TPWKY	This is Exactly Right.
Erin Welsh	"Towards the beginning of spring, the doleful effects of the pestilence began to be horribly apparent by symptoms. An issue of blood from the nose was a manifest sign of inevitable death. But in men and women alike, it first betrayed itself by the emergence of certain tumors in the groin or armpits, some of which grew as large as a common apple. From the two said parts of the body it soon began to propagate and spread itself in all directions, after which the form changed. Black spots making their appearance in many cases on the arm or thigh or elsewhere. Now few and large than minute and numerous. Almost all within three days from the appearance of said symptoms, sooner or later, died. Many dropped dead in the open streets by day and night whilst a great many others, though dying in their own homes, drew neighbors' attention to the fact more by the smell of their rotting corpses than by any other means."
	"And what with these and the others who were dying all over the city, bodies were here, there, and everywhere. It was not merely a question of one citizen avoiding another. This scourge had implanted such a great terror in the hearts of men and women that brothers abandoned brothers, uncles their nephews, sisters their brothers, and in many cases wives deserted husbands. But even worse, and almost incredible, was the fact that fathers and mothers refused to nurse and assist their own children as though they did not belong to them."
Erin Allmann Updyke	That was so hard for me to remain quiet while you recorded that. (laughs)
Erin Welsh	(laughs) Yeah. So that is from everyone's favorite plague chronicler, which everyone has a favorite plague chronicler, right? Yeah.
Erin Allmann Updyke	Of course they do.
Erin Welsh	Giovanni Boccaccio. I think that's how you say it.
Erin Allmann Updyke	That sounds right.
Erin Welsh	Who was living in Florence during the time of the Black Death.
Erin Allmann Updyke	Wow.
Erin Welsh	And so he wrote a book called 'The Decameron' based on what he saw and that was just one of the little bits in there. According to other contemporary accounts, quite accurate.
Erin Allmann Updyke	Oh my god. So hi everybody!
Erin Welsh	Hi.
Erin Allmann Updyke	Welcome to Episode 5?
Erin Welsh	Yes. Of This Podcast Will Kill You.
Erin Allmann Updyke	Yeah, it really will today.
Erin Welsh	Yeah. And you know what we haven't done yet, I realized?

Erin Allmann Updyke	Tell me.
Erin Welsh	Said our last names.
Erin Allmann Updyke	Oh my god, you're right. (laughs)
Erin Welsh	Yeah. We're always like, 'I'm Erin!'
Erin Allmann Updyke	And I'm also Erin!
Erin Welsh	Well it turns out I'm Erin Welsh.
Erin Allmann Updyke	And I'm also Erin Allmann Updyke. (laughs)
Erin Welsh	(laughs) So yeah, we wanted to, I mean...
Erin Allmann Updyke	We should have introduced ourselves earlier.
Erin Welsh	Maybe.
Erin Allmann Updyke	Well if you've made it this far, it's nice to meet ya.
Erin Welsh	Yeah. Thanks for listening. Can I just tell you how excited I am to talk about plague?
Erin Allmann Updyke	I know how excited you are.
Erin Welsh	This is the one, this is the disease that got me into epidemiology, into disease ecology, into history. I'm thrilled.
Erin Allmann Updyke	I just am so excited based on how excited you are. Like regardless of how much, like, you know? Your excitement is through the roof and that thrills me.
Erin Welsh	(laughs) Yay! And so this week we're gonna do something a little bit different, and next week also. So because plague is such a beast of a topic and has been all over the news lately, we're gonna be splitting this up into two episodes to give it the time that it deserves.
Erin Allmann Updyke	Yeah. Yeah. Plague is deserving of multiple episodes.
Erin Welsh	And this week we'll be focusing on the biology of plague and then tracing its history up into the 20th century. And then next week we'll talk about the impact of plague in last 120 years or so and then fill you in on what's been going on in Madagascar.
Erin Allmann Updyke	Yep.
Erin Welsh	And don't worry, each week we'll be drinking quarantinis.
Erin Allmann Updyke	Oh yeah!
Erin Welsh	Slightly different ones. (laughs) Uh, speaking of which. What are we drinking this week?

Erin Allmann Updyke	Speaking of which it's quarantini time!
Erin Welsh	It's quarantini time! Yay!
Erin Allmann Updyke	This week we're drinking the 'Bubo Bebida'. Right?
Erin Welsh	Bubo. Bebida. Yep. And what is in the Bubo Bebida?
Erin Allmann Updyke	It's essentially an extra dry martini.
Erin Welsh	Okay.
Erin Allmann Updyke	It's pretty thrilling. This is a gin martini. So if you'd like to drink along at home, go ahead and mix 1 3/4 oz of your favorite gin, my favorite is Hendrick's, and you mix that with 1/4 oz dry vermouth, and then a hefty splash of the juice from cocktail onions.
Erin Welsh	And we're doing cocktail onions because-
Erin Allmann Updyke	(laughs) They look the most like buboes!
Erin Welsh	Which you'll learn all about and it's disgusting, but hey. Okay, so speaking of buboes, I wanna know about the biology and the symptomology and all of that good stuff about plague.
Erin Allmann Updyke	I can't wait to tell you.
TPWKY	(transition theme)
Erin Allmann Updyke	I'm really excited to talk about plague today because this is our first real zoonotic disease.
Erin Welsh	And vector-borne.
Erin Allmann Updyke	And our first vector-borne disease, so that's really exciting for me and I would guess for you too, since we're disease ecologists, and so this type of disease is what's really exciting to us.
Erin Welsh	And we also both study vector-borne diseases.
Erin Allmann Updyke	Exactly, right. If you are not aware, a zoonotic disease is essentially a disease that generally circulates in animal populations and often spills over into human populations. And a vector-borne disease is a disease, for example such as malaria, that is transmitted by an insect vector. In the case of plague it is transmitted by the humble flea.
Erin Welsh	Ugh.
Erin Allmann Updyke	I'm gonna say some things that might actually make you have some sympathy for the fleas. No lie. I didn't think it was possible but as I was reading I kinda felt bad for fleas.
Erin Welsh	I'm gonna keep an open mind.

Erin Allmann Updyke	Keep an open mind.
Erin Welsh	And wait to be convinced.
Erin Allmann Updyke	(laughs) So let's go through the life cycle of plague. So plague is caused by a bacterium called Yersinia pestis which likely evolved to be a blood-borne pathogen quite a long time ago. And I'm assuming you'll talk a bit more about the evolutionary history of this disease.
Erin Welsh	Yeah.
Erin Allmann Updyke	Cool. So we won't get into that now. But what's really interesting is the life cycle of plague. Here's how it happens. A flea takes a blood meal from an infected - let's call it a rat, because those are really common.
Erin Welsh	Yeah.
Erin Allmann Updyke	And the amount of bacteria that is in the rat's blood directly correlates with the percentage of fleas that get infected. Not all fleas are gonna get infected, but usually around 30% of fleas that are feeding on a rat will get infected. And if you think of a common rat, it's got more than a few fleas on it, right?
Erin Welsh	Yeah. Lots and lots and lots.
Erin Allmann Updyke	Exactly, so a good proportion of those fleas end up getting infected. What happens is Yersinia pestis travels to the flea's stomach where it starts multiplying., and multiplying, and multiplying. And within 3-9 days after taking that infected blood meal, the bacteria have multiplied so much that they entirely block the esophagus of the flea.
Erin Welsh	Oh my god.
Erin Allmann Updyke	Isn't that the craziest thing?!
Erin Welsh	That's disgusting.
Erin Allmann Updyke	So then this poor flea is so hungry it tries to take another blood meal from another rat, but it can't because its esophagus is completely blocked. And so gobs and gobs of bacteria are blocking the entrance into the stomach. As it tries and fails to take a blood meal, it ends up regurgitating a mixture of blood and bacteria back into the rat. It's amazing.
Erin Welsh	It's so cool.
Erin Allmann Updyke	And what's sad, and this is why you should have a little bit of empathy for the flea, is that that blocked flea will end up dying of starvation and dehydration.
Erin Welsh	Only after bringing the world to its knees.
Erin Allmann Updyke	Well, you know. That's just one humble flea. (laughs) But it's suggested that it has barfed 11,000-24,000 individual bacillae into its new host. (laughs)

