chardonnay-at-a-wedding disease. Open bar wedding is aka a dancing plague.

Greg, Hannah Silverman, Allison Bray, and Brittany Bell all asked, essentially: As global warming continues to expose more and more diseases and we generally work to destroy ourselves through our own shortsightedness, are we as humans destined for a sudden massive population crash? Essentially, how is climate change affecting things like mosquitoes, vector-borne diseases... How is climate change affecting epidemics and how much are we going to die?

Erin A: Yeah, that's a good question. The one thing that people can say for sure is that climate change is going to affect infectious disease. Whether that means it's going to change the distribution of diseases – meaning that diseases will happen in places that they didn't happen before – or whether it means that you're going to have more diseases than we had before. It's a little bit hard to say at this point. It's still sort of a crapshoot, and it's who you talk to, and also where you live.

So, it could be that as climates warm in more temperate regions and it's warmer for longer, maybe diseases might shift, but then that also might mean that in some areas it becomes too hot for certain diseases, like in some areas of the tropics perhaps. It definitely can shift the placement of vectors. You might have mosquitoes moving into new areas, or ticks wintering better, or their population is lasting longer. You actually study climate, I don't. *[laughs]*

Erin W: I think that that you answered it perfectly. I think the other thing is that climate change: yes, will impact infectious diseases. And the direction, and the strength, etc., is always very dependent upon where you are and what disease you're talking about. But I also think that having studied climate change and tick-borne disease, that the way climate change is actually going to probably impact humanity is not as much through vector-borne disease as it is through farming and crops and famine worldwide. Clean water is not accessible for so many people now, it's only going to get worse and worse and worse. So, diseases are not the least of our problems, but it is, I think, trumped by a couple of other big names.

Aside: Trumped... by big names. Ahhh. *[awkward groan]* So, you know, don't worry about diseases that much because other problems might get us first. And while that seems depressing, if you've listened to this show before, you know I always like to reflect on mortality or the upcoming apocalypse as an excuse today to say, "Fuck it!" Text your crush, cut bangs, eat a quesadilla... We're all going to die.

Alie: Anna Thompson wants to know: Were the Salem Witch Trials a mass delusion brought on by ergot? I can't remember... I know it's a wheat rust, but I can't remember how it's pronounced.

Aside: As promised, more on this. This is a grain fungus containing all kinds of toxic alkaloids, and in some cases; precursors to LSD. Symptoms of contamination can include muscle spasms, fever and hallucinations, mania, feeling dazed, you can have tremors, and distorted perceptions, according to Wikipedia.

In terms of its pronunciation I found out it's [*clip from YouTube channel Basic Survival: "This is a... ergot fungus."*] So, ergot or *Claviceps*, if you're nasty. And I learned this because I just accidentally watched way too much of a YouTube video by a guy called Basic Survival. It's just the visual image of his hand palming an infected blade of grass, as his very, very, oddly sensual – like beyond ASMR – voice just drones for an astounding 6 minutes about the history of ergot fungus. I feel like I just... I *need* to know his life story.

And I'm sorry but I just have to play you ten more seconds because it's so bizarrely soothing. [*clip from Basic Survival: "That destroys the nerves underneath the skin there, and also bothers the capillaries and causes intense burning feeling and big bad sores crop up and it'll even destroy your brain."*] Anyway, grain fungus. Makin' people silly since witch-burning times.

Erin W: I have heard that before. There's this new Netflix movie called *Brain on Fire*, based on a book by a journalist who... I can't remember what the name of the...

Alie: She had encephalitis, right?

Erin W: Yes! So they don't know the exact source of what it was, but that's another hypothesis, is that some of these witch trials were based on people who had this encephalitis that caused them to have these psychotic-like delusions and were labeled as a psychotic person instead of saying, "Okay well, let's actually find out what's going on."

Alie: Especially in children. There's PANDAS, which is a brain encephalitis caused by strep that children are susceptible to, which can cause immediate behavioral changes. I wonder if there was something like a strep outbreak?

Erin A: I think it was just fragile masculinity. [*Erin W. laughs*]

Alie: Quite possibly. Just a pandemic fear of witches. Aki wants to know: Is antibiotic resistance a critical issue?

Erin A: Heck yes. Oh! I can say hell! Hell yes!

Alie: You can say fuck yes.

Erin A: Fuck yes! We don't cuss on our podcast. So, this is new with a microphone. Fuck yes. It's a huge problem. [*Alie laughs*] Oh my god! It is one of the scariest problems for sure. Antibiotic resistant strep or staph in hospitals is massively huge. My dad got sepsis from an antibiotic-resistant UTI infection. It was awful. Antibiotic resistant tuberculosis is terrifying. XDR-TB, that's what they call it.