Erin Welsh	Which is insane considering that in some the infective dose, meaning the number of bacteria needed to cause an infection, is one, in some cases. One!
Erin Allmann Updyke	Yeah, exactly. It's crazy.
Erin Welsh	So just one little vomitorious...
Erin Allmann Updyke	You could infect 24,000 rats in theory, I guess. In the mammalian host, Yersinia pestis will spread from the bite wound into the lymph system, the lymphatics underneath the skin, and then it will travel to the lymph nodes where it will replicate and replicate and replicate. Eventually that infection can then spread to the bloodstream, it can spread to your liver, your spleen, and other organs. And so that is sort of the general life cycle until another flea bites you and the cycle begins again. Isn't that cool?
Erin Welsh	That's super cool.
Erin Allmann Updyke	It's really fun. So that's generally how the disease circulates in it's enzootic host, which means the host that it generally circulates in in the natural environment.
Erin Welsh	Okay, so that's basically rodents for the most part.
Erin Allmann Updyke	For the most part rodents and different species of rodents have different susceptibility to it. But if you think of - I believe its name is rattus rattus, the common sewer rat, right?
Erin Welsh	It is, yeah. Black rat.
Erin Allmann Updyke	Black rat, city rat.
Erin Welsh	There are some other species of rat that are common in North America. Like the Norway rat, for instance, which is bigger and browner.
Erin Allmann Updyke	Oh, cool.
Erin Welsh	Yeah. (laughs)
Erin Allmann Updyke	But so most species of rodent have at least some susceptibility to it but whether or not they're gonna have extreme symptoms and end up dying, for example prairie dogs, or they'll be able to sustain a mild infection such as sewer rats, it varies. But what's really interesting is that over 200 mammalian species are known to be naturally infected with plague.
Erin Welsh	Naturally infected.
Erin Allmann Updyke	Naturally infected. So rodents are the most important host but they are by no means the only host. Rodents are likely the most important in part because they have a very short lifespan, a high replacement rate - so they're reproducing very rapidly - and they have a generally long breeding season. And additionally it's likely that this bacterium evolved with these rodents and so there is only mild resistance in the majority of these rodent species, if that makes sense.
Erin Welsh	I think so.

Erin Allmann Updyke	So these rodents serve to be really good hosts to maintain infection in a given area. And then other hosts, like for example cats, can amplify the disease and allow for it to spread to other victims.
Erin Welsh	Is that because the proximity of cats to crazy humans who have cats?
Erin Allmann Updyke	That is certainly-
Erin Welsh	No offense to all of our cat-owning listeners.
Erin Allmann Updyke	Like me for example. (laughs) That is certainly possible, yeah. So that's sort of the life cycle of the plague. But that's all in animals.
Erin Welsh	Yeah, I wanna hear about it in humans. Get to the good stuff.
Erin Allmann Updyke	I do too, I wanna get to the good stuff. I mean that was good stuff too. (laughs)
Erin Welsh	No, I know, I really liked it. (laughs)
Erin Allmann Updyke	So the plague in humans. There's three different forms of plague. The first is the bubonic.
Erin Welsh	The famous.
Erin Allmann Updyke	The most famous, most likely that you've heard of it, it's what we named our drink after.
Erin Welsh	Bubo!
Erin Allmann Updyke	The bubonic plague. This plague is caused when a human is infected via the bite of an infected flea. So it's not dissimilar from what we discussed in the animal cycle. A flea bites you, barfs a whole bunch of bacteria into your blood, and that's how you get infected. Those bacteria travel through your lymph system to your lymph nodes, most commonly the ones in your armpit or your groin. And then the bacteria multiply a whole bunch of times there and it forms what's called a bubo, which is essentially a giant infected lymph node full of bacteria.
Erin Welsh	Ugh! Did you know that in - and I may talk a lot about the Black Death in a little bit - but did you know that during the Black Death, one of the things that people wrote about in regards to buboes was that they made gurgling noises?
Erin Allmann Updyke	Oh my god. Like (gurgling sounds).
Erin Welsh	Yeah! Like the buboes were speaking!
Erin Allmann Updyke	Oh my god that's disgusting.
Erin Welsh	I need to hear it.
Erin Allmann Updyke	I would love to hear that, actually. I wonder if there's recordings on YouTube or something.
Erin Welsh	So I'm not sure if this has ever been replicated in moderne events but I want to know.

Erin Allmann Updyke	I know, that would be really cool.
Erin Welsh	Gurgling buboes.
Erin Allmann Updyke	Might just be those medieval exaggerators. Hyperbolizers.
Erin Welsh	I mean yeah, what did they think the world was ending or something?
Erin Allmann Updyke	(laughs) So the incubation period for the bubonic plague is generally around 1-7 days, it has a pretty large variation. And in addition to those characteristic buboes you also have some general signs like fever, chills, head and body aches, vomiting and nausea is very common with the bubonic plague.
Erin Welsh	So it's pretty generalized at the beginning.
Erin Allmann Updyke	Pretty generalized except for that very characteristic bubo.
Erin Welsh	Right.
Erin Allmann Updyke	However not everyone who gets infected with the plague is going to end up with buboes. There are two other forms of the disease.
Erin Welsh	Oh yeah.
Erin Allmann Updyke	The first that I'll talk about briefly is septicemic.
Erin Welsh	Okay.
Erin Allmann Updyke	So, sepsis is a disease that can actually happen with any infection, it's essentially just an overload of bacteria in your bloodstream specifically. And with bubonic plague, bubonic plague can spread to the bloodstream from the lymphatics and then become septicemic plague. However it's also possible to get primary septicemic plague which means that you have an overload of bacteria, a very high bacterial load in your bloodstream, without any characteristic buboes.
Erin Welsh	Could a person get septicemic plague for instance somehow either via a flea or via contact with an infected individual, get bacteria deposited directly into their bloodstream? Through like an open wound?
Erin Allmann Updyke	Yes, that's certainly possible.
Erin Welsh	Okay.
Erin Allmann Updyke	And there may be differences in that different species of flea feed differently. There's not a lot of information on the various species of flea and how they transmit but it is certainly possible that you can get infected directly through your bloodstream brom the bite of a flea.
	It is also possible to get infected from... So the advanced stages of the bubonic plague can end with open sores. Your buboes open up and they are just blah.

Erin Welsh	Ugh! Like oozing and seeping.
Erin Allmann Updyke	Seeping bacteria! Just everywhere!
Erin Welsh	Oh god.
Erin Allmann Updyke	But human to human transmission of bubonic plague is very, very limited. You'd have to have a ton of contact with that bubo to really get infected that way.
Erin Welsh	Bubonic plague.
Erin Allmann Updyke	Exactly, bubonic. That is in contrast to pneumonic, which I know is your favorite.
Erin Welsh	Oh yeah. Well, favorite is a tricky word.
Erin Allmann Updyke	(laughs) Too strong of a word, maybe?
Erin Welsh	It's the most terrifying to me.
Erin Allmann Updyke	It is the most virulent form of the disease. Pneumonic plague, which means that it has infected your lungs, is transmitted via respiratory droplets. It is quite high. So for bubonic plague the mortality rate is between 30-60% and for septicemic-
Erin Welsh	Untreated.
Erin Allmann Updyke	Untreated, yes. And for septicemic plague, it's on the high end, maybe 80% or 90%. But pneumonic plague, if untreated, is almost 100% fatal. It's really sad.
Erin Welsh	Wow. Yeah.
Erin Allmann Updyke	So pneumonic plague again means that it was transmitted via respiratory droplets. So bubonic plague, if it spreads to your lungs, can become pneumonic plague. But what's scary about pneumonic plague is that it can also be transmitted directly, human to human, via respiratory droplets.
Erin Welsh	Uh oh.
Erin Allmann Updyke	Yeah.
Erin Welsh	Like the flu.
Erin Allmann Updyke	Like the flu. Like smallpox. Like so many other diseases that we've seen. So with pneumonic plague the incubation period here, in some cases, can be as short as 24 hours. And again, the untreated fatality rate is almost 100%.
Erin Welsh	And remind our listeners. Incubation period is...?
Erin Allmann Updyke	Incubation period is the time from when you become infected to when you show symptoms.

Erin Welsh	Okay. And so with pneumonic plague-
Erin Allmann Updyke	It can be as little as 24 hours.
Erin Welsh	Very soon.
Erin Allmann Updyke	Very short. And what's really sad is that you can also die within that amount of time. So it takes over your body very rapidly. It encompasses very severe respiratory symptoms including shortness of breath and coughing. Initially the cough will be dry but in time-
Erin Welsh	Oh no.
Erin Allmann Updyke	-it will become very productive, that's what we call it, productive cough. Meaning you're coughing up gunk from your lungs.
Erin Welsh	Phlegm.
Erin Allmann Updyke	Phlegm, but mostly blood and bacteria.
Erin Welsh	Whoa!
Erin Allmann Updyke	So the one good thing about the pneumonic plague-
Erin Welsh	There's a good thing about it?
Erin Allmann Updyke	Surprisingly, yes.
Erin Welsh	(laughs)
Erin Allmann Updyke	Is that it is most infectious at the end stage of the disease.
Erin Welsh	Okay, and so if you're treating someone or caring for someone who has pneumonic plague and they've just come down with symptoms, you may still be okay.
Erin Allmann Updyke	Yes.
Erin Welsh	As long as you just abandon them right before they die.
Erin Allmann Updyke	Abandon them before they die. Just kidding, wear a mask!
Erin Welsh	Oh that's an alternative, yeah. (laughs)
Erin Allmann Updyke	That's an alternative. Abandon them or wear a mask. But yeah, you're most infectious during the last few hours, especially, of your disease. However, what's scary is that you also remain infectious after you die.
Erin Welsh	What?

Erin Allmann Updyke	So people who are preparing bodies for burial, for example, can become infected by close contact with the body because their body is still full of bacteria and that bacteria is still alive.
Erin Welsh	And all it takes is just a couple bacteria.
Erin Allmann Updyke	Exactly.
Erin Welsh	Ooh.
Erin Allmann Updyke	Yeah. So that's a little bit scary.
Erin Welsh	That's rough.
Erin Allmann Updyke	The other good news is that all of the plague is treatable with antibiotics as long as you catch it early enough.
Erin Welsh	Caveat.
Erin Allmann Updyke	That's the big caveat, and we'll talk a lot about that when we talk about what's going on with plague today.
Erin Welsh	Yeah.
TPWKY	(transition theme)
Erin Welsh	Are you ready to learn about the history of plague?
Erin Allmann Updyke	I literally can't wait. (laughs)
Erin Welsh	There's a lot of ground to cover here, so-
Erin Allmann Updyke	Oh my god, let's just jump in.
Erin Welsh	All right. The plague bacterium likely evolved as a human pathogen during the time when agriculture and large, stationary human settlements became widespread.
Erin Allmann Updyke	Okay.
Erin Welsh	Which was about 5000-10,000 years ago. That's for the plague jumping into humans.
Erin Allmann Updyke	Awesome.
Erin Welsh	Are you noticing a pattern yet, by the way?
Erin Allmann Updyke	That every disease is from the agricultural revolution?

Erin Welsh	All! All of the diseases that we've discussed so far and probably many in the future had emerged as a result of farming and human crowding. The invention of agriculture was great for humans in many ways. It allowed us to have some degree of food security which could support larger populations. And then we could have division of labor, governments, more time for creative output, art, trade... Basically the things we think of as being human.
Erin Allmann Updyke	Right.
Erin Welsh	But humans weren't the only ones who were positively impacted by this new way of life.
Erin Allmann Updyke	Oh yeah, who else?
Erin Welsh	Oh yeah. The domestication of livestock and long-term storage of grains and other food meant that humans were living in close proximity to animals and their pathogens. Do you know who else loves piles and piles of grains?
Erin Allmann Updyke	I can guess.
Erin Welsh	Well your husband should know, Erin.
Erin Allmann Updyke	(laughs) He does!
Erin Welsh	He works in a brewery.
Erin Allmann Updyke	He does.
Erin Welsh	So what is it?
Erin Allmann Updyke	It's rats and mice and rodents.
Erin Welsh	Yeah, rodents.
Erin Allmann Updyke	They just got a cat so they no longer have that problem.
Erin Welsh	That's great! But cats can still give you pneumonic plague, as we learned.
Erin Allmann Updyke	You know, whatever.
Erin Welsh	(laughs) Do you know who loves rodents? Their fleas.
Erin Allmann Updyke	Ew, yeah.
Erin Welsh	When humans domesticated livestock and began growing crops, some rodents were basically domesticated alongside livestock, though less intentionally. Rats and mice started living alongside humans, adapting to live in the nooks and crannies of houses and food storage buildings. And they became a constant fixture, they were everywhere all the time. Wherever humans went, so did the rats and their fleas. And their fleas' bacteria.
Erin Allmann Updyke	Yeah.

Erin Welsh	And the more humans, the more rats.
Erin Allmann Updyke	And the more rats, the more fleas, and the more fleas, the more plague!
Erin Welsh	You got it.
Erin Allmann Updyke	I understand this cycle.
Erin Welsh	(laughs) But what about the plague bacterium? Well, the plague bacterium jumped from harmless little beep-bop to destroyer of worlds in central Asia right as farming was taking off. The plague bacterium doesn't just reside in so-called domestic rodents, as you learned from the biology, just a little bit about, it also thrives in many, many species of wild rodent. And it's thought that wild rodents were where the plague bacterium turned pathogen.
Erin Allmann Updyke	Oh, wow.
Erin Welsh	Yeah. The favorable climate and newly-adapting farming practices of humans led to huge population growths. For the first time, cities could sustain themselves and wide-scale travel for trade increased. As human populations grew, they expanded into natural areas which made them and domestic rats basically neighbors with these wild, plague-bearing rodents. And fleas were happy to jump from wild to domestic rat and vice versa.
Erin Allmann Updyke	Oh yeah.
Erin Welsh	Take with them their pathogens. And this is how humans were likely first exposed to the plague bacterium. As a side note, an increase in disease following human encroachment on natural areas has been seen time and time again.
Erin Allmann Updyke	Yeah.
Erin Welsh	Spikes in disease or emergence of zoonotic disease following deforestation or ecological upheaval are super common and we're definitely going to be addressing them in future episodes.
Erin Allmann Updyke	Definitely. Especially when we talk about things like Ebola, for example.
Erin Welsh	Yeah, that's a big one.
Erin Allmann Updyke	Yeah.
Erin Welsh	Back to plague. All right. So we've established how the plague got into humans in the first place, but what did it do once it was there?
Erin Allmann Updyke	Kill them all. (laughs)
Erin Welsh	(laughs) Yeah. Spoilers! Well the answer is that it probably, in the beginning, caused local small epidemics. It bided its time, waiting until the black rat, who is the main reservoir for the plague bacterium, and plague's flea host had reached a near global distribution.
Erin Allmann Updyke	Wow.