Alie: What about MRSA?

Erin A: MRSA, exactly. That's *Staphylococcus aureus*.

Alie: Now the fix to that is stop taking antibiotics when you have viruses, right?

Erin A: Yeah, so definitely doctors shouldn't be prescribing antibiotics for things that they don't know are bacterial, but a large part of the problem too is the agricultural industry. They use antibiotics prophylactically. "We're just going to give all of our cows antibiotics so they don't get sick." So prophylactic antibiotic use is a huge issue that is helping drive it. It's kind of the same thing when you talk about, "How can we solve climate change or stop putting trash everywhere?" Yes, we have personal responsibilities, but there's also this systemic responsibility that is not being addressed as much.

Erin W: On the personal side of things, if you are prescribed an antibiotic for something, take the entire course of it! Don't save a few pills for, "In case next time I have a sore throat." Don't do that! People will do that all the time. Don't do that. Take every single pill. What that does is, when you take, let's say three-quarters of your antibiotics you're gonna kill – this is very basic – three-quarters of the bacteria in your body, and your body will probably fight off the rest of it, or it might just be selecting the ones that are resistant.

Alie: The strongest ones. Like the people who are left at your party at like two in the morning... The worst people!

Erin A: You're like, "GO HOME!"

Alie: "Go home! Get off the couch! You should've left forever ago!" Okay, so keep kicking them out. It's funny, our healthcare system is such a beautiful thing that I have friends who are actors who don't have health insurance, who are like, "Oh, if I get strep throat, I just order fish antibiotics online." And you're like, "Oh, America..." They're like, "Yeah you can use them in fish tanks, but you can also take them for strep." People do that! There are whole subreddits about it.

Erin A: Oh my gosh! This is such a good learning experience.

Alie: Veterinary antibiotics that you can get for your dogs and cats that are cheaper online. Don't do it!

John Worster and Stephanie Hancock both wanted to know: Is there any cure for the lone star tick bite that makes you allergic to meat, and do you think there's a possibility that the lone star tick is evolution's way of helping with global warming by moving us to a red meat-reduced society?

Erin A: That's a fun thing to think about, but that's just not how evolution works. But you can answer this tick one.

Erin W: I actually do love every time someone brings up the red meat allergy from lone star tick, they're like, "Maybe that's a good thing." And I'm like, "Well yeah, it could be a good thing." [Erin A. laughs]

Alie: The almost dying part: not a plus.

Erin W: I have some anecdotal evidence, not personally, but it seems that the strength of the allergy varies depending on who you are. It might depend on what tick bit you, but for some people, it seems to last decades or even a lifetime and anytime they re-expose themselves to red meat, it's a really bad reaction, like anaphylaxis, etc. On the other hand, there seems to be a high frequency of cases where we worked in Panama, for some reason. I had a lot of friends who would be like, "Yeah, now I have this red meat allergy, what do I do?" Which is really strange. So, it's on every continent except for Antarctica. I think it first popped up in Australia.

Anyway, some of these people would come back to me and say, “Yeah, actually I’ve tried out different meats and I tried out different kinds of meats. So, a steak, still a no go; pepperoni, yeah, that’s actually okay if I eat it.” And then another person said, “I tried lamb, I tried veal, I tried deer,” and a few years after they had first gotten the allergy, it kind of just went away. As far as I know, there’s no treatment for it, but I think it really depends on who you are.

Aside: I just looked this up on some health sites and even they were like, “I don’t know man, Benadryl? Epinephrine? Fuckin’ sucks dude. There’s always chicken I guess?” Cut to chickens, in a lab, engineering the next tick-borne pathogens.

Alie: Last questions. What about your job suuuucks so bad? What is the worst thing about your job?

Aside: Dr. Allmann Updyke started off:

Erin A: I guess our jobs right now are grad school. So, I just finished half of my grad school, but I still have three more years left, and I think the worst part for me is how small academia can feel. Am I glad I did it? Mostly, yeah. It’s done now.

Alie: But you’re also shaking it up by doing your own sci-comm, which is kind of cool. [*singsong voice*] You’re doing it your way. [*Erin A. laughs*] Erin, what about you?

Erin W: I think my answer’s going to be fairly similar. The culture of academia. The fact that we’re doing disease ecology work. We’re doing work that can be applied to public health, that can be applied to wildlife conservation, but it doesn’t feel that way and it also feels very frustrating. I look around and think, “We’re disease ecologists, why aren’t we actually helping people?” It feels like the data that I’m collecting, the results that I’m writing up, are just going to sit in an academic journal where they’re going to be accessed by people who have subscriptions, who have the privilege to be able to read these journals, and that’s it.