Erin Welsh	And then it struck. The first time we see plague rear its ugly little head is in 541-542 AD.
Erin Allmann Updyke	Wow!
Erin Welsh	Yeah. A while ago. In what is called the Plague of Justinian, named after the guy who was Roman Emperor at the time in the East Roman Empire.
Erin Allmann Updyke	You know what's crazy? If this thing jumped and was able to infect mammals 10,000 years ago, that means it spent 8000 years just hanging out, not really killing people all that much.
Erin Welsh	Well it might just be that there are gaps in the historical record.
Erin Allmann Updyke	I bet that's probably true.
Erin Welsh	So similar to cholera, this doesn't leave any mark or bone or skeleton and so the evidence would be harder to detect.
Erin Allmann Updyke	Ah, cool! So it's only once we have sort of written records that say, 'This is totally plague, guys' that's when we know for sure that this was happening to people.
Erin Welsh	Well and even then it's disputed sometimes whether the disease is plague or another pathogen.
Erin Allmann Updyke	Right. Smallpox, measles... Well I guess those are kind of, you can see the symptoms are very different. But a lot of this is generalized symptoms, so...
Erin Welsh	Right. And so in the Plague of Justinian, the reason that they think that it was actually bubonic plague is because they described the buboes.
Erin Allmann Updyke	Oh, I can't wait. Okay tell me all about it.
Erin Welsh	Okay yeah, the Plague of Justinian. This one is a doozy.
Erin Allmann Updyke	Ooh, good.
Erin Welsh	About 25-50 million people died during the pandemic. Yup. In 500 AD.
Erin Allmann Updyke	I literally didn't know there were that many humans at that point.
Erin Welsh	It was remarkable, the devastation.
Erin Allmann Updyke	Wow.
Erin Welsh	Remember the 1918 Influenza everyone?
Erin Allmann Updyke	I do.
Erin Welsh	50-100 million people died then, which is a lot of people.

Erin Allmann Updyke	Yeah.
Erin Welsh	About an estimated 3-6% of the global population. In the Plague of Justinian at least 13% of the global population died. And that's without the disease reaching global distribution.
Erin Allmann Updyke	What?!
Erin Welsh	If it had, that number would be a lot higher.
Erin Allmann Updyke	So where was it limited to?
Erin Welsh	Mostly the region of Constantinople and like the, so the Eastern Roman Empire at the time. And it spread a little bit into North Africa and a little bit further into Eastern Asia.
Erin Allmann Updyke	Oh my god.
Erin Welsh	Yeah. In the infected areas, the death toll was really high.
Erin Allmann Updyke	Oh god.
Erin Welsh	In Constantinople during the peak of the epidemic, 5000 people died every day.
Erin Allmann Updyke	(gasp)
Erin Welsh	I mean that happening in a modern city today would be unbelievable. Like I can't, there are no words.
Erin Allmann Updyke	No there really are no words. 5000 people a day. Just dead.
Erin Welsh	So there are roughly 44,000 students at this university.
Erin Allmann Updyke	Yeah, total.
Erin Welsh	So how many days would it take for everyone to die if 5000 people died a day?
Erin Allmann Updyke	No, stop. That's too depressing. Also it's math.
Erin Welsh	9 days.
Erin Allmann Updyke	Oh my god.
Erin Welsh	Just 9 days. The population loss and resulting chaos caused by the Plague of Justinian may have, and probably did, contribute to the downfall of the Roman Empire.
Erin Allmann Updyke	That's like every disease we've talked about so far. This is responsible!

Erin Welsh	Everything, I know. Measles, smallpox. And this pandemic, oddly enough, seems to be more of a sidenote in history, attracting much less interest than the Black Death of the Middle Ages despite having similar mortalities and far-reaching impacts. But this is probably, or at least could be, due to the fact that there are fewer sources, first-hand accounts for this time period.
Erin Allmann Updyke	Okay.
Erin Welsh	All the same, this particular plague probably deserves an episode of its own.
Erin Allmann Updyke	But we just don't have the time y'all!
Erin Welsh	Maybe someday. But not today, no. Today is reserved for one of the most, if not the most devastating pandemics of all time.
Erin Allmann Updyke	I'm so excited!
Erin Welsh	Finally the moment we've all been waiting for. Introducing the Black Death!
Erin Allmann Updyke	(trumpeting sounds)
Erin Welsh	A pandemic so devastating that to simply say it changed the course of history does not do it justice.
Erin Allmann Updyke	(continues trumpeting) (laughs) That was not planned.
Erin Welsh	(laughs) I loved that! Let's own it.
Erin Allmann Updyke	Yeah.
Erin Welsh	The Black Death, which swept the Asian and European continents from 1347-1350 and killed up to 200 million people - estimates range from around like 75-200 million people.
Erin Allmann Updyke	That's...what...
Erin Welsh	That's close to like 30% of the global population at the time.
Erin Allmann Updyke	30% of the global population?
Erin Welsh	I mean estimates vary widely, but... Are you doing some math right now?
Erin Allmann Updyke	I'm trying to figure out what is 30% of 7.5 billion.
Erin Welsh	Oh god. Yeah, let that sink in for a moment.
Erin Allmann Updyke	That's 2.25 billion people today.
Erin Welsh	Honestly-
Erin Allmann Updyke	I can't even... There's no way to wrap your head around that number.

Erin Welsh	No.
Erin Allmann Updyke	It's almost too much to even comprehend.
Erin Welsh	We can't articulate how we're feeling right now.
Erin Allmann Updyke	No, we don't have the words. As my therapist just told me.
Erin Welsh	(laughs) And so yeah, the effect of such annihilation is really the only word for it, reverberated for centuries and is reflected in art, literature, language, and even the economic structure following the Black Death.
Erin Allmann Updyke	That is so cool. I mean 'cool' maybe isn't... I get in trouble for using the word 'cool' talking about things like this. That is so...
Erin Welsh	It's so fascinating.
Erin Allmann Updyke	Fascinating.
Erin Welsh	Yeah.
Erin Allmann Updyke	We'll just stick with that one.
Erin Welsh	Before I get into all the nitty-gritty of the Black Death, let's get a sense of time and place. When I read that a certain event took place in the middle ages or the Victorian era or something, I have a hard time seeing what that time period looks like. So let's talk about it.
Erin Allmann Updyke	Let's.
Erin Welsh	What was the first half of the 14th century like in Europe?
Erin Allmann Updyke	I'm gonna guess. Dirty?
Erin Welsh	Mm-hmm.
Erin Allmann Updyke	And not very pleasant. I don't know.
Erin Welsh	That seems to be the case.
Erin Allmann Updyke	That's just my guess.
Erin Welsh	Let me just fill in some of those extra details.
Erin Allmann Updyke	(laughs)
Erin Welsh	Well, steady population growth during the first couple centuries before 1300 led to a population of about 75 million people in Europe.

Erin Allmann Updyke	Wow.
Erin Welsh	Which is a lot fewer people than today, which is around 400 million.
Erin Allmann Updyke	Oh, okay.
Erin Welsh	But growth had stalled as resources became much more limited and actually the population was hanging by a thread.
Erin Allmann Updyke	Really? I did not know that.
Erin Welsh	Yeah. Starvation was a problem, resources were tapped.
Erin Allmann Updyke	Wow.
Erin Welsh	The carrying capacity had been met.
Erin Allmann Updyke	Uh oh.
Erin Welsh	Just 20 or so years before the Black Death, periods of cooling - climatological cooling - had led to a lot of rain, very poor harvests, and famine was a result. Outbreaks of cattle disease such as anthrax and rinderpest also contributed to famine. About 10-15% of the population died of starvation and the rest of them were severely malnourished during this time, prior to the Black Death.
Erin Allmann Updyke	I'm just really excited.
Erin Welsh	(laughs) It was just one bad thing after another! Oh also war and conflict was a near constant.
Erin Allmann Updyke	Oh.
Erin Welsh	Yeah. You remember last week's episode about cholera and the description of filth-ridden London in the 1800s?
Erin Allmann Updyke	That's what I'm guessing, it's like worse obviously. Yeah.
Erin Welsh	Oh yeah, no different. In Paris, for example, several streets were named after the French word for 'poop'.
Erin Allmann Updyke	(French accent) Merde.
Erin Welsh	You got it. (laughs) Butchers everywhere did their jobs in open view on the street and let the blood and guts of animals run freely.
Erin Allmann Updyke	One time I went to an event where they butchered a pig on stage.
Erin Welsh	Ugh!
Erin Allmann Updyke	It was... I don't know why I was at that event.

Erin Welsh	How have we never talked about this?
Erin Allmann Updyke	It was very weird.
Erin Welsh	(laughs) Oh my god.
Erin Allmann Updyke	We should talk about it off microphone.
Erin Welsh	Yeah, okay. We'll get back to that. Also bathing was not a thing that people did.
Erin Allmann Updyke	Yeah, no.
Erin Welsh	When one person - I had to do some quotes here - when one person was stripped down after being assassinated-
Erin Allmann Updyke	Just cause that happened.
Erin Welsh	It explains why, I guess, his body was being written about. Whatever. It was said that vermin, quote, "Boiled over like water in a simmering cauldron from his body".
Erin Allmann Updyke	(laughs) Oh my... We need to have like a 'not safe for breakfast' on all of our future episodes.
Erin Welsh	(laughs) Maybe we should release at like noon?
Erin Allmann Updyke	Maybe.
Erin Welsh	Not gonna happen, sorry y'all.
Erin Allmann Updyke	No. Fair warning halfway through.
Erin Welsh	Yeah. And living in the country didn't keep you much safer. In fact, the rat to person ration was much higher in rural areas.
Erin Allmann Updyke	(laughs) The rat to person ratio. That's such a great... Why don't we do anything in that ratio anymore?
Erin Welsh	I think we do! I think we could, yeah.
Erin Allmann Updyke	The rat to person ratio. Oh my god.
Erin Welsh	Rats were everywhere, living in every nook and cranny, every thatched roof, every barn. Keep in mind that a rat, a black rat or Norway rat, can fit through a hole with the circumference of a human pointer finger.
Erin Allmann Updyke	Are you serious?!
Erin Welsh	I read that somewhere.

Erin Allmann Updyke	Their skulls and ribs are that tiny? That's what I imagine are the limiting factors.
Erin Welsh	Mm-hmm.
Erin Allmann Updyke	What?
Erin Welsh	That's what I read.
Erin Allmann Updyke	They're so moldable! Like a rat is kind of like chubby and cute.
Erin Welsh	They can come up through your toilet.
Erin Allmann Updyke	Let's stop talking.
Erin Welsh	Yep. (laughs)
Erin Allmann Updyke	(laughs) Ooh.
Erin Welsh	So yeah they were everywhere.
Erin Allmann Updyke	Wow.
Erin Welsh	Also, medieval medicine is not something I'd wish even on my worst enemy.
Erin Allmann Updyke	That's saying something.
Erin Welsh	(laughs) Largely driven by superstition and religion, doctors at this time were as clueless as their patients as to healthcare, but more dangerous since they held the illusion of knowledge and the power to wield it.
Erin Allmann Updyke	(laughs)
Erin Welsh	Did you like that?
Erin Allmann Updyke	That was so good, I love that. Beautifully written.
Erin Welsh	Thank you. (laughs) All in all, the setting for the Black Death was gray and dismal with a population half-starved and surrounded by rats and filth. In other words it was perfect for a pandemic. Let's head to the European ground zero of this plague.
Erin Allmann Updyke	Yes!
Erin Welsh	The port city of Kaffa, which is in modern Crimea. This is where I tell you to pull up a map - unless you're driving.
Erin Allmann Updyke	(laughs)

Erin Welsh	If you're driving, I'll try to help you out. Okay, everyone knows what Italy looks like. Find Italy. Put your finger about halfway through Italy and then head east. Jump that first body of water to the land mass, then you'll see a second body of water to the east again. This slightly bigger body of water is called the Black Sea. At the northeast corner of the Black Sea, there's some land that juts out. This is around where Kaffa was located.
Erin Allmann Updyke	Oh. That was so useful. I cam so bad at geography.
Erin Welsh	(laughs) I mean, we were educated in the United States.
Erin Allmann Updyke	Yeah. One time I did know all the countries of the world though and where they were on a map. In seventh grade. It's been a long time.
Erin Welsh	And then it made room for...
Erin Allmann Updyke	I know all the Backstreet Boys lyrics to every song. (laughs)
Erin Welsh	(laughs) Worth it!
Erin Allmann Updyke	Ah, dear.
Erin Welsh	Okay. Anyway. By 1347, rumors of plague depopulating cities in China, India, and Syria had been circulating. Well, they weren't rumors. Plague was actually on their doorstep. Outside of the city walls were Mongol ships laying siege to the city.
	Frustrated with their lack of success and probably sick of the smell, some of the Mongol army tossed plague-ridden dead bodies over the walls in what may have been the first recorded act of bioterrorism.
Erin Allmann Updyke	That is awesome.
Erin Welsh	(laughs)
Erin Allmann Updyke	Like it's not awesome that it happened, but that is amazing that there are A) records of that, and B) that we can trace an actual plague outbreak to something like that. That is so incredible!
Erin Welsh	Well is was probably too late for the residents of Kaffa anyway.
Erin Allmann Updyke	Oh.
Erin Welsh	Rats bearing plague-infected fleas had already traveled down the ropes tying the ships to the harbor, so they'd already brought plague into the city.
Erin Allmann Updyke	Right, right. They're sneaky little rats.
Erin Welsh	Oh yeah. And they probably went under the disguise of dark. Nighttime.
Erin Allmann Updyke	Ooh, they always do.