And that feels so disappointing and it feels so unfulfilling in so many ways because it is more than that. The reason that I’m interested in doing this research is so that I can actually help people. The world is on fire around us and we’re just kind of dawdling like, “Oh, but you know, this p-value isn’t quite significant, so I don’t know. I guess I can’t publish this.” We get too in our own heads.

Alie: It’s funny that your work deals with assassin bugs, tick bombs, probably not the best toilets, and you’re like, “The worst thing is the culture of academia.” That says a lot, that there needs to be some change there, culturally, if you’re like, “The 6,000 ticks on my body is not the worst thing about my life.”

Erin A: While you’re slugging through it, you’re like, “This day is the worst!” But realistically, it’s fun. Those are the funnest times out of grad school, doing field work and being miserable while you’re doing field work, but also having fun.

Alie: What is the best thing about epidemiology, or your work, or what are you looking forward to the most in your career?

Erin A: I think for me, I would say the best thing about grad school in general – and when I am able to take a step back and look at it from this perspective, it makes things a lot better – is that for the last five... actually seven years, I got paid to learn, which is so cool and what an awesome opportunity. I love the things that I’m learning, and I do love the program that I’m in. And I’m so happy that even though I have three years left and I’m going to be

in Champagne, which isn't the most exciting town, I'm thrilled about the next three years of doing more clinical work and being able to actually do things with everything that I've learned. But being able to be paid to learn cool stuff is awesome. It's legit. It's pretty great.

Alie: What about you, Erin?

Erin W: I mean, honestly, I think my favorite thing is the field work, which was horrible at times, but also I got to basically spend years in Panama being outside collecting data and then being able to analyze these data and say, "Okay, but what actually is going on here?" So, the excitement of finding out the answer to your problem or the answer to your questions is really thrilling. Also sort of the satisfaction, which sounds very selfish, of being like, "Oh, you know what? This can actually help people. I just have to make that leap to do it."

There were so many times when I would be in Panama, and I would look around, and I would say, "I can't believe that this is my life. I get to do this?? Why didn't anyone tell me this when I was a kid that I could actually have a life like this?"

Alie: I'm glad you guys are doing it. Thanks for fixing the world! I'm such a big fan. Thank you guys so much for being on and I hope I never catch any of these diseases.

Erin A: Me Too.

Alie: Yayyyy! Thanks, you guys.

So, ask smart doctors stupid questions, because without them, we're all festering skin bags full of bacteria. JK; we are already that and it's fine, but that's a topic for a microbiologist.

Now, to find more about the Drs. Erin, check out *This Podcast Will Kill You* wherever you get podcasts, they are @ThisPodcastWillKillYou on [Instagram](#), and @TPWKY on [Twitter](#). We are @Ologies on [Twitter](#) and [Instagram](#), and I'm [Alie Ward](#) on [both](#). So do follow along!

The Ologies Podcast group is a wonderful collection of curious humans on [Facebook](#), and thank you to Hannah Lipow and Erin Talbert for moderating that group, which contains at present count: zero assholes. You can cover your body in *Ologies* merch at [OlogiesMerch.com](#), and find my merch queens Shannon Feltus and Boni Dutch tagged on the *Ologies* Instagram and follow them because they make such pretty pictures. They're both artists and they're wonderful.

Nick Thorburn wrote and performed the music, and big, big thanks as always to Steven Ray Morris for editing this all together and for pulling last week's all-nighter to get Shaaarrks up in time for Shark Week! Steven, you are a glimmering treasure from the sea.

If you listen to the end of the episode you know I tell a secret, and this week's secret is more of a life hack that I'm trying to use to help myself have some life-work balance and it's called time blocking. It's where you say, "Okay from this time to this time, I answer emails; from this time to this time I write; from this to this time I will eat." So far, it's helped me get this episode turned around two days faster, so boom! There you go. You're welcome. We're going to see if this sticks. I don't know, we'll check in next week. I'll let you know if I'm still doing it. But so far so good this week. Okay, go cut those bangs, and wash your hands, maybe.

Transcribed by:

Aska Djikia, your pal who loves fungi and lives in beautiful BC.

Lisa Zhan, that dust bunny that escaped the vacuum.

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[Science Kate of the Field Museum is cool](#)

[What is an epidemiologist, exactly?](#)

[Plague: A real...pest?](#)

[Please, call me Phage.](#)

[Listen Sandy, men are rats](#)

[They're fleas on rats](#)

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[The Flu: nothing to Sneeze at](#)

[The history of Edward Jenner's cow shots](#)

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