Erin Welsh	Ugh. People began dropping like flies. The sight of so many dead and dying struck terror into many, including a group of traders from Genoa in Italy who hopped right onto a boat headed west. Unfortunately for the rest of Europe, they brought with them the plague. Over the course of the next three years the plague would touch nearly every corner of the continent, convincing many that the end of days had truly come. In Florence, where the author of our firsthand account from earlier witnessed the plague, 50% of the population died. Not just 50% of those infected, 50% of the entire population. Gone.
Erin Allmann Updyke	Holy mackerel!
Erin Welsh	Wiped out.
Erin Allmann Updyke	Oh my good Jesus H...
Erin Welsh	(laughs) You've seen Monty Python and the Holy Grail, right?
Erin Allmann Updyke	(british accent) Bring out yer dead! Bring out yer dead!
Erin Welsh	Yeah, yeah.
Erin Allmann Updyke	I've been waiting to say that.
Erin Welsh	That happened! That was real.
Erin Allmann Updyke	Oh my god.
Erin Welsh	Yep. People were actually punished for keeping dead bodies inside.
Erin Allmann Updyke	Okay but also we learned that dead bodies can transmit plague so maybe they should've been punished for that, you know what I mean?
Erin Welsh	Oh sure. Sure, I mean.
Erin Allmann Updyke	Not like the people who were taking them were probably protecting themselves as well as they should have been, but still. You can't harbor a plague-ridden body.
Erin Welsh	There were laws to not keep dead bodies inside.
Erin Allmann Updyke	Lots of laws enacted from diseases, as we've learned in this podcast so far.
Erin Welsh	Yeah. There was no time for rituals, no time for coffin building, no time for funerals. And even if there was time, there was no one to perform them. The dead were laid out, quote:
	"Layer upon layer just like one puts layers of cheese on lasagna."
Erin Allmann Updyke	(laughs) I'm sorry.
Erin Welsh	(laughs) That was according to one chronicler from Florence.

Erin Allmann Updyke	Obviously they're from Italy, first of all. And second of all, who puts layers of cheese on their lasagna? That's absurd.
Erin Welsh	Well I would expect that the recipe for lasagna may have changed over the last 600 years or so. 700.
Erin Allmann Updyke	Oh my god, that's a hilariously disgusting... Layers of bodies layered like lasagna. Great.
Erin Welsh	Keep that image in your mind.
Erin Allmann Updyke	I've got it front and center.
Erin Welsh	Dirt was barely sprinkled over the bodies and the stench of rotting flesh was in every molecule of air you breathed.
Erin Allmann Updyke	Grody.
Erin Welsh	The devastation spread from Italy west to France, Spain, Germany, and then on to Great Britain, north to Scandinavia and so on, killing anywhere from 40-80% of the cities and villages it struck.
Erin Allmann Updyke	Not just 40-80% of those infected. 40-80% of the entire village.
Erin Welsh	Yeah.
Erin Allmann Updyke	Good gracious.
Erin Welsh	There were some villages that were entirely wiped out or at least knocked down to the point where people abandoned the villages and only recently have these old villages been found via drone technology and looking at aerial views.
Erin Allmann Updyke	Oh my god! Wow that's amazing.
Erin Welsh	People seemed to be struck down instantly by this disease. Healthy one minute - well, I mean healthy by medieval standards - and then dead 24 hours later, coughing up blood and writhing in pain.
Erin Allmann Updyke	So I'm gonna guess they had pneumonic plague at that point, you know.
Erin Welsh	Well many cases of the Black Death were bubonic plague-
Erin Allmann Updyke	Okay.
Erin Welsh	-but the horrifying descriptions of symptoms and the interval between initial infection and death suggest a high rate of pneumonic plague with a dash of septicemic plague thrown in.
Erin Allmann Updyke	Yeah, of course. There's always a dash.

Erin Welsh	A little bit here and there. In fact it has been suggested that the name 'Black Death' refers to one of the symptoms of septicemic plague in which the extremities turn very black and hard. But actually, just gonna be a little corrective, here-
Erin Allmann Updyke	Let's push up our glasses a little bit. (laughs) And get your nerd on!
Erin Welsh	Here we go. Actually that name was used to describe the pandemic a couple of centuries after it happened.
Erin Allmann Updyke	Oh interesting. So it wasn't people who were seeing the symptoms that described it that way.
Erin Welsh	No, while it was happening it was usually referred to, in translation, 'The Great Mortality' or colloquially 'The Big Death'.
Erin Allmann Updyke	So just everyone's dying, guys.
Erin Welsh	Yeah. Which really speaks to the impact that it had. I mean when you think about WWI was only called WWI after WWII started. Before it was just called the Great War, the war to end all wars, that kind of thing.
Erin Allmann Updyke	Yeah, yeah.
Erin Welsh	So I think it's similar to that.
Erin Allmann Updyke	Well of course during a war you're not gonna call it, 'Here's the first of the many.'
Erin Welsh	Ugh, my gosh. Well nowadays, who knows? Anyway... In any case the great numbers of dead struck fear and panic into all. No one knew what was the cause of the pestilence. Well some thought they knew. There was the usual one of 'god is smiting us for our wicked ways'.
Erin Allmann Updyke	Gotta be god. It's gotta be god.
Erin Welsh	Well, astrology was another contender. Cats were also blamed.
Erin Allmann Updyke	Maybe they had something to do with it but it wasn't their fault.
Erin Welsh	Well in many cities they were killed by the hundreds or thousands-
Erin Allmann Updyke	Aw poor babies.
Erin Welsh	Which would have actually increased the rat population and thus plague incidents.
Erin Allmann Updyke	Ugh! So it's like double sad cause they were trying to help out but then they all got infected by eating infected rats and then they all died so then they couldn't do their job and then the humans died. So the solution is we need more cats. (laughs)
Erin Welsh	Ew, never the solution. I'm gonna get roasted for that.
Erin Allmann Updyke	(laughs)

Erin Welsh	It wouldn't be for another 500 years, actually, half a millennium, that the transmission cycle of plague from rat to flea to human would be described.
Erin Allmann Updyke	Wow!
Erin Welsh	Yeah. So as you can guess, there were many popular hypotheses as to what was causing the plague. The most damaging and widespread was that it was Jews.
Erin Allmann Updyke	Are you serious?
Erin Welsh	Oh yeah.
Erin Allmann Updyke	I did not know that at all.
Erin Welsh	And sometimes Jews teaming up with leprosy victims.
Erin Allmann Updyke	Oh my god. Humans are the worst.
Erin Welsh	The rumor was that there was a conspiracy in which Jewish people were poisoning the water supplies. Way to be a nasty cliché, medieval European Christians.
Erin Allmann Updyke	Seriously, gross!
Erin Welsh	Extermination of entire Jewish populations in France, Spain, Germany, Switzerland, the list goes on.
Erin Allmann Updyke	Literally how have I never heard about this? Listeners! Have you heard about this? Because what the actual eff?
Erin Welsh	(laughs) It's a big part. Nevermind that the Jewish people were dying at the same rate as Christians.
Erin Allmann Updyke	Oh god.
Erin Welsh	Nevermind that the "confessions" of well poisoning by Jews were drawn out of people only after days of endless torture. The Christians wanted a scapegoat and so they turned to their old favorite, claiming a widespread anti-Christian conspiracy to mask their age-old racist hatred.
Erin Allmann Updyke	Oh my god.
Erin Welsh	Any excuse would do. Thousands of Jews were tortured or burned alive, mostly burned alive, to stop the plague or in some areas prevent it from even appearing.
Erin Allmann Updyke	Oh my god.
Erin Welsh	So some were killed in advance of the plague.
Erin Allmann Updyke	Preemptory. That's disgusting.

Erin Welsh	Obviously the plague came for them anyway. And some felt despair rather than fear. And Irish monk wrote that he was, quote: "Waiting among the dead for death to come." And that sentence was to be the second-to-last in his manuscript. The final one was written by another monk. Quote: "And here it seems the author died."
Erin Allmann Updyke	(laughs) That's a bummer.
Erin Welsh	(laughs) Yeah. That's gonna be my dissertation.
Erin Allmann Updyke	And here it seems the author died.
Erin Welsh	Yeah. Despair also came in the form of flagellants.
Erin Allmann Updyke	Flatulence? Farting? (laughs)
Erin Welsh	Which sounds like I'm saying 'flatulence'.
Erin Allmann Updyke	You're talking about they were so sad cause they were farting?
Erin Welsh	No, I'm talking about flagellants.
TPWKY	(a pronunciation of 'flagellants' plays)
Erin Allmann Updyke	Flatulence! (laughs) She just said 'flatulence' is what she just said!
Erin Welsh	(laughs)
Erin Allmann Updyke	She did not say 'flagellants', she said 'flatulence'.
Erin Welsh	Oh, okay, okay. Okay getting back to the despair part. Flagellants were a radical anti-Semitic Christian group who believed that the only way to halt the plague was to atone with blood for their sins. Groups of 50-500 would travel from village to village dressed in white cloaks with red crosses on them. Sound familiar?
Erin Allmann Updyke	Yeah it does.
Erin Welsh	(laughs) Whipping themselves with a stick which had at the end of it tails of knotted rope with bits of iron in the knots to draw out the blood.
Erin Allmann Updyke	So this is just like Da Vinci Code.
Erin Welsh	Yeah. I mean, flagellants were not unique to the plague itself or the Black Death itself, but this was like a widespread movement. And part of it was that they didn't want or need priests or official leaders for this. And in many ways the Black Death actually led to a shift in the more personal form of religion in which you did not have to go through a priest to commune with god.
Erin Allmann Updyke	Interesting.
Erin Welsh	And also because a lot of the priests and monks died.

Erin Allmann Updyke	So there's no more god communicators, you just gotta do it yourself.
Erin Welsh	You gotta do it yourself. The Black Death impacted more than just religious practices, though. By the time it ended in 1350, around 30-60% of Europe's population had been wiped from the face of the earth.
Erin Allmann Updyke	Holy... Oh my god.
Erin Welsh	The Middle East lost about 1/3 of their population as well.
Erin Allmann Updyke	Wow.
Erin Welsh	I could list shocking mortality rates for cities and countries, but the numbers would lose their impact because they're all so high.
Erin Allmann Updyke	That's the thing, it's too much for our brains to even...
Erin Welsh	We can't absorb it.
Erin Allmann Updyke	No.
Erin Welsh	The death toll was so huge, partially because of the high incidents of pneumonic plague, but also because the preceding famine had weakened the population substantially.
Erin Allmann Updyke	Right.
Erin Welsh	There were also many who may have recovered if they'd received treatment, but there was no one to nurse them.
Erin Allmann Updyke	Yeah, there was also no real treatment back then, it's not like they had antibiotics.
Erin Welsh	Well even just bringing someone food and water.
Erin Allmann Updyke	Water, food.
Erin Welsh	And cleaning them.
Erin Allmann Updyke	Yeah. Thank god.
Erin Welsh	Although you probably wouldn't have wanted to be clean.
Erin Allmann Updyke	(laughs) I like my dirt.

Erin Welsh	The world that the Great Mortality left behind was fragmented, hopeless, baffled as to why they were spared when so many were not. And this was reflected in a popular art theme that arose after the pandemic called the Danse Macabre, or dance of the dead. In this allegory, Death with a capital D goes to a ball and chooses his dance partners randomly, without regard to age or class, just as the plague spared no group. In general, art became very realistic if not fatalistic with depressing depictions of death and suffering. And did you know tapestries probably arose from Black Death?
Erin Allmann Updyke	No, why?
Erin Welsh	Airflow should not be permitted. And so these giant tapestries covering windows and walls were made to ward off plague and pestilence.
Erin Allmann Updyke	Oh my god. To not let things get in. That's so interesting, wow.
Erin Welsh	The plague also inspired many works of literature including the Decameron, which we've already talked about. Have you ever read The Mask of the Red Death by Poe?
Erin Allmann Updyke	No, but I feel like I need to.
Erin Welsh	Really? Oh you definitely need to, it's a great short story. And it may have been inspired by the Decameron and the Black Death also.
Erin Allmann Updyke	Cool!
Erin Welsh	On the medicine front, there became a push towards more anatomical analysis of the stages of disease, more observational medicine - which was a good thing. Unfortunately though the failure of physicians to combat the plague in any way, and in some areas physicians actually died at higher rates than their patients-
Erin Allmann Updyke	Oh, that's not surprising because they were probably the ones in there, getting all up in there and then getting pneumonic plague from patients.
Erin Welsh	Mm-hmm, yeah. And so that led to a complete lack of confidence in the field of medicine. It is often reported that English became the predominant language in England as a result of the Black Death.
Erin Allmann Updyke	Really?!
Erin Welsh	Mm-hmm. This is so cool. (laughs) Before the plague the French language dominated the cities in England among the educated and nobility, while the clergy mostly spoke Latin. The only people who spoke English were the country folk and the poor in the city.
Erin Allmann Updyke	Interesting.
Erin Welsh	Both clergy and city dwellers experienced overall higher rates of death than their rural counterparts and as a result English took over.
Erin Allmann Updyke	Oh my god. So we could all be speaking French, potentially.

Erin Welsh	Yeah, we could. Plague also gave us the word 'quarantine', which comes from the Italian phrase for '40 days'. Ships and people arriving in the city of Ragusa, which is modern day Dubrovnik, Croatia-
Erin Allmann Updyke	I've been there!
Erin Welsh	Oh cool. Were forced to undergo isolation for 40 days in an attempt to halt plague. Unfortunately rats were not quarantined and plague spread anyway.
Erin Allmann Updyke	(laughs)
Erin Welsh	Okay, what else? How about the logistic side of a sharp population decline? Before the plague, Europe was pretty much on the edge. The population had grown beyond what the land could support. The Black Death solved this, to put it frankly. And Europe didn't recover to its pre-plague population levels for another 150 years.
Erin Allmann Updyke	Wow.
Erin Welsh	Also after the plague, it was a laborer's market. The cost of goods and services skyrocketed so much so that governments imposed wage limits so as to not let those pesky peasants reach the income level of the nobility. Seriously, that happened.
Erin Allmann Updyke	Oh! Oh my god. Oh dear.
Erin Welsh	Still though, this caused a shift in economic structure and an end to feudalism where basically all of the classes lower than a Lord were forced to work and live on a particular piece of land. Kind of like slavery, just with more freedom.
Erin Allmann Updyke	Just a different name, essentially.
Erin Welsh	Some researchers suggest that the population drop led to a massive reforestation in Europe with so few people to work the land. And that could have contributed to the little Ice Age that the world was undergoing.
Erin Allmann Updyke	What?
Erin Welsh	Yeah.
Erin Allmann Updyke	So you're telling me that so many people died that the entire ecology of the environment shifted which literally caused climatological change?
Erin Welsh	That's reported in some literature.
Erin Allmann Updyke	That has gotta be like the first evidence of anthropological climate change! Thank you!
Erin Welsh	Yeah. Anthropocene, here we go.
Erin Allmann Updyke	Black Death. Wow, that is so crazy!
Erin Welsh	Honestly I could go on and on about the impact of plague.

Erin Allmann Updyke	I believe you.
Erin Welsh	And I kind of have already. But I do want to cover a couple more things. The first is to briefly discuss the so-called quote "plague deniers" which are many - maybe many is stretching it at this point - several historians and biologists who believe that the Black Death was caused by something other than Yersinia pestis, which is the agent that we recognize today as causing bubonic, pneumonic, and septicemic plague. Some have suggested a hypervirulent form of anthrax, a hemorrhagic virus, or a completely unknown disease that is now extinct.
Erin Allmann Updyke	Oh god.
Erin Welsh	They point to a few things to support their claim. One is the extreme speed with which the plague traveled across Europe and Asia. Modern outbreaks of plague took much longer to travel a similar distance. Another piece of evidence is the reported symptoms, high death toll, and quick onset of death, none of which were exactly replicated in modern epidemics or in the third pandemic. However, DNA steps in and saves the day.
Erin Allmann Updyke	Love it when science rules.
Erin Welsh	Well those were, I would say, fairly legit scientific claims before researchers went out and collected tooth pulp from victims buried in mass graves during the Black Death. They then tested this pulp for Yersinia pestis DNA, which they found.
Erin Allmann Updyke	That's so cool.
Erin Welsh	The Black Death and subsequent outbreaks were caused by the plague bacterium, the same one that causes plague today. Well, slightly different, it has evolved. The high mortality rate was probably due to its tendency to turn pneumonic and also the very poor health of victims to begin with.
Erin Allmann Updyke	Right. Yeah.
Erin Welsh	The next and final thing I want to do is dispel the notion that the pandemic we call the Black Death was the last one. Not in the slightest. The plague continued to simmer throughout Eurasia in the centuries following the 14th century pandemic, causing local epidemics here and there. Which is not to suggest they weren't devastating. The 1665 Great Plague of London killed 70,000 residents out of a population of 450,000.
Erin Allmann Updyke	Oh my god! That's crazy!
Erin Welsh	Mm-hmm. That's about 16.6%.
Erin Allmann Updyke	That's a lot of people.
Erin Welsh	And during that particular outbreak, many of the wealthy nobility fled the city since they had the means to do so, often bringing their doctors with them. And so no one was left to help the poor as they became infected and died by the thousands.
Erin Allmann Updyke	Oh, that's so sad.

Erin Welsh	It wasn't until the 1800s that the third pandemic began. And that is where our episode next week will pick up.
Erin Allmann Updyke	Yep cause we are so out of time. (laughs)
Erin Welsh	Oh yeah. That's a lot of history right there.
Erin Allmann Updyke	It really was.
Erin Welsh	It had to be done, though.
Erin Allmann Updyke	Yes.
Erin Welsh	The Black Death left such a monumental impact on the world in so many ways. Reading about it is slightly terrifying-
Erin Allmann Updyke	And also thrilling.
Erin Welsh	Yeah, I always get chills when I try to imagine the kind of devastation that a 50% or 60% or 70% mortality rate had on a city or the world.
Erin Allmann Updyke	Yeah there's really not a good way to put it into words, really. I mean 60% mortality. That's of your 100 friends, 60 of them dead. You've only got 40 friends left.
Erin Welsh	I mean even still, it's really hard to visualize.
Erin Allmann Updyke	It really is. It's too devastating.
TPWKY	(transition theme)
Erin Welsh	Well I hope you enjoyed learning about that.
Erin Allmann Updyke	I loved it.
Erin Welsh	Cause I loved telling it.
Erin Allmann Updyke	It was really enjoyable despite the fact that it's some of the most depressing things I've ever heard.
Erin Welsh	Well if you want to read more, I have some suggestions for ya.
Erin Allmann Updyke	Great.
Erin Welsh	Okay. 'The Great Mortality' by John Kelly is a fantastic, exciting read all about the Black Death/Great Mortality of the 14th century. It is really well done, it'll give you a really great view of what it was like. Better than I could do, for sure.
	Justinian's Flea' by William Rosen I didn't actually read but it does cover the Plague of Justinian in the 500s.

Erin Allmann Updyke	Cool.
Erin Welsh	Plagues and Peoples' by William McNeill takes a nice broad view of the Black Death. '12 Diseases That Changed Our World' by Irwin Sherman. I do not recommend 'In the Wake of the Plague' by Norman Cantor. It's terrible, it's vaguely misogynistic, it's not well done, it doesn't give you a good overview, the title is extremely misleading. Put it to the side.
Erin Allmann Updyke	Sounds also more than vaguely misogynistic based on your description of it to me, so...
Erin Welsh	The final one that I'll actually recommend is called 'Plague: An Ancient Disease in the 20th Century' by Charles Gregg. And a couple of fiction books, I mean there are many more out there, but a couple of them that tackle plague outbreaks. One is called 'Year of Wonders' by Geraldine Brooks and this is a good one, it's really interesting. So it's based on the true story of a town in a village in England that willingly quarantined itself when it had an outbreak of plague within the village to prevent it from spreading to other populations in like the 1600s.
Erin Allmann Updyke	Interesting. Huh. That sounds interesting.
Erin Welsh	And then 'A Journal of the Plague Year' by Daniel Defoe, who also wrote Robinson Crusoe. He was a kid during the 1665 London plague but he wrote a book based off of it.
Erin Allmann Updyke	Cool. Awesome. I don't have as many books to recommend but I did read the longest paper of all time that may as well be a book. It was called 'Yersinia pestis: etiologic agent of plague' by Perry and Fetherston, published in Clinical Microbiology Reviews in 1997. It's kind of an old paper but it's a really interesting overview of plague. So I don't know how many of you are that into reading deep microbiology papers but it was cool. But also in case you didn't know, dear listeners, we have a Goodreads list called These Books Will Kill You. Right?
Erin Welsh	Yes, that's right.
Erin Allmann Updyke	So you should definitely, if you're on Goodreads, check it out. If you're not on Goodreads, I don't know, get on Goodreads, it's great. Erin converted me.
Erin Welsh	You can still access it.
Erin Allmann Updyke	Right, you can still see the list regardless. But that'll have all the books that we've ever recommended on that list so you don't have to like frantically scribble them down as we're reading them.
TPWKY	(TPWKY outro theme)
Erin Allmann Updyke	And as always, thanks for listening.
Erin Welsh	Thank you so much for listening. Thank you to Bloodmobile for the music. And I feel the need to point out today, since today is the day of self-identification. Bloodmobile is my younger brother Daniel.
Erin Allmann Updyke	Thanks Dan! We love you.
Erin Welsh	Thanks Dan, we love the music.

Erin Allmann Updyke	We really do.
Erin Welsh	And also some of the tracks were done by Dan and his friend Ian.
Erin Allmann Updyke	Thanks Ian!
Erin Welsh	(laughs)
Erin Allmann Updyke	As always, don't forget to rate, review, and subscribe. Check us out on all of the social medias. And thanks for listening!
Erin Welsh	Yeah, thanks so much.
Erin Allmann Updyke	And tune in next week when we talk all about what is happening with plague today.
Erin Welsh	Wash your hands.
Erin Allmann Updyke	Ya filthy animals